

PROCEEDINGS
OF THE
LOUISIANA
ENGINEERING SOCIETY

VOL. X. 1924

PUBLISHED BI-MONTHLY
BY THE
LOUISIANA ENGINEERING SOCIETY
NEW ORLEANS

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

CONTENTS

EDITORIAL NOTES AND COMMENT:	PAGE
American Institute to Hold Big Exposition of Inventions	176
Annual Reports	8
Bulletin of the Federated American Engineering Societies, The....	7
Correction, A	177, 215
Different Point of View on the Comparison of Pump Tests, A	81
Drainage and Flood Control in Louisiana	217
Error in Mr. Delery's Paper	117
Hydraulic Laboratory Hearings Distributed	218
Important Note, An	174
Influence of Engineering Upon Social and Economic Progress, The	113
January Nineteenth	7
John H. Dunlap	216
Louisiana Man for the Mississippi River Commission, A.....	82
Louisiana State Board of Engineering Examiners	173
Member Societies of American Engineering Council.....	230
Natural Gas for New Orleans	115
New Members	82, 219
New Underground Electric Service for New Orleans	171
Olsen Membership Prize, The	81
Opportunities for Engineers in the Tropics ..	79
Our New President	3
Our Official Family	5
Proceedings, The	10
Refuse Disposal in New Orleans	5
Report of Board of State Examiners	116
Revision of the Building Code	218
Sauve Crevasse, The	7
September Meeting, The	216
Silicon Steel	229
Surface Indicators of Oil in Louisiana	228
"Usual Collation", The	116
Visit of Mr. Grunsky and Mr. Dunlap	81
Water Purification	227
Work of the American Engineering Council, The.....	172
OBITUARY	108, 166, 178
PAPERS AND DISCUSSIONS:	
Address of the Retiring President. <i>By John S. Barelli</i>	11
"Alternating Current Underground Distribution for New Orleans." <i>By W. R. Bullard</i>	179
Discussion	199
"American Engineer in the Tropics", The. <i>By Arthur M. Shaw</i> ..	84

"Comparison of Pump Tests with Special Reference to Low Head Pumps", The. <i>By Eugene F. Delery</i>	98
"Engineering Education and the Industries."	
<i>By John H. Dunlap</i>	220
"Influence of Engineering Upon Social and Economical Progress", The. <i>By C. E. Grunsky</i>	118
Discussion	134
"Refuse Problem in New Orleans", The. <i>By Carl Schneider</i>	13
Discussion	30
"Report on the Natural Gas Situation as Applied to the City of New Orleans". <i>By Frank T. Payne</i>	138
Discussion	141
"Sauve Crevasse", The 1849.	43
Discussion. <i>By W. B. Gregory</i>	45
"Surface Indications of Oil". <i>By R. A. Steinmayer</i>	257
Discussion	268
"Water Purification". <i>By John L. Porter</i>	232
Discussion	251
"Work of the American Engineering Council", The. <i>By L. W. Wallace</i>	203
MEMBERSHIP LIST FOR 1924	46
MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY:	
Minutes of Board of Direction, December 10, 1923	56
Minutes of Board of Direction, January 19, 1924	57
Minutes of Board of Direction, January 19, 1924	58
Minutes of Board of Direction, February 11, 1924	109
Minutes of Board of Direction, March 10, 1924	109
Minutes of Board of Direction, April 14, 1924	168
Minutes of Board of Direction, May 12, 1924	169
Minutes of Board of Direction, June 9, 1924	214
Minutes of Board of Direction, August 11, 1924	224
Minutes of Board of Direction, September 8, 1924	224
Minutes of Board of Direction, October 13, 1924	273
Minutes of Board of Direction, November 10, 1924	273
Minutes of Board of Direction, December 8, 1924	274
Minutes of the Society, December 10, 1923	56
Minutes of the Society, January 19, 1924	57
Minutes of the Society, February 11, 1924	109
Minutes of the Society, March 10, 1924	110
Minutes of the Society, April 14, 1924	168
Minutes of the Society, May 12, 1924	169
Minutes of the Society, June 9, 1924	214
Minutes of the Society, September 8, 1924	225
Minutes of the Society, October 13, 1924	273
Minutes of the Society, November 10, 1924	274
Minutes of the Society, December 8, 1924	274
Annual Report of the Board of Direction for 1923	59
Annual Report of the Secretary for 1923	60
Annual Report of the Treasurer for 1923	66
Annual Report of the Entertainment Committee for 1923	70
Annual Report of the Library Committee for 1923	71
Annual Report of the Employment Committee for 1923	73
Report of the Auditor	73

The Proceedings of the Louisiana Engineering Society

Published bi-monthly, February, April, June, August, October, December,
under the auspices of the Committee on Publication.

DOUGLAS ANDERSON, Editor.

The Louisiana Engineering Society is not responsible for any
statement made or opinion expressed in this publication.

Subscription, \$2.00 per annum

Single copy, 35 cents

ADVERTISING RATES

	ONE YEAR	HALF YEAR	ONE ISSUE
Full page	\$50.00	\$28.00	\$10.00
Half-page	28.00	15.00	6.00
Quarter-page	15.00	10.00	4 00
One-eighth page	10.00	6.00	2.00

For the back outside cover add 50 per cent to the above
rates. For the inside covers add 25 per cent to the above
rates.

Address all communications to
Douglas Anderson, Editor, Tulane University,
New Orleans, La.

Entered as second-class matter July 27, 1916, at the Post Office at
New Orleans, Louisiana, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in section 1105,
Act of October 3, 1917, authorized August 1, 1918.

LOUISIANA ENGINEERING SOCIETY

OFFICERS FOR 1925

President, MARCEL GARSAUD, 201 New Orleans Court Building.
Vice-President, FARRAR P. HAMILTON, 1126 Hibernia Building.
Secretary, FRANK A. MUTH, 7705 Willow Street.
Treasurer, WALTER B. MOSES, 640 S. Peters Street.

DIRECTORS

CHARLES MCD. KERR, 1403 Hibernia Building.
F. P. HAMILTON, 1403 Hibernia Building.
E. S. LANPHIER, Room 224 Custom House Building.
JOHN S. BARELLI, 612 Godchaux Building.

STANDING COMMITTEES

On Technical Papers

W. B. Gregory, Chairman
I. O. Mall
A. M. Shaw

On Library

Ralph Earl, Chairman
W. E. Koch
John Klorer
Ralph H. Mann

On Publications—Division "A"

Douglas Anderson
Frank A. Muth

On Publications—Division "B"

John T. Eastwood, Chairman
V. L. Willoz
E. F. Delery
George Hammett
Geo. A. Seaver
Paul F. Jahneke

On Entertainments and Outings

A. M. Lockett, Chairman
W. T. Hogg
Lester F. Alexander
Ole K. Olsen

On Membership—Division "A"

W. T. Hogg, Chairman
A. F. Jacobi
B. B. Kohnke
Cecil N. Bean
Lester C. Smith
Ira W. Sylvester
David Godat
J. L. Henning
B. W. Pegues
Bryson Vallas
Merrill Bernard

On Membership—Division "B"

D. S. Elliott, Chairman
J. F. Coleman
Jacques de Tarnowsky

On Employment

R. H. Baumbach, Chairman
R. Bassich

On Civic and Industrial Affairs

A. T. Dusenbury, Chairman
John H. O'Niell
E. H. Coleman

The headquarters of the Society are in the State Museum
Building, Jackson Square.

All business communications should be addressed to F. A. Muth, Secretary,
7705 Willow Street, New Orleans, La.



MARCEL GARSAUD

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

VOL. XI.

FEBRUARY, 1925

No. 1

CONTENTS

EDITORIAL NOTES AND COMMENT:	PAGE
Our New President	3
Other Officers for 1925	5
Highway Location	5
The Smoker	5
The Olsen Membership Prize	7
A Copy of the Humphreys and Abbot Report for the Society's Library	7
The "Plain Business Man" and the Engineer	8
New Members	11
 PAPERS AND DISCUSSIONS:	
A Discussion of Highway Location. <i>By J. C. Carpenter</i>	14
Discussion	20
MEMBERSHIP LIST	22
MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY	33
ANNUAL REPORTS	35
REPORT OF THE AUDITOR	49

EDITORIAL NOTES AND COMMENT

Our New President. At the Annual Meeting of the Society, January 10, 1925, Colonel Marcel Garsaud was unanimously elected President for the year 1925.

Col. Garsaud is a native of Louisiana, born in New Orleans, May 29, 1881. He received his primary and high school education in the public schools of this city, and graduated from the College of Technology of Tulane University in 1903 with the degree of Bachelor of Engineering in the Civil Engineering Course.

Shortly after graduation Mr. Garsaud began work as an assistant engineer with the Sewerage and Water Board and was engaged in sewer design and construction. He followed this line of work for four and a half years, the next three years being devoted to private practice and construction work. This was followed by an experience of two years in contracting work on highways and as engineer in charge of several important investigations and reports.

From 1913 to 1917, he was chief engineer for Hampton Reynolds engaged in the construction of highways, buildings, pumping stations, wharves, levees, drainage canals and many similar projects.

When the United States entered the World War in 1917 Mr. Garsaud offered his services and was commissioned as Major in the Corps of Engineers. He was in general charge of the completion of the sewerage and water systems at Camp Pike, Arkansas, as well as other engineering work incident to the establishment and operation of such a camp. He was discharged in October, 1919 with the title of Lieutenant Colonel of Engineers.

For the next five years Col. Garsaud engaged in the practice of general engineering and contracting as a member of the firm of Hackett and Garsaud.

In August, 1924, he was made Chief Engineer of the Orleans Levee Board, a position which makes him responsible for several new and important developments, such as the sea-wall along the Lake Shore, and new measures of flood protection and control.

Col. Garsaud is a member of the Building Code Board of Appeal, and has been for a number of years a most active and efficient member of the State Board of Engineering Examiners. He was the first President of the National Council of State Board of Engineering Examiners, is a member of the Society of American Engineers and is Colonel of Engineers in the Reserve Corps.

A member of the Louisiana Engineering Society since 1905, Col. Garsaud has had experience and been of service in all its varied lines of activity. Under his able guidance it is destined to enjoy one of its most successful and prosperous years.

Other Officers for 1925. Mr. Farrar P. Hamilton, member of the Board of Direction, having been elected to the Vice-Presidency, Dr. D. S. Elliott was elected to fill his place on the Board.

The other members of the Board of Direction are Charles McD. Kerr, E. S. Lanphier and John S. Barelli.

Frank A. Muth was re-elected Secretary and Walter Moses Treasurer.

Highway Location. Mr. Carpenter opens his paper on this subject with the very pertinent suggestion that engineers and others responsible for the location of our principal highways should avail themselves of the experience and the methods which have been developed over a period of many years in the location of railways.

Other phases of the subject discussed are mileage, volume of traffic, grades, the character of the traffic, alignment, railway crossings, alignment in passing through towns or cities and safety of operation.

The location itself is the one permanent feature of the road and all due allowance should be made for future development, such as the necessary widening of the roadway, strengthening of bridges and other structural features, reduction of grades and lengthening of tangents.

The proper locating of highways like many other engineering projects, particularly in our Southern States, is very apt to be decided by political considerations rather than by engineering and economic principles. This is just another illustration of the advisability of having engineers in control of the policies to be adopted as well as in charge of the technical details of the problem.

The Smoker. If noise is a fair criterion by which to measure one's enjoyment of a festive occasion, then everyone must have had a glorious time at Kolb's on the evening of January 10th. The keynote (not musical) of the evening was noise. Everybody made some kind of a noise. So great and so continuous was the din that the quiet and sober gentleman who was chosen to act as toastmaster could not make himself heard in order to

introduce the speakers. The meeting was thus deprived of the pleasure of hearing some of the carefully prepared impromptu speeches which some of the participants doubtless had up their sleeves. The toastmaster had also prepared some very witty remarks with which to introduce the speakers, and these too were wasted.

The Society had the pleasure of entertaining as its guests Col. C. McD. Townsend, U. S. District Engineer; Commandant H. A. McClure, U. S. Naval Station; Col. Jas. H. Frier, Commanding Officer, 87th Division, U. S. Army, and Col. H. C. Boyden, Official Lecturer of the Portland Cement Association.

A jazz band, engaged by the committee as a part of the evening's entertainment, succeeded in proving to the satisfaction of its leader as well as to all others that it was no slouch itself when it was a question of making a noise. A very charming feature of the entertainment was contributed by Miss Marian Draper and her dancing partner, Miss Hazel Verges, who presented two attractive dance numbers, gracefully executed and artistically costumed.

According to Mr. Muth, the attendance at this smoker was the largest in a number of years, there being 141 members and guests present.

For the first time in many years there was absent from the smoker one who has always been its leading spirit and the chief promoter of its fun and jollity, "Ole K." He did not forget us, however, and sent in the following telegram from Chicago, where he was detained on business:

Louisiana Engineering Society,
Care of Kolbs' Restaurant,
New Orleans, La.

Sorry I cannot be with you tonight, boys. First time in many years. Feeling it keenly. Have a good time with plenty of pep. Love to all.

OLE K.

Another whose smiling countenance and gay spirit was missed at the entertainment was Charles M. Kerr. He also sent us a message from Oklahoma City:

Am marooned in this burg and can be with you only in spirit. Hope that this will not be the only brand avail-

able, however, and that you will "hit it up on all six." Give my regards to the tout ensemble. Keep out of jail if possible.

CHARLES KERR.

The Olsen Membership Prize. Fifty-three new members were added to our lists during the past year, twenty-five of whose applications were obtained through the activities of Mr. William Bres Gregory. Mr. Gregory was therefore awarded the prize of \$50.00 contributed by Mr. Ole K. Olsen to give added zest to the campaign for membership.

Making allowances for resignations and deaths, the net increase in membership was thirty. The average net increase for the past ten years has been twenty-one.

The total membership of the Society is now 378, of which number 207 are residents of New Orleans.

A Copy of the Humphreys and Abbot Report for the Society's Library. Col. A. M. Shaw has made a number of efforts to secure a copy of this valuable report for our library. He finally enlisted the support of Congressman James O'Connor, who took the matter up with Major General Taylor, Chief of Engineers of the Army. General Taylor secured a copy of the report and transmitted it to Mr. O'Connor. In his letter of transmittal General Taylor makes the following statement, in part:

"In reply, I would say that this book, which, for a great many years, has been a standard work on hydraulics, has become very scarce, but in view of the value of the book and the interest which the Engineers Society of the State of Louisiana has in the Mississippi River problem, I am forwarding to you one of the few copies which we have in order that this book may be made available to the Engineers of Louisiana."

It may be of interest to note that the full title of this book is:

"Report upon The Physies and Hydraulics of the Mississippi River; upon the Protection of the Alluvial Region against Overflow; and upon the Deepening of the Mouths; based upon Surveys and Investigations made under the Acts of Congress directing the Topographical and Hydrographical Survey of the

Delta of the Mississippi River, with such Investigations as might lead to determine the most practicable plan for securing it from inundation, and the best mode of deepening the Channels at the Mouths of the River."

Submitted to the Bureau of Topographical Engineers, War Department, 1861.

Prepared by

Captain A. A. Humphreys
and

Lieut. H. L. Abbot

Corps of Topographical Engineers, United State Army.

"I approve much more your method of philosophising, which proceeds upon actual observation, makes a collection of facts, and concludes no further than these facts will warrant."—Dr. Franklin to Abbé Souliave.

The thanks of the Louisiana Engineering Society are certainly due to General Taylor for the donation of this volume; to the Hon. James O'Connor for his kindly offices, and to Col. Shaw for his finally successful efforts to secure the book.

Owing to its great value the Report will be left in charge of the librarian, but may be had for reference upon application to her.

The "Plain Business Man" and the Engineer. The caption to this paragraph has been selected after reading an item which appeared in the December, 1924, issue of "The Nation's Business," the official organ of the National Board of Commerce. Our attention has been called to the article by Mr. H. M. Gould, Assistant General Manager of the Department of Street Railways, City of Detroit. This is the article:

I sat one evening listening to two fairly successful engineers, one of whom is now a business executive, discussing the present state of the engineering profession. They agreed that a competent engineer is likely to be found working for a plain business man who is not an engineer.

"I can hire a fairly good engineer," declared one, "for less money than I'm obliged to pay a first-class stenographer. Of course such an engineer won't have much imagination or initiative, but he will do what he's told accurately and acceptably."

The other engineer remarked that he is sending his two boys to a college where they will get an old-fashioned cultural course—mostly Latin and Greek—largely for the purpose of diverting them from a line of study which might lead to a degree in engineering.

Both declared that an engineer will not ordinarily go far because he is too busy doing one routine thing which can easily be done by another younger engineer whenever he gets tired of it.

I was astonished that engineering could be held in such low esteem by those within the profession. Is the trouble that there are too many engineers? Certainly it isn't that they are lacking in fundamental intelligence. Army tests applied to officers during the World War showed that engineers were not only at the top in the intelligence scale, but 60 per cent ahead of medical officers at the bottom of the scale. I wish other business men and engineers would write and tell me their impressions of opportunities or lack of opportunities in engineering work at the present time.

This country is pre-eminently the home of big business and the business man, whether he be just plain or whether he be complex, is the standard by which we measure success; and the unit in terms of which we measure success is the dollar.

By this token the business man will always be more of a success than the engineer for the reason that the end and aim of his life is to make money. This is true whether he is running his own business or whether he is an executive or manager for a corporation.

The engineer is a professional man and the nature of his work is such that it is rather the usual thing for him to work on a salary basis.

There are engineers and engineers! In the exceedingly careless way which prevails in this country of bestowing professional titles upon men, the profession of engineering is the worst sufferer, unless it be that of the college professor.

Confining our attention to those men who through education and experience are really entitled to call themselves engineers, is the situation with them so different from that in other professions, or even from that in business?

There are poor engineers, good engineers and geniuses. Are there not poor business men, good business men and big busi-

ness men? Are not the routine workers just as much a part of the system as the men at the top?

It would seem, therefore, that the first of the "two fairly successful engineers" quoted above has fallen into the bad habit, not at all unusual with business men, of employing for the engineering features of his projects the cheapest labor he can find. Your business man will often pass the really competent engineer by in favor of one less competent because he thinks he sees an opportunity thereby of increasing his profits on the deal. Big business, so called, has many sins of commission to its discredit in this respect.

Our second "fairly successful engineer," who is sending his two boys to a college where they will get an old-fashioned cultural course—mostly Latin and Greek—is probably doing a wiser thing than even he himself appreciates. If his boys develop thereby imagination and initiative, a modicum of Latin and Greek will not keep them from being engineers if they feel the call to that line of endeavor. In the estimation of many of us, it may even make them better engineers. Perhaps if their father had had more Latin and Greek in his youth, it might have stimulated his imagination to an appreciation of the real values in his own profession, which he now appears to hold in such low esteem.

Many of our most distinguished engineers have had the advantage of just this type of education.

Doubtless there are many engineers who occupy positions in which they are engaged largely in routine work. Is this not equally as true in the case of the business man? Thousands upon thousands of them are engaged in routine work of a particularly onerous and tiresome character. The engineer has opportunities to go as far as his ambition and his capabilities will carry him. Even the business man cannot do more than that.

There may not be as many dollars at the top of the hill for the engineer, but he has other compensations and satisfactions which come from the consciousness of service to others, and from the fact that his training and his experience enable him to contribute to the welfare and progress of his community

through the more efficient utilization of its natural resources. He is a builder and, as has been well said, "the act of building is its own best reward."

There are *not* too many enigneers. Reports from students of the future economic development of this country indicate, on the contrary, that in a few years to come there will not be enough engineers. And this in spite of the seemingly large numbers being turned out from our schools of engineering each year.

It is ridiculous to feel that the profession of engineering is in any such pitiful condition as would seem to be indicated by the article in question. Engineers of the right sort hold their profession in high esteem. Since the World War there has been a considerable amount of questioning and of adjustment in the profession of engineering, just as there has been in all lines of human endeavor.

And the engineer is slowly but surely coming to the point where he will take a larger share of the financial returns from enterprises and projects to the success of which his work is the largest contributing factor. He is working out his own salvation in his own way.

He can view with pride the achievements of his profession and its contributions to the progress and development of civilization in the past; he can have the satisfaction that comes with the realization that he, by his own efforts, is contributing to its advancement in the present; and when he wants to dream, he can let his imagination (a quality which he is far from lacking) lead him into the illimitable possibilities of the future.

New Members. Through the activities of the membership campaign, Mr. Gregory being the greatest contributor thereto, the Society has recently elected a very large number of new members. We extend to them all a hearty welcome and trust that they may all take an active part in its affairs.

The man who gets the most out of the Louisiana Engineering Society is the man who puts the most into it.

Resident Members.

Walter J. Barnes, with New Orleans Public Service, Inc.

Harry D. Bowles, member firm of Copp & Bowles Co.

Frank P. Broussard, with Lukens Steel Company.

Roger E. Chestnut, with Board of Commissioners, Port of New Orleans.

Charles Davis, with Board of Commissioners, Port of New Orleans.

George J. DeGarmo, student of Engineering and Instructor, Tulane University.

Archibald Lee Dunlap, Assistant Professor of Mechanical Engineering, Tulane University.

Francis Willis Gavin, District Manager, Trusecon Steel Company.

Lafayette F. Griffith, Superintendent Line Department, New Orleans Public Service, Inc.

Edward C. Hyatt, with City Engineer.

Charles Johnson, with New Orleans Sewerage and Water Board.

George R. W. Lewis, with New Orleans Public Service, Inc.

Thomas Smith, Jr., with New Orleans Public Service, Inc.

Reinhard A. Steinmayer, Assistant Professor of Geology, Tulane University.

Wayne Dudley Stewart, Portland Cement Association.

Charles McD. Townsend, Corps of Engineers, U. S. A.

Bryson Vallas, Assistant City Engineer.

Resident Associate Member.

Edward R. Greenlaw, President, Greenlaw Truck and Tractor Co.

Junior Members.

John S. Burke, with New Orleans Public Service, Inc.

John Walter Emrich, with New Orleans Public Service, Inc.

Edwin Frank.

Gilbert Tesla Gray, with New Orleans Public Service, Inc.

Robert James Kuhn, with New Orleans Public Service, Inc.

Charles Rene Maduell, with Board of Commissioners, Port of New Orleans.

Student Members.

Salvador di Benedetto,
Percy L. Bernstein,
Lester B. Clark,
James Murray Cracroft,
Edwin E. Elam
Charles Julius Fritchie,
Vic F. Hartel,
Edmund Favre Hughes,
E. Lawes Kleinpeter,

Francis A. Landrieu,
Leo Levy Lowentritt,
J. F. Nunenmacher,
Philip Phillips,
Everett G. Roessle,
Lewis Monroe Shelton,
Joseph F. Thomson,
John Mort Walker,
Albert G. Wyler.

All Senior Engineering students in Tulane University.

PAPERS AND DISCUSSIONS

A DISCUSSION ON HIGHWAY LOCATION.

By J. C. CARPENTER,

Assistant District Engineer, U. S. Bureau of Public Roads.

Read Before the Society, December 8, 1924.

The engineers of this Society are to be complimented on their interest in the important and timely subject of highway location. It is a theme that deserves profound study and one that this professional organization may profitably discuss and apply in the interest of the public.

It is the common impression that modern highway location follows railway practice. We would be fortunate if this were true. The modern highway location is too often influenced by local opinion and property division lines. Imagine a crack railway locator following a section line to avoid property damage, or running a trunk line down the main street of a village so that the patrons might stop at the Main Street drug store for a cold drink.

As more highways are built we may expect an approach to the ideals that were handed down to us by a century of railway builders. One billion dollars invested annually will soon bring to light the glaring errors in highway location and convince the public that they should have the best location possible for this enormous investment.

Few of us will be called upon to participate in the laying out of a State system of highways. The federal aid laws have practically solved that problem. But the determination of locations between control points on the state system will be important factors in the development of a system of well located lines of travel.

The Federal Aid System as now laid out is to be threaded through designated control points which have been established by agreement between the states and the federal government. It is conceded that the control points thus established have been well selected and the system of roads which is contemplated will adequately serve local through traffic.

The present problem is to link up these control points with locations founded on the best practice in highway location.

There is a large mileage of local roads outside of the state systems, and the same principles of location apply to it.

I will indulge in a few generalities before getting down to business. Mileage is the first and foremost factor of service. Build to get somewhere, and open up lines of traffic. Once the way is opened between two centers of trade, we will be obliged to maintain communication. But in opening up these lines of traffic the location must be so planned that alignment and ruling grades will be suitable for all reasonable requirements of the future.

The volume of local traffic will undoubtedly control the design and to a certain extent the location. Heavier expenditures will be required near large centers of population, and gradually diminish as the volume of traffic falls off. Volume of traffic will control the design of safeguards. Heavy traffic roads must be made foolproof, whereas warning signs may be made to serve on light traffic roads. A traffic census is an invaluable asset in the design of roads and every state highway department should have a well planned system of recording traffic.

One of the primary considerations in location practice is the ruling grade. Reasonably low grades are desirable, and the question always resolves itself into what is reasonable for a specific case. Horse-drawn traffic is not the controlling factor that it was in the early days of road building. At one time 12 per cent grades were considered the maximum limit on account of safety in descent. Now we consider a 4 per cent grade the safe grade for a car descending with motor declutched. For Louisiana topography it is conceded that a 5 per cent maximum grade is reasonable. There is no economy in reducing a grade below 3 per cent unless the expenditure involved is very light. Trucks usually change from high to low gear at 4 per cent and passenger cars at 6 per cent. Reduction of rise and fall on grades of less than 3 per cent has little value so far as operating costs are concerned.

Cost maintenance of shoulders and ditches as well as gravel surface increases rapidly on grades over 5 per cent. This factor alone would limit the grades to this maximum in this State. Where light soils are encountered lower grades may prove eco-

nomical even though the first cost is high. Intermediate grades require careful study to determine the most economical layout.

Reduction in distance and total rise and fall is desirable on heavy traffic roads. This applies to all of the federal system. It is hard to place a money value on this feature. Using ten cents per mile as the expense of operation the capitalized value of a saving of one foot in distance of 100 vehicles per day results in \$14 per annum. A saving of one mile would mean \$14,000 on the same basis. This does not consider drivers' time and other important factors.

The nature of the traffic has some bearing on the question. At a hearing on location in an eastern State one route was about eight miles longer than the other, but passed some beautiful scenery and points of historic interest. The advocates of the longer route spent the larger part of their allotted time in praising the scenery on their route. When the opposition started their argument then introduced a prosperous farmer who lived beyond the junction of the two routes. He said, "My trucks average two round trips to town every day of the year. I have five colored drivers, who are not particularly interested in scenery or history." The shorter route was adopted.

Distance should never be increased between fixed points in order to reduce grades below a reasonable maximum. Short grades above the maximum may be used in connection with long lower maximums to improve alignment, provided the grades can be later reduced when more funds are available.

The most important feature of location is alignment. Safety to traffic governs alignment cost. So far as detailed alignment is concerned, cost of traffic operation has no practical effect. It is far better to use a steeper grade with good alignment than a poor alignment on a flatter grade.

The first requirement is a good map of the territory to be covered. If topographic maps are not available, such as U. S. Geological Survey sheets, or soil survey maps, a quick traverse with stadia methods will be well worth while. On this map locate the control points and draw a straight line between them. Obviously the most direct location is the one which comes closest to this ideal line. Natural barriers such as mountain ranges, rivers, and swamps, will pull the line to right or left. In ordi-

nary easy rolling topography the principle of straight line location is generally sound. This may appear to be academic, but the policy outlined should be followed in all preliminary investigations.

Having determined upon a reasonable routing the following principles apply to detailed location. Long tangent locations are desirable. Necessary curvature should be as light as possible. The 500 feet radius curves is about the sharpest that should be tolerated, except in mountainous country. A six degree curve (955' radius) is considered a reasonable maximum for flat topography. Such curves make reasonable speeds safe and speed up traffic. Grades on sharp curves should be compensated. This feature should not be important in Louisiana for there is little reason for sharp curvature. Reverse curves should have an intervening tangent and curves in the same direction should be flattened and combined or else have a long intervening tangent. Bridges, underpasses, railway crossings, and road intersections should have at least 100 feet of tangent approach.

Aside from these mechanical features the location should be fitted to natural conditions. Ridge locations are preferable in this State, unless the distance is materially increased. A round-about location may be justified if swampy land intervenes on the direct line. The importance of through traffic will usually decide this issue. A southern exposure is sometimes of great value and worth some additional length.

Where railways parallel the main highways a desirable location is away from the railway. Adjacent to population centers, the location should be far enough away from the railway to allow development on both sides of the highway. Outside of towns a desirable spacing is five miles.

All railway grade crossings should be eliminated if possible. The desirable method of elimination is by relocation of the highway where two crossings of the same railroad are in existence. If a town is to be served, a spur line with a grade crossing for local traffic is better than two grade crossing for through traffic.

Where it becomes necessary to cross the railway, separations are desirable. Good designs for these structures are es-

sential. A badly located underpass or overhead crossing is almost as dangerous as a well protected grade crossing. If topographic features will not allow a grade separation, the crossing should be protected by warning signs, automatic or manual signals, gates, or watchmen. The crossing should be at a 90 degree angle, and on a level grade on the highway with good sight distance along the track.

One of the most important features of highway location is the alignment through towns and cities. Where the main street of a village lies in the direct line of location, is amply wide and straight, there is little excuse for detouring. But where the main street is narrow, requires several angles to swing onto it and will be badly congested with the highway traffic it is poor engineering and short-sighted judgment to route a through highway along it. Local funds usually control these locations. Arguments against such locations are: Traffic increases, and with congested parking, accidents occur. Police control in small towns is inadequate to cope with the situation. As traffic grows, business people learn that the through highway in front of their door is a menace rather than a blessing. The only argument for the location is that the local people want their main street paved, and local tradesmen have the false idea that their business will prosper if the highway is close to them.

A side street location allows wider right of way on account of lower property values, encourages the segregation of business peculiar to a highway, such as garages and filling station, at a point removed from the business center, and allows through traffic to pass on a location where there is little parking and consequent danger.

The Third International Road Congress in 1913 concluded that, "As a general principle it is better that new main roads be constructed to pass outside rather than through towns, and where an existing main road passing through a town is unsatisfactory for through traffic, it is often better, in preference to widening an existing narrow main road through the center of a town, that new roads should be planned according to the principles of the science of town planning."

This policy was adopted in France many years ago. The Dupont Highway through eastern Delaware was laid out on

this principle and the towns along it have grown and prospered without having the main street on a through highway. Maryland has recently built detours around some of the small towns to avoid congestion and accidents. Had the original location been away from the main street a better alignment could have been obtained at much less expense and trouble.

Safety of operation of motor vehicles requires that the vertical and horizontal curves be designed for 500 foot sight distance. A car traveling thirty miles an hour covers forty-four feet per second. Assuming two seconds to apply the brake and 5.5 seconds to stop the car, the distance traveled is $121 + 88$ or 209 feet. This contemplates good surfacing and prompt attention, and leaves only 82 feet as a factor of safety on a 500 foot sight distance. This is an allowance of one second for each car. With 200 feet vertical curves for breaks of grade of 2 per cent or less, and 50 feet additional length for each additional 2 per cent difference of grade, this sight distance can be obtained on vertical curves.

In planning highway developments it should always be borne in mind that the location is the one permanent feature of the road, if properly made. Grades can be changed as funds become available, and structures may be removed and strengthened to carry heavier traffic. But once a good location is adopted, property develops along it and is almost impossible to change the location. Wide right of ways adjacent to cities are essential to prevent restriction of future development. Alignment should be so planned as to direct traffic to the proper centers of large cities, and to by-pass through traffic.

Where alignment is correct, grades reasonable, and structures fairly permanent, the cost of the related construction may be spread over a long time of payment for these on the permanent features.

In planning any highway liberal allowance must be made for the development of future traffic, each individual location must be considered as an important location on a larger transportation system, and the public must be served satisfactorily.

Discussion

THE CHAIRMAN: We have heard the very interesting address by Mr. Carpenter on the subject of highway location, and I know that Mr. Carpenter will be glad to answer any questions which may occur to our members present.

COL. SHAW: The speaker has touched on the similarity of highway location problems and those of railway location. This was particularly interesting to me for the reason that I have had a feeling that in the past highway engineers have not made as full use as they might of the work that has been done by railway location engineers. I was particularly interested in the remarks on the use of compound curves. Everyone who has had anything to do with railway maintenance knows that a compound curve in the track is an abomination and is to be avoided if possible. In my own experience, I do not recall ever having located but one compound curve, and this was in an especially difficult crossing of the Sierra Madre mountains. If such curves usually can be avoided in railway location in the mountains, it should be practicable to avoid them in highway location unless the governing conditions are exceptionally severe.

I would like to ask the speaker if he does not find that in projecting a location through a fairly rough country it pays to take and plat topography quite in detail and to project a fairly accurate "paper location" of the line before attempting to stake it out on the ground? In railway work, I have always found that it is easier (and cheaper) to run trial lines on paper than on the ground; provided, of course, that the topography has been taken with due regard to both detail and accuracy.

MR. CARPENTER: That is true. I think one of the first things is to map the country project a true line and see if you can get through on it, or work out each way from it.

In rugged sections it is essential to have contours. We desire contours on curves of more than six degrees, if the topography is rough or there is anything that would warrant sharp curves. As a general rule, the State submits the topography to justify sharp curves. That is not exactly the point you have in mind. What you mean is the actual location of the road. You can save a whole

lot of time by making a contour map in new locations through rugged country where you do not have the property lines to contend with.

A great deal of new location was done through the Blue Ridge Mountains of Virginia and North Carolina, and almost all done by railroad locaters, who located a preliminary line, developed a contour map and projected paper location.

MEMBERSHIP LIST.

HONORARY MEMBERS.

SIDNEY F. LEWIS, (C. M.), Member Board of State Engineers, 213-215 New Orleans Court Bldg., New Orleans.

RESIDENT MEMBERS.

- ORLANDO P. ADAMS, (1920), 7503 Maple St., New Orleans.
CHARLES F. AKINS, (1924), 418 Government St., Baton Rouge, La.
LESTER F. ALEXANDER, (1915), Engineer and Contractor, 834 Maison Blanche Annex, New Orleans.
WALTER J. AMOSS, (1924), Engineer with Hampton Reynolds, Contractor, 910 Burdette St., New Orleans.
DOUGLAS S. ANDERSON, (1909), Professor of Electrical Engineering and Dean of the College of Engineering, Tulane University, New Orleans.
KENNETH McGRATH BAILEY, (1924), Engineering Department, Cuyamel Fruit Co., 901 Cherokee St., New Orleans, La.
A. F. BARCLAY, (1908), Engineer Public Belt Railroad, 5670 Rosemary Place, New Orleans.
JOHN S. BARELLI, (1908), Machinery and Power Plant Equipment, 612 Godchaux Bldg., New Orleans.
WALTER J. BARNES, (1925), with N. O. Public Service, Inc., 1437 Nashville Ave., New Orleans.
WADE BARNETT, (1910), Engineer, 8821 Spruce St., New Orleans.
CECIL N. BEAN, (1922), Supervising Inspector Steam Vessels, 10th District, 7928 Oak St., New Orleans.
JAMES D. BECK, (1916), Consulting Engineer, 2331 Constance St., New Orleans.
BEN H. BELL, (1920), 4215 Freret St., New Orleans.
LEONHARDT W. BENZ, (1919), Vice-President and Chief Engineer, Harry Bros. Co., of La., New Orleans.
JOHN H. BERNHARD, (1922), Hibernia Bank Bldg., New Orleans.
EARLE A. BERRY, (1919), Chief Electrician, N. O. Public Service, Inc., 7823 S. Claiborne Ave., New Orleans.
F. N. BILLINGSLEY, (1915), Consulting Engineer, 702 Interstate Bank Bldg., New Orleans.
JAMES W. BILLINGSLEY, (1914), Consulting Engineer, 702 Interstate Bank Bldg., New Orleans.
A. MERRICK BLAMPHIN, (1908), Construction Engineer, Box 897, 606 Maison Blanche Bldg., New Orleans.
HARRY B. BOWLES, (1925), Copp & Bowles Co., 1208 Milan St., New Orleans.
WALTER P. BRANDON, (1907), Draftsman, Public Belt Railroad, 1726 Elysian Fields Ave., New Orleans.
SHIRLEY C. BRASELMAN, (1919), General Manager American Creosote Works, Station F, New Orleans.
FRANK P. BROUSSARD, (1925), with Lukens Steel Co., 4234 S. Miro St., New Orleans.
LOUIS M. BUJA, (1922), Assistant City Engineer, 3112 Esplanade Ave., New Orleans.
EDWARD W. BURGIS, (1919), 528 Bouny St., New Orleans.
R. T. BURWELL, (1908), Manager New Orleans Department, Hartford Steam Boiler Inspection and Insurance Co., 1128 Hibernia Bank Bldg., New Orleans.
C. GLEN CAPPEL, (1915), Vice President, W. Horace Williams Co., Inc., Engineers and General Contractors, 816 Howard Ave., New Orleans.
E. WHEELER CARR, (1908), President, E. W. Carr, Inc., Engineers and Contractors, Appraisers' Estimates, Mechanical Equipment of Buildings, Sokol Automatic Oil Heating for Homes, Ray Rotary Oil Burners for fuel oil installations, 415-417 Gravier St., New Orleans.
D. B. H. CHAFFE, JR., (1920), Vice-President, Southern States Equipment Co., Inc., 712 Canal-Commercial Bldg., New Orleans.

- ROGER E. CHESTNUT, (1925), with Board of Commissioners, Port of New Orleans, 323 Eliza St., New Orleans.
- E. H. COLEMAN, (1911), J. F. Coleman Engineering Co., 814 Hibernia Bldg., New Orleans.
- J. F. COLEMAN, (C. M.), of J. F. Coleman Engineering Co., 814 Hibernia Bldg., New Orleans.
- RAGNER O. COMER, (1922), Designing Engineer, Board of Commissioners, Port of New Orleans, 2219 Adams St., New Orleans.
- JOSEPH B. CONVERSE, (1921), Consulting Engineer, 729 Lowerline St., New Orleans.
- HENRY BELL COOLEY, (1924), Assistant Engineer, City Hall, 1516 Amelia St., New Orleans.
- ROBERT E. CRAIG, II, (1922), Engineer with Doullut & Williams, 1138 Third St., New Orleans.
- CHARLES C. CRAWFORD, (1921), 3227 Coliseum St., New Orleans.
- W. H. P. CREIGHTON, (1912), Professor of Mechanical and Sagan Engineering, Tulane University, New Orleans.
- HORACE E. CRUMP, (1912), Office Engineer, Board of Commissioners of the Port of New Orleans, No. 1 Canal St., New Orleans.
- DAVID L. CULLOM, (1916), Assistant Engineer, Board of Commissioners of the Port of New Orleans, 3620 Baronne St., New Orleans.
- ARTHUR B. DAVIS, (1923), with Virginia Bridge & Iron Co., Box 785, New Orleans.
- CHARLES DAVIS, (1925), Board of Port Commissioners, 4514 Prytania St., New Orleans.
- B. N. DAVIS, (1913), Engineer and Contractor, 1006 Tchoupitoulas St., New Orleans.
- GEORGE J. DE GARMO, JR., (1925), Tulane University, New Orleans.
- EUGENE F. DELERY, (1915), Assistant Engineer, Sewerage & Water Board, 3945 Camp St., New Orleans.
- DONALD DERICKSON, (1912), Professor of Civil Engineering, Tulane University, New Orleans.
- JACQUES de TARNOWSKY, (1915), Structural Engineer, 703 Title Guarantee Bldg., New Orleans.
- J. L. DICKEY, (1915), Civil Engineer and Contractor, 1427 Carrollton Ave., New Orleans.
- M. P. DOULLUT, (1911), Capitalist, 490 Egan St., New Orleans.
- P. C. DOWELL, (1922), Manufacturers' Agent and Structural Engineer, 4920 S. Robertson St., New Orleans.
- PETER J. DROMGOOL, (1923), Superintendent Engineer, Southern and Gulf Districts for Mexican Petroleum Corp., 824 Whitney Bank Bldg., New Orleans.
- ARCHIBALD LEE DUNLAP, (1925), Assistant Professor of Mechanical Engineering, Tulane University, 5829 Clara St., New Orleans.
- ALLAN T. DUSENBURY, (1909), Drainage and Reclamation Engineer, 508 Marine Bank Bldg., New Orleans.
- GEORGE E. EARL, (1900), General Superintendent, Sewerage and Water Board of New Orleans, Room 402 Sewerage and Water Board Bldg., New Orleans.
- RALPH EARL, (1913), Assistant Director of Water Purification Department, 2142 Eagle St., New Orleans.
- JOHN T. EASTWOOD, (1901), Principal Assistant Engineer, Sewerage and Water Board, Sewerage and Water Board Bldg., New Orleans.
- FRED ECKSTEIN, (1924), Assistant Distribution Engineer, New Orleans Public Service, Inc., 1636 Peniston St., New Orleans.
- EUGENE N. EHRHART, (1921), 4218 S. Robertson St., New Orleans.
- FRANK P. ELIZARDI, (1924), with A. M. Lockett & Co., 4825 Carondelet St., New Orleans.
- DANIEL STANLEY ELLIOTT, (1921), Professor of Physics, Tulane University, New Orleans.
- MARION J. EPLEY, (1920), President, Automobile Security Corp., 809 Canal-Commercial Bank Bldg., New Orleans.
- JAMES P. EWIN, (1915), Vice-President and General Manager, Doullut & Ewin, Inc., 208 Queen and Crescent Bldg., New Orleans.
- CHARLES A. FAVROT, (1919), 18 Richmond Place, New Orleans.

- WILLIAM L. FEY, (1922), with Board of Commissioners, Port of New Orleans, 1922 Short St., New Orleans.
- EDWIN J. FISHER, (1913), Proprietor of the Electrical Contracting and Engineering Co., The Electrical Fixture and Material Co., 518-520 Gravier St., New Orleans.
- FREDERICK H. FOX, (1922), Assistant Professor, Civil Engineering, Tulane University, New Orleans.
- ROLAND WOODWARD FRENCH, (1924), with N. O. Public Service, Inc., 7127 Hampson St., New Orleans.
- A. M. FROMHERZ, (1915), President, Jos. Fromherz, Inc., 507 Title Guarantee Bldg., New Orleans.
- FRANK G. FROST, (1919), General Superintendent, Electrical Dept., New Orleans Public Service, Inc., New Orleans.
- HERBERT M. GALLAGHER, (1921), General Manager, Port Utilities Commission, 2723 Octavia St., New Orleans.
- MARCEL GARSAUD, (1905), Chief Engineer, Orleans Levee Board, 201 New Orleans Court Bldg., New Orleans.
- FRANCIS WILLIS GAVIN, (1925), District Manager, Truscon Steel Co., 605 Carondelet Bldg., New Orleans.
- WILL J. GIBBENS, SR., (1900), President, Gibbens & Gordon, Inc., 532-534 Canal St.
- WILL J. GIBBENS, JR., (1924), Secretary, Gibbens & Gordon, Inc., 532-534 Canal St., 1404 Octavia St., New Orleans.
- DAVID J. GODAT, (1924), Assistant Engineer in Charge of Bridges, City Engineer's Office, 7826 Zimble St., New Orleans.
- MAYER GODCHAUX, (1920), 3815 Carondelet St., New Orleans.
- JOSEPH McCORMICK GONDROX, (1924), Structural Engineer with Lukens Steel Co., 12040 Josephine St., New Orleans.
- ARTHUR A. GRANT, (1923), Manager, Jahncke Dry Dock, 2907 Calhoun St., New Orleans.
- WALTER K. GRANT, (1922), 1527 Audubon St., New Orleans.
- W. B. GREGORY, (1907), Professor of Experimental Engineering, Tulane University, and Irrigation Engineer, U. S. Department of Agriculture, Tulane University.
- WILLIAM BRES GREGORY, (1924), Mechanical Engineer with New Orleans Public Service, Inc., 630 Pine St., New Orleans.
- B. H. GREHAN, (1914), 1736 Second St., New Orleans.
- LAFAYETTE F. GRIFFITH, (1925), New Orleans Public Service, Inc., 1033 Broadway, New Orleans.
- A. H. GUILLOT, (1917), Assistant Engineer, New Orleans Public Service, Inc., 201 Baronne St., New Orleans.
- ALLEN S. HACKETT, (1921), Contracting Engineer, 515 Whitney Bldg., New Orleans.
- DAN HALLORAN, JR., (1924), Assistant Engineer, Distribution Department, New Orleans Public Service, Inc., 1111 Elysian Fields Ave., New Orleans.
- FARRAR PETRIE HAMILTON, (1915), President, Creosoted Materials Co., 1126 Hibernia Bldg., New Orleans.
- GEORGE R. HAMMETT, (1920), Sales Engineer, A. M. Lockett & Co., 2016 Calhoun St., New Orleans.
- ALLAN J. HARRIS, (1921), Sales Engineer with Walter Castenado Co., 1423 Adams St., New Orleans.
- Chas. J. HARDY, (1909), Civil Engineer, 2128 S. Gayoso St., New Orleans.
- M. V. HAULARD, (1906), Superintendent of Track, New Orleans Public Service, Inc., 2154 Iberville St., New Orleans.
- W. S. HENNING, (1919), 2025 Robert St., New Orleans.
- WALTER H. HOFFMAN, (C. M.), Civil Engineer, Secretary, Board of State Engineers, 213 New Orleans Court Bldg., New Orleans.
- W. T. HOGG, (1913), Assistant Engineer, Board of Commissioners, Port of New Orleans, 7930 Belfast St., New Orleans.
- FRANK L. HOLT, (1915), Electrical Designer, Engineering Department, Board of Commissioners, Port of New Orleans.
- FERDINAND G. HUMMEL, (1919), 406 Atlanta National Bank Bldg., Atlanta, Ga.

- EDWARD C. HYATT, (1925), Office, City Engineer, 3802 Prytanla St., New Orleans.
 ANDREW W. JACKMAN, (1913), 1704 Calhoun St., New Orleans.
 LEWIS R. JACKSON, (1922), Sales and Engineering, Walsh & Weldner Boller Co., Chattanooga, Tenn., P. O. Box 452, New Orleans.
 ALFRED F. JACOBI, (1922), 3915 Prytanla St., New Orleans.
 HARRY JACOBS, (1919), Civil Engineer, 264 Audubon Blvd., New Orleans.
 ERNEST LEE JAHNCKE, (1900), President, Jahncke Dry Docks Corporation; President, Jahncke Service, Incorporated, New Orleans.
 PAUL F. JAHNCKE, (1908), Vice-President, Jahncke Dry Docks Corporation, 814 Howard Ave., New Orleans.
 JOHN M. JENKS, (1920), with Dock Board, No. 1 Canal St., New Orleans.
 CHARLES JOHNSON, (1925), with Sewerage and Water Board, 323 Olivier St., New Orleans.
 WARREN JOHNSON, (1903), Vice-President and General Manager, Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc., P. O. Box 840, New Orleans.
 C. LEONARD JONES, (1923), Designer, with Dock Board, 2427 Camp St., New Orleans.
 CHARLES E. JOUBERT, (1909), Civil Engineer, 427 Lowerline St., New Orleans.
 ERROL E. KELLY, (1920), 602 Queen and Crescent Bldg., New Orleans.
 JAMES P. KEMPER, (1909), Civil Engineer in Private Practice, 901 Cherokee St., New Orleans.
 CHARLES MACDONALD KERR, (1914), Field Engineer, American Wood Preservers' Association, 5831 S. Robertson St.
 JOHN KLOMER, (1898), City Engineer, City Hall, New Orleans.
 R. B. KOHNKE, (1911), Principal Assistant Engineer, Orleans Levee Board, 119 S. Anthony St., New Orleans.
 ALFRED A. LANAUX, (1921), Gulf Pipe Line Co., 513 Gulf Bldg., Houston, Texas.
 HERRICK J. LANE, (1922), Auditor, W. Horace Williams Co., Inc., 5926 Hurst St., New Orleans.
 EDWARD S. LANPHIER, (1918), Superintendent of Lighthouses, Room 224 Custom House Bldg., New Orleans.
 FERD. L. LARUE, (1919), 823 Esplanade Ave., New Orleans.
 G. W. LAWES, (1898), Civil Engineer, 208 Alva Bldg., 810 Union St., New Orleans.
 RANDALL FRANK LEGEAL, (1923), Distribution Department, New Orleans Public Service, Inc., 2801 Lepage St., New Orleans.
 ALBERT J. LEGETT, JR., (1919), Assistant Manager, Johnson Iron Works, Dry Dock and Shipbuilding Co., 5859 Catina Ct., New Orleans.
 GEORGE R. W. LEWIS, (1925), Distribution Department, New Orleans Public Service, Inc., 2606 Prytanla St., New Orleans.
 J. H. LEWIS, (1908), 203 Romain Bldg., Baton Rouge, La.
 ROWLAND LINFIELD, (1923), 2404 Arabella St., New Orleans.
 A. M. LOCKETT, (1900), President, A. M. Lockett & Co., Ltd., 521 Baronne St., New Orleans.
 GERVAIS LOMBARD, (C. M.), Assistant State Engineer, Board of State Engineers, New Orleans.
 GEORGE LEWIS LORD, (1924), Engineer, Union Title Guarantee Co., 7528 Plum St., New Orleans.
 CHAS. S. McFARLAND, (1903), care J. B. Camors, New Orleans.
 J. A. McNIVEN, (1922), Assistant Engineer, Dock Board, 6034 Hurst St., New Orleans.
 JOSEPH P. MAGUIRE, (1923), Head of Science and Mathematics, Delgado Trade School, 1114 Madison St., McDonoghville, La.
 IVOR ORIN MALL, (1922), with New Orleans Public Service, Inc., 201 Baronne St., New Orleans.
 HENRY J. MALOCHEE, (1898), Vice-President and Engineer, Buckmaster-Luck-Malochee, Inc., Room "E" Association of Commerce Bldg., New Orleans.
 RALPH G. MALONE, (1924), Chief Engineer, Louisiana Fire Prevention Bureau, 2831 Calhoun St., New Orleans.
 RALPH H. MANN, (1921), Assistant Engineer, J. F. Coleman Engineering Co., 814 Hibernia Bldg., 1334 Henry Clay Ave., New Orleans.

26 *Proceedings of the Louisiana Engineering Society*

- ALBION K. MILLER, (1923), A. K. Miller Engineering Co., 109 Tchoupitoulas St., New Orleans.
- JOHN W. MONTGOMERY, (1924), Engineer with Lukens Steel Co., Box 320 New Orleans.
- A. S. MONTZ, (1919), Constructing Engineer, (Structural), 205 Strand Bldg., New Orleans.
- WALTER B. MOSES, (1912), Mechanical and Electrical Engineer; Vice-President, Engineering Sales Co., Inc., 640 S. Peters St., New Orleans.
- ROBERT K. MULNIX, (1922), care New Orleans Chess, Checkers and Whist Club, New Orleans.
- JOHN HENRY MURPHY, (1914), 1322 Felicite St., New Orleans.
- FRANK A. MUTH, (1915), First Assistant Superintendent, Lighthouse Service, 7705 Willow St., New Orleans.
- ALLEN J. NEGROTTO, (1920), Engineer, with J. W. Billingsley, 4914 S. Claiborne Ave., New Orleans.
- BERNARD STANLEY NELSON, (1911), Chief Engineer, A. M. Lockett & Co., Ltd., 521 Baronne St., New Orleans.
- LEROY J. NEWMAN, (1923), with New Orleans Public Service, Inc., 201 Baronne St., New Orleans.
- WILLIAM T. NEWTON, (1915), Master Mechanic, U. S. Engineers, 1004 Broadway, New Orleans.
- WILLIAM F. OAKES, (1918), 707 Title Guarantee Bldg., New Orleans.
- THOMAS D. OAKLEY, (1924), Bragman-Bluff Lumber Co., Puerto Cabezo, Nicaragua, C. A.
- JOHN A. O'BRIEN, (1920), Engineer and Contractor, 1824 S. Dupre St., New Orleans.
- ROBERT M. O'BRIEN, (1916), Superintendent of Equipment, New Orleans Public Service, Inc., 5315 Camp St., New Orleans.
- OLE K. OLSEN, (1905), Contracting Engineer, 822 Perdido St., New Orleans.
- JOHN H. O'NEILL, (1916), Sanitary Engineer, Louisiana State Board of Health, 637 Lowerline St., New Orleans.
- J. DEVEREUX O'REILLY, (1912), Engineer, 1828 Palmer Ave., New Orleans.
- ALBERT B. PATERSON, (1923), Vice-President, New Orleans Public Service, Inc., 2021 Peters Ave., New Orleans.
- FRANK T. PAYNE, (1924), Engineer, Conservation Commission, 128 New Orleans Court Bldg., New Orleans.
- JOHN L. PORTER, (1924), Director, Water Purification Stations, Sewerage and Water Board, 8407 Panola St., New Orleans.
- HYMAN RABINOVITZ, (1911), General Contractor, 205 Strand Bldg., New Orleans.
- CHARLES FREDERICK RANTZ, (1924), Rantz Engineering and Machine Works, 2826 Esplanade Ave., New Orleans.
- LESTER H. RAYNER, (1920), with John H. Murphy Iron Works, 2116 Canal St., New Orleans.
- LYMAN C. REED, (1907), 515-519 S. Peters St., New Orleans.
- HAMPTON REYNOLDS, (1910), General Contractor, 1304 Carrollton Ave., New Orleans.
- JOHN RIESS, (1906), Civil Engineer and Contractor, 503 Carondelet Bldg., New Orleans.
- OSCAR RIESS, (1916), Engineer, with John Riess, Civil Engineer and Contractor, 1423 Milan St., New Orleans.
- GEORGE P. RICE, (1924), with Lukens Steel Co., Box 320, New Orleans.
- JAMES M. ROBERT, (1908), Professor of Machine Design, Tulane University, Director Night Classes in Engineering, Tulane University, New Orleans.
- THOMAS H. ROBERTS, (1923), Mechanical Engineer, 1530 N. Broad St., New Orleans.
- EDWIN J. H. RODRIGUEZ, (1918), Zymothchnic Chemist, 143 Park Row, New Orleans.
- GEORGE C. SCHOENBERGER, (1919), Chief State Engineer, 213 New Orleans Court Bldg., New Orleans.
- ARTHUR M. SCOTT, (1915), Engineer, with Ole K. Olsen, Concrete Engineer, 822 Perdido St., New Orleans.
- HARRY D. SCOTT, (1920), Manager, Standard Fruit and Stemship Co., Celba, Spanish Honduras.

- GEORGE ARTHUR SEAVER, (1920), Chief Engineer, George J. Glover Co., Inc., 1219 Eleanore St., New Orleans.
- A. M. SHAW, (1910), Consulting Engineer, 1412 Hibernia Bldg., New Orleans.
- LESTER C. SMITH, (1920), Secretary-Treasurer, Doullut & Ewin, Inc., 208 Q. & C. Bldg., New Orleans.
- THOMAS SMITH, JR., (1925), Engineering Department, New Orleans Public Service, Inc., 2406 Jena St., New Orleans.
- CHARLES E. SNYPP, (1922), Engineer, with Southern Cotton Oil Co., Gretna, La.
- REINHARD A. STEINMAYER, (1925), Assistant Professor of Geology, Tulane University, 1217 Calhoun St., New Orleans.
- DAVID WHYTE STEWART, (1920), 2329 General Pershing St., New Orleans.
- WAYNE DUDLEY STEWARD, (1925), Field and District Engineer, Portland Cement Association, 1227 Henry Clay Ave., New Orleans.
- JOSEPH L. SWANSON, (1922), President, Swanson-McGraw Co., Consulting Engineers, 705 United Fruit Bldg., New Orleans.
- ALFRED F. THEARD, (C. M.), Drainage Engineer, Sewerage and Water Board Bldg., New Orleans.
- JAMES M. TODD, (1923), Mechanical Engineer with William H. Ennis, 2433 Pine St., New Orleans.
- CHARLES McD. TOWNSEND, (1925), District Engineer, U. S. Engineer Department, 329 Custom House Bldg., New Orleans.
- FREDERICK G. TUPPER, (1922), 1201 Carondelet Bldg., New Orleans.
- EUGENE UNSWORTH, (1919), Assistant Chief Inspector, New Orleans Department Hartford Steam Boiler Inspection and Insurance Co., 1128 Hibernia Bank Bldg., New Orleans.
- BRYSON VALLAS, (1925), Maintenance Engineer, Louisiana State Highway Commission, 4239 Iberville St., New Orleans.
- GILBERT D. VON PHUL, (1916), Engineer-Contractor-Manufacturer, Office, Carondelet Bldg., Works, St. Patrick and St. Louis Sts., New Orleans.
- FRANK H. WADDILL, (1898), Consulting Civil Engineer, 407 Canal Bank Annex, New Orleans.
- GEORGE D. WADDILL, (1911), Assistant Engineer, U. S. Engineers Office, 5219 Camp St., New Orleans.
- J. D. WALKER, (1908), Engineer for Craven and Lang, Carondelet Bldg., New Orleans.
- JOHN H. WALSH, (1922), Manager, Board of Commissioners of the Port of New Orleans, 1529 Henry Clay Ave., New Orleans.
- ALLEN E. WASHBURN, (1908), U. S. Engineer Department, 329 Custom House Bldg., New Orleans.
- ALFRED L. WEBRE, (1913), 20 Kent Road, Upper Darby, Pa.
- LEO S. WEIL, (1918), Mechanical and Electrical Engineer; President, Engineering Sales Co., Inc., 640 S. Peters St., New Orleans.
- LEON C. WEISS, (1918), 613 Maison Blanche Bldg., New Orleans.
- BEN WILLARD, (1900), Local Manager, General Electric Co., 901 Maison Blanche Bldg., 7111 Freret St., New Orleans.
- W. HORACE WILLIAMS, (1908), President and General Manager, W. Horace Williams Co., Inc., Engineers and General Contractors, 816 Howard Ave., New Orleans.
- C. S. WILLIAMSON, JR., (1916), Head of School of Chemical Engineering, Tulane University, New Orleans.
- ARMAND L. WILLOZ, (1922), with Commissioner, Port of New Orleans, 2429 General Taylor St., New Orleans.
- VICTOR L. WILLOZ, (1900), Distribution Engineer, New Orleans Public Service, Inc., 911 Common St., New Orleans.
- J. NORMAN WILSON, (1911), Assistant Engineer, Mechanical Engineering Department, Sewerage and Water Board, 2425 Audubon St., New Orleans.
- WALTER E. WINSHIP, (1921), Marketing and Distributing Petroleum Products, 1404 Whitney Bldg., New Orleans.
- A. R. WINGATE, JR., (1924), Engineering Department, Lukens Steel Co., 1731 Robert St., New Orleans.

ROBERT WOLCOTT, (1923), Manager, Lukens Steel Co., 626 S. Peters St., New Orleans.
 JOHN K. WOOLF, (1922), Manager, Texas Office, Doullut & Williams Co., Inc., 1106
 Second National Bank Bldg., Houston, Texas.
 CHARLES J. WYLER, (1919), Principal Assistant Engineer, A. M. Lockett & Co., Ltd.,
 530 Jackson Ave., New Orleans.
 LOUIS J. WYLER, (1922), Superintendent, Lukens Steel Co., Box 320, New Orleans.
 SAMUEL YOUNG, (1911), Chief Engineer, Port Commission, No. 1 Canal St., New
 Orleans.
 HENRY L. ZANDER, (1898), Civil Engineer, 821 N. Rampart St., New Orleans.
 ANTHONY M. ZIBILICH, (1922), Assistant Superintendent, U. S. Lighthouse Service,
 969 Wilson Drive, New Orleans.

NON-RESIDENT MEMBERS.

JAMES R. ADAMS, (1911), Lake Providence, La.
 FELIX L. ALCUS, (1922), with L. T. Alcus & Co., Ltd., Pearl River, La.
 LEWIS SCHERCK ALCUS, (1922), 7445 Maple St., New Orleans.
 EDWARD A. ARPIN, (1918), Florence, La.
 JOSEPH P. BERANGER, (1915), Chief Engineer, West India Sugar Finance Corp., 129
 Front St., New York City.
 M. A. BERANGER, (1918), General Manager, Bernard Lodge Central, Grange Lane,
 Jamaica, B. W. I.
 MERRILL BERNARD, (1917), Civil Engineer, Crowley, La.
 JOS. M. BING, (1917), Consulting Engineer, 53 Hamilton Terrace, New York City.
 A. L. BLACK, (C. M.), with Ford, Bacon and Davis, Inc., 58 Sutter St., San Francisco,
 Calif.
 R. W. BRINGHURST, JR., (1912), Commissioner Parks and Streets, P. O. Box 706,
 Alexandria, La.
 FOREST LEROY BUCKLEY, (1923), Resident Engineer with J. W. Billingsley, Harrison-
 burg, La.
 JOHN CALLAN, (1918), care W. F. Biggs Engineering Co., Volunteer Bldg., Chattanooga,
 Tenn.
 H. D. CAMERON, (1914), Superintendent, Tulsa Light & Power Co., Tulsa, Okla.
 THEO. F. CHENET, (1922), Resident Engineer, Arkansas Highway Commission, Bates-
 ville, Ark.
 L. C. DATZ, (1906), Chief Engineer, Memphis Power & Light Co., 16 S. Second St.,
 Memphis, Tenn.
 JOHN J. DAVIDSON, (1918), care Avoca P. O., Morgan City, La.
 GEORGE H. DAVIS, (1909), Member Ford, Bacon & Davis, Inc., 115 Broadway, New
 York City.
 A. D'HEUR, (C. M.), Vice-President, Pacific Oil Co., 79 New Montgomery St., Room 543,
 San Francisco, Calif.
 WILLIAM F. EBLEN, (1916), Houston Light & Power Co., Houston, Texas.
 L. P. ELBERSON, (1911), Superintendent, Louisiana Irrigation & Mill Co., Crowley, La.
 S. WALLACE ELBERSON, (1911), Engineer with A. M. Lockett & Co., Crowley, La.
 FRANK E. EVERETT, (1914), Civil Engineer, Crowley, La.
 CHARLES H. FENSTERMAKER, (1914), Chief Engineer, Industrial Lumber Co., Engi-
 neer, Road District No. 5, Allen Parish, Elizabeth, La.
 FRANCIS T. FOOTE, (1909), Lumber Business, Kaplan, La.
 JAMES McC. FOURMY, (1916), Consulting Engineer, Hammond, La.
 A. A. FRASER, (1922), Engineer, The Building Products Co., 350 Woodruff Co., 350
 Woodruff Ave., Toledo, Ohio.
 FLOYD HAMILTON, (1919), Lake Charles, La.
 JACK HARRIS, (1924), Superintendent of Construction, Harrisonburg, La.
 JOHN LOVEJOY HENNING, (1919), 525 Kirby St., Lake Charles, La.
 FREDERICK McH. HILL, (1919), Monroe, La.
 SAMUEL A. HONAKER, (1922), Civil Engineer, 615 Jordon St., Shreveport, La.
 GEORGE P. HOPKINS, (1922), Contractor, Gulfport, Miss.
 CHARLES L. JACOB, (1911), 600 Kerlerec St., New Orleans.

- E. S. JARRETT, (1909), President, Jarrett-Chambers Co., Inc., Contractors, 30 E. 42nd St., New York City.
- XAVIER KRAMER, (1911), Consulting Engineer, McComb, Miss.
- JULES A. LORIO, (1921), Gelsmar, La.
- L. A. LOUSTALOT, (1913), General Contractor, Hammond, La.
- R. S. McCORMICK, (1922), District Maintenance Engineer, Louisiana Highway Commission, Napoleonville, La.
- HERBERT H. McGEHEE, (1920), 432 S. Boulevard, McComb, Miss.
- RUFUS S. MANLEY, (1912), President, Texas Creosoting Co., Orange, Texas.
- ERNEST J. MEAD, (1923), Forest Engineer, 2219 Broadway, Beaumont, Texas.
- HENRY A. MENTZ, (1915), Consulting Engineer, Magnolia, Miss.
- JULIAN DUNBAR MONETTE, (1921), Resident Engineer, State Highway Department, Calhoun City, Miss.
- J. D. MURPHY, (1922), Civil Engineer, Mandeville, La.
- CHARLES W. OKEY, (1911), 807 McCall Bldg., Memphis, Tenn.
- WILLIAM C. OLSEN, (1911), Consulting Engineer, Raleigh, N. C.
- GUY OSBORNE, (1913), Gable, S. C.
- BOYKIN W. PEGUES, (1907), Professor of Civil Engineering, Louisiana State University, Baton Rouge, La.
- H. N. PHARR, (1908), Sugar Planter and Manufacturer, Olivier, La.
- H. A. PHILIPPI, (1912), Civil Engineer and Superintendent of Construction, 316 Audubon St., New Orleans.
- FREDERICK F. PILLET, (1922), Associate Professor, Civil Engineering, Louisiana State University, 613 St. Mary St., Baton Rouge, La.
- OTTO F. REISZNER, (1916), Reiszner & White, Civil Engineers, Lecompte, La.
- FRANK LOUIS REYNOLDS, (1919), Construction Superintendent, Todd, Robertson and Todd Engineering Corporation, 476 Clinton Ave., Brooklyn, N. Y.
- WILLIAM H. RHODES, (1922), Maintenance Engineer, Oklahoma Highway Commission, Oklahoma City, Okla.
- W. B. ROBERT, State Highway Engineer, Baton Rouge, La.
- FRANK L. ROE, JR., (1920), Omega, Madison Parish, La.
- J. F. ROSS, (1922), County Engineer, Crenshaw County, Box 175, Luverne, Ala.
- FRED E. SMITH, C. E., (1916), care Texas Construction Co., Box 197, Houston, Texas.
- JOHN A. SALMEN, (1911), Vice-President, Salmen Brick & Lumber Co., Ltd., Slidell, La.
- T. H. SAMPSON, (1900), Ambarwood Manufacturing Co., P. O. Box 138, Helena, Ark.
- REGINALD McC. SCHMIDT, (1915), Junior Engineer, 4th District, Mississippi River Commission, 1023 Leontine St., New Orleans.
- GEORGE SELMAN, (1908), Surveying and Engineering, Box 596, Monroe, La.
- HOBART D. SHAW, (1917), City Engineer and General Practitioner, Gulfport, Miss.
- ELMER E. SHUTTS, (1918), Lake Charles, La.
- JOHN A. SILSBEE, (1915), Consulting Petroleum Engineer, Okmulgee, Okla.
- WILLIAM LUKE SIZEMORE, (1923), with J. W. Billingsley, Jonesville, La.
- JULIUS SLOVENKO, (1924), 1834 S. Millard Ave., Chicago, Ill.
- T. BAKER SMITH, (1919), Houma, La.
- JOHN Y. SNYDER, (1918), Engineer, 1210-1211 Merchants Bldg., Shreveport, La.
- IRA W. SYLVESTER, (1901), Consulting Engineer, Rapides Bank Bldg., Alexandria, La.
- ROGER I. TANNER, (1921), Abbeville, La.
- STEWART TICHNOR, (1922), Standard Oil Co., Shreveport, La.
- WM. F. TRIGGS, (1914), Operating and Maintenance Engineer, E. Fifth St., Crowley, La.
- THOS. H. TUTWILER, (1898), President and General Manager, The Memphis Street Railway Co., also President, Memphis Power and Light Co., Memphis, Tenn.
- WM. VON PHUL, (1908), Ford, Bacon & Davis, Inc., 115 Broadway, New York, N. Y.
- J. LESTER WHITE, (1920), Reiszner & White, Civil Engineers, Lecompte, La.
- W. S. WHITE, (C. M.), Box 44, Sulphur, La.
- A. A. WOODS, (1911), Chief Engineer, Maintenance of Ways and Structures, Southern Railway System, Lines West, 506 Southern Railway Bldg., Cincinnati, Ohio.
- D. F. WOODS, (1922), Litcher, La.

ASSOCIATE MEMBERS.

- JOHN A. ABELE, (1922), Manager, Woodward, Wight & Co., 3215 Palmyra St., New Orleans.
- RAYMOND P. BASSICH, (1923), Manager, N. O. Blue Print & Supply Co., Inc., 824 Union St., New Orleans.
- R. H. BAUMBACH, (1911), Manager, Eugene Dletzgen Co., 316 Camp St., New Orleans.
- JOSEPH BRENNAN, (1920), General Superintendent, 400* Caruth Court, Dallas, Texas.
- E. C. BROWN, (1915), Sales Engineer, 3820 St. Charles Ave., New Orleans.
- LEWIS McCLELLAN DALGARN, (1921), 1517 Nashville Ave., New Orleans.
- H. W. FLETCHER, (1913), Treasurer and General Manager, The Clyde Co., Inc., 309 Magazine St., New Orleans.
- GEORGE B. GIBSON, (1921), 2103 Palinter St., New Orleans.
- GEORGE J. GLOVER, (1916), General Contractor, 1032-1035 Whitney Bldg., New Orleans.
- JULES GODCHAUX, (1899), 221 Golchaux Bldg., New Orleans.
- EDWARD R. GREENLAW, (1925), President, Greenlaw Truck and Tractor Co., 6831 West End Blvd., New Orleans.
- WALTER F. JAHNCKE, (1920), Secretary-Treasurer, Jahneke Service., Inc., 814 Howard Ave., New Orleans.
- A. A. KEITHER, (1919), 234 S. Scott St., New Orleans.
- JOHN McINERNEY, (1920), Construction Superintendent, Detroit Free Press, Detroit, Mich.
- EDWARD T. MALLOY, (1920), 1211 N. Hagan Ave., New Orleans.
- EDWIN L. POWELL, (1914), President, New Orleans Coffee Co., 1531 Exposition Blvd., New Orleans.
- JOHN J. STEADHAM, (1912), Supervisor, Bridges and Buildings, N. O. & N. E. R. R. and N. O. T. Co., Room 308 Ross Bldg., Hattiesburg, Miss.
- F. W. STEVENS, (1909), Manager, New Orleans District Sales Office, Allis-Chalmers Mfg. Co., 719 Maison Blanche Bldg., New Orleans.
- JAMES W. SPENCE, (1921), President, Cresartile Roofing Co., Inc., Lopez and Julia Sts., New Orleans.
- HENRY H. WATERS, (1922), 715 Hibernia Bldg., New Orleans.

NON-RESIDENT ASSOCIATE MEMBERS.

- CECIL A. EBY, (1922), Box 1085, Shreveport, La.
- LOUIS G. FLOWER, (1922), care of Layne & Bowler Co., 1510 McGowan Ave., Houston, Texas.

RESIDENT JUNIOR MEMBERS.

- HENRY HESTER BATE, (1921), Civil Engineer, Huasteca Pet. Corp., Tampico, Tampas, Mexico.
- J. J. BULLUING, (1915), Market Street Power House, New Orleans.
- JOHN S. BURKE, (1925), Distribution Engineering Department, New Orleans Public Service, Inc., 8219 Neron St., New Orleans.
- F. FOWLER CASE, (1922), Draftsman with Sewerage and Water Board, 823 Arabella St., New Orleans.
- DONALD C. DUPLANTIER, (1922), Assistant Engineer, New Orleans Public Service, Inc., 1326 Lowerline St., New Orleans.
- JOHN WALTER EMBRICH, (1925), Civil Engineer with New Orleans Public Service, Inc., 250 City Park Ave., New Orleans.
- EDWIN FRANK, (1925), 2375 Laurel St., New Orleans.
- JAMES L. FULMER, (1923), with Cumberland Telephone and Telegraph Co., 2238 General Pershing St., New Orleans.
- LOUIS KAUFMAN GOOD, (1923), Material Clerk and Labor Foreman, Box 1109, Monroe, La.
- HORATIO L. GILBERT, (1917), Surveyor, 602 Queen and Crescent Bldg., New Orleans.
- GILBERT TESLA GRAY, (1925), with New Orleans Public Service, Inc., 1321 Nashville Ave., New Orleans.

- WALTER HOLLOWAY, (1923), Distribution Engineering Department, New Orleans Public Service, Inc., 911 Common St., 34 Washington Ave., Ocean Springs, Miss.
- MAURICE F. HUNT, (1919), 3629 Chestnut St., New Orleans.
- S. DOUGLAS JACKSON, (1916), 326 Ward Bldg., Shreveport, La.
- JOSEPH W. JOACHIM, (1919), President and Manager of Home Ice Co., 5117 Prytanla St., New Orleans.
- WILHELM EMIL Koch, (1913), Civil Engineer, 2627 Colliseum St., New Orleans.
- ROBERT JAMES KUHN, (1925), Electrolysis Engineer, New Orleans Public Service, Inc., 529 Washington Ave., New Orleans.
- CHARLES RENE MADUELL, (1925), Engineering Department, Board of Commissioners, Port of New Orleans, 5650 Ada Place, Lawview, New Orleans.
- ALEX H. McCOMISKEY, JR., (1919), 2837 Carondelet St., New Orleans.
- GORDON J. McLEAN, (1924), Assistant Engineer, New Orleans Public Service, Inc., 1544 Henry Clay Ave., New Orleans.
- EDWARD M. NABERSCHNIG, JR., (1923), Works Superintendent, Southern Cotton Oil Co., Gretna, La., 5206 St. Peters St., New Orleans.
- ROBERT A. PIERPONT, (1915), Engineer, The Celotex Co., 1036 Napoleon Ave., New Orleans.
- CHARLES L. RITTENBERG, (1923), Draftsman, with Dock Board, 2634 Marengo St., New Orleans.
- CLIFFORD HOEY STEM, (1914), Sales Engineer, 7933 Willow St., New Orleans.
- S. A. THEARD, (1920), Assistant Engineer, Louisiana State Highway Commission, Baton Rouge, La.

NON-RESIDENT JUNIOR MEMBERS.

- G. O. ALLAIN, JR., (1916), Division Plant Engineer, Cumberland Telephone & Telegraph Co., Nashville, Tenn.
- G. C. BADGER, (1913), Superintendent of Engineering and Construction, Grinnell Co., of the Pacific, 453 Mission St., San Francisco, Calif.
- JOHN L. EBAUGH, (1922), Drexel Institute, Philadelphia, Pa.
- E. C. GRAVELY, (1918), Design Engineer, 602 Sewerage and Water Board Bldg., New Orleans.
- C. A. IVES, JR., (1922), Louisiana Highway Commission, 256 St. Phillip St., Baton Rouge, La.
- JACOB F. MULLER, JR., (1912), Plant Superintendent, Muller Furniture Manufacturing Co., Ltd., 3731 Canal St., New Orleans.
- HERBERT P. NATHAN, (1913), Mechanical Engineer, Southwestern Engineering Corporation, 632 Lafayette Ave., Culver City, Calif.
- JAMES KILBOURNE PETRIE, (1924), Natchitoches, La.
- J. B. REYMOND, (1922), 709 Main St., Baton Rouge, La.
- CARL SCHNEIDER, (1916), Superintendent, Municipal Repair Plant, 7711 Plum St., New Orleans.
- LUCIEN J. TROXLER, JR., (1915), Assistant Radio Engineer, Camp Alfred Vall, 55 Bergen Place, Red Bank, N. J.

STUDENT MEMBERS.

- MICHAEL CHARLES ABRAHAM, 816 Cherokee St., New Orleans.
- R. L. ATKINSON, 312 Audubon Blvd., New Orleans.
- SALVADOR DI BENEDETTO, 4526 St. Claude Ave., New Orleans.
- PERCY L. BERNSTEIN, Tulane University, New Orleans.
- LESTER B. CLARK, 6318 S. Robertson St., New Orleans.
- JAMES MURRAY CRACROFT, 1539 Exposition Blvd., New Orleans.
- WALTER COOKE, 2728 Louisiana Ave., New Orleans.
- EDWIN E. ELAM, 1131 Cadiz St., New Orleans.
- CHARLES JULIUS FRITCHE, Slidell, La.
- VIC F. HARTEL, 1001 Prytanla St., New Orleans.
- E. C. HAWKINS, 7919 Panola St., New Orleans.

W. T. HESS, 7917 Burthe St., New Orleans.
 ARTHUR M. HILL, 1322 Arabella St., New Orleans.
 EDMOND FAYRE HUGHES, 2126 Robert St., New Orleans.
 E. LAWES KLEINPETER, 2210 Nashville Ave., New Orleans.
 FRANCIS A. LANDRIEU, 1113 N. Rampart St., New Orleans.
 LEO LEVY LOWENTRITT, 1620 Audubon St., New Orleans.
 HAROLD E. MEADE, 119 Audubon Blvd., New Orleans.
 ARTHUR J. NAQUIN, JR., 524 Audubon St., New Orleans.
 J. F. NUNENMACHER, 4915 Baccich St., New Orleans.
 PHILIP PHILLIPS, 2428 General Taylor St., New Orleans.
 ASHLEY HURT ROBINSON, 1735 Palmer Ave., New Orleans.
 G. P. ROBBINS, JR., with Allis-Chalmers Co., 1816 Magnolia St., Dallas, Texas.
 EVERETT G. ROESSLE, 1019 Leontine St., New Orleans.
 JOSEPH HENRY SAUCIER, 2616 Ursuline St., New Orleans.
 S. B. SCHWARTZ, Assistant Superintendent, Maginnis Cotton Mills, New Orleans.
 LEWIS MONROE SHELTON, 4915 Baccich St., New Orleans.
 JOSEPH F. THOMSON, 139 S. Genois St., New Orleans.
 JOHN MORT WALKER, JR., 6039 Prytanla St., New Orleans.
 O. P. WALKER, 5918 Chestnut St., New Orleans.
 CHARLES CARROLL WIGGIN, JR., 3203 Napoleon Ave., New Orleans.
 CHARLES LAFAYETTE WRIGHT, JR., Romeville, La.
 ALBERT G. WYLER, 530 Jackson Ave., New Orleans.

SUMMARY.

Honorary Member.....	1
Resident Members.....	207
Non-Resident Members.....	79
Associate Members.....	20
Non-Resident Associate Members.....	2
Junior Members.....	25
Non-Resident Junior Members.....	11
Student Members.....	33
Total.....	378

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, January 10, 1925.

The meeting was called to order with President Robert in the chair and the following members present:

Messrs. Garsaud, Lanphier, Hamilton, Moses and Muth.

The minutes of the previous meeting were read and approved and bills on hand were ordered paid.

The resignations of the following were accepted with regret: Edw. W. Bres, R. O. Comer, A. C. Davis, John L. Ebaugh, Jr., Wm. H. Rhodes.

Letter from the Treasurer was read advising the Board that a Motor Lien Certificate of \$1,000.00 had matured and he requested authority to reinvest this fund. On motion duly seconded it was voted to authorize the Treasurer to reinvest this money and the Secretary was instructed to so advise the Treasurer by letter.

The matter of award of the Ole K. Olsen Prize Fund for the member bringing in the largest number of new memberships was brought up by the Secretary and award of \$50.00 was made to W. B. Gregory, Jr., as he was credited with twenty-five memberships.

The annual reports were read from the Board of Direction, Treasurer, and Secretary, and the Secretary was instructed to read them at the meeting of the Society which followed.

The meeting then adjourned.

F. A. MUTH, Secretary.

Minutes of Annual Meeting of the Society, January 10, 1925.

The annual meeting was called to order about 8:10 P. M. with President Robert in the chair and twenty-four members and guests present. Minutes of the previous meeting were read and approved.

The Secretary read the annual reports of the Board of Direction, Treasurer, and Secretary. On motion, duly seconded, it was voted that these reports be received and that the officers for the year 1924 be thanked for their services.

Announcement was made that the \$50.00 prize of the Ole K. Olsen Prize Fund was awarded by the Board to W. B. Gregory, Jr., as he was credited with twenty-five new members. On motion, duly seconded, it was voted that Mr. Olsen be advised of the award and that he be thanked for the Prize Fund which he had so generously donated.

Ballots for new members and for officers for 1925 were opened. There were 100 formal ballots cast for members and the following were elected:

Resident Members.

Walter J. Barnes,
 Harry B. Bowles,
 Frank P. Broussard,
 Roger E. Chestnut,
 Charles Davis,
 George J. De Garmo, Jr.,
 Archibald Lee Dunlap,

Francis Willis Gavin,
 Lafayette F. Griffith,
 George R. W. Lewis,
 Thomas Smith, Jr.,
 Reinhard A. Steinmayer,
 Wayne Dudley Steward,
 Charles McD. Townsend,

Bryson Vallas.

For Reinstatement, Resident Members.

Edward C. Hyatt,

Charles Johnson.

Resident Associate Member.

Edward R. Greenlaw.

Junior Members.

John S. Burke,
 John Walter Emrich,
 Edwin Frank,

Gilbert Tesla Gray,
 Robert James Kuhn,
 Charles Rene Maduell.

Student Members.

Salvador Di Benedetto,
 Percy L. Bernstein,
 Lester B. Clark,
 James Murray Cracroft,
 Edwin E. Elam,
 Charles Julius Fritchie,
 Vic F. Hartel,
 Edmund Favre Hughes,
 E. Lawes Kleinpeter,

Francis A. Landrieu,
 Leo Levy Lowentritt,
 J. F. Nunenmacher,
 Philip Phillips,
 Everett G. Roessle,
 Lewis Monroe Shelton,
 Joseph F. Thomson,
 John Mort Walker, Jr.,
 Albert G. Wyler.

There were 111 formal ballots cast for officers and the following were elected for the ensuing year:

Marcel Garsaud, President.

Farrar P. Hamilton, Vice-President.

F. A. Muth, Secretary.

Walter B. Moses, Treasurer.

Orlando P. Adams, Director to serve three years.

The meeting then adjourned to the Annual Smoker held at Kolb's Restaurant, which was much enjoyed by all.

F. A. MUTH, Secretary.

Special Meeting of the Board of Direction, January 10, 1925.

A special meeting of the Board of Direction was held after the meeting of the Society. President Robert was in the chair and the following were present: Messrs. Garsaud, Lanphier, Hamilton, Moses, Muth.

Dr. D. S. Elliott was unanimously elected Director to serve the unexpired term of Farrar P. Hamilton, who was advanced to Vice-President.

The meeting then adjourned.

F. A. MUTH, Secretary.

ANNUAL REPORT OF THE BOARD OF DIRECTION.

Year 1924.

New Orleans, La., January 4, 1925.

To the Members of the Louisiana Engineering Society:

Gentlemen: Your Board of Direction begs to report that during 1924 there were held eleven regular and two special meetings or a total of thirteen meetings of the Board for the transaction of the business of this Society.

Our Technical Papers Committee has given us an excellent program of very high grade papers.

Our Library Committee has done very excellent work and a number of books suggested by the members have been added during the year. The Committee has also provided keys to the library, which the membership has been notified can be secured from the Secretary by making a deposit therefor.

The Membership Committee has done good work, and during this year attention was again invited to the Ole K. Olsen Prize Fund of \$150.00. With the permission of the donor, the fund was divided into two parts, that of \$100.00 which was awarded for the year 1923 to Charles M. Kerr and another prize of \$50.00 which was announced would be awarded to the member securing the largest number of new memberships during this year. The award will be made at an early meeting of the Board.

The increase in membership this year has been most gratifying in that a total of fifty-three were elected. Of course, as usual there have been a number of resignations and adjustments, and with two deaths the net increase amounts to thirty members. It may be of interest to note the net increase during the past ten years:

1915.....	36	1920.....	11
1916.....	26	1921.....	11
1917.....	5	1922.....	41
1918.....	11	1923.....	11
1919.....	28	1924.....	30

The Publication Committee has given us six very excellent issues of the Proceedings during 1924. This Journal has a much wider influence than its circulation would lead one to believe. Numerous requests are made from the different parts of the country for copies or re-prints of articles which have been published therein. The maintenance and continuance of the Journal, however, depends largely upon the number of advertisements included in each issue. We are justly proud of this Journal and our Editor, Professor Douglas Anderson, who deserves the highest praise for the high quality and tone of this magazine. It forms a very powerful factor in the interest and enthusiasm of our Society, and every member should do what he can to secure advertisements to main-

tain the high character of the Proceedings. More advertisements are needed to keep the Journal on a firm financial basis. The Committee on Publications Division B has done good work this year, yet we are hopeful great gains will be made next year.

The financial statement shows that the Proceedings reserve fund has decreased \$120.26.

Splendid work has been done by the Special Committee appointed by the President to confer with the representatives of the other Engineering Societies and the Louisiana State Board of Engineering Examiners to investigate and report on further legislation relating to licensing of engineers.

Attention is called to the financial condition of the Society. Our investments are well placed and amount to \$3,700.26. The general reserve fund amounts to \$3,368.11, and the Proceedings reserve fund has a balance of \$1,127.41. The Treasurer's report shows a cash balance on January 1, 1925, of \$769.87.

In conclusion, the Board wishes to thank the various committees and members of the Society for their co-operation and interest in carrying on so successfully the work of the Society.

Respectfully submitted,

JAMES M. ROBERT, President,
MARCEL GARSAUD, Vice-President,
F. A. MUTH, Secretary,
WALTER B. MOSES, Treasurer,
F. P. HAMILTON,
E. S. LANPHIER,
CHARLES M. KERR,
JOHN S. BARELLI,

Board of Direction.

ANNUAL REPORT OF THE SECRETARY.

Year 1924.

New Orleans, La., January 4, 1925.

To the Board of Direction, Louisiana Engineering Society, New Orleans, La.:

Gentlemen: As Secretary of the Society, I herewith submit the following report for the year 1924.

During the past year the Board of Direction held eleven regular meetings and two special meetings; the Society held ten regular meetings with an average attendance of 48, maximum 74, minimum 28. One of the meetings of the Society was a joint meeting of the Local Section of the American Society of Civil Engineers, and the Society had the honor of having present Mr. C. E. Grunsky, President, and Mr. John H. Dunlap,

Secretary, American Society of Civil Engineers. The Society also had the pleasure of having Mr. L. W. Wallace, Executive Secretary of the American Engineering Council, address the membership.

The membership shows a steady increase from year to year. This year there has been a net increase of thirty members, although there were a total of fifty-three members elected and reinstated.

GRADE	On Roll Jan. 1, 1924	Elected	Reinstated	Transferred to	Transferred from	Dropped	Resigned	Failed to Qualify	Died	On Roll Jan. 1, 1925
Honorary	1	...	...	...	...	...	...	...	...	1
Resident	191	26	2	1	2	3	6	...	2	207
Non-Resident	84	1	...	2	1	3	4	...	...	79
Associate	21	1	...	...	...	...	2	...	...	20
Non-Res. Associate	2	...	...	...	...	...	...	...	...	2
Junior	20	6	...	...	1	...	...	...	...	25
Non-Res. Junior.....	10	1	...	1	...	...	1	...	...	11
Student	19	18	...	...	...	3	1	...	...	33
Non-Res. Student..	...	...	...	...	...	...	...	...	...	...
Total.....	348	53	2	4	4	9	14	...	2	378

It is with great regret that we report the deaths of Major Frank M. Kerr on May 5, 1924, and Mr. Duncan Buie on June 5, 1924, both Resident Members.

The Treasurer's Report is submitted separately and shows a cash balance of \$769.87.

During the year the investment account as submitted in the Treasurer's Report stands as follows:

2—\$100.00 Second Liberty Loan.....	\$ 200.00
2— 100.00 First Liberty Loan.....	200.00
1— 50.00 First Liberty Loan.....	50.00
5— 50.00 1917 First Liberty Bonds.....	250.00
1—Motor lien certificate.....	1,000.00
Greater New Orleans Homestead certificate.....	750.00
Savings Account realized from the sale of certificates	1,250.26
Total.....	\$3,700.26

In addition to the above the Society still holds a share in the New Orleans Building, Louisiana State Fair, costing \$100.00.

The following technical exercises have been held:

February 11.—Mr. Eugene F. Delery, Design Engineer, Sewerage and Water Board, spoke on the "Comparison of Pump Tests."

March 10.—Colonel A. M. Shaw, Consulting Engineer, spoke on the "American Engineer in the Tropics."

April 14.—Mr. C. E. Grunsky, President, American Society of Civil Engineers, spoke on the "Influence of Engineering on Social and Economical Progress."

May 12.—"Natural Gas Problem as Applied to the City of New Orleans," by Frank T. Payne, Engineer, Louisiana State Conservation Commission.

June 9.—"The A. C. Underground Distribution in New Orleans," by Mr. W. R. Bullard, Engineer with the Phoenix Utility Co.

Mr. L. W. Wallace, Executive Secretary of the American Engineering Council, Washington, D. C., gave an interesting talk on "The Work of the American Engineering Council."

September 8.—"The Story of the Motor Truck" (motion picture film), by Mr. E. R. Greenlaw.

Following the film there was a discussion of proposed change in the licensing law as related to engineers.

October 13.—"Water Purification," by Mr. John L. Porter, Director of Water Purification Stations, Sewerage and Water Board.

November 10.—"Principal So-Called Surface Indicators and Their Relation to the Occurrence of Oil," by R. A. Steinmayer, Assistant Professor of Geology, Tulane University.

December 8.—"A General Discussion of Highway Location," by Mr. J. C. Carpentier, Assistant District Engineer, U. S. Bureau of Public Roads, Fort Worth, Texas.

Attached hereto are statements showing the financial condition of the Society.

During this year an innovation was instituted in giving luncheons in a nearby restaurant in lieu of the usual collation which has heretofore been served in the corridor of the State Museum. At the restaurant the members have been enabled to fraternize and all reports received have been most favorable for continuing this plan for cultivating the social activities of our Society.

Another feature which has given satisfaction to the membership is the employment at our meeting of a uniformed watchman to watch the automobiles of the members attending the meeting.

The following is quoted from the October, 1924, issue of the Proceedings of our Society relative to the activity shown by this Society in connection with the revision of the Building Code:

"It is characteristic of the spirit of the Louisiana Engineering Society that it always stands ready to lend its co-operation and assistance to any public movement for the good of the city and community. It is not surprising, therefore, to find that the membership of the Society is

well represented upon the committees which have charge of the work of revising the building code of the City of New Orleans. Mr. F. A. Muth, Secretary of the Society, and engineer with the Lighthouse Department of the United States, has been given temporary release from the latter position in order to enable him to serve as secretary and technical expert of the Advisory Committee on Revision of the Code. Col. Marcel Garsaud is Chairman of this Committee, and the following Society members are on the Committee: A. S. Montz, R. G. Malone, Donald Derickson.

Professor Derickson is also Chairman of the Sub-Committee of the Louisiana Engineering Society, which consists of the following members: A. M. Shaw, J. F. Coleman, G. A. Seaver, A. B. Davis, W. T. Hogg, C. G. Cappel, G. P. Rice, John Riess, J. de Tarnowsky, E. F. Delery, J. L. Porter, F. A. Muth. Douglas Anderson is also Chairman of the Electrical Sub-Committee which is handling that particular phase of the revision."

Your Secretary wishes to express his appreciation of your co-operation during the past year. It has been an honor and a privilege to serve you. I thank you.

Respectfully submitted,

FRANK A. MUTH, Secretary.

FINANCIAL CONDITION OF THE SOCIETY, JANUARY 1, 1925.

Assets:

Cash on Hand.....	\$ 769.87
Membership Accounts Receivable.....	796.00
Advertisers' Accounts Receivable.....	304.16
Investments	3,700.26
Expense of Delegates.....	9.54
Entrance Fees.....	10.00
	—————\$5,589.83

Liabilities:

Library Fund.....	\$ 553.32
Proceedings Reserve Fund.....	1,127.41
Ole K. Olsen Prize Fund.....	50.00
Building Fund.....	151.65
Accounts Payable.....	335.84
Dues in Advance, 1925.....	3.00
	————— 2,221.72
	————— \$3,368.11

General Reserve Fund.

Balance from 1914.....	\$ 165.00
Balance from 1915.....	189.75
Balance from 1916.....	377.45

40 *Proceedings of the Louisiana Engineering Society*

Balance from 1917.....	299.49
Balance from 1918.....	27.47
	\$1,059.16
Deficit from 1919.....	62.93
	\$ 996.23
Balance from 1920.....	198.09
Balance from 1921.....	90.94
Balance from 1922.....	1,186.58
Balance from 1923.....	309.84
Balance from 1924.....	586.43
Total.....	\$3,368.11

General Fund, Year 1924.

Revenues:

Membership Dues.....	\$3,173.75
Smoker Account.....	272.50
Entrance Fees.....	246.00
Deposits for Keys.....	3.50
Cash (A. S. M. E.).....	25.00
1923 Dues Collected.....	11.00
Gain in Investments.....	100.00
	\$3,832.05

Expenses:

Subscription to Proceedings.....	\$ 686.00
Appropriation to Library.....	480.00
Losses on Non-payment of Dues.....	109.25
Secretary Account.....	420.00
Dues of Secretary.....	12.00
Printing and Postage.....	340.61
Refreshments	130.30
General Expense.....	122.82
Exchange	6.05
Smoker Expense.....	460.46
Dues, American Engineering Council.....	270.08
Auditing	50.00
1922 Balances, Closed, December 31, 1924.....	158.05
	3,245.62
	\$ 586.43

Proceedings Reserve Fund.

Balance from 1915.....	\$ 112.20
Balance from 1916.....	566.13
Balance from 1917.....	568.14
Balance from 1918.....	567.52
Balance from 1919.....	41.08
Total Balances.....	\$1,855.07
Deficit for 1920.....	221.98
	\$1,633.09
Balance from 1921.....	26.25
	\$1,659.34
Deficit from 1922.....	\$ 301.02
Deficit from 1923.....	110.65
Deficit from 1924.....	120.26
	531.93
Total Balance on Hand.....	\$1,127.41

Proceedings Fund, Year 1924.

Revenues:

Advertisements	\$1,002.20
Subscription Members.....	686.00
Proceedings Sales.....	1.85
	\$1,690.05

Expenses:

Salary of Editor and Secretary.....	\$ 360.00
Printing and Mailing.....	1,192.47
Stenographer	73.00
Miscellaneous Expense.....	180.00
Losses on Cancelled Advertisements.....	4.84
	1,819.31
	\$ 120.26

Annual Statement of the Library Fund—January 1, 1925.

Revenues:

Balance on Hand, January 1, 1924.....	\$ 492.62
Received from General Fund.....	480.00
	\$ 972.62

Expenditures—1924:

January 3—

American Society, Testing Materials.....	\$ 10.40
--	----------

42 *Proceedings of the Louisiana Engineering Society*

February 12—	
Eng. Pub. Co.....	2.00
G. Gus Pilie.....	4.00
Miss Carrie Freret.....	15.00
Railway Age.....	6.00
March 11—	
G. Gus Pilie.....	1.00
Miss Carrie Freret.....	15.00
April 15—	
Miss Carrie Freret.....	15.00
May 12—	
Tulane Press.....	15.00
E. J. Dreull.....	12.20
S. Boardman Pub. Co.....	1.25
G. Gus Pilie.....	4.00
June 10—	
Miss Carrie Freret.....	15.00
J. B. Pierre.....	6.00
July 2—	
Miss Carrie Freret.....	15.00
August 11—	
Amer. Society for Testing Materials.....	2.25
Miss Carrie Freret.....	15.00
September 8—	
McGraw Hill Pub. Co.....	3.00
Globe Wernicke Co.....	4.40
Eugene Dietzgen Co.....	99.95
October 13—	
Eugene Dietzgen Co.....	15.05
Miss Carrie Freret.....	15.00
November 10—	
Electrical World.....	5.00
Miss Carrie Freret.....	15.00
December 9—	
Engineering Pub. Co.....	2.00
Engineering and Contracting.....	4.00
American Society for Testing Materials.....	8.80
American Society of Mechanical Engineers.....	3.00
Miss Carrie Freret.....	15.00
Eugene Dietzgen Co.....	17.50
McGraw Hill Co.....	5.00
December 31—	
Miss Carrie Freret.....	15.00
Electrical World.....	5.00
	418.80
Balance on Hand, January 1, 1925.....	
	\$ 553.82

Cash Account.

Receipts:

1922 Dues.....	\$ 3.00
1923 Dues.....	422.00
1924 Dues.....	2,464.75
1923 Smoker.....	20.00
1924 Smoker.....	240.00
1925 Dues.....	3.00
Entrance Fees.....	216.00
Luncheon	4.50
Proceedings Advertisers.....	1,038.94
Pin	4.00
Profit and Loss.....	25.00
Deposit on Keys.....	3.50
Delegate Expense.....	130.00
Proceedings Sales.....	1.85
Investment and Interest.....	1,163.80
	\$5,740.34
Add 1923 Balance.....	953.29
	\$6,693.63
Less Checks N. S. F.....	17.50
	\$6,676.13
Less Exchange.....	6.05
	\$6,670.08
Total Disbursements.....	5,900.21
Cash Balance December 31, 1924.....	\$ 769.87

ANNUAL REPORT OF THE TREASURER.

Year 1924.

January 1, 1925.

To the President, Louisiana Engineering Society, New Orleans, La.:

Dear Sir: As per requirements of Article No. 4 of the Constitution, I have the honor to submit the following report covering receipts and disbursements for the period of January 15, 1924, up to and including January 1, 1925.

Received from Secretary—	Deposited in New Orleans Bk. & Tr. Co.	Exchange Charged
Feb. 1, Memo 1 to 10.....	\$1,408.29	\$2.20
March 3, Memo 11 to 13.....	356.43	.80
April 7, Memo 14 to 15.....	312.98	.30

44 *Proceedings of the Louisiana Engineering Society*

May 1, Memo 16 to 20.....	649.79	.40
June 2, Memo 21 to 23.....	325.98	.40
July 5, Memo 22a to 23a.....	235.21	.20
Aug. 5, Memo 24 to 27.....	350.53	.80
Sept. 3, Memo 28 to 29.....	100.97	.20
Oct. 6, Memo 30 to 31.....	161.93	.25
Nov. 5, Memo 32 to 33.....	257.39	.10
Dec. 1, Memo 34 to 35.....	152.04	.20
Dec. 23, Memo 36 to 37.....	265.00	.20
	\$4,576.54	\$6.05
Less Checkers Returned (N. S. F.).....	17.50	
	\$4,559.04	
Coupons Deposited January 9, 1924.....	135.92	
U. S. Certificate Redemmed January 9, 1924.....	1,000.00	
Coupons Deposited December 5, 1924.....	27.88	
	\$5,722.84	
Less Motor Lien Certificate Purchased.....	929.60	
	\$4,793.24	\$4,793.24
Less Exchange.....		6.05
		\$4,787.19
Balance on Hand as per Treasurer's Report, January 15, 1924.....		953.29
		\$5,740.48

Disbursements from January 3, 1924, to January 1, 1925.

January 3—

No.	Name—	Amount
1	J. S. Barelli.....	\$ 130.40
2	Miss Carrie Freret.....	15.00
3	G. G. Pilie.....	2.00
4	Simmons Boardman Co.....	3.00
5	Concrete Publishing Co.....	3.00
6	Tulane University Press.....	186.16
7	Jos. Levy.....	2.50
8	John Klorer.....	14.25
9	T. J. Corbrey.....	12.50

No.	Name—	Amount
10	F. A. Muth.....	50.50
11	Miss Edna Doll.....	15.00
12	American Society for Testing Materials.....	10.40
13	R. J. Derbes, Jr.....	50.00
14	New Orleans Bank & Trust Co.....	3.00
15	G. W. Lawes.....	136.20
16	Engineering Publishing Company.....	2.00
17	G. Gus Pilie.....	4.00
18	Federated American Eng. Society.....	67.52
19	Jos. Levy & Bros. Co.....	36.60
20	N. O. Chess, Checkers & Whist Club.....	214.90
21	Tulane University Press.....	167.31
22	Miss Edna Doll.....	15.00
23	F. A. Muth.....	44.32
24	Miss Carrie Freret.....	15.00
25	French Cooking Restaurant.....	9.00

February 12—

26	Railway Age.....	6.00
27	E. H. Coleman.....	15.00
28	T. J. Corbrey.....	5.00
29	G. Gus Pilie.....	1.00
30	Boylan's Detective Agency.....	3.00
31	F. A. Muth.....	44.50
32	Miss Edna Doll.....	15.00
33	Miss Carrie Freret.....	15.00
34	French Cooking Restaurant.....	10.20
35	P. Kaul & Son.....	7.50
36	Chas. M. Kerr.....	100.00
37	Federated American Engineering Society.....	67.52
38	Boylan's Detective Agency.....	3.00
39	Tulane University Press.....	376.36
40	F. A. Muth.....	50.50
41	Miss Carrie Freret.....	15.00
42	Miss Edna Doll.....	15.00
43	French Cooking Restaurant.....	15.75

May 12—

44	Tulane University Press.....	18.50
45	E. J. Drenill.....	12.20
46	New Orleans Stencil Works.....	1.00
47	Farish Art Store.....	.90
48	F. A. Muth.....	45.20
49	Miss Edna Doll.....	15.00
50	Miss Carrie Freret.....	15.00

46 *Proceedings of the Louisiana Engineering Society*

No.	Name—	Amount
51	Boylan's Detective Agency.....	3.00
52	Simmons Boardman Pub. Co.....	1.25
53	French Cooking Restaurant.....	11.25
54	G. Gus Pilie.....	4.00
June 10—		
55	Earle J. Christenberry.....	15.00
56	Mrs. M. Giglio.....	12.00
57	P. Kaul & Sons.....	10.00
58	Douglas Anderson.....	150.00
59	Boylan's Detective Agency.....	3.00
60	F. A. Muth.....	43.50
61	Miss Edna Doll.....	15.00
62	Miss Carrie Freret.....	15.00
63	French Cooking Restaurant.....	13.75
64	Tulane Press.....	157.55
65	Jacob R. Pierce.....	6.00
66	H. Salzer.....	3.00
67	G. Gus Pilie.....	2.00
July 3—		
68	Tulane University Press.....	25.85
69	T. J. Corbrey.....	17.00
70	Miss Edna Doll.....	15.00
71	F. A. Muth.....	42.00
72	Miss Carrie Freret.....	15.00
August 15—		
73	American Society Testing Materials.....	2.25
74	Miss Edna Doll.....	15.00
75	Miss Carrie Freret.....	15.00
76	F. A. Muth.....	41.00
77	Federated American Engineering Society.....	67.52
78	Tulane University Press.....	176.63
September 9—		
79	Tulane University Press.....	306.05
80	Miss Edna Doll.....	15.00
81	Miss Carrie Freret.....	15.00
82	F. A. Muth.....	43.50
83	McGraw Hill.....	3.00
84	Globe Wernecke.....	4.40
85	Eugene Dietzen Company.....	99.95
86	French Cooking Restaurant.....	11.25
87	Boylan's Detective Agency.....	3.00
October 17—		
88	Eugene Dietzgen Company.....	15.05

Annual Reports

47

No.	Name—	Amount
89	American Engineering Council.....	67.52
90	T. J. Corbrey.....	8.00
91	Tulane University Press.....	8.00
92	F. A. Muth.....	43.50
93	Miss Edna Doll.....	15.00
94	Miss Carrie Freret.....	15.00
95	Boylan's Detective Agency.....	3.00
96	Victor Restaurant.....	26.35
97	Greater New Orleans Homestead Association.....	750.00
November 11—		
98	Electrical World.....	5.00
99	T. J. Corbrey.....	7.00
100	Tulane University Press.....	80.50
101	F. A. Muth.....	44.50
102	Miss Edna Doll.....	15.00
103	Miss Carrie Freret.....	15.00
104	Boylan's Detective Agency.....	3.00
105	Victor Restaurant.....	16.40
December 9—		
106	Tulane University Press.....	23.75
107	Engineering Publishing Company.....	2.00
108	Engineering Contracting Company.....	4.00
109	American Society for Testing Materials.....	8.80
110	American Society of Mechanical Engineers.....	3.00
111	Wm. T. Frantz & Company.....	4.00
112	F. A. Muth.....	49.40
113	Douglas Anderson.....	150.00
114	Miss Edna Doll.....	15.00
115	Miss Carrie Freret.....	15.00
116	Boylan's Detective Agency.....	3.00
117	T. J. Corbrey.....	5.00
118	Victor Restaurant.....	16.35
119	Eugene Dietzgen Company.....	17.50
120	A. G. Roberts.....	5.00
121	Mrs. N. J. Braud.....	25.00
122	McGraw Hill Publishing Company.....	5.00
Total Disbursements.....		\$4,970.61

Recapitulation.

Total Receipts.....	\$5,740.48
Total Disbursements.....	4,970.61
Balance	\$ 769.87
Checking Account in New Orleans Bank & Trust Co.....	\$ 769.87
2 \$100.00 Second Liberty Loan.....	\$ 200.00
2 \$100.00 First Liberty Loan.....	200.00
1 \$ 50.00 First Liberty Loan.....	50.00
5 \$ 50.00 1917 First Liberty Loan.....	250.00
1 Motor Lien Certificate.....	1,000.00
Greater New Orleans Homestead.....	750.00
Savings account realized from the sale of certificates..	1,250.26
	\$3,700.26
	\$4,470.13

Respectfully submitted,

WALTER B. MOSES, Treasurer.

REPORT OF THE LIBRARY COMMITTEE.

January 10, 1925.

To the Board of Direction of the Louisiana Engineering Society, New Orleans, La.

Gentlemen: Your Library Committee begs to report as follows for the year just ending:

The suggestion made the previous Committee that the Library be moved from the Cabildo to a more central location was deemed inexpedient and consequently no action was taken in that direction. With the idea of making the books and periodicals more accessible a better shelf arrangement was adopted and the Secretary instructed to furnish members with keys to the Library on deposit of a small fee. A cursory examination indicates that 50 per cent more books were signed out of the Library than during the previous year, without any conspicuous loss of library property.

In connection with the usual routine of ordering new books, thanks are due to Eugene Dietzgen Company for cooperation. Grateful acknowledgment of cheerful assistance is made to Miss Carrie Freret, the Librarian, on whose shoulders fell most of the routine work and to whom credit is due for the good condition in which we find the Library.

A mimeographed list of books acquired by the Society during the current year will be subsequently furnished by the Secretary.

Respectfully submitted,

D. S. ELLIOTT,
MARCEL GARSAUD,
W. T. HOGG,
RALPH EARL,
Library Committee.

REPORT OF THE EMPLOYMENT COMMITTEE.

January 6, 1925.

Louisiana Engineering Society, care of Frank A. Muth, Secretary, Louisiana State Museum Building, New Orleans, La.

Gentlemen: As Chairman of the Employment Committee, permit me to make the following report for 1924:

According to my records I received 108 applications and during the year there were fifty-six vacancies, fifty-one of which were filled by applicants who applied to me.

I would appreciate very much if all members would please bear in mind to refer to me all members who may be out of employment, as well as informing me of any positions that may be open, and I will continue to use my best efforts in placing all applicants.

Yours truly,

R. H. BAUMBACH, Chairman.

REPORT OF THE AUDITOR.

To the President and Board of Directors, Louisiana Engineering Society, New Orleans, La.

Gentlemen: In accordance with your instructions I have audited the books and records of your Society for the calendar year 1924, and as a result of this examination beg to submit the following report and schedules:

EXHIBIT "A"—Balance Sheet as of December 31, 1924.

EXHIBIT "B"—Fund Balances as of December 31, 1924.

EXHIBIT "C"—Cash Receipts and Disbursements.

SCHEDULE "ONE"—Accounts Payable.

EXHIBIT "A" shows in detail all assets and liabilities as they stood on the books December 31, 1924, and to the best of my knowledge and belief reflect the true financial condition of your Society on that date.

EXHIBIT "B" also shows in detail revenues and expenditures as applied to each fund with a net balance for each separate fund.

EXHIBIT "C" shows in detail all receipts and disbursements for the year under review, with a cash balance of \$769.87.

Membership.

The membership roll of the Society at the close of the year 1924 stood as follows:

Honorary	1
Resident	191
Non-Resident	80
Associate	19
Non-Resident Associate.....	2
Junior	19
Non-Resident Junior.....	11
Student	15
Total.....	338

It gives me pleasure to say that I have found all books and records correctly and neatly kept.

Respectfully,

R. J. DERBES, JR.,
Certified Public Accountant.

BALANCE SHEET.

January 1, 1925.

ASSETS:

Cash on Hand.....	\$ 769.87
Membership Accounts Receivable.....	796.00
Advertisers' Accounts Receivable.....	304.16
Investments	3,700.26
Expense of Delegates.....	9.54
Entrance Fees.....	10.00
	—————\$5,589.83

LIABILITIES:

Library Fund.....	\$ 553.82
Proceedings Reserve Fund.....	1,127.41
Ole K. Olsen Prize Fund.....	50.00

Building Fund.....	151.65
Accounts Payable.....	335.84
Dues in Advance 1925.....	3.00
	2,221.72
Balance General Fund.....	\$3,368.11

EXHIBIT "A"

GENERAL RESERVE FUND.

Balance from 1914.....	\$ 165.00
Balance from 1915.....	189.75
Balance from 1916.....	377.45
Balance from 1917.....	299.49
Balance from 1918.....	27.47
	\$1,059.16
Deficit from 1919.....	62.93
	\$ 996.23
Balance from 1920.....	198.09
Balance from 1921.....	90.94
Balance from 1922.....	1,186.58
Balance from 1923.....	309.84
Balance from 1924.....	586.43
	\$3,368.11

GENERAL FUND YEAR 1924.

REVENUES:

Membership Dues.....	\$3,173.75
Smoker Account.....	272.50
Entrance Fees.....	246.00
Deposit for Keys.....	3.50
Cash (A. S. M. E.).....	25.00
1923 Dues Collected.....	11.00
Gain in Investments.....	100.00
	\$3,832.05

EXPENSES:

Subscriptions to Proceedings.....	\$ 686.00
Appropriation to Library.....	480.00
Losses on Non-payment of Dues.....	109.25
Salary of Secretary.....	420.00
Dues	12.00
Printing and Postage.....	340.61

52 *Proceedings of the Louisiana Engineering Society*

Refreshments	130.30
General Expense.....	122.82
Exchange	6.05
Smoker Expense.....	460.46
Dues Federated American Engineering Society.....	270.08
Auditing	50.00
1922 Balances Closed December 31, 1924.....	158.05
	3,245.62
Balance for the Year 1924.....	\$ 586.43

EXHIBIT "B"

ANNUAL STATEMENT OF THE LIBRARY FUND.

January 1, 1925.

REVENUES:

Balance on Hand January 1, 1924.....	\$ 492.62
Received from General Fund.....	480.00
	\$ 972.62

EXPENDITURES—1924:

January 3—

American Society Test Material.....	\$ 10.40
-------------------------------------	----------

February 12—

Engineering Publication Co.....	2.00
G. Gus Pilie.....	4.00
Miss Carrie Freret.....	15.00
Railway Age.....	6.00

March 11—

G. Gus Pilie.....	1.00
Miss Carrie Freret.....	15.00

April 14—

Miss Carrie Freret.....	15.00
-------------------------	-------

May 12—

Tulane Press.....	15.00
E. J. Drewill.....	12.20
Miss Carrie Freret.....	15.00
S. Boardman Publishing Co.....	1.25
G. Gus Pilie.....	4.00

June 10—

Miss Carrie Freret.....	15.00
-------------------------	-------

J. B. Pierre.....	6.00	
G. Gus Pilie.....	2.00	
July 2—		
Miss Carrie Freret.....	15.00	
August 11—		
American Society for Testing Material.....	2.25	
Miss Carrie Freret.....	15.00	
September 8—		
Miss Carrie Freret.....	15.00	
McGraw-Hill Publishing Co.....	3.00	
Globe-Wernicke	4.40	
Eugene Dietzgen Co.....	99.95	
October 13—		
Eugene Dietzgen Co.....	15.05	
Miss Carrie Freret.....	15.00	
November 10—		
Electrical World.....	5.00	
Miss Carrie Freret.....	15.00	
December 9—		
Engineering Publishing Co.....	2.00	
Engineering and Contracting Co.....	4.00	
American Society for Testing Material.....	8.80	
A. S. of Mechanical Eng.....	3.00	
Miss Carrie Freret.....	15.00	
Eugene Dietzgen Co.....	17.50	
McGraw-Hill Co.....	5.00	
December 31—		
Miss Carrie Freret.....	15.00	
Electrical World.....	5.00	
		418.80
Balance on Hand January 1, 1925.....	\$ 553.82	

EXHIBIT "B"

PROCEEDINGS RESERVE FUND.

Balance from 1915.....	\$ 112.20
Balance from 1916.....	566.13
Balance from 1917.....	568.14

54 *Proceedings of the Louisiana Engineering Society*

Balance from 1918.....	567.52	
Balance from 1919.....	41.08	
	\$1,855.07	
Deficit 1920.....	221.98	
	\$1,633.09	
Balance from 1921.....	26.25	
	\$1,659.34	
Deficit from 1922.....	\$ 301.02	
Deficit from 1923.....	110.65	
Deficit from 1924.....	120.26	
	531.93	
Total.....	\$1,127.41	

PROCEEDINGS FUND YEAR 1924.

REVENUES:

Advertisements	\$1,002.20
Subscription Members.....	686.00
Proceedings Sales.....	1.85
	\$1,690.05

EXPENSES:

Salary of Editor and Secretary.....	\$ 360.00
Printing and Mailing.....	1,192.47
Stenographer	73.00
Miscellaneous Expense.....	180.00
Losses on Cancelled Advertisements.....	4.84
	1,810.31
Deficit for Year.....	\$ 120.26

EXHIBIT "B"

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS.

For the Calendar Year 1924.

Balance on Hand January 1, 1924.....	\$ 953.29
--------------------------------------	-----------

RECEIPTS:

1922 Dues.....	\$ 3.00
1923 Dues.....	422.00
1924 Dues.....	2,464.75
1923 Smoker.....	20.00
1924 Smoker.....	240.00

1925 Dues.....	3.00
Entrance Fees.....	216.00
Luncheon	4.50
Proceedings Advertisers.....	1,038.94
Pin	4.00
Profit and Loss.....	25.00
Keys	3.50
Delegates	130.00
Proceedings Sales.....	1.85
Interest	1,163.80
	5,740.34

Total Receipts.....\$6,693.63

DISBURSEMENTS:

Stenographer	\$ 69.00
Ole K. Olsen Prize Fund.....	100.00
Bills Payable.....	433.91
General Expense.....	118.32
Library	398.80
Auditor	50.00
Profit and Loss.....	17.50
Investments:	
Motor League Certificate.....	\$ 929.60
Greater N. O. Homestead Association..	750.00
	1,679.60
Proceedings Expense.....	165.00
Smokers Expense.....	450.46
American Engineering Council.....	270.08
Exchange	6.05
Pin	4.00
Postage and Mailing.....	1,020.28
Postage and Printing.....	270.46
Salary of Secretary and Editor.....	355.00
Secretary's Salary.....	385.00
Refreshments	130.30
	5,923.76

Cash Balance December 31, 1924.....\$ 769.87

EXHIBIT "C"

ACCOUNTS PAYABLE.

As of December 31, 1924.

Miss Carrie Freret.....	\$ 15.00
Electrical World.....	5.00
Printing and Postage.....	70.15
Porterage and Lights.....	4.50
Double Cards for Smoker.....	10.00
Secretary's Salary (December).....	35.00
Stenographer's Salary (December).....	4.00
Printing and Mailing.....	172.19
Salary of Secretary and Editor (Proceedings).....	5.00
Miscellaneous Expense (Proceedings).....	15.00
Total.....	\$ 335.84

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

FEBRUARY, 1925

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

	PAGE
Lester F. Alexander & Co.....	4
Allis-Chalmers.....	6
The American Cement Machine Co., Inc.....	5
American Creosote Works, Creosoted Timber.....	14
American Creosoting Co., Inc.....	12
The Anchor Packing Co.	17
H. Bodenheimer & Sons.....	9
Brook Tarpaulin Co., Inc.	14
Canal-Commercial Trust & Savings Bank.....	3
Columbian Iron Works.....	17
Concrete Pipe Company, Inc.....	20
Concrete Steel Company.....	9
W. G. Coyle & Co.....	9
Creosoted Materials Co., Inc.....	10
Eugene Dietzgen Co., Surveying Instruments.....	16
Gaiennie Company.....	5
Gamon Meter Company	15
The Garlock Packing Company.....	19
Geo. J. Glover Company, Inc.....	7
Greenlaw Truck and Tractor Co., Inc.....	11
Harry Bros. Co. of La., Galvanized Iron Tanks, etc.....	12
Hattiesburg Creosoting Company	10
Robert W. Hunt & Co., Engineers, Chemists, Inspectors.....	10
Jahncke Service, Inc.	17
A. M. Lockett & Co., Ltd.....	8
The Lufkin Rule Co.....	3

INDEX TO ADVERTISEMENTS—Continued.

	PAGE
The Manhattan Rubber Mfg. Co.....	13
Albert A. Martinez, Southern Yellow Pine.....	Inside Front Cover
Guy R. Molony & Co.	13
John H. Murphy Iron Works	8
New Orleans Bank and Trust Co.	11
New Orleans Blue Print and Supply Co., Inc.	13
Ole K. Olsen, Concrete and Structural Steel.....	7
Pacific Flush-Tank Co.....	13
Shakspeare Iron Works	3
Southern States Equipment Co.....	5
The Tulane University of Louisiana.....	4
The Tulane University Press, Printing.....	6
Turnerized Roofing Co.....	Outside Back Cover
Westinghouse Electric & Manufacturing Co.....	18
The White Company	6
Woodward, Wight & Co., Railway and Mill Supplies.....	16

This Journal reaches the officials with whom rests the responsibility for the bulk of the municipal, state and industrial works in Louisiana and the surrounding territory. Its advertising pages afford you an effective and dignified means of cultivating a wider acquaintance among prospective buyers.

WHEN
YOU BUY
A

LUFKIN

Measuring Tape

YOU MAY BE SURE THAT

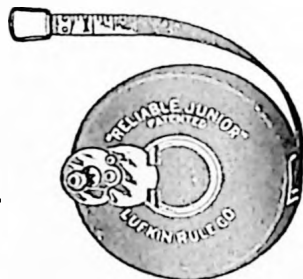
You have an ACCURATE and DURABLE tape of a brand that has given universal satisfaction for years and that the maker guarantees direct to you.

Send for catalogue.

Saginaw, Mich.

THE LUFKIN RULE CO.

New York,
London, Eng.
Windsor, Can.



OLDEST BANK IN THE SOUTH

When considering new banking connections,
remember to consult with the

CANAL - COMMERCIAL TRUST & SAVINGS BANK

New Orleans

SAVINGS - COMMERCIAL - TRUST

Capital and Surplus - - - \$7,000,000.00

MEMBER FEDERAL RESERVE SYSTEM

Phone Main 541

913 Girod Street

SHAKSPEARE IRON WORKS JULIAN M. SWOOP, Proprietor

Machinery Repairs Given Prompt Attention

Grey Iron Castings, Brass Castings
Plantation Sugar Mill Repairs a Specialty

Blaksmith Work of all Kind

Pattern Making Grate Bars—ordinary or circular

WE WELD ANY PARTS OF BROKEN MACHINERY

PHONE MAIN 541

NEW ORLEANS, LA.

LESTER F. ALEXANDER,
M. La. Engr. Soc.
M. S. A. M. E.

J. L. DICKEY,
M. Am. Soc. C. E.
M. La. Engr. Soc.
M. S. A. M. E.

LESTER F. ALEXANDER & CO.

CIVIL ENGINEERS and CONTRACTORS

**River and Harbor Improvements
River and Gulf Towing**

Barges, Derricks and Pile Drivers

830-32-34 Maison Blanche Annex. New Orleans, La.

Phones—Main 4195-1967

TUGS—Boswell, H. H. Colle, Wm. F. Flanders, Panther.

TULANE UNIVERSITY OF LOUISIANA NEW ORLEANS

Located in the choicest residential section of the South's leading city, with climatic and other advantages enjoyed by no other institution of equal rank, offers superior instruction in standard college courses, and in Engineering, Law, Medicine, Pharmacy, Dentistry, Art, Music, Domestic Science, Household Economy, Commerce and Business Administration. Separate department for women in the Newcomb College. Extensive laboratories, many scholarships in under-graduate colleges for men and women. Board and accommodation in dormitories at low rates. Twenty-four buildings. Campus of 100 acres. Full descriptive catalog, or a bulletin of any college sent free upon application. Address The Registrar, Tulane University, New Orleans, La.

SOUTHERN STATES EQUIPMENT CO., Inc.

712 Canal-Commercial Building

New Orleans

**Contractors-&-Power Plant Equipment
New-&-Used Equipment**

Phone Main 6756

Warehouse
1153 Tchoupitoulas



**Pavers, Grouters, Building
Mixers, Hoists, Back - Fillers,
Elevators, Pumps, Carts**

Low Prices—Cash or Terms

CONTRACTORS' EQUIPMENT.

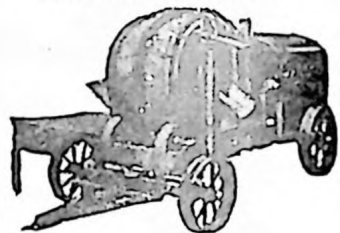
All Sizes from 5 ft. to 22 ft. Gas, Steam or Electric.
Ask about the BOSS High Drum two-bag Mixer.

THE AMERICAN CEMENT MACHINE CO. (Inc.) Keokuk, Ia.

CARRIED IN STOCK BY

OLE K. OLSEN

822 Perdido Street, New Orleans, La.



\$325 Buys Low Charger

Gaiennie Company

**STEAM HEATING
HOT WATER HEATING
MOIST AIR HEATING
GAS STEAM HEATING
PLUMBING
PLUMBING SUPPLIES**

ESTIMATES FURNISHED UPON APPLICATION

Howard Avenue and Baronne Street
Phone Main 4020

COMPLIMENTS OF

Tulane University Press

PRINTING DEPARTMENT
TULANE UNIVERSITY
OF LOUISIANA



**POWER, ELECTRICAL and
INDUSTRIAL MACHINERY**

ELECTRICAL Machinery, Steam Engines, Steam Turbines, Condensers, Gas Engines, Oil Engines, Hydraulic Turbines, Pumping Engines, Centrifugal Pumps, Mining Machinery, Metallurgical Machinery, Crushing Machinery, Cement Machinery, Flour Mill Machinery, Saw Mill Machinery, Air Compressors, Air Brakes, Steam and Electric Hoists, Farm Tractors, Power Transmission Machinery, Perforated Metals, Timber Preserving Machinery.

COMPLETE POWER
UNITS WITH ANY
TYPE OF
PRIME MOVER

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

WHITE MOTOR TRUCKS PREDOMINATE

Because of their
**DURABILITY, DEPENDABILITY
AND ECONOMY**

THE WHITE COMPANY

Girod and Dryades

New Orleans

7

Ask Your Friends About
The Concrete Engineer

OLE K. OLSEN

822 PERDIDO STREET

Phone Main 2104. New Orleans.

Geo. J. Glover Co., Inc.

General Contractors

*Member: American Society for Testing Materials
Contractors & Dealers Exchange of New Orleans*

Whitney-Central Building New Orleans, La.

PHONE MAIN 1276

*Office Buildings, Railway Buildings, Manufacturing
Plants, Heavy Masonry, Pile Foundations*

AT YOUR SERVICE

To engineers we offer our services and the services of the manufacturers of high-grade equipment whom we represent; some of whom are as follows:

Babcock & Wilcox Co; Boilers and Superheaters. **Worthington Pump & Machinery Corporation;** Pumps, Compressors, Oil Engines, Condensers, etc. **American Blower Co;** Fans and Blowers and Air Conditioners. **Nash Engineering Co;** Vacuum and Steam-heating Pumps. **Spray Engineering Co;** Spray Cooling Ponds. **Frick Co;** Refrigeration Equipment. **Diamond Power Specialty Co;** Soot Blowers. **Diamond Rubber Co;** Mechanical Rubber Goods. **Robins Conveyer Co;** Conveyors and Handling Equipment. **Griscom-Russell Co;** Heat Exchange Apparatus. **A. M. Lockett & Co;** Oil-Burning Equipment.

Each of these has in its employ engineers who represent the highest talent in their respective lines; and the engineer whose client's requirements call for equipment covered by any of these lines, can count on the advice of these specialists, as well as that of our own engineering organization, in selecting proper equipment for a wide variety of service.

A. M. LOCKETT & CO., Ltd.
Contracting Mechanical Engineers and Machinery Merchants
NEW ORLEANS
Houston, Dallas, San Antonio, Texas

JOHN H. MURPHY IRON WORKS

MANUFACTURERS AND CONTRACTORS

Vacuum Pans, Coil and
Calandria

Webre Multiple Effects

Centrifugals and Mixers

Crystalizers, any type

Return Current Juice Heaters

Oil Storage Tanks, all sizes and shapes

Internally Fired Boilers

High Pressure Boilers Fitted
with Steel Casings

Quinn Flat Top Bagasse
Furnaces

Juice and Syrup Tanks

Main Office, 643 Magazine St.
New Orleans, La., U. S. A.
Phone Main 160

Foundry and Machine Works
A. J. Naquin, Manager
Alexandria, La.

Boiler and Tank Works
Broad and Perdido Sts.
Phone Main 161

Machine Shop, Copper and
Brass Works
Magazine and Girod Sts.

W. G. COYLE & CO.

(INCORPORATED)



Bunker Coal and Towing

BARGES, LIGHTERS, ETC.

High Grade Coals Competent Tugs

Telephone Main 4429

Main Office: 1322 Whitney-Central Bldg. New Orleans, La.

H. BODENHEIMER & SONS

Everything Pertaining to
INSURANCE

810 UNION STREET

Phones Main 1817-1818 NEW ORLEANS, LA.

SPECIFY

HAVEMEYER BARS

For Your Reinforced Concrete Work.
The Most Efficient and Economical Bar.
Rolled to same weight as plains.
Round—Square—Flat.

"EVERY POUND PULLS."

PROMPT SHIPMENTS—MILL OR WAREHOUSE

Concrete Steel Company

42 Broadway NEW YORK

SOUTHERN OFFICE

Birmingham, :: Ala.

OLE K. OLSEN, Sales Agent
New Orleans.

Hattiesburg Creosoting Co.

Plants at Hattiesburg, Miss. and Slidell, La.

Main Office, Hattiesburg, Miss.

CREOSOTED MATERIAL

— INCLUDING —

**Lumber, Timbers, Piles, Telephone and Telegraph
Poles and Cross-Arms, Paving Blocks,
Cross-Ties, Etc.**

CAPACITY, 70,000,000 FEET B. M. PER ANNUM

Facilities for Shipping by Rail or Water

Creosoted Materials Co., Inc.

1126 HIBERNIA BUILDING

Phone Main 3818

New Orleans, La.

— DEALERS IN —

Creosoted Materials of All Kinds

Robert W. Hunt Co.

Engineers, Chemists, Metallurgists, Inspectors

Inspection and Tests of Steel and Cement for Bridges, Buildings
and Other Structures. Inspection of Rails and Fastenings.
Creosoted Block, Timber and Ties. Paving Brick and Asphalt.

General Office, Chicago, 2200 Insurance Exchange Bldg.

New Orleans, 919 Carondelet Bldg.

JOIN THE
CHRISTMAS CLUB
NOW
FOR 1925

We Pay
4^c/₁₀₀
Compound Interest
on Savings Accounts

Save
Part of Your
Christmas Check
and Deposit it
in the—

New Orleans Bank & Trust Company

"The Young Business Man's Bank"

Member Federal Reserve System

222 Carondelet

GREETINGS FROM
**Greenlaw Truck and Tractor
Company, Inc.**

GMC Trucks

C. T. Electric Trucks

Lee Trailers and Dump Bodies

Athey-Truss-Wheel Logging Wagons

424 Girod Street

New Orleans, La.

PHONES MAIN 3299 - 3322

CREOSOTED

TIMBERS - PILING

CROSS TIES - POLES

LUMBER - PAVING BLOCKS

AMERICAN CREOSOTING COMPANY

COLONIAL
CREOSOTING
COMPANY
INCORPORATED



GEORGIA
CREOSOTING
COMPANY
INCORPORATED

LOUISVILLE ~ KENTUCKY

SALES OFFICES

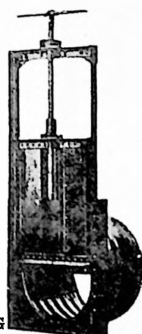
350 MADISON AVE. NEW YORK CITY - 401 W. MAIN ST. LOUISVILLE, KY.
BOGALUSA, LA. BRUNSWICK, GA.



Louisiana Engineers should have in their files our catalog of Galvanized Iron Tanks, Sectional Steel Towers, All Metal Sectional Buildings, Garages, Silos Culvert, Water Tight Pipe Gate Valves, Etc.

¶ We are prepared to submit blueprints and specifications on the above or on any kind of metal buildings.

ASK FOR CATALOG



HARRY BROS. CO. of LA. New Orleans, La.

The Manhattan Rubber Mfg. Co.

HIGH GRADE
MECHANICAL RUBBER GOODS



500 CAMP STREET, :: New Orleans, La.

Miller Flushtank Siphons



Simple, Reliable, Automatic
Also Sewage Disposal
Apparatus, Automatic
Sewage Ejectors, Centri-
fugal Pump, Outfits,
Sewer Jointing Com-
pounds.

PACIFIC
FLUSH-TANK CO.
CHICAGO NEW YORK

GUY R. MOLONY & CO.

General Drayage

418 GRAVIER STREET

Phone Main 6281

NEW ORLEANS, L.A.

TRANSITS

LEVELS

ENGINEERING SUPPLIES

BLUE PRINTING

New Orleans Blue Print & Supply Co., Inc.

RAYMOND BASSICH, Mgr.

824 Union Street

Phones 7543-945

Agt. KEUFFEL & ESSER CO.

American Creosote Works

INCORPORATED

CREOSOTED
Cross Arms, Lumber, Paving
Blocks, Piles, Poles, Ties

Private Wharf for Ocean Vessels at NEW ORLEANS, LA.

Capacity 115,000,000 Feet B. M. Per Annum

Branch Plants:

Louisville, Miss.
Winnfield, La.

STATION "B"
NEW ORLEANS, LA.

COTTON DUCK

TARPAULINS

TENTS

DISTRIBUTORS FOR
WHITLOCK MANILA ROPE

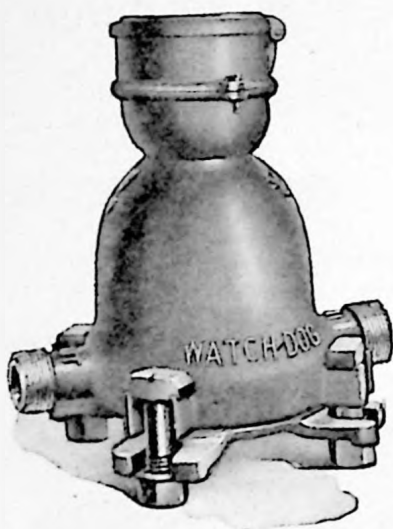
Brook Tarpaulin Company, Inc.

(ESTABLISHED 1840)

429 Celeste Street

New Orleans, La.

"Watch Dog" Water Meters



Disc
Current
and
Compound
Types

More Than 1,000,000 in Service

Gamon Meter Co.

Newark, N. J.

CHICAGO OFFICE
380 N. Michigan Ave.



Transits and Levels

that will give perfect
service under all conditions
of use are manufactured by

DIETZGEN

—the firm with the quality reputation. *Catalog on request.*

EUGENE DIETZGEN CO.
Manufacturers
Chicago New York San Francisco
New Orleans Pittsburgh
Philadelphia

WOODWARD, WIGHT & CO.

— LIMITED —

Largest General Supply House South Since 1867

EXCLUSIVE SOUTHERN SELLING AGENTS FOR

LIDGERWOOD Hoisting Engines, Cableways and Log
Handling Machinery.

HAYWARD Orange Peel and Clam Shell Buckets.

GENERAL ELECTRIC CO. Apparatus and Supplies.

ROEBLING'S Wire Rope.

Heavy Hardware; Mill Supplies; Marine Hardware; Cordage; Elevating, Conveying and Power Transmitting Machinery.

· OPEN DAY AND NIGHT

Howard Avenue, Constance
and St. Joseph Streets

NEW ORLEANS

SAND

GRAVEL

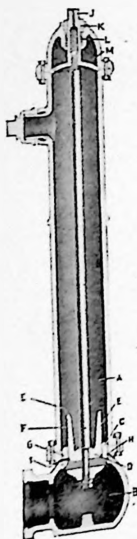
JAHNCKE SERVICE Inc.

NEW ORLEANS

Concrete and Builders' Materials
Dredging

SHELLS

CEMENT

**COLUMBIAN
IRON WORKS**

CHATTANOOGA, TENN.

Manufacturers of

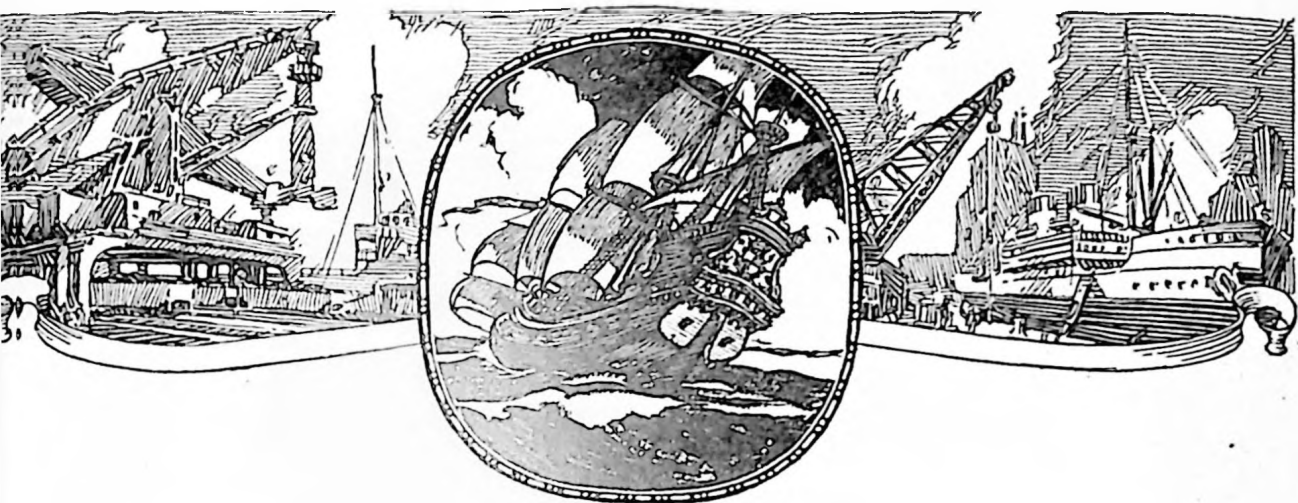
Fire Hydrants, Valves,
Valve Boxes, Sluice
Gates, Meter Boxes,
Water Works SuppliesNew Orleans Representative:
J. S. BARELLI
612 Godchaux Bldg.

COMPLIMENTS

The Anchor Packing Company

418 COMMON STREET

NEW ORLEANS, LA.



Sailing West to India

SINCE the days of Christopher Columbus men have felt the call to "sail due west to find India." In an organization like Westinghouse, such pioneering spirits find happy haven as research engineers. Their every thought is a question—every energy bent to discover new and more effective answers to baffling problems.

Immediately Westinghouse began to build alternating current machines of high voltages, for example, the problem of insulation became acute. For thirty-five years high voltages and insulation have formed an endless chain of problems. As voltages have been increased, improved insulation has been demanded. As insulation has

been bettered, voltages have been still further increased.

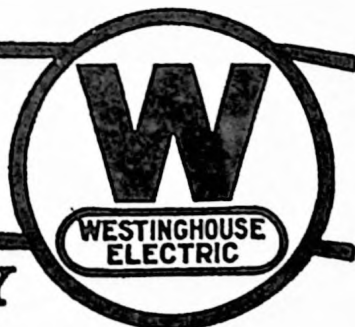
One striking contribution of Westinghouse research engineers has been the perfection of an entirely new insulation material—Micarta. Possessing many of the qualities of metal, paper, fiber, mica, gum, rubber, Micarta differs in radical respect from all of these.

It serves industry indirectly as improved insulation material, and also directly because of superiorities when used for gears, propeller blades, and the like.

Only the imagination can set a limit on the field for the research engineer—or for an organization that centers around him.

Westinghouse

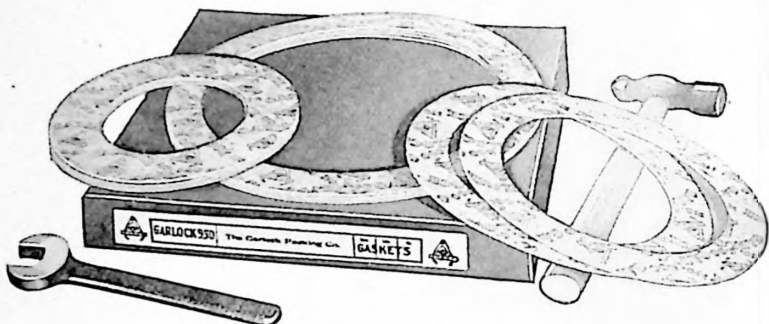
ACHIEVEMENT & OPPORTUNITY



GARLOCK

"GARLOCK-950"

Gasket Packing Service



"Garlock-950" Asbestos Fibre Gaskets

PIPE LINE INSURANCE

When you purchase or specify "Garlock-950" Pipe Line Gasket Service it is the same operation as taking out an Insurance Policy against blow-outs or leaky pipe joints. You are assured of continuous production and long service.

"GARLOCK-950" Asbestos Fibre Gaskets are cut from "GARLOCK-900" Compressed Asbestos Fibre Sheet Packing, and are recommended for service against superheated or saturated steam, air, gas, ammonia and most chemical solutions.

There is a "GARLOCK SERVICE"
for every Packing Problem

The Garlock Packing Company



Asbestos
Rubber

Manufacturers of

GARLOCK PACKINGS

Metal
Fibrous



General Offices and Factories, Palmyra, N. Y.

Canadian General Offices and Factory, Hamilton, Ont.

Sales Offices in all Principal Industrial Centers

The Standard Packing of the World

MANUFACTURERS OF

Sanitary Sewer Pipe
Drain Pipes

Highway Culverts
Railroad Culverts

Drain Tile

Concrete Pipe Co.,

Incorporated

1025 SOUTH LIBERTY STREET

Main 1836

"CONCRETE PIPE FOR PERMANENCE"

The Proceedings of the Louisiana Engineering Society

Published bi-monthly, February, April, June, August, October, December,
under the auspices of the Committee on Publication.

DOUGLAS ANDERSON, Editor.

The Louisiana Engineering Society is not responsible for any
statement made or opinion expressed in this publication.

Subscription, \$2.00 per annum

Single copy, 35 cents

ADVERTISING RATES

	ONE YEAR	HALF YEAR	ONE ISSUE
Full page	\$50.00	\$28.00	\$10.00
Half-page	28.00	15.00	6.00
Quarter-page	15.00	10.00	4.00
One-eighth page	10.00	6.00	2.00

For the back outside cover add 50 per cent to the above
rates. For the inside covers add 25 per cent to the above
rates.

Address all communications to
Douglas Anderson, Editor, Tulane University,
New Orleans, La.

Entered as second-class matter July 27, 1916, at the Post Office at
New Orleans, Louisiana, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in section 1105,
Act of October 3, 1917, authorized August 1, 1918.

LOUISIANA ENGINEERING SOCIETY

OFFICERS FOR 1924

President, JAMES M. ROBERT, Tulane University.
Vice-President, MARCEL GARSAUD, 515 Whitney Building.
Secretary, FRANK A. MUTH, 2323 Short Street.
Treasurer, WALTER B. MOSES, 640 S. Peters Street.

DIRECTORS

CHARLES MCD. KERR, 1403 Hibernia Building.
F. P. HAMILTON, 1403 Hibernia Building.
E. S. LANPHIER, Room 224 Custom House Building.
JOHN S. BARELLI, 612 Godchaux Building.

STANDING COMMITTEES

On Technical Papers

W. B. Gregory, Chairman
I. O. Mall
A. M. Shaw

On Library

D. S. Elliott, Chairman
Marcel Garsaud
W. T. Hogg
Ralph Earl

On Publications—Division "A"

Douglas Anderson
Frank A. Muth

On Publications—Division "B"

P. J. Dromgool, Chairman
Lester Alexander
Paul F. Jahucke
Geo. A. Seaver
J. P. Ewin
C. A. Favrot

On Entertainments and Outings

Charles M. Kerr
L. F. Alexander
Ole K. Olsen
C. H. Stem

On Membership—Division "A"

H. E. Crump, Chairman
W. T. Hogg
F. G. Frost
B. H. Grehan
Cecil N. Bean
L. C. Smith
George Hammett
Ira W. Sylvester
T. B. Smith
J. L. Henning
B. W. Pegues
Merrill Bernard

On Membership—Division "B"

F. P. Hamilton, Chairman
J. F. Coleman
Jacques de Tarnowsky

On Employment

R. H. Baumbach, Chairman
R. Baccich

On Civic and Industrial Affairs

John Klorer, Chairman
A. T. Dusenbury
John H. O'Niell

The headquarters of the Society are in the State Museum Building, Jackson Square.

All business communications should be addressed to F. A. Muth, Secretary, 2323 Short Street, New Orleans, La.

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

VOL. X.

APRIL, 1924

No. 2

CONTENTS

EDITORIAL, NOTES AND COMMENT :	PAGE
Opportunities for Engineers in the Tropics	79
A Different Point of View on the Comparison of Pump Tests	81
The Olsen Membership Prize.....	81
Visit of Mr. Gruusky and Mr. Dunlap.....	81
A Louisiana Man for the Mississippi River Commission.....	82
New Members	82
PAPERS AND DISCUSSIONS:	
The American Engineer in the Tropics. <i>By Arthur M. Shaw</i>	84
The Comparison of Pump Tests with Special Reference to Low Head Pumps. <i>By Eugene F. Delery</i>	98
OBITUARY.....	108
MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.....	109

EDITORIAL NOTES AND COMMENT

Opportunities for Engineers in the Tropics. New Orleans is often spoken of as the logical place for the centralization and control of our commercial intercourse with the Central and South American countries. Colonel Shaw's paper, therefore, has a timely interest for those of us who, as engineers, may be giving some consideration to the question of either seeking new fields of activity, or of accepting a professional position in that part of the world.

In the Central American countries the lines of commercial activity which seem to offer the best opportunities for engineers from the United States are mining, oil field developments, engineering projects of the different fruit companies, and general contracting. Colonel Shaw's advice is, however, "Don't go, unless you have something very definite in the way of a position when you arrive." Latin America is full of "Tropical Tramps."

If, however, an engineer decides that it would be to his advantage to accept employment in that part of the world, it would certainly be a wise policy for him, as a trained and educated man, to make some study of the conditions he will have to meet, both as regards the technical character of his work as well as the general conditions of living.

There are doubtless many reasons for it, but it does seem to be a fact that Americans do not possess the ability to adapt themselves to conditions in foreign countries as readily as do the citizens of other nations. Englishmen have always been good pioneers, and with the rapid development of their colonization schemes prior to the World War, the Germans were beginning to run them a close second. The psychology of their methods, however, is quite distinct. The Englishman brings with him all his insular prejudices and points of view, but at the same time he has the proper regard for the point of view of the other man, and he is a sincere believer in fair play. Furthermore, he has absolute confidence that his home government will back him to the limit when he is in the right. Perhaps it is the conviction in the minds of foreigners as to this latter characteristic of the British Government that gives the Englishman so much influence when he does take up his residence in one of our South or Central American countries.

It may be said of the German, however, that his methods are quite different. He identifies himself so closely with the customs, habits, and methods of doing business of the new country that in time he becomes almost a native. Before he leaves home he has made a careful study of all these things, and as a rule he very quickly learns the language. This is one matter in which so many Americans are lacking; they seem to have a certain sort of inertia or prejudice against learning to speak a foreign language.

If in the near future the United States is to have a predominating influence in these neighboring countries, the engineer will naturally play a very important part, and it will behoove him to give some study to the particular conditions under which he will be called upon to work. Reprints of Colonel's Shaw's paper will be sent to the engineering graduates of this year at Louisiana State University and Tulane University.

A Different Point of View on the Comparison of Pump Tests. Published in this issue of the Proceedings is a paper by Mr. Eugene Delery, Engineer with the Sewerage and Water Board, which raises the question as to whether efficiency should be the sole, or even the most important, criterion for the comparison of the performance of low head pumps.

Mr. Delery claims, for example, that in many cases a basis of comparison, better than the comparison of efficiencies, would be to compare their percentages of *lost velocity heads*. Formulae are given for making this comparison and cases are cited in which two pumps, rated on the basis of efficiencies, are equally good, but by Mr. Delery's method of rating one may be a much better pump than the other.

The Olsen Membership Prize. At the March meeting of the Board of Direction the first prize of \$100.00 donated by Mr. Ole K. Olsen for that member securing the greatest number of new members for 1922, was awarded to Mr. Charles M. Kerr. As there were three members who tied for the second prize it was decided not to award it this year, but to offer the \$50.00 as a new prize for the largest number of new members secured for the year 1924. Take notice, therefore, that this is an opportunity to do some good work for the Society and at the same time to win a substantial money prize.

Visit of Mr. Grunsky and Mr. Dunlap. As President and Secretary respectively of the American Society of Civil Engineers, these two gentlemen are making a round of visits to various Local Sections throughout the South. Upon invitation of the Faculty they spoke to the student body of the College of Engineering, Tulane University, on Monday afternoon, April 14th. The New Orleans section of the A. S. C. E., of which there are about seventy members, entertained them at a dinner on Monday evening, and later on in the evening each of the gentlemen spoke before a joint meeting of the Local Section and the Louisiana Engineering Society.

Mr. Grunsky spoke first upon the importance of the engineer in the economic and social progress of the country. He

followed this by a brief account of the work of himself and others in the problem of flood control in the Sacramento Valley of California. This touched very closely upon our local spillway problem, and Mr. Grunsky answered many questions concerning his experience with spillways.

Mr. Dunlap was then called upon and gave a brief but very interesting talk upon the general problem of engineering education, particularly with reference to the investigations now being carried on by the Committee of Investigation and Coordination of the Society for the Promotion of Engineering Education.

The next day Mr. Grunsky and Mr. Dunlap left for Houston to attend a meeting of the Texas Section.

A Louisiana Man for the Mississippi River Commission.

The members of the Safe River Committee, as well as other persons interested in the construction of a spillway below New Orleans, held a conference a short while ago with President Coolidge.

They took occasion to propose the name of Mr. J. P. Kemper and to endorse him as the man to fill the existing vacancy on the Mississippi River Commission. As is well known in this community, Mr. Kemper has been a consistent and persistent advocate of the spillway as a relief from flood conditions in the Mississippi River. He has been a constant and untiring observer and student of the problems of our great river, and he is well fitted for membership in the Commission which has charge of the engineering operations carried out in connection with these problems. It is greatly to be hoped that the President will see fit to accept the recommendations of the Louisiana delegation. Mr. Kemper has been for many years a prominent and active member of the Louisiana Engineering Society.

New Members. The following members have recently been elected to the Society:

Resident Members.

CHARLES F. AKINS, Principal Assistant Engineer, Louisiana Highway Commission.

KENNETH MCG. BAILEY, Engineer with Beeler Organization.

HENRY B. COOLEY, Engineer with Cuyamel Fruit Co., Honduras.

GEORGE L. LORD, Map and Survey Department of Union Title Guarantee Co.

CHARLES F. RANTZ, Rantz Engineering and Machine Works.

Non-Resident Member.

JULIUS SLOVENKO, care of Cuyamel Fruit Co., Puerto Cortez, Honduras.

Non-Resident Junior Member.

JAMES K. PETRIE, Mansfield, La.

PAPERS AND DISCUSSIONS

THE AMERICAN ENGINEER IN THE TROPICS

BY ARTHUR M. SHAW.

Read before the Society, March 10, 1924.

Whether we consider our vocation as a profession or, as some do, as a specialized trade, the fact must be faced that we have this in common with commercial concerns, we must find a market for our product. Whether the output be shingles or shoes, cakes or coal, brawn or brain, the centers of production seldom provide a sufficient market for all the output. The question of finding our market (or, as we usually put it, finding a job) is of vital importance to nearly every engineer. Each student gives to it more or less careful thought at various times during his course of training and as graduation approaches the problem becomes increasingly important and insistent. "Back in the 80's," railroad location and construction offered an opportunity for practically every good man turned out by the Civil Engineering schools, and, to a lesser degree, afforded a market for the graduates from the other technical courses. Among the older men now following the profession it is most unusual to find one who has not been engaged, at one time or another, in railroad work. Those of us who came out in the early '90's made a strenuous effort to get into railroad work, but we found that there was not a world demand for such services as we felt in a position to render, and many a rebuff was encountered. I shall never forget my first contact with the gruff but kindly old Swiss who was Chief Engineer of the Duluth & Iron Range R. R. in 1893. I had already had some experience as rodman and instrumentman on railroad surveys, and after spending some weeks and practically all my reserve cash at the Chicago World's Fair, I bought a ticket to Duluth. My reason for going to Duluth was that I had heard that some construction was being done there and, also, the cost of the ticket just about fitted my available capital. An audience was easily secured with Mr. Angst, but on stating the purpose of my visit, he said, peering at me over his glasses: "Why, young

man, I could go out here on the street and in twenty minutes I could fill out a party, from chairman up, out of ex-chief engineers." For some reason, though, possibly to put an end to my frequent calls, he sent me out to the "end of line" on construction.

Today the opportunities for engineering graduates are more varied, but still there are times when really good men have difficulty in securing suitable employment. The Central and South American field is by no means a new one for American engineers, but it is continually growing and is worthy of consideration at this time, especially by the younger men of this section. I would not, however, urge a man out of employment to go to the tropics, regardless of his temperament, health and habits, for Latin America is full of "Tropical Tramps" who are looking for jobs, and many of them belong to our profession. As a matter of fact, a trip to the tropics without a definite position arranged before leaving would almost be sure to end in disaster, unless one had sufficient funds to insure a return passage. In his own country, a stranded engineer can turn his hand to almost anything, not excluding manual labor, to tide himself over an emergency, but a stranded American in the tropics is a pitiable object.

Securing Employment.

Owing to varying conditions, it would be impossible to set down any best rules for securing employment, but, for the younger men who might wish to go to the tropics, the following might be considered as a safe guide:

Secure a position with some thoroughly established American or European concern doing business in the tropics, arranging details as to salary, expenses and living conditions before leaving this country. If the employing concern is a large one with an extensive engineering staff, you can afford to accept a smaller salary (other things being equal) than if the organization is small and the opportunities for advance correspondingly limited.

Many of the better corporations operating in the tropics either advance a part of the passage money to new employees or provide for a refund after a reasonable term of service. If

dealing with a new concern, however, or with one which is not thoroughly established financially, the employment contract should be scrutinized most critically. As an illustration of the need of this, I was offered employment a few years ago by a company which had been engaged in fruit growing in the tropics but which was reorganizing to go into the fruit export and general shipping business. The compensation offered was liberal, but, on investigation, I found that the assets of the reorganized company consisted principally of enthusiasm and promotion literature. The work on which I was to have been engaged would have required an absence from this country of about three months, and before that time was up the company had made its one and only shipment of fruit, had exhausted its liquid assets and credit and had quietly passed into history.

It should not be assumed from this that there are no worth while positions available excepting with the old and well established concerns, but until one has learned the ways of the country and something of the affairs of the newer projects it is better to play safe.



COMPLETED SUB-GRADE FOR RAILROAD. ADJOINING LANDS TO BE
CLEARED AND PLANTED IN BANANAS.

Even the best concerns seldom guarantee employment for a definite length of time, though in the event of a sudden shut-down of work and laying off of men, they are reasonably liberal in their provisions for returning men to the States. It is always well, however, to have available in convenient form sufficient funds to insure passage back home. A reserve of one to two hundred dollars would be sufficient for the return from any point in Mexico or along the Caribbean Sea, but from most South American points a substantially greater amount should be provided.

Class of Positions Available.

Following are some of the lines in which American engineers are finding employment in the tropics:

Mining: Principally along and near the west coast of South America. Civil, Mechanical and Mining Engineers employed at good salaries. Much of this work is at altitudes that insure temperate, if not frigid, conditions.

Oil Companies: In Colombia and along the west coast. These employ Civil and Mechanical Engineers principally.

Fruit Companies: Central and South America and the West Indies. Employ Civil, Agricultural and Mechanical Engineers and sugar chemists. Their work consists principally of railroad building, land surveys, drainage and irrigation, mapping and exploration. Some of the larger companies are engaged in sugar growing and manufacture.

Contractors: Well established and reliable American contracting companies are operating in all parts of Latin America. The pay offered by them to young engineers is usually small, but on short time jobs the travel allowances are liberal, the chances to gain new experiences are unsurpassed and the chances for advancement are frequently excellent.

Just at present, Mexico is a good place to stay away from, but that country has gone too far to turn back permanently, and it doubtless will offer great opportunities for the engineer in the near future. At this time its principal needs (for its physical development) are the rehabilitation and extension of its railways, and the utilization of its agricultural resources.

In the great central plateau of Mexico there are literally hundreds of feasible irrigation projects which require only a few years of stable government and a wise policy of development to insure their construction.

Contracting.

While this has been written principally for the young engineer, it may be found worthy of consideration by the contractor who considers the possibility of work in the tropics. It is obvious that a man cannot "break into the contracting game" in a new country as readily and as easily as is frequently done in this country. To make a success as a contractor in Central and South America, one should have a thorough knowledge of the climate, people, language, labor supply, transportation facilities, local materials and frequently local politics. Americans who have been successful as contractors in the tropics usually have gone there as engineering employees of large corporations or as contractors on specific work for American concerns. In this way they have gained a knowledge of governing conditions without the financial risk that would be involved by starting into independent contracting at the outset.

Perhaps the greatest source of worry and loss to the American contractor when he starts work in the tropics is his failure to appreciate both the limitations and the possibilities of the local labor. One should learn all that he can from others who have had experience in that field, but should be careful not to be misled by generalizations and prejudices. Remember that the laborers that you will employ are members of the human race and may be expected to show all the frailties and some of the good qualities of other classes of labor. If there is such a thing as a typical member of the laboring class in the tropics, he might be described somewhat as follows: He is the result of the mixture of many races; his education is limited and his impulses primitive; his physical development and powers of endurance are good, but modified and limited by inheritance, locality and mode of living; he will respond slowly but surely to fair treatment, but promptly and sometimes in a grotesque way to unfair treatment. He is more easily moved by oratory and impulse than by cold reasoning. His pride is not all hom-

bast, and under a wise and understanding supervisor this may be led into useful channels. Contrary to popular belief in this country, he can be taught to perform almost any class of manual labor well and efficiently. His teaching, however, demands infinite patience and tact as well as a considerable length of time. Best results can be secured by holding each individual or group of laborers to as small a variety of work as practicable. The average laborer will be found to be deficient in initiative and in ability to adapt himself quickly to new conditions or a new class of work. It is also unwise to make frequent changes in foremen and other members of the organization who come in direct contact with the laborers.

Use local labor and materials to the fullest extent possible. Do not be too anxious to get men experienced in the particular work expected of them. If the job is to extend over a considerable period of time, it frequently will be found better to make your special men from selected "raw material" than to hunt them up ready trained. As soon as a man is broken into a "key position," one or more understudies should be provided so that they will be ready for a similar job when the time comes for expansion or when the principal drops out. In dealing with the laborers, you cannot afford to let them get the idea that you are an "easy mark," but it is essential that you be fair to them, even to the point of generosity. If you are convinced that an employee has sold his shovel to a friend, but he comes in with some interesting story describing how it was unavoidably lost, let it go at that, but do not forget to make a deduction in a fair amount when the man comes for his pay. This amount should be slightly above what the friend would have to pay to a local dealer for a similar tool. Such a course permits the employee to save his face, makes for mutual understanding and still discourages "unavoidable losses."

Technical Preparation.

Engineers and engineering contractors who contemplate doing general work in the tropics should realize that they will be thrown on their own resources to a much greater degree than is usual in the States. They should be as fully equipped as possible in a wide variety of lines. The Civil Engineer

should have at least a "speaking acquaintance" with mechanical and electrical subjects, as he may find himself in charge of isolated work with no other technical man within reach. As nearly as practicable, he should be an "all 'round" engineer.

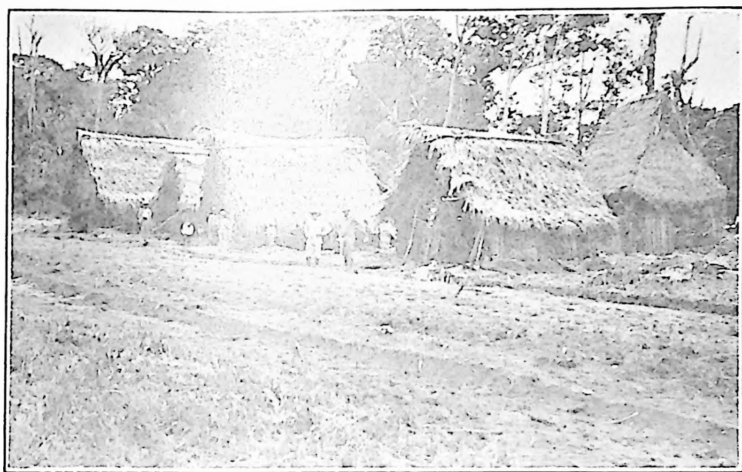
Reference Books.

No one can expect to become so thoroughly equipped by previous training that he can break away from all text and reference books and solve all his problems with no other backing than a slide rule. The slide rule is a wonderful appliance and will do many things, but it will not give you the holding power of a ten penny nail, tell you the proper size of stack to provide for a 100 H. P. engine, nor describe the difference between a "pigtail" and a "Western Union" splice. At least half a dozen reference books should be carried, and this number should be increased if practicable. Even in this country, it is my opinion that the average engineer would be better equipped if he had more, and a greater variety, of books in his own library where they would be available for ready reference, and in the tropics this is especially true. There, technical libraries are unknown, and each engineer is so isolated from other members of the profession that he should be equipped to function as an independent unit. If supplied with a well selected set of books, he will find opportunities for study in other lines as well as in those in which he is immediately engaged. Reference books are expensive, they are difficult to transport and they deteriorate rapidly in a humid climate, but they are almost as essential as pencil and paper. In my own work, I usually carry Trautwine, Kent and Kidder, supplementing these by works bearing on the special work in view. Other handbooks doubtless are just as good and possibly better, but one prefers a reference book with which he is familiar. Among the railroad engineers, you can be almost as sure of an interesting argument by suggesting the best handbook as you can by assailing a man's family, politics, religion or automobiles.

Purchase of Materials and Equipment.

When the engineer must also act as purchasing agent, ordering material from the States after he has gone to the tropics, he will serve his own and his client's interest best by

reaching as definite an understanding as possible regarding prices, deliveries, terms and service than can be given by some one reliable concern in each line than by an effort to secure competitive prices at long range. This will reduce the number



ENGINEERS' TEMPORARY CAMP. FRAMES OF POLES AND COVERING
OF MANACA LEAVES.

of catalogs to be carried and will make it possible to secure more prompt service. In selecting a dealer, make sure that he has had experience in export business. He should be well versed in shipping matters, consular invoices, etc., and should understand that a printed shipping tag, bearing the legend "handle with care" does not mean much in the life of the average stevedore and roustabout. Stencilled directions as to handling are of value, especially plain marks on heavy packages indicating where slings should be placed, but nothing will take the place of substantial crating and waterproof coverings. Even the lighter members of a fabricated steel job should be crated before they are forwarded for export shipment. Proper packing and crating appear to be subjects far beyond the powers of comprehension of the average American dealer and manufacturer.

A number of years ago, while constructing a municipal water plant in central Mexico, I received a seven foot cast iron spur gear of light construction which was as innocent of crating as the shipper was of common sense. The remnant of one paper shipping tag, tied to one of the unbroken spokes, bore the only mark indicating the destination of the shipment. A liberal use of steel plates and rivets and some crude dentistry performed by the local blacksmith to replace a couple of missing teeth, made it possible to use this wheel until another was secured from the factory.

Only a few months ago, I checked over the shipment of a large engine which was shipped to the tropics by a well known American company. This engine weighed eight or ten tons, cost several thousand dollars, and the shippers were advised that it would come to New Orleans by freight, be transferred to steamer for ocean shipment and then go into the interior in the tropics by rail. I inspected the shipment when it arrived at destination on a flat car. Among the first discouraging things noted were that the "crating" consisted of a couple of three inch plank skids, there were a number of loose and swinging copper oil pipes, a lot of loose brass fittings, many of which were found on the car floor, and a broken fuel pump. The assembly and starting of that engine was **not** the simple matter that it should have been.

The only way in which the engineer victim can control such atrocities is by dealing with concerns who realize the conditions under which export shipments are handled, and who are willing and sufficiently intelligent to take reasonable precautions against injury in transit. Every order should specify "**PACKED FOR EXPORT.**" This costs more than packing for domestic shipment, but it is worth the price.

Difficulty is frequently experienced by erroneous filling of orders. This is not always the fault of the dealer or the resident purchasing agent. It frequently is due to faulty or deficient orders. A friend of mine who acts as purchasing agent for a large concern recently received an order for "one ten ton locomotive"—no further description nor specifications. The company by which he is employed has track of three different

gages, uses steam and gasoline locomotives and coal and oil fuel. The order asked for "Immediate Shipment."

General Conditions.

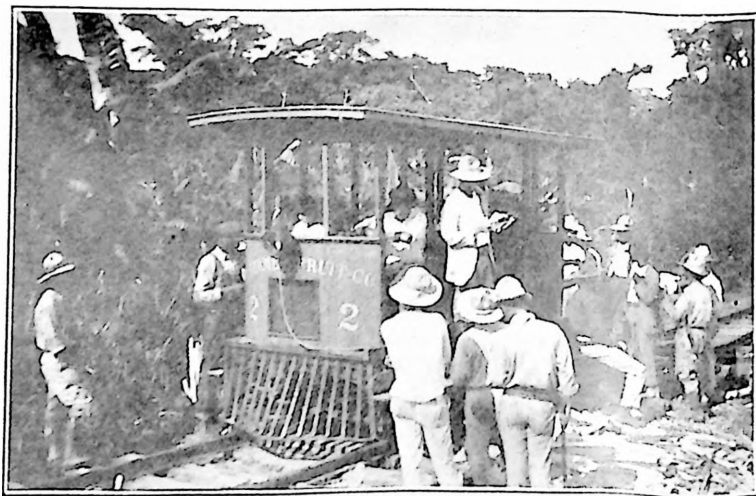
The objection most frequently raised by engineers to work in the tropics is that one gets so completely out of touch with work in the States and that on returning it is difficult to get a start excepting by going to the bottom. There is considerable truth to this, but it can be partially offset by systematic reading of technical journals, by keeping up membership in technical societies and by a judicious use of vacations. A liberal vacation should be provided for, at least once every two years, and a part of this time should be spent in visiting engineering organizations and works, attending meetings of technical societies and generally re-establishing contact with affairs of the profession. With a very few exceptions, I have never known an American who has stayed continuously for a long period in the tropics who has not shown signs of deterioration.

One should know something of the language before starting to work in a foreign country, though this is not an absolute essential if the work is to be with an organization employing large numbers of Americans. Failure to speak the language of the locality is a serious handicap, however, and should be overcome as soon as possible. Americans are notoriously poor linguists, but our engineers usually acquire a sufficient stock of phrases to enable them to handle an ordinary survey party within a few weeks, especially if the assistants assigned to them have become wise to the ways of the gringoe. Within a year, they can carry on something of a conversation; but without systematic study of the language, their sentence construction is apt to be weird and their accent and pronunciation startling. A man who has a fair command of the language and conducts himself decently frequently has an opportunity to meet local people socially, and this makes a pleasant break in what may be a monotonous life.

Some Americans acquire an excellent knowledge of Spanish in a very few months while others are hopeless. One man of my acquaintance has been in the tropics for over twenty years. In that time, he has acquired a wife and several children, none

of whom speak a word of English, but his brand of Spanish is unique. He will take a board over to the carpenter and tell him: "Cuta me this aqui."

New Orleans is so closely in touch with Latin America that even those of us who have never been farther south and the mouth of the river know something of the conditions under which men work and live in the tropics. We know the "Tropical Tramp" type of man, we appreciate the fact that malaria is still too prevalent in many sections, that living conditions, at their best, are seldom equal to those in the State and, at their worst, are unspeakable; and that Rex parades are not to be seen in the jungle. Yet, the "lure of the tropics" is a real thing and many engineers who go there find it most fascinating. The born engineer is essentially a pioneer and he will find the new experiences in Central and South America for which he craves, even though many of these sections had an advanced civilization long before the days of Columbus. It is a place, however, in which hard, serious work counts and where the typical "rolling stone" will find difficulty in securing what he considers his deserts.



PAY DAY

Preparations for a Trip to the Tropics.

As this paper has been written principally for the benefit of the younger members of the profession who may later secure a position in the tropics, the following suggestions concerning preparations for the trip may be of interest. In the first place, the chances are that you will not be located at a point convenient to large department stores, good doctors and efficient dentists. Therefore you should go prepared to do without these adjuncts of civilization. Ascertain, before leaving this country, all that you can of the character of work expected of you, the climate, living conditions and whether or not bedding will be furnished. Items which may be overlooked usually can be secured at the port cities, but at a higher price than in the States. Some items can be secured in certain localities, however, cheaper than at home. For instance, it used to be possible (and still may be) to purchase excellent blankets in Mexico for about one half the cost of a similar article in the States, and you can now purchase, in Guatemala and Honduras, a better and more serviceable rain coat than can be bought in New Orleans and the price is reasonable. Shoes are an important item, and if you are to be on field work, you should have at least two pairs that are suitable for rough work. The best way to avoid blistered feet is by changing from one pair of shoes to another. A good combination is to take two pairs of the army type of shoes, one pair of high lace boots and a pair of puttees. In addition to this, a pair of lighter shoes and a pair of slippers will be found convenient.

The medicine chest which many men take with them to a new country doubtless does more harm than good, but a small emergency surgical outfit should be carried and a liberal supply of quinine and some good cathartic may prove useful. If going into a section where malaria is known to be prevalent, moderate doses of quinine should be taken regularly as a preventive.

A visit to your dentist before leaving home is most important. If he repairs all the visible defects and you have good luck, you may get back before more work is required; other-

wise, you may have to go to a local dentist. The experience may prove novel but trying.

The foregoing may be summarized and supplemented by the following list of "Don'ts":

Don't give up a job in the States for a promise of one in the tropics unless you know the concern making the offer and that they have the reputation and ability to carry out their part of the contract.

Don't get into the habit of knocking the company employing you if things do not go just to suit you. If you must knock, do it from the outside. So long as you are taking their money, they are entitled to loyal as well as energetic service.

Don't be a "sissy" or a grouch, especially if living in camp. There is nothing like camp life to bring out all the qualities of a man, and if he is not a good sport, he will soon become a disturbing factor, and this will result in inefficient service and ultimate increase in cost of work to the employer. The disturbing factor is then removed.

Don't suddenly discover that Volstead laws are unknown and start in to make a dry country of your new home by drinking up all the booze in sight. It can't be done. Many a better man than you are has tried it and failed.

Don't become a chronic gambler. If you enjoy an occasional game of poker or "rolling the bones," establish your limit and stick to it! Remember that a few hundred dollars saved up will enable you to take a real vacation when the time comes. One good plan is to budget your gambling expenses as you would any others, putting into this fund the amount that you think that the fun is worth and stopping when the fund is exhausted. Sometimes you may find that the amount has increased during the month, but frequently you will have to stay out of the game until next pay day.

Don't lose touch with technical affairs in the States. Read, study and maintain your connection with engineering societies. Visit other works whenever feasible.

Don't lose your sense of proportions in matters of business and professional ethics, personal habits nor morals. A slip made in the tropics may be slow in "coming home to roost," but it will get there eventually. If your self respect is not sufficient to keep you straight, supplement it with caution and fear of consequences.

Don't think that just because you are a thousand, or four thousand, miles from home, no one will ever hear of your conduct. When I first went to Honduras three years ago, I did not know of a person there of whom I had ever heard, yet, before the first line had been thrown out to tie the steamer to the wharf, I was greeted by a man from the dock with whom I had been rather intimately associated only three years before.

When you go to the tropics, it doubtless will be with a more or less definite object in view, which may include some or all of the following: Financial gain, professional training, new experience; business opportunity.

The chances are that if you start out with such definite objects, and do not lose sight of them during your stay there, you will gain them in a measurable degree.

THE COMPARISON OF PUMP TESTS WITH SPECIAL REFERENCE TO LOW HEAD PUMPS

BY EUGENE F. DELERY

Read before the Society, February 11, 1924.

We are all familiar with the time honored device of comparing the performance of pumps directly by means of their efficiencies, usually, without reference to any other feature. In many cases not the slightest reference is made to size, capacity, spouting velocity, or lift, or whether this lift is static or dynamic. In comparing the efficiencies of pumps you will very seldom see any reference to the spouting velocity as related to the lift or to the piping design. Yet all these factors are of prime importance in the comparison of any two plants, especially if the comparison is made with the object of selecting pumps for a new installation.

Nearly all modern installation of any size are tested and in most cases these tests are available to prospective purchasers through their engineers, but if efficiency alone is made the basis of comparison, the comparison is meaningless. A purchaser naturally desires to secure as much service for his outlay as possible, and it is up to the engineer to get it for him. We, nevertheless, find men designing drainage and irrigation layouts, with scant knowledge and no study of the subject. The worst case, and it still occurs, is the failure to flare the suction and discharge pipes, although most of those present tonight would hardly be guilty of this.

We will first treat this case, merely to show the effect of neglecting this precaution. Assume an installation with straight suction and discharge pipes, not flared, a spouting velocity of 8 ft. per sec., and a static lift of 5 ft. and a real pump efficiency of 80% under the conditions. Now assume the usual entrance loss co-efficient of 0.6, the discharge loss co-efficient being 1. The dynamic head against which the

pump must operate will be $5 + 1.6 \frac{v^2}{2g} = 6.59$ feet; and $6.59 / .8$ gives 8.22 feet of head which must be overcome by the im-

PELLER. The efficiency of the pump would then be only $5/8.59$ or 58.2% efficiency across the station.

HAD the suction and discharge pipe been flared so as to reduce the entering and discharge velocities to 2 ft. per sec. each, the velocity loss would be 0.0993' and with a pipe efficiency of 80% and pump efficiency of 80%, the station efficiency would be 78.5%.

CASE 2: Assume two pumps of the same size with identical suction and discharge pipes, properly flared, both pumps identical in design except that the impeller of one is designed to deliver twice as much water as the other, against the same lift.

Assume both to operate against 10 ft. head, with 80% efficiency, but pump No. 1 has a Spouting Velocity of 10 feet per second, while pump No. 2 has only 8 ft. per second Spouting Velocity. It is very apparent without calculation that pump No. 1 is a better pump, hydraulically, than pump No. 2. It is also easily apparent that the lost head through No. 2 is greater than through No. 1.

CASE 3: Both pumps operate, at 80% efficiency with a Spouting Velocity of 8 ft. per second, but No. 1 operates against 5 ft. lift, while No. 2 operates against 10 ft. lift. It is apparent that there is more loss through No. 2 than through No. 1. No. 1 is therefore a better pump.

Allowance for leakage past the ring, stuffing box leakage, friction and other mechanical losses are omitted in order to keep the reasoning clear, though this must be taken into account in making careful comparisons.

At this point we will bring out what I consider the real measure of the efficiency of a pump; the lack of loss of Velocity head through the pump, that is, the lack of energy loss through the pump. Call h_s the Static Lift, h_d the Dynamic head, h_v the velocity head at the pump flanges (both flanges the same size) f_v the factor of the lost Velocity head, g gravity or 32.2, e the efficiency of the pump, h_l the velocity head lost in passage of the water through the pump, v the velocity at the pump

$$\text{flanges, } h = \frac{h_d}{e} = h_s + h_v.$$

If we had a 100% efficient pump, we will all readily acknowledge that the loss of velocity head through the pump would be nil. But no such pump can be, and our pumps are efficient only in so far as they approach that ideal, and their efficiency is equal to the head which they do develop divided

by the head which they should develop, or $h_1 = f_v \frac{v^2}{2g}$.

Returning to case 2, we find both pumps operating at 10 ft. head and 80% efficiency with a loss of head of 1.25 ft. each.

$$\text{For No. 1 } f_v = \frac{1.25 \times 64.4}{10^2} \text{ or } .805.$$

$$\text{Pump No. 2 gives } f_v = \frac{1.25 \times 64.4}{64} \text{ or } 1.256.$$

Pump No. 1 is the better pump, having a less percentage of lost velocity.

Case 3: Both pumps are the same size, with a Spouting Velocity of 8 ft. per second but No. 1 has a lift of 5 ft. while No. 2 operates against 10 ft. Both are 80% efficient.

The lost head in No. 1 is 1.25 and f_v is 1.256, while for No. 2 h_1 is 2.50 and f_v will be 2.52, or with equal efficiencies No. 1 is twice as good. These examples are sufficient to bring out the idea involved and its application in comparing pumps of various types under vary conditions. The curve of f_v corresponding to any pump test can be as readily plotted as an efficiency curve, and should be much more enlightening.

The equation for f_v may be variously expressed as shown:

$$f_v = \frac{\left[\frac{h_d}{e} - h_d \right] 2g}{v^2} = \frac{h_d(1-e)}{h_v e}.$$

The other method known to us is Specific Speed, which as given by Dauherty and others means nothing as regards comparative efficiencies and relates only to one set of homologous designs.

$$N_s = \frac{N \sqrt{gpm}}{H^{\frac{3}{4}}}$$

The equation of the lost Velocity Head Factor f_v takes into consideration all the essential features, and brings out strongly the effect of reduction of capacity on the efficiency, making it possible to get some measure of comparison between pumps operating under widely divergent conditions.

While the above furnishes a measure of direct performance comparison between pumps, it must always be borne in mind that common sense is as essential to the application of a formula as in anything else, and that discretion should be exercised in making comparisons. This is particularly necessary in comparing high speed with slow speed pumps.

While every writer on the subject stresses the fact that the shorter passages through the high speed impeller give it an advantage over the slow speed type, it must also be remembered that owing to the higher speed of the high speed impeller the entrance angle of the blades is much more acute, constricting the entrance area to the impeller, suddenly increasing the velocity of the water, and causing more loss of head at the impeller entrance, which loss cannot be recovered. This may or may not apply at discharge.

Other factors which enter into the problem, are the shape of the suction entrance pipe. If this is a short turn, such as is very common, we are confronted with an entrance elbow delivering water to the impeller at considerably different velocities and pressures on opposite sides of the impeller, thus making it impossible to so design the impeller as to give a correct angle to the blades at all points.

It is easy to understand that if the velocity of the water entering the impeller is different at opposite points the entrance blade angle can not be right at all points, as all blades must be equally pitched. Cases have been cited in which by simply changing the entrance elbow to a straight entrance pipe of considerable length, the efficiency of a pump has been changed from 52% to 70%.

As these last figures were given by the chief engineer of one of our foremost manufacturers, I believe that they are well worth our attention. This condition of incorrect entrance

obtains in most centrifugal and screw pumps. In some cases it is carried so far that the water is flowing with the direction of rotation on one side of the impeller and against it on the opposite side.

These are a few of the things that go to make up the loss of head through the pump, and reduce its efficiency, and the more of these losses introduced the less the efficiency, and the fewer of these losses the greater the efficiency.

In the case of the High-head pump another potent loss of efficiency is the leakage past the impeller ring. This increases as the square of the lift, thus making it impossible to attain the very high efficiencies which would otherwise be attained with the high head pump. In high head pumps, another loss factor not to be reckoned with in low head pumps is the disc friction. This can however be regulated by smooth castings and by sufficiently spacious balance chambers. I show all these factors to show how many factors go to lower the efficiency of a pump, by the cumulative effect.

As each of these losses can be represented as a factor of the velocity head, when properly added together they make up the pump loss factor, which may be represented as f_v , or the lost velocity head factor. Of course, in considering pumps operating under widely varying conditions some judgment must be used in comparing the lost head factors. It is safe to say, however, that a comparison of the lost velocity head factors will give us a better idea of probable performance of pumps under varying conditions than either the Specific Speed, or a simple statement of the efficiency. One thing very strongly brought out by a consideration of the lost velocity head factor is the influence of the Spouting Velocity on the efficiency.

A table of comparisons, taken from published tests is given at the end of this paper, which shows the effect of Spouting Velocity on the Velocity Head Loss Factor, regardless of efficiency, and also shows the related pumping head. In most cases the head given is the head across the station, but with final discharge velocities so low that for the sake of comparison we may consider them as substantially equal to the dynamic

head. I know that I will be answered that what the usual buyer is interested in is the efficiency that his pump will give at a stipulated head and capacity, but as I see it that is not all.

Consideration must be given to that all governing factor known by the vulgar appellation of Price. This is especially true when we consider that large pumps for drainage and irrigation usually operate not over 100 days per annum, thus reducing the overall effect of very high efficiency at high first cost. In order to get very high efficiency it is usually necessary to reduce the Spouting Velocity by using a larger pump than would otherwise be called for, at a larger investment; when it might be cheaper in the end to buy a pump with a somewhat lower efficiency. It sometimes requires considerable figuring, and judgment, to decide the lesser of two evils, and anything which will aid us in making a correct decision is to be desired.

Now as the lost Velocity Head through the pump is a direct measure of the lost energy it appears to me that it is a better gauge of the relative merit of a hydraulic pumping machine than is the bare statement that its efficiency is such and such.

TABLE OF COMPARED TESTS

All Efficiencies Taken at Peak of Curve

Type—	Place—	Lift.	Efficiency.	f_v .	V.	Size.	Authority—
Rotary.....	Neeches Relift.....	10.0	76.00%	?	?		W. B. Gregory
Centrifugal.....	Citrus.....	6.10	49.7	2.95	11.6	51.3"	W. B. Gregory
Centrifugal.....	Citrus.....	6.13	55.7	2.41	11.4	51.3"	W. B. Gregory
Centrifugal.....	White Lake.....	5.02	65.7	2.68	9.5	54"	W. B. Gregory
Centrifugal.....	Onishi.....	39.43	70.0	6	10.0	24"	W. B. Gregory
Centrifugal.....	Avoca.....	2.22	41.1	2.1	9.84	72"	W. B. Gregory
Centrifugal.....	Avoca.....	7.03	82.3	1.49	8.1	72"	W. B. Gregory
Centrifugal.....	New Orleans.....	11.0	77.5	1.92	10.45	72"	H. P. Morris Co. (Dauherty)
Centrifugal.....	Lafourche.....	3.17	33.8	2.8	11.75	24"	W. B. Gregory
Centrifugal.....	Duson Relift.....	11.31	75.0	.965	16.25	36"	W. B. Gregory
Screw.....	Milwaukee.....	3.569	66.56	5.00	4.57	168"	Eng. News
Screw.....	New Orleans.....	7.00	76.00	2.16	8.0	12"	S. & W. Board Tests
Screw.....	New Orleans.....	6.9	80.00	4.0	5.2	30"	S. & W. Board Tests
Screw.....	New Orleans.....	7.55	77.3	6.57	4.36	144"	S. & W. Board Tests
Screw.....	New Orleans.....	4.00	73.0	2.30	6.55	144"	S. & W. Board Tests
Screw.....	New Orleans.....	8.00	78.00	7.84	4.3	144"	S. & W. Board Tests
Rotary Flow.....	New Orleans.....	3.5	44.00	5.5	7.00	4"	Delery & Harris
Rotary Flow.....	New Orleans.....	5.0	36.00	6.0	9.8	4"	Delery & Harris
Rotary Flow.....	New Orleans.....	6.00	38.5	7.2	9.6	4"	Delery & Harris
Augur.....	Grand Rapids.....	4.5	39.00	13.75	5.73	16"	Eng. News Record
Screw.....	Chicago.....	7.06	82.00	15.6	2.59	168"	Eng. News Record
Centrifugal.....		29.1	82.00	5.8	8.3	18"	Dauherty
Centrifugal.....		26.0	86.00	6.3	10.2	18"	Dauherty

Note: All the above figures taken and deduced, by slide rule, from published tests. They are given for their face value and it is left to the reader to place his own interpretation on the results. Attention is called to the relationship between low Spouting Velocity and High Efficiency, and the fact that a low Loss of Head Factor does not necessarily follow a high efficiency. It will be observed that while low Spouting Velocity and High efficiency do not always go hand in hand, it is the rule that high efficiency follows low Spouting Velocity, and that many pumps with very low Spouting velocities and rather high efficiencies have somewhat high velocity loss factor, also that for the same pump the point of best performance (i. e. where the loss velocity factor is lowest) is not necessarily the point of maximum efficiency.

Note.

Abbott-Duson Relift Over-all Record.

Lift.	Eff.	f.	V.	Size.
11.31	64.2	1.54	16.0	36"

Note: Wire rope drive test by Gregory, July 31, 1905.

The pump efficiency was estimated at 75% by Professor W. B. Gregory.

ADDENDA

As the idea in this paper appears not to have been made sufficiently clear, and in order to remedy this defect, it was thought better to elucidate somewhat further and to explain the notation.

h_d = the dynamic head, would be measured between gauges set near the flanges of the suction and discharge of the pump. It is assumed that the suction and discharge are equal, hence their velocities are equal, and that the gauges are set at the same level. The above gauges measure the total head by the pump, including the velocity head, and measure the total difference of pressure between the two gauges.

e is the efficiency of the pump and
$$= \frac{\text{water HP}}{\text{HP Input}}$$

$$h = \frac{h_d}{e}$$
 the head which the impeller would make if both impeller and casing were 100% efficient.

Therefore $h - h_d = h_s$, the head consumed or lost due to the inefficiency of the impeller and casing between gauges.

h_s is the static head, or difference between suction and discharge water levels.

v is the velocity at the suction and discharge gauges, these being equal velocities or reduced to equality.

h_v is the velocity head due to v at these points, then:

$$f_v \frac{v^2}{2g} = h_s = h - h_d = \frac{h_d}{e} - h_d = h_d \left[\frac{1-e}{e} \right]$$

$$\text{so } f_v v^2 = \frac{h_d (1-e) 2g}{e 2gh_v} = \frac{h_d (1-e)}{h_v e}$$

Note that this equation takes into account the dynamic head, the velocity head, and the efficiency, directly, and covers all the factors, and shows that f_v is a function of the ratio of the dynamic head to the velocity head and of $\frac{1-e}{e}$.

Thus establishing a direct relation between these quantities at all times.

A very little inspection will show that with all but one function known the rest can be worked out and applied, as was done in the body of this paper.

The attached table shows the relationship for varying conditions.

Values of h_d	When $e =$										
	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95	.100
	$1 - e$										
	then $=$										
h_v	9	4	2.34	1.5	1	.67	.43	.25	.111	.052	0
values of f_v —when e is as above											
1	9	4	2.34	1.5	1	.67	.43	.25	.111	.052	0
10	90	40	23.4	15	10	6.66	4.3	2.5	1.11	.523	0
20	180	80	46.8	30	20	13.2	8.6	5	2.22	1.05	0
30	270	108	70.2	45	30	19.8	12.9	7.5	3.33	1.58	0
40	360	160	93.6	60	40	26.4	17.25	10	4.44	2.1	0
50	450	200	117	75	50	34	21.5	12.5	5.55	2.54	0
60	540	240	140	90	60	40	25.8	15	6.66	3.16	0
70	630	280	164	105	70	46.7	30	17.5	7.77	3.69	0
80	720	320	187	120	80	53.5	34.4	20	8.88	4.22	0
90	810	360	210	135	90	60	38.8	22.5	9.99	4.75	0
100	900	400	234	150	100	66.6	43	25	11.11	5.28	0

The above table brings out the fact that for any determined values e and of $\frac{h_d}{h_v}$ there is a definite value of f_v .

An application of the above would be found where different makers offer different size pumps of varying capacities and varying discharge velocities at a letting making guarantees as to efficiencies and capacities (velocities) at equal heads.

By reducing the capacities to velocities in feet per second, and then to h_v , divide this into h_d , hunt up the value of f_v corresponding in the table and that pump which shows the lowest value of f_v will be the pump with the least energy through the pump.

This makes it possible to compare pumps with greatly varying capacities, size being taken into consideration.

The table may also be used to check up the examples cited in the body of the paper.

I hope that this additional explanation will clear up any ambiguities in the original paper.

OBITUARY.

Frank G. Churchill.

Whereas, it has pleased Divine Providence to take from our midst our friend and fellow citizen, Mr. Frank G. Churchill.

Whereas, members of Louisiana Engineering Society have recognized Mr. Churchill's ability as an architect of high attainments and unquestioned professional integrity and have also been appreciative of his admirable qualities as a man and a useful citizen of the community.

Therefore, be it resolved that it is the sense of Louisiana Engineering Society that, in the passing of Mr. Churchill, the architectural profession has lost a most worthy member, the community a useful citizen of the highest and most honorable and admirable type—one about whom it may be truthfully said that the world is better for his having lived in it.

Be it further resolved that a copy of these resolutions be spread upon the minutes of this Society and that a copy be sent to the family of Mr. Churchill.

Respectfully,

DOUGLAS ANDERSON,
A. M. SHAW,
SAMUEL YOUNG,

Committee.

Alonzo B. Robert.

Whereas, it has pleased Divine Providence to take from our midst Mr. Alonzo B. Robert, father of our esteemed fellow member and President of the Louisiana Engineering Society, James M. Robert.

Be it resolved, that the Louisiana Engineering Society extend to Mr. James M. Robert, President of this Society, its most profound and heartfelt sympathy in the loss of his father.

R. H. MANN,
W. B. GREGORY,
DOUGLAS ANDERSON,

Committee.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Meeting of the Board of Direction, February 11, 1924.

The meeting was called to order with President Robert in the chair and the following present: Messrs Barelli, Moses and Muth.

The minutes of the previous meeting were read and approved and bills on hand were ordered paid.

The resignations of Messrs. Solis Seiferth and R. P. Rordam were accepted with regret.

The matter of awarding of the Ole K. Olsen prize Fund for Membership Drive from November 14, 1921, to December, 1922, was taken up and instructions were given to tabulate results of the membership drive for action at an early date.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Regular Meeting of the Society, February 11, 1924.

The meeting was called to order with President Robert in the chair and thirty-two members and guests present.

Minutes of previous meeting were read and approved.

Mr. J. S. Barelli made an interesting report as our Delegate at the Conference of the Federated American Engineering Societies held in Washington in January and announced that he had been elected Representative for this year for this District.

Announcement was also made that for the protection of automobiles of members parked outside the building during our meetings arrangements would be made for a watchman beginning at next meeting.

The technical exercises of the evening consisted of a very interesting paper on "The Comparison of Pump Tests" by Mr. E. F. Delery. The paper was followed by interesting discussion and the speaker was tendered a rising vote of thanks.

The meeting then adjourned to the usual collation.

F. A. MUTH, Secretary.

Meeting of the Board of Direction, March 10, 1924.

The meeting was called to order with Director John S. Barelli in the chair and the following present: Messrs. Hamilton, Lanphier, Moses and Muth.

Announcement was made that President James M. Robert was forced to be absent because of the death of his father and Vice-President Gar-saud was out of the city.

Minutes of previous meeting were read and approved and bills on hand were ordered paid.

Letter of February 28 from the Assistant Secretary of the State Board of Engineering Examiners was read relative to vacancies on the Board, and on motion, duly seconded, the Secretary was instructed to request the President to furnish the Governor with a number of names of eligible members from whom two appointments can be made.

The matter of the award of the Ole K. Olsen Prize Fund was brought up again, and the Prize of \$100.00 was declared won by Charles M. Kerr with fourteen memberships. In view of the fact that there were three members to whose credit there were six memberships for the year 1922, on motion, duly seconded, it was voted to award no second prize, but to offer the remaining Fifty Dollars as a prize to the member bringing in the largest number of members for the year 1924, crediting memberships elected from this meeting to December 31, 1924.

Membership of Mr. John L. Ebaugh, Jr., was changed from Junior to Non-Resident Junior.

There being no further business the meeting adjourned.

F. A. MUTH, Secretary.

Regular Meeting of the Society, March 10, 1924.

The meeting was called to order with John S. Barelli in the chair, F. A. Muth, Secretary, and forty-two members and guests present.

Minutes of previous meeting were read and approved.

Letter from Mr. James M. Todd, Member, offering to donate three volumes of Appleton's Cyclopedia of Mechanics to the Society was read, and on motion, duly seconded, it was voted to accept the donation of three books, with thanks.

The Society desired to take this opportunity of expressing sympathy to President James M. Robert in the death of his father, and on motion, duly seconded, the Chairman was requested to appoint a Committee to draft resolutions of sympathy. The Committee was appointed: Mr. R. H. Mann, Chairman; Professors W. B. Gregory and Douglas Anderson.

Announcement was made that Mr. C. E. Grunsky, President, and John H. Dunlap, Secretary, of the American Society of Civil Engineers, will be in New Orleans, and that they will attend a joint meeting of the Local Section of the A. S. C. E. and the Louisiana Engineering Society, addressing the members April 14. On motion, duly seconded, it was voted that a Committee be appointed to co-operate with the Local Section of the A. S. C. E. in entertaining the officials of the American Society of Civil Engineers and that the joint meeting of these societies be held at next meeting. The Secretary was instructed to request the President, Professor Robert, to appoint the Committee.

Announcement was made that the Board had checked over the records of the Membership Drive for the Ole K. Olsen Prize Fund, and

Mr. Charles M. Kerr won the first prize of \$100.00. No second prize was awarded, but the remaining \$50.00 has been offered as a prize to the member credited with bringing in the largest number of new members from this meeting until December 31, 1924. The announcement to be brought before members through the Proceedings.

The technical exercises of the evening consisted of a very interesting and instructive paper on "The American Engineer in the Tropics" by Col. Arthur M. Shaw. The paper brought forth much interesting discussion and the speaker was tendered a rising vote of thanks. On motion, duly seconded, it was voted that extra copies of Colonel Shaw's paper be printed and furnished to senior students in Tulane University and Louisiana State University.

Reference was made to the recent death of Mr. Frank Churchill, Architect, who had been of great assistance in the design of the architectural features of the Library of the Society assisting in the work of producing the room we now occupy, and on motion, duly seconded, the Chairman was requested to appoint a Committee to draft resolutions to be furnished the family and a copy for spreading on the minutes of the Society. The Committee was appointed: Samuel M. Young, Chairman; Prof. Douglas Anderson, Col. A. M. Shaw.

The meeting then adjourned to the usual collation.

F. A. MUTH, Secretary.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

APRIL, 1924

“PATRONIZE OUR ADVERTISERS”

INDEX TO ADVERTISEMENTS

	PAGE
Lester F. Alexander & Co.....	4
Allis-Chalmers.....	6
The American Cement Machine Co., Inc.....	5
American Creosote Works, Creosoted Timber.....	14
American Creosoting Co., Inc.....	12
The Anchor Packing Co.	17
H. Bodenheimer & Sons.....	9
Brook Tarpaulin Co., Inc.	14
Citizens' Bank & Trust Company.....	13
Columbian Iron Works.....	17
Concrete Steel Company.....	9
W. G. Coyle & Co.....	9
Creosoted Materials Co., Inc.....	10
Dixie Mill Supply Co., Inc.	15
Doullut & Williams Co., Inc.....	11
Eugene Dietzgen Co., Surveying Instruments.....	16
Gaiennie Company.....	5
Geo. J. Glover.....	7
Gray Artesian Well Company	6
Harry Bros. Co. of La., Galvanized Iron Tanks, etc.....	12
Hattiesburg Creosoting Company	10
Robert W. Hunt & Co., Engineers, Chemists, Inspectors.....	10
Jahncke Service, Inc.	17
Kittredge-Waters Supply Co., Ltd.....	5
A. M. Lockett & Co., Ltd.....	8
The Lufkin Rule Co.....	3

INDEX TO ADVERTISEMENTS—Continued.

	PAGE
The Manhattan Rubber Mfg. Co.....	13
Albert A. Martinez, Southern Yellow Pine.....	Inside Front Cover
Guy R. Molony & Co.	13
John H. Murphy Iron Works	8
N. O. Coal and Bisso Towboat Co.	19
Ole K. Olsen, Concrete and Structural Steel.....	7
Pacific Flush-Tank Co.....	13
Profit Island Gravel and Sand	3
Shakspeare Iron Works	3
Standard Oil Co. of Louisiana	11
The Tulane University of Louisiana.....	4
The Tulane University Press, Printing.....	6
Turnerized Roofing Co.	Outside Back Cover
Westinghouse Electric & Manufacturing Co.....	18
Woodward, Wight & Co., Railway and Mill Supplies.....	16

This Journal reaches the officials with whom rests the responsibility for the bulk of the municipal, state and industrial works in Louisiana and the surrounding territory. Its advertising pages afford you an effective and dignified means of cultivating a wider acquaintance among prospective buyers.

WHEN
YOU BUY
A

LUFKIN

Measuring Tape

YOU MAY BE SURE THAT

You have an ACCURATE and DURABLE tape of a brand that has given universal satisfaction for years and that the maker guarantees direct to you.

Send for catalogue.

THE LUFKIN RULE CO.

Saginaw, Mich.

New York,
London, Eng.
Windsor, Can.



PROFIT ISLAND GRAVEL AND SAND

(Sized, Washed and Mixed)

(Concrete and Screened)

Also Carry a Complete Line of

Building Materials

Including

Portland Cement, Plaster, Brick, Lime, Clay
Products, Laths, Finishing Plaster, etc.

J. W. Thompson

708 Commercial Bank Bldg.

(FORMERLY HENNER BLDG.)

Phones Main 1165-1166

New Orleans, La.

Phone Main 541

913 Girod Street

SHAKSPEARE IRON WORKS JULIAN M. SWOOP, Proprietor

Machinery Repairs Given Prompt Attention

Grey Iron Castings, Brass Castings

Plantation Sugar Mill Repairs a Specialty

Blacksmith Work of all Kind

Pattern Making Grate Bars—ordinary or circular

WE WELD ANY PARTS OF BROKEN MACHINERY

PHONE MAIN 541

NEW ORLEANS, LA.

LESTER F. ALEXANDER,
M. Ia. Engr. Soc.
M. S. A. M. E.

J. L. DICKEY,
M. Am. Soc. C. E.
M. Ia. Engr. Soc.
M. S. A. M. E.

LESTER F. ALEXANDER & CO.

CIVIL ENGINEERS and CONTRACTORS

**River and Harbor Improvements
River and Gulf Towing**

Barges, Derricks and Pile Drivers

830-32-34 Maison Blanche Annex. New Orleans, La.

Phones—Main 4195-1967

TUGS—Boswell, H. H. Colle, Wm. F. Flanders, Panther.

TULANE UNIVERSITY OF LOUISIANA NEW ORLEANS

Located in the choicest residential section of the South's leading city, with climatic and other advantages enjoyed by no other institution of equal rank, offers superior instruction in standard college courses, and in Engineering, Law, Medicine, Pharmacy, Dentistry, Art, Music, Domestic Science, Household Economy, Commerce and Business Administration. Separate department for women in the Newcomb College. Extensive laboratories, many scholarships in under-graduate colleges for men and women. Board and accommodation in dormitories at low rates. Twenty-four buildings. Campus of 100 acres. Full descriptive catalog, or a bulletin of any college sent free upon application. Address The Registrar, Tulane University, New Orleans, La.

Telephones Main 1495-1496

Kittredge-Waters Supply Co., Ltd.

Machine Shop

Engineer and Mill Supplies

422-424 Common Street

New Orleans



CONTRACTORS' EQUIPMENT

All Sizes from 5 ft. to 22 ft. Gas, Steam or Electric.
Ask about the BOSS High Drum two-bag Mixer.

THE AMERICAN CEMENT MACHINE CO. (Inc.) Keokuk, Ia.

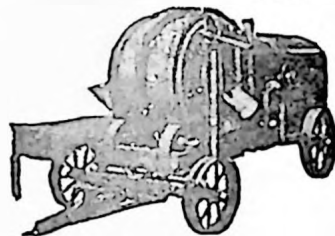
CARRIED IN STOCK BY

OLE K. OLSEN

822 Perdido Street, New Orleans, La.

Pavers, Grouters, Building
Mixers, Hoists, Back - Fillers,
Elevators, Pumps, Carts

Low Prices—Cash or Terms



\$325 Buys Low Charger

Gaiennie Company

STEAM HEATING
HOT WATER HEATING
MOIST AIR HEATING
GAS STEAM HEATING
PLUMBING
PLUMBING SUPPLIES

ESTIMATES FURNISHED UPON APPLICATION

Howard Avenue and Baronne Street

Phone Main 4020

ENGINEERS

We are Official Printers of the
Louisiana Engineering Society,
and make a specialty of the
PRINTING needs of Engineers

Tulane University Press

QUALITY PRINTERS

PHONE WALNUT 82



POWER, ELECTRICAL and INDUSTRIAL MACHINERY

ELECTRICAL Machinery, Steam Engines, Steam Turbines,
Condensers, Gas Engines, Oil Engines, Hydraulic Tur-
bines, Pumping Engines, Centrifugal Pumps, Mining
Machinery, Metallurgical Machinery, Crushing Machinery,
Cement Machinery, Flour Mill Machinery, Saw Mill Machinery,
Air Compressors, Air Brakes, Steam and Electric Hoists, Farm
Tractors, Power Transmission Machinery, Perforated Metals,
Timber Preserving Machinery.

COMPLETE POWER
UNITS WITH ANY
TYPE OF
PRIME MOVER

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

Gray Artesian Well Company

Water Supply Contractors

PENSACOLA, FLORIDA

Send your Specifications to us.

We Guarantee Water

BACKED BY BOND

Ask Your Friends About
The Concrete Engineer

OLE K. OLSEN

822 PERDIDO STREET
Phone Main 2104. New Orleans.

Geo. J. Glover

General Contractor

*Member: American Society for Testing Materials
Contractors & Dealers Exchange of New Orleans*

Whitney-Central Building New Orleans, La.

PHONE MAIN 1276

*Office Buildings, Railway Buildings, Manufacturing
Plants, Heavy Masonry, Pile Foundations*

AT YOUR SERVICE

To engineers we offer our services and the services of the manufacturers of high-grade equipment whom we represent; some of whom are as follows:

Babcock & Wilcox Co; Boilers and Superheaters. **Worthington Pump & Machinery Corporation;** Pumps, Compressors, Oil Engines, Condensers, etc. **American Blower Co;** Fans and Blowers and Air Conditioners. **Nash Engineering Co;** Vacuum and Steam-heating Pumps. **Spray Engineering Co;** Spray Cooling Ponds. **Frick Co;** Refrigeration Equipment. **Diamond Power Specialty Co;** Soot Blowers. **Diamond Rubber Co;** Mechanical Rubber Goods. **Robins Conveyer Co;** Conveyors and Handling Equipment. **Griscom-Russell Co;** Heat Exchange Apparatus. **A. M. Lockett & Co;** Oil-Burning Equipment.

Each of these has in its employ engineers who represent the highest talent in their respective lines; and the engineer whose client's requirements call for equipment covered by any of these lines, can count on the advice of these specialists, as well as that of our own engineering organization, in selecting proper equipment for a wide variety of service.

A. M. LOCKETT & CO., Ltd.
Contracting Mechanical Engineers and Machinery Merchants

NEW ORLEANS
Houston, Dallas, San Antonio, Texas

JOHN H. MURPHY IRON WORKS

MANUFACTURERS AND CONTRACTORS

Vacuum Pans, Coil and
Calandria

Webre Multiple Effects

Centrifugals and Mixers

Crystalizers, any type

Return Current Juice Heaters

Oil Storage Tanks, all sizes and shapes

Internally Fired Boilers

High Pressure Boilers Fitted
with Steel Casings

Quinn Flat Top Bagasse

Furnaces

Juice and Syrup Tanks

Main Office, 643 Magazine St.

New Orleans, La., U. S. A.

Phone Main 160

Foundry and Machine Works

A. J. Naquin, Manager

Alexandria, La.

Boiler and Tank Works

Broad and Perdido Sts.

Phone Main 161

Machine Shop, Copper and

Brass Works

Magazine and Girod Sts.

W. G. COYLE & CO.

(INCORPORATED)



Bunker Coal and Towing BARGES, LIGHTERS, ETC.

High Grade Coals

Competent Tugs

Telephone Main 4429

Main Office: 1322 Whitney-Central Bldg.

New Orleans, La.

H. BODENHEIMER & SONS

Everything Pertaining to

INSURANCE

810 UNION STREET

Phones Main 1817-1818

NEW ORLEANS, LA.

SPECIFY

HAVEMEYER BARS

For Your Reinforced Concrete Work.
The Most Efficient and Economical Bar.
Rolled to same weight as plains.
Round—Square—Flat.

"EVERY POUND PULLS."

PROMPT SHIPMENTS—MILL OR WAREHOUSE

Concrete Steel Company

42 Broadway

NEW YORK

SOUTHERN OFFICE

Birmingham,

::

Ala.

OLE K. OLSEN, Sales Agent
New Orleans.

Hattiesburg Creosoting Co.

Plants at Hattiesburg, Miss. and Slidell, La.
Main Office, Hattiesburg, Miss.

CREOSOTED MATERIAL

—INCLUDING—

**Lumber, Timbers, Piles, Telephone and Telegraph
Poles and Cross-Arms, Paving Blocks,
Cross-Ties, Etc.**

CAPACITY, 70,000,000 FEET B. M. PER ANNUM

Facilities for Shipping by Rail or Water

Creosoted Materials Co., Inc.

1403 HIBERNIA BUILDING

Phone Main 3818

New Orleans, La.

—DEALERS IN—

Creosoted Materials of All Kinds

Robert W. Hunt Co.

Engineers, Chemists, Metallurgists, Inspectors

Inspection and Tests of Steel and Cement for Bridges, Buildings
and Other Structures. Inspection of Rails and Fastenings.
Creosoted Block, Timber and Ties. Paving Brick and Asphalt.

General Office, Chicago, 2200 Insurance Exchange.
New Orleans, 919 Carondelet Bldg.

Stanocola Mexican Asphalt

FOR
Sheet Asphalt
Asphaltic Concrete
Brick and Block Filler
Penetration Macadam
Surface Treatment

Standard Oil Co. of Louisiana

NEW ORLEANS

W. HORACE WILLIAMS,
 Pres. and Gen'l Mgr.*

J. P. EWING,
 Secty-Treas. and
 Managing Engineer

PAUL DOULLUT,
 Vice-Pres.

Doullut & Williams Co., Inc.

Engineers and General Contractors

NEW ORLEANS, LA.

CAPITALIZED AT \$1,000,000.00

Competent Engineers in charge of Departments covering design and construction of the following:

Docks, Wharves and Bulkheads of Concrete or Timber.
 Industrial Plants, Bridges, Pipe Lines, Levees and Roads.
 Electrical and Steam Power Plants, Water Works Systems.

Tugs, Barges, Derricks, Pile Drivers, Dredges, Diving Outfits
 for Sale or Charter

CREOSOTED

TIMBERS - PILING
CROSS TIES - POLES

LUMBER - PAVING BLOCKS

AMERICAN CREOSOTING COMPANY

COLONIAL
CREOSOTING
COMPANY
INCORPORATED

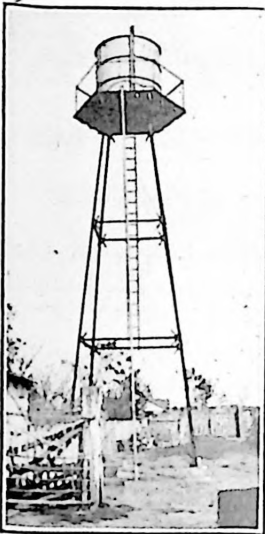


GEORGIA
CREOSOTING
COMPANY
INCORPORATED

LOUISVILLE - KENTUCKY

SALES OFFICES

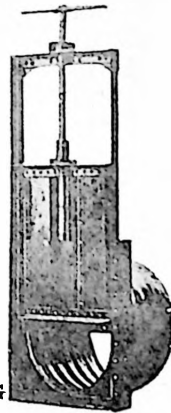
330 MADISON AVE. NEW YORK CITY - 401 W. MAIN ST. LOUISVILLE, KY.
BOKALUSA, LA. BRUNSWICK, GA.



Louisiana Engineers should have in their files our catalog of Galvanized Iron Tanks, Sectional Steel Towers, All Metal Sectional Buildings, Garages, Silos Culvert, Water Tight Pipe Gate Valves, Etc.

☐ We are prepared to submit blueprints and specifications on the above or on any kind of metal buildings.

ASK FOR CATALOG



HARRY BROS. CO. of LA. New Orleans, La.

The Manhattan Rubber Mfg. Co.

HIGH GRADE
MECHANICAL RUBBER GOODS



500 CAMP STREET, :: New Orleans, La.

Miller Flushtank Siphons



Simple, Reliable, Automatic

Also Sewage Disposal
Apparatus, Automatic
Sewage Ejectors, Centri-
fugal Pump Outfits,
Sewer Jointing Com-
pounds.

PACIFIC
FLUSH-TANK CO.
CHICAGO NEW YORK

GUY R. MOLONY & CO.

General Drayage

418 GRAVIER STREET

Phone Main 6281

NEW ORLEANS, LA.

OLDEST BANK IN THE SOUTH

4%

Interest
on
Savings

CITIZENS

Bank and Trust Company, of La.

620 Gravier Street

American Creosote Works

INCORPORATED

CREOSOTED

**Cross Arms, Lumber, Paving
Blocks, Piles, Poles, Ties**

Private Wharf for Ocean Vessels at NEW ORLEANS, LA.

Capacity 115,000,000 Feet B. M. Per Annum

Branch Plants:

Louisville, Miss.
Winnfield, La.

STATION "B"

NEW ORLEANS, LA.

COTTON DUCK

TARPAULINS

TENTS

DISTRIBUTORS FOR

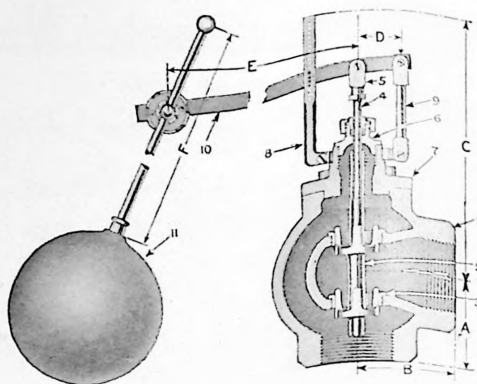
WHITLOCK MANILA ROPE

Brook Tarpaulin Company, Inc.

(ESTABLISHED 1840)

429 Celeste Street

New Orleans, La.



VALVES

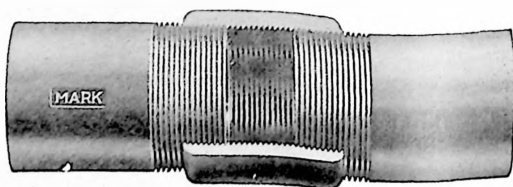
Pipe and Fittings

PIPE—Cast Iron

PIPE—Wrought Steel

PIPE—Wrought Iron

Dixie Mill Supply Co., Inc.
New Orleans





Transits and Levels
 that will give *perfect*
service under all conditions
 of use are manufactured by
DIETZGEN
 —the firm with the quality rep-
 utation. *Catalog on request.*
EUGENE DIETZGEN CO.
Manufacturers
 Chicago New York San Francisco
 New Orleans Pittsburgh
 Philadelphia

WOODWARD, WIGHT & CO. —LIMITED—

Largest General Supply House South Since 1867

EXCLUSIVE SOUTHERN SELLING AGENTS FOR
LIDGERWOOD Hoisting Engines, Cableways and Log
 Handling Machinery.

HAYWARD Orange Peel and Clam Shell Buckets.

GENERAL ELECTRIC CO. Apparatus and Supplies.

ROEBLING'S Wire Rope.

Heavy Hardware; Mill Supplies; Marine Hard-
 ware; Cordage; Elevating, Conveying and
 Power Transmitting Machinery.

OPEN DAY AND NIGHT

Howard Avenue, Constance
 and St. Joseph Streets

NEW ORLEANS

SAND

GRAVEL

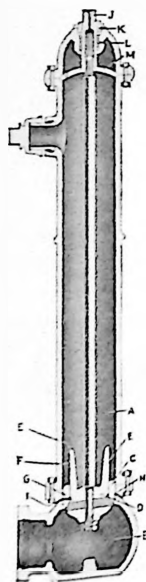
JAHNCKE SERVICE Inc.

NEW ORLEANS

Concrete and Builders' Materials
Dredging

SHELLS

CEMENT



COLUMBIAN IRON WORKS

CHATTANOOGA, TENN.

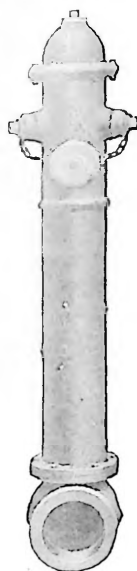
Manufacturers of

Fire Hydrants, Valves,
Valve Boxes, Sluice
Gates, Meter Boxes,
Water Works Supplies

New Orleans Representative:

J. S. BARELLI

612 Godchaux Bldg.



COMPLIMENTS

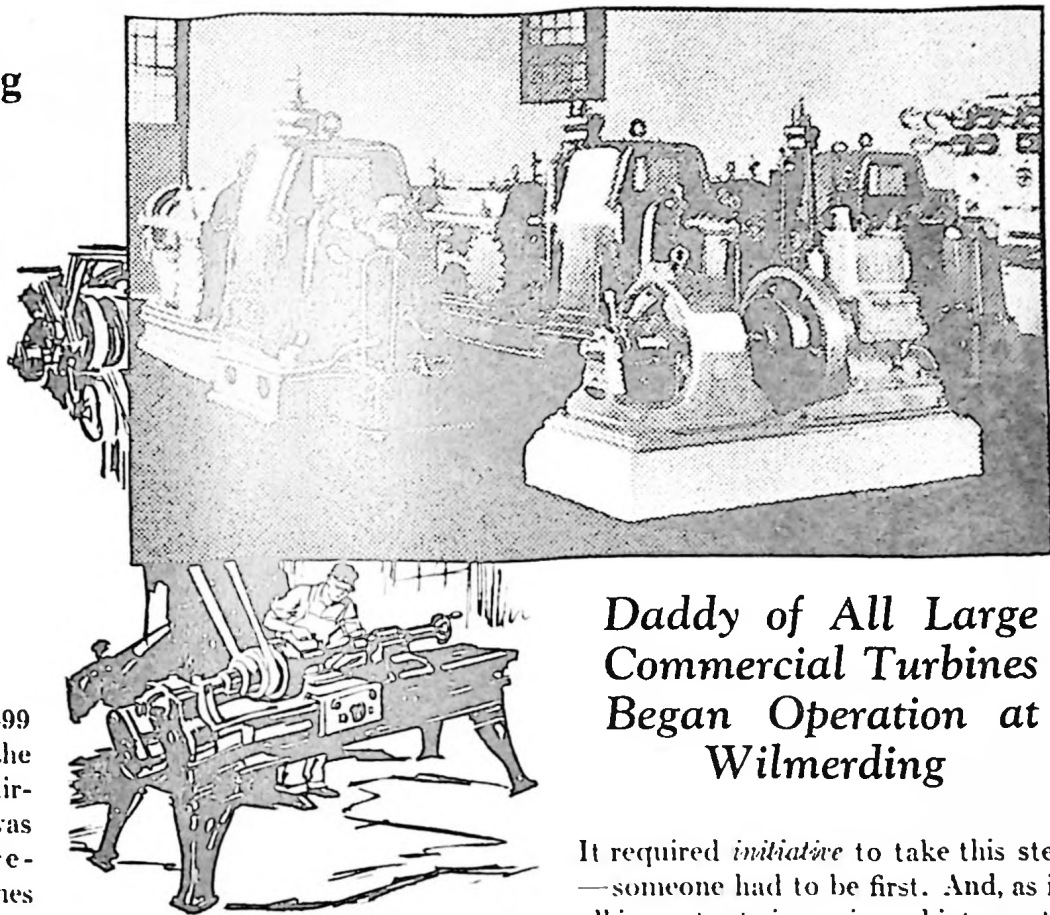
The Anchor Packing Company

418 COMMON STREET

NEW ORLEANS, LA.

The Great Engineering Achievement of 1899

What
Engineering
Owes to
Initiative



PRIOR to 1899 the works of the Westinghouse Airbrake Company was operated by reciprocating engines distributed in various parts of the plant. While this source of power was inefficient in many respects, it was the best known commercial motive force of the day.

By 1899, however, remarkable developments had been made in the design and construction of steam turbines and electric generating equipment. Called to the attention of the Airbrake officials, it was decided to give the new machines a chance, and three Westinghouse Steam Turbines were installed without delay. This was the first large installation of its kind, anywhere.

Daddy of All Large Commercial Turbines Began Operation at Wilmerding

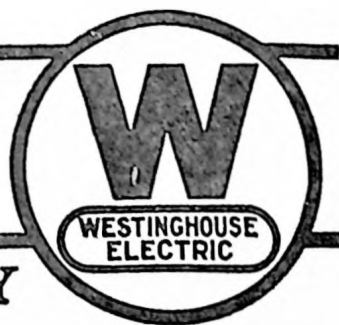
It required *initiative* to take this step—someone had to be first. And, as in all important pioneering achievements, there was much skepticism as to results.

However, the new units quickly proved their practicability. Although of only 400 K. W. capacity they proved much more efficient and economical than the old reciprocating engines. Their economy was particularly conspicuous because by careful test they showed a fuel saving of approximately 36 per cent.

Steam turbine development thus received its first real impetus in 1899, the Wilmerding, Pa., performance definitely establishing this electrical unit as a *better* method of turning the wheels of industry.

Westinghouse

ACHIEVEMENT & OPPORTUNITY



Facilities for Handling Coal in River, Tug Boats, Tow Boats, Barges
and Modern Coal Colliers

New Orleans Coal and Bisso Towboat Company

W. A. BISSO, President and General Manager

MAIN OFFICE: 606 United Fruit Company Bldg.

BRANCH OFFICE: Cor. Walnut and Levee

75 Ton Marine Steel Derrick, Marine Divers, and Flush-Deck Lighters

TELEPHONES: Main 2752, Main 233; Walnut 29, Walnut 20, Walnut 410

COLLIERS: Uncle Jim, Uncle Bill

TUGS: W. A. Bisso, J. A. Bisso, A. L. Bisso, Barranca, Independent, Captain Bud.
Leo, L. E. Patton, Joe.

NEW ORLEANS, LA., U. S. A.

The Proceedings of the Louisiana Engineering Society

Published bi-monthly, February, April, June, August, October, December,
under the auspices of the Committee on Publication.

DOUGLAS ANDERSON, Editor.

The Louisiana Engineering Society is not responsible for any
statement made or opinion expressed in this publication.

Subscription, \$2.00 per annum

Single copy, 35 cents

ADVERTISING RATES

	ONE YEAR	HALF YEAR	ONE ISSUE
Full page	\$50.00	\$28.00	\$10.00
Half-page	28.00	15.00	6.00
Quarter-page	15.00	10.00	4.00
One-eighth page	10.00	6.00	2.00

For the back outside cover add 50 per cent to the above
rates. For the inside covers add 25 per cent to the above
rates.

Address all communications to
Douglas Anderson, Editor, Tulane University,
New Orleans, La.

Entered as second-class matter July 27, 1916, at the Post Office at
New Orleans, Louisiana, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in section 1105,
Act of October 3, 1917, authorized August 1, 1918.

LOUISIANA ENGINEERING SOCIETY

OFFICERS FOR 1924

President, JAMES M. ROBERT, Tulane University.
Vice-President, MARCEL GARSAUD, 515 Whitney Building.
Secretary, FRANK A. MUTH, 2323 Short Street.
Treasurer, WALTER B. MOSES, 640 S. Peters Street.

DIRECTORS

CHARLES MCD. KERR, 1403 Hibernia Building.
F. P. HAMILTON, 1403 Hibernia Building.
E. S. LANPHIER, Room 224 Custom House Building.
JOHN S. BARELLI, 612 Godchaux Building.

STANDING COMMITTEES

On Technical Papers

W. B. Gregory, Chairman
I. O. Mall
A. M. Shaw

On Library

D. S. Elliott, Chairman
Marcel Garsaud
W. T. Hogg
Ralph Earl

On Publications—Division "A"

Douglas Anderson
Frank A. Muth

On Publications—Division "B"

P. J. Dromgool, Chairman
Lester Alexander
Paul F. Jahneke
Geo. A. Seaver
J. P. Ewin
C. A. Favrot

On Entertainments and Outings

Charles M. Kerr
L. F. Alexander
Ole K. Olsen
C. H. Stem

On Membership—Division "A"

H. E. Crump, Chairman
W. T. Hogg
F. G. Frost
B. H. Grehan
Cecil N. Bean
L. C. Smith
George Hammett
Ira W. Sylvester
T. B. Smith
J. L. Henning
B. W. Pegues
Merrill Bernard

On Membership—Division "B"

F. P. Hamilton, Chairman
J. F. Coleman
Jacques de Tarnowsky

On Employment

R. H. Baumbach, Chairman
R. Baccich

On Civic and Industrial Affairs

John Klorer, Chairman
A. T. Dusenbury
John H. O'Niell

The headquarters of the Society are in the State Museum
Building, Jackson Square.

All business communications should be addressed to F. A. Muth, Secretary,
2323 Short Street, New Orleans, La.



MAJOR FRANK M. KERR

Chief State Engineer

1904-1924

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

VOL. X.

JUNE, 1924

No. 3

CONTENTS

EDITORIAL NOTES AND COMMENT:	PAGE
The Influence of Engineering upon Social and Economic Progress	113
Natural Gas for New Orleans	115
The "Usual Collation"	116
Report of Board of State Engineers	116
Error in Mr. Delery's Paper	117
PAPERS AND DISCUSSIONS:	
The Influence of Engineering upon Social and Economic Progress. <i>By C. E. Grunsky</i>	118
Discussion	134
Report on the Natural Gas Situation as Applied to the City of New Orleans. <i>By Frank T. Payne</i>	138
Discussion	141
OBITUARY	166
MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY	168

EDITORIAL NOTES AND COMMENT

The Influence of Engineering Upon Social and Economic Progress. Under this title there is published in full in this issue of the Proceedings the text of the address delivered by Mr. C. E. Grunsky before the joint meeting of the Louisiana Engineering Society and the Local Section of the A. S. C. E. This was on the occasion of the visit of Mr. Grunsky, as President, and Mr. Dunlap, as Secretary of the American Society of Civil Engineers, to the various local sections in the Southern territory.

This year marks the 200th anniversary of the birth of John Smeaton, the first "civil engineer," and the builder of the Eddystone Lighthouse. Probably the first serious problem to

be tackled by those pioneers of civilization, who afterwards came to be called engineers, was that of transportation. It would be difficult to imagine any phase of one economic and social progress which is not intimately connected with the problem of transportation.

Archeological discoveries and monuments indicate that people of even the most ancient civilizations were able to accomplish feats of engineering and construction, many of which were worthy of even these modern times with all of our improved methods and facilities.

Probably the most striking differences between engineering operations of the present day and those of the ancient times was the fact that the ancient builders did not have generated power at their disposal. They were forced to depend upon human and animal power.

The invention of the steam engine about the middle of the eighteenth century, therefore, gave a tremendous impetus to engineering and from that time on, progress has been almost unlimited in all lines. Transportation still remains as one of the greatest fields of engineering activity, but transportation of this day, with steam, internal combustion engine and electrically driven locomotives, automobiles and ships, is a far cry from that of ancient days, when the only available source of propelling power were those of animals, the currents of streams and the winds.

The term "civil engineer" arose originally from the desire or necessity of distinguishing between the military engineer and the engineer in civil life. Great wars have always given a decided stimulus to engineering projects and activities, and many engineering achievements of ancient as well as modern days, have had their origin in the necessities of war. This is particularly true of transportation, which still is one of the outstanding problems in time of war.

With many other interesting illustrations and facts Mr. Grunsky has traced the influence of the engineer upon economic and social progress throughout the development of our civilization.

It is of interest to note in this connection that many of the "engineers" of ancient times, like Leonardo da Vinci, for

instance, were men of such broad attainments, and were engaged in so many different lines of activity that their work as engineers was often obscured by their greater renown in other fields.

The tendency in later years has been to look upon the engineer as a strictly technical man, and to accord him very little voice in the economic or political control of national, state and municipal affairs. There is now, however, a great awakening going on in the minds of the engineers, and they are beginning more and more to realize not only their rights in this regard, but their duties and responsibilities as well.

In fact the statement is often made that there lies before the engineer the possibility of becoming in the near future the guiding force in the social and economic progress of our nation.

Natural Gas for New Orleans. Once again this subject comes before the Louisiana Engineering Society. It's proponent this time is Col. Frank Payne, Engineer for the Department of Conservation of the State of Louisiana. Col. Payne has made a very careful study of the whole problem and has given an accurate analysis of the engineering and financial phases of the project.

The accuracy of his conclusions, from the data is a question which can be determined only by actual experience in the use of natural gas. As usual, the engineering phase of the problem is the simplest. While there are difficulties and obstacles to be overcome in the construction of such a long pipeline, none of these are insuperable. The real difficulties of the project lie with its economic, political and social phases. New Orleans is a troublesome city in which to carry out any scheme for civic or economic betterment. Witness the mass of petitions, counter-petitions, injunctions, and what-not that develop whenever any proposal is made for the benefit of the city as a whole. In fact, private interests in our city seem almost at times to be given greater consideration than is shown to the general public welfare.

At the very conclusion of the discussion on Col. Payne's paper, Mr. Lanphier made a remark which, perhaps, is the keynote of the situation. He said in substance, that when the City of New Orleans has developed the type of citizen, with the sense of civic pride, and with a sound public opinion, such as is found in some of the cities of Texas, then we will not be such laggards in the use of our natural resources.

But while New Orleans is a great seaport, it is not an industrial center, and the economic utilization of the natural gas from the Monroe field depends in a very large measure upon the ability of the city to smooth out the load curve, by relieving it of the high peaks which are always characteristic of domestic consumption.

The "Usual Collation." The Editor has a suggestion to make. For a long time now, since we have been occupying our present quarters on Jackson Square, we have followed the custom of setting forth the "collation" on a newspaper-covered table down in the dismal depths of the Museum under the stairs. There we stand around drinking near-beer and pop and eating sandwiches. It is depressing, to say the least, and in all probability from the assimilative or nutritive point of view, the environment does not aid in the proper flow of our digestive juices.

Here is the suggestion. In the near neighborhood of our meeting place there still remain a number of erstwhile saloons, now become eating places or restaurants. Why not adjourn to one of these after each meeting and have the usual collation served there. It would certainly be much more cheerful to be in a nicely lighted room and to have our refreshments served at a table. No doubt the proprietor of almost any of these places would be glad to turn it over for one evening a month to such a distinguished group of men.

Report of Board of State Engineers. The Editor wishes to acknowledge the receipt of a complimentary copy of the Report of the Board of State Engineers of Louisiana for the two years from April 20, 1922, to April 20, 1924.

The report carried as its frontispiece the portrait of the late lamented Major Frank M. Kerr, Chief State Engineer of Louisiana for the past twenty years. There is also an obituary notice setting forth briefly his professional career. The first ninety-eight pages are taken up with a detailed statement of the work of the different levee districts. This is followed by an appendix showing in tabular statements the location, lengths, quantity and cost of levee work, drainage revetment, etc., undertaken by the State of Louisiana, the several boards of levee commissioners, and the United States.

The report concludes with two tables giving data as to highest and lowest waters during the period covered by the report, and the highest water for flood years at various stations.

Error in Mr. Delery's Paper. An article on Comparison of Pump Tests by Mr. Eugene F. Delery was published in the April issue of the Proceedings. The second equation on page 106 thereof contains a slight error:

$$\text{It there reads: } f_v V^2 = \frac{h_d(1-e)2g}{e2gh_v} = \frac{h_d(1-e)}{h_v e}$$

$$\text{It should read: } f_v = \frac{h_d(1-e)2g}{e2gh_v} = \frac{h_d(1-e)}{h_v e}$$

PAPERS AND DISCUSSIONS

THE INFLUENCE OF ENGINEERING UPON SOCIAL AND ECONOMIC PROGRESS

By C. E. Grunsky.

Read Before a Joint Meeting on the Louisiana Engineering Society and the Louisiana Section of the American Society of Civil Engineers, April 14, 1924.

We accept as a matter of course and as though they had always existed, the conditions of our own day—and, yet, when we pause for a moment—calling history to our aid—we find that only a few generations ago our forefathers were denied many of the advantages and conveniences which we now enjoy. There has been phenomenal progress even in our own line, to which the engineer has contributed in no small degree.

It is well for us to recall, in this year, the 200th anniversary of the birth of the great English engineer, John Smeaton, the builder of the Eddystone Lighthouse, that Civil engineering as a profession, is generally considered to be still young. Smeaton we are told was the first to use the term “civil engineer.”

This does not mean that there were no engineers nor notable engineering feats and achievements before that time. We can well imagine, however, that theretofore the systematic assembling of the results of experience on projects involving the use of materials and the controlling of nature's forces, had not yet advanced to the point, where these results were available to every constructively inclined individual who felt bold enough to undertake the solution of an engineering problem.

No better illustration of this fact is needed than that afforded by the experience of the engineers of Smeaton's time. He, as you may recall, began his career in a lawyer's office, and like so many other engineers of his time acquired his skill and ability as an engineer by the actual doing of such work as came to hand, by observation and the liberal use of common sense, combined with a genius for recognizing the reasonable thing to do in overcoming difficulties as they presented them-

selves. He did not have the advantage of an engineering education such as the young men of our day start out with. His is truly a record to be proud of.

It is due to the achievements of such engineers as Smeaton both abroad and in our own country, that the conveniences have been provided, which have made possible the world's phenomenal progress of the last hundred years. Let us pause for just a moment to take stock of the most obvious engineering achievements which have influenced social and economic progress. We need not go far from home. What, let me ask, would this country be like today were it without modern transportation facilities? We use the good roads and travel by automobile; we travel by rail across the length and breadth of this country; we ship our raw products and the output of our industrial establishments to all parts of this country and abroad over highways, railroads and by water,—in cars, in trains and in boats—which have embodied the highest type of engineering skill to evolve. And yet, as already suggested, we take all this as a matter of course, frequently forgetting that for 6000 years and more, i. e., before generated force had been called to aid, and before the modern methods of attacking engineering problems were evolved, there were periods of stagnation and even of decline, instead of the rapid progress in the arts and sciences with which recent generations are familiar. The road builder of 100 years ago was any one who by observation and clear thinking could devise means for drainage of the roadway and knew how to use available materials to provide a foundation and wearing surface that would sustain the wheels of wagons and coaches. The hard smooth paved country roads, the highways that now interconnect our cities and make the remotest sections of our country easily accessible, were hardly thought possible a quarter of a century ago. Such pavements were for cities only. No one then foresaw how tremendously traffic on the highway would increase, due to the comfort provided by the happy combination of the automobiles and the smooth surfaced road.

In the development of water transportation, too, the genius of the engineer is everywhere apparent. With great labor, and, only after surmounting untold obstacles physical, politi-

cal, and financial, could America's first canals be constructed early in last century. But their usefulness was restricted to limited areas and but few of them have been able to survive the competition with the railroads which had such a vigorous growth a little later. But water transportation was not confined to artificial waterways. The application of the steam engine to the propulsion of boats, but little over 100 years ago, opened up new avenues to commerce, stimulated business with foreign countries and made of our rivers and of the ocean, great highways of travel and trade. The activity of the engineer is here again recognized. He was not content with a first success but advanced the art of shipbuilding with astounding strides. Larger and better ships have been the order of the day until vessels of stupendous size and great speed now facilitate travel and the interchange of goods. There are many still living who will remember vessels of 5000 to 6000 tons burden as the largest afloat. Now we are not startled by ships of 30,000 tons and larger ships, ships of the Leviathan class can be economically operated, if only harbor and suitable docking facilities are provided. Perhaps the engineers may work out this problem although there are those of us who think that there is an upper limit to the size of ocean going vessels which should not be exceeded, because otherwise only the one or two harbors on each side of the ocean with necessary dimensions of channels of approach and with adequate docks can be made terminal ports, and concentration of business at these ports to an embarrassing extent would ultimately result. The thought in this connection is that any additional advantage in reduction of cost of service that might result from the use of the monster ship is more than offset by the disadvantage due to the resulting centralization of commerce in single large ports. It would be much better in the long run to plan for maximum attainable facilities in many ports, rather than in one only, even though such a program should set a limit to the ultimate size of the ship. But, even if the engineer is restricted in striving for greater bulk, the field is yet broad, even in shipbuilding, for progress. Some are so bold as to tell us that, just as the steam turbine has superseded the triple expansion engine on ship board, even so will the internal com-

bustion engine replace the use of steam. Perhaps! who can tell?

Of course, it is natural to speak here mainly of this country when referring to specific engineering activities and, we should remember, that we have not long been without a frontier. In the days of your fathers or at most your grandfathers, it was still possible to come west and settle on the public domain. Now, the land suitable for homebuilders in regions where nature supplies sufficient rain, or rain and snow, to make the land cultivable without irrigation has been exhausted. Frontier life will soon be a memory only.

The early settler, of course, found himself confronted with the same engineering problems which always accompany early stages of community life. It was a simple though sometimes a laborious process, to clear his land, and then to dig a few drain ditches and even to fill a mudhole in the road once in a while, but very soon the early settler found himself part of a community that needed some of the conveniences of civilization. The needs of the community became paramount. There must be a school and all the institutions that make for protection of life and property. There must be provision made for those who do not make their living on the soil. The resulting settlement must have the conveniences which make life bearable. The engineer began to function—following up the installation of a water supply system, gravity or pumped as the case might be with a sewerage system and perhaps even sewage disposal works,—it would not always do to just let some convenient creek or river carry off the town waste waters. Then came the provision for storm waters and more sanitary provisions such as the disposal of garbage, and as the town grew, space became valuable, better buildings were needed in whose economic design the engineer has become so expert. Soon, too, the problem of urban transportation was presented and we see first the one horse street car, on light rails, later replaced by the cable car where steep grades must be overcome, or the now so popular electric car, supplemented by the motor bus. Still later there is need, or, at least there is supposed to be a need for the sky scraper and for rapid transit systems above or below the street surface, so well exemplified in the sub-way and the elevated

railway, which have functioned and are functioning so efficiently in our great centers of population.

Not, only, is engineering the essential element, making this urban progress possible, but, where a bridge or canal has to be built or mountains pierced, engineering stands ready to the task. Just one or two well-known examples near at home.

We all know the Brooklyn bridge. Its construction was a remarkable feat. The Roeblings, John Augustus and his son Washington Augustus, built it. The elder Roebling had already shown the world that the impossible could be done. In the face of prediction of failure he had erected the Niagara suspension bridge and was prepared for the larger project—now 41 years in service and of powerful influence in the development and growth of Brooklyn and New York.

Here, too, as in Smeaton's case we find the engineer resourceful not alone in conceiving the structure of unprecedented magnitude but also in overcoming each difficulty as presented. Fascinating indeed, is the account of the achievement—How compressed air was used to keep the water out of those great timbered foundation caissons, corresponding to the inverted bell, one of Smeaton's inventions, and how the pressure of the compressed air in these caissons, was utilized to transport aloft the material excavated in the sinking thereof, from a convenient water filled pump, on the same principle that applies in the modern suction dredge; how some of this material, discharged at times at high velocity into a scow, rebounding from deflecting plates of iron or steel would occasionally endanger the lives of passing boatmen; and then the ingenuity and care that was exercised in assembling, stretching, binding together, and protecting against rust the wires of which the great suspension cables were built up.

As another example, we note a few years earlier, the achievement of Captain James B. Eads in so concentrating the flow in one of the delta channels of the Mississippi River by the building of jetties, that the current of the stream scoured the channel to navigable depth and maintained the depth. It is noteworthy that Captain Eads had at the time of doing this work already established his reputation as a resourceful engineer by the construction of the St. Louis bridge (over the Mis-

issippi River). The recognition of the merit of these and other achievement by Captain Eads has resulted in the assignment of space in the Hall of Fame at New York for a bust of Captain Eads, which is soon to be unveiled with appropriate ceremonies. May it prove an inspiration to the present and coming generations of engineers and may it be an incentive to them to emulate the example of such men as Captain Eads, and to give honest endeavor to every assigned task and assumed responsibility.

When discussing the influence of engineering upon social and economic progress we must be mindful of the fact, true today as it has been in the days of the ancients, that great centers of population could not have been maintained without the aid of engineering.

As far back as history can trace activities which are the outgrowth of the concentration of population—such as the erection of buildings and monuments; sculpture; painting; music and the like, whether in Chaldea or Egypt, China or India, Mexico or Peru—the engineer has been active and has laid the foundation on which the complex structure, civilization, stands.

As soon as the human race turned to pursuits requiring permanency of abode the art of engineering had its birth. How far back in time we would have to go, for the beginning, no one can tell. It is sufficient to note the survival of occasional works of the ancients, which frequently astound us not alone by their magnitude, but also by the advanced state of civilization of which they mutely give evidence. Without any attempt to discuss the art of engineering as known to the ancients, it should, nevertheless, be noted that they did not have generated power at their disposal. They had to accomplish their engineering feats with human and animal power. On the other hand the dependence of the populace on their rulers for sustenance, placed at the disposal of these rulers hordes of workers who in all probability received little or no compensation other than shelter and food while engaged on such tasks as the transportation of huge blocks of stone, and their erection as obelisks, or their placing in the pyramids; or when erecting temples, or building canals or tunnels.

The surprising fact in connection with the influence of engineering upon progress is that despite the high planes to which civilization was known to have advanced in various parts of the world 5000 or 6000 or more years ago, that there should have been periods of complete cessation of progress, as one empire after another went into a period of decline. We marvel, too, that in such a country as China where inventions and engineering achievements are traced far back in time, progress toward modernization has been so long delayed. China is perhaps the best example of what may happen when an entire nation is content to travel on in a time worn rut. Vision is essential if progress is to be made.

Let us glance for a moment at China. The art of working with metals was known in China 3000 years B. C. There is record of one Chow Kung who about 1122 B. C. used on his wagon an instrument that always pointed to the north; and, too, of a navigator who used a light reed enclosing a magnetic needle, floated on oil to give him his bearings when in a fog or out of sight of land. Paper of rags was made in China as early as the first century. The art of printing was known, according to some historians as early as 593 A. D. when it was decreed "that drawings and unpublished texts should be collected and engraved on wood for publication." Another date sometimes assigned to the invention of printing in China is 932 A. D.—still more than 500 years before Gutenberg brought movable type into use in Europe. Glass was manufactured in China in the second century of the Christian era; and, in medicine we find Surgeon Hwa To using a certain powder to render his patients unconscious before operating on them, also, in the second century. The oldest section of the Grand Canal in China is believed to have been undertaken nearly 500 years before the Christian era and probably no one can tell how far back the first attempts in China at flood control and construction of canals for navigation go.

But the building of good roads in China has not been commensurate with our modern idea. The lack of adequate transportation and inter-communication facilities is undoubtedly one of the factors that has held back the development of the country. There has only recently been an awakening in the great

need of such facilities to get China out of the rut in which she has so long been traveling. Great changes in China may be looked for whenever there is established in the country a firm central government with adequate power of taxation.

What is true of China, in the matter of slow progress for many centuries past, applies with equal force to India and other parts of Asia. When we see the remnants of some 30,000 storage reservoirs which were at one time in use to supply irrigation water to the plains of India and picture to ourselves vast areas under intense cultivation centuries ago, we can but marvel that there has been such long stagnation,—that changes are coming so slowly and that younger nations had to come in and demonstrate possibilities.

More familiar to us than the works in the far east are those of Chaldea and Egypt, of Greece and of the Roman Empire. A mere allusion to them must suffice for present purposes. The great engineering feats performed by the Egyptians have already been referred to. But they did more than build pyramids and erect obelisks. They had learned to utilize the waters of the Nile for irrigation and we may accept it as certain that the utilization of these waters for this purpose, and, probably also for navigation, were among the earliest notable works making for the advance of civilization in that part of the world. The same statement will apply also to Chaldea where remnants of works can be seen which many centuries before the Christian era were in use to bring the waters of the Tigris and the Euphrates to the land, and these canals may, too, have been used as means of facilitating the transportation of products.

In ancient Greece engineering skill of a high order was required in the erection of temples and the building of harbors. And then, Rome, where for centuries the progress of civilization as it had been in Greece was of a type comparable with that of modern days, presents for our contemplation its aqueducts and public buildings, its sewers and its highways as evidence that the art of engineering was highly developed at the time that Roman civilization was at its best. History tells us that at Rome about the beginning of the Christian era, water commissioners were recognized as an institution necessary to

safeguard the water supply and to distribute the water to the consumers. From the records that have come down to us we know, for example, that Frontinus, who lived in the first century of the Christian era, was not alone an engineer of exceptional attainments but was also a man who stood high in public estimate. He was twice consul of Rome and was also for a time governor of Britain.

But even Roman civilization could not maintain itself. The incentive to advance the art of engineering was lost as the Roman empire went into its decline, and, for centuries thereafter, there appear no notable achievements along engineering lines in Europe, where alone we should have expected progress, except in the north of Europe, on the North Sea frontage, where the Dutch were advancing their dikes and other works for the reclamation of marsh lands and of broad areas of shoals; and where they were incidentally establishing a system of canals for drainage and navigation which command admiration;—and excepting, too, some activity in Northern Italy and in Spain on flood protection and irrigation works all of which is to be noted as contributing to the progress of the human race.

Reference to this period should not be passed, however, without mention of Leonardo da Vinci of Italy who lived in the fifteenth century, and whose attainments and achievements as a painter, as a sculptor, as an engineer, as a musician and as an anatomist mark him as one of the most gifted men the world has ever produced. He served in public life both as a military and civil engineer there being in his day no such fine differentiation of engineering activities as we are now accustomed to, and he would probably have hardly claimed the privilege of being classed primarily as an engineer, a classification which now might well be accorded to him.

Perhaps at no time in the world's history is the effect of engineering upon progress so apparent and so pronounced as in the period made notable by a series of remarkable inventions near the close of the 18th and beginning of the 19th century. Going back a little farther the improvement in mechanical spinning by Lewis Paul in 1738 may be noted. James Hargreaves invented the spinning jenny in 1764 and this in-

vention was soon followed by further improvements in mechanical spinning by Richard Arkwright in 1769 and Samuel Crompton, 1774. In 1763 James Watt gave to the world the condensing steam engine. In 1807 came Robert Fulton's successful steamboat. In 1825 the first railroad was put in operation by Robert Stephenson. It was then that the world entered upon an era of transportation by land and water not theretofore dreamed of. Rapid population growth, in regions where earlier development had been slow, has resulted, as well in our own country as abroad.

This was, of course, accompanied by a development and utilization of natural resources at a rapid rate, the end of which is still far off.

Of course, human ingenuity has not overlooked the fact that the cultivation of the soil to produce the food required by mankind is the world's basic industry. To supply a population of increasing density with food, it is obvious, that either more distant areas must be called into contribution or the nearby land must be made to yield greater returns. Both methods have contributed to meet requirements and the engineer has had to help out in both cases.

Arable lands, can, of course, be made more productive by adding to the soil such ingredients, required by plants, as may be lacking. Exhaustion of the soil is thus prevented. Or, again, where there are occasional periods of drought the growing may be prolonged by artificial application of water. Under conditions in which a source of water is dependable, a deficiency of natural moisture in the soil can thus be made good and crop losses from lack of moisture can be prevented. Experience along this line probably goes back to the dawn of civilization. The floods of the Nile were controlled in a measure for irrigation purposes at least 5000 or more years ago. Irrigation, as an institution, not only serves to insure and increase crops on land which under natural conditions of soil quality, and of rainfall, is arable, but, as in the case of Egypt, in India and elsewhere, has made vast areas productive which without irrigation would be arid wastes.

In our own country the reclamation of these arid and semi-arid lands by irrigations has in recent years become a matter

of no small importance. Throughout the western and southwestern states where the summers are practically rainless, water, wherever conveniently available was used for irrigation as soon as settlement commenced—first, of course, on a small scale, but as markets became available, and farming for the market became a profitable occupation, irrigation was found to be essential for the making of larger and new areas arable. In this field of activity the engineer has made an enviable record. By a glance at the United States Census of 1920 you will see that 19,191,716 acres of land in the Rocky Mountain, Western and Southern states are reported in the irrigated class and that the area commanded by irrigation enterprises is 35,000,000 acres. There are over 231,000 farms on which irrigation is practiced. The irrigation enterprises in 1919 numbered 63,298 and the capital invested therein amounted to nearly \$700,000,000.

It would manifestly be impossible in an address of this kind to treat fully of the activities of the engineer in all the branches of the profession. There is hardly a convenience in use in the industries, in the mines, in the field, in the city, or in the home, which does not bear the imprint of the engineer. Think but of the way in which electricity has been made useful and how dependent the world has become not alone upon the electrical transmission of power and the furnishing of light but upon the telegraph, the telephone and now the wireless—back of all of which is the apparatus the offspring of the engineer, that makes the subtle and mysterious forces of nature subservient to man.

In the days of the ancient Egyptian, of ancient Greece and Rome and as far along in time as the 18th century there was no separation of architecture from engineering. Someone tells us that the term engineer first appears in one of Shakespear's plays. The term "civil engineer" as already stated, was first used by Smeaton. When we see the statement that civil engineering is a new profession we must remember that this has reference to its being recognized as distinct from architecture, and from military engineering and does not imply recent origin of the art of engineering.

The field of engineering in its broadest sense is constantly being extended and has already become so vast that subdivision into many branches has resulted. The engineer of today elects as a rule to specialize in one or more of these branches. Without attempting a complete enumeration the following subdivision of the field is obvious, though no clear delimitation is possible. There is necessarily much overlapping. There are surveyors; mechanical; mining; electrical; hydraulic; canal; river and harbor; flood control; irrigation and drainage engineers; municipal; structural; waterworks; and sanitary engineers; agricultural engineers; heating engineers; telegraph; telephone; and radio engineers; oil engineers; marine engineers and so forth.

Societies for the purpose of promoting social intercourse among engineers and for stimulating the discussion of engineering and scientific subjects are comparatively young institutions. The need was felt in England a little over 100 years ago to secure co-operation of engineers and to establish facilities for the interchange of ideas and to make a record of engineering experiences. There resulted an organization of engineers in 1818 which led up to the establishment in 1828 of the Institution of Civil Engineers of Great Britain with Thomas Telford, the road builder, as its first president. It was not long after the formation of this great Society, which has done so much for the profession, that the differentiation already alluded to commenced. Those concerned with the design and construction of machinery found that they had a field of their own and formed a separate organization. So, too, the engineers who invented and directed the processes for the recovery of metals from ores or operated underground in mines, soon found that they, also, needed a separate organization.

Time will not permit the following of this subject further than to remind you that the oldest of our own national engineering societies, the American Society of Civil Engineers was organized in 1852 and that now nearly every branch of engineering is represented in this country either by an independent society, or, as a division, in the American Society of Civil Engineers.

The great progress of civilization in modern times to which the engineer has so largely contributed may reasonably be ascribed to a full appreciation of the experience, and a full utilization of the results of the work of those who have lived before. It would be needless to dwell upon the fact that it is to our institutions of learning that we look to assemble the records of past achievements and to make these conveniently available. The deductions drawn therefrom fix our modern starting point. It is in the University, too, that those who enter any particular profession are taught how to find the accumulated information and how to use it. It is to these institutions that they come for the mental equipment that will qualify them to properly use the assembled information.

The modern engineer not only has the advantage of educational facilities but he has another great advantage over the engineer of the remote ages. He commands and brings to his aid a knowledge of forces which his predecessor could not dream of. The early engineer was but superficially acquainted with the forces he had to deal with. He could not determine a result in advance, unless, perchance, the same thing he was trying to do had been done before. The situation became very different when the engineer learned how to bring generated forces to his aid. The use of water power came first as a supplement to animal power and steam only 161 years ago.

It would carry us too far afield as you will have gathered from this feeble presentation, to attempt exhaustively to trace in fairly connected sequence the engineers influence upon economic and social progress. A single further illustration will suffice. We note in the brief period, covered by our own history as a nation, the change from the production of articles singly or in small lots—largely at home—to their production wholesale, resulting in the establishment of our great industries with their wonderful facilities and their enormous output. We recognize the tremendous influence that this change has had upon family and social life. The number of independent proprietors has been reduced, the salaried employee and wage-earner has become relatively more numerous. We may deplore the fact that this must militate against the highest development of the individual who no longer builds a machine or makes a

clock, devoting his whole life, perhaps, to some simple operation in a factory;—but we may well consider the question as to whether the disadvantages of factory employment are not more than offset by the advantages which the big industries have brought within our reach.

In the broad field of engineering there will ever be a place for the alert well equipped engineer. He must choose according to inclination and opportunity the branch or branches of engineering in which he wishes to be best prepared. He must be careful to lay the foundation broad and firm.

Every student of engineering has probably been told at one time or another that a prime requisite to success in the profession is a good measure of common sense. If this means anything, it means that the engineer must have the power and the will to observe carefully and to think clearly. He must have a broad outlook, should be sufficiently familiar with social, business, commercial and political institutions to be rated as a business man as well as engineer. He needs in other words a fair, liberal, as well as technical education.

No one can survey the field of present day human activity without being impressed with the part which engineering plays in furthering social and economic progress. Let what has already been accomplished be an inspiration to those who have elected to serve their fellows along engineering lines.

After the presentation of this paper Mr. Gurnsky gave an informal, but very interesting talk on "River Control in California," as follows:

"Now, to pass to a subject entirely distinct and different from that made the topic of the meeting this evening. I would like to take you for a few minutes to California. I wish I could bring some of the climate to you. Not that it would be any better than you have here now. California, however, has a reputation in this respect, and I am doing my share to sustain it.

"You cannot think of climate without thinking of rainfall, and rainfall runs to the streams, and in California we have a river of some magnitude. We have a great central valley,

extending north to south about four hundred miles, with a width of 40 to 50 miles, tapering a little at the north and at the south. We have two principal rivers in this valley, the Sacramento from the north and the San Joaquin from the south. Where these two rivers meet, or unite, one from the south; the other from the north, they form the Suisun Bay, which opens into the San Francisco Bay. The Sacramento River is about 250 miles long, in its course from north to south through Sacramento Valley. It drains about 9,000 square miles where it enters Sacramento Valley. Its flood discharge there may reach 250,000 second feet. These are small figures compared with those applying here to your Mississippi River.

The Sacramento River has a number of tributaries—mainly on the east side the principal one of which is the Feather River, with about 5,500 square miles of drainage area. The Sacramento River brings into the valley a considerable amount of sediment. This sediment is deposited in greatest amounts close to the banks. The river banks are thus warped up more rapidly than land away from the river with the result that the river flows in a channel on the crest of a ridge. In some sections of the Sacramento Valley this ridge is so pronounced that the fall from the river bank landward is some 20 feet in a half mile. In attempting to confine the flood waters of the river to the river channel it was, therefore, natural that embankments of earth or levees should be put immediately on the river bank, that being the highest ground.

A study of the river by the State Engineering Department was commenced in 1878 and this soon showed that there were sections of the river which could not be made to carry anywhere near the flood discharge of the river. It will suffice to say, by way of illustration, that the section of the river next up-stream from the mouth of the Feather River even with levees 15 to 20 feet in height, can not carry more than about one-eighth of the volume of water which is passing down the valley at the river's extreme flood stages. The excess, under natural conditions, went out of the river into flood basins which served as retarding basins. There was, in the case of this river, no question about the insufficiency of the channel capacity. Some water must be allowed to escape therefrom.

In view of this situation the following fundamental principle of river treatment was made the basis of the flood control project:

- (a) By means of channel improvement and the construction of levees force the river to carry as much water as possible.
- (b) Let water in excess of the river capacity escape at selected points, under control, through relief outlets.
- (c) Confine the escaping waters to limited areas over which it is to flow to a re-entry into the river at some down-stream point where channel capacity can be made adequate.

This fundamental principle was early recognized and was incorporated in a report by Dr. Marsden Manson and the speaker as consulting engineers, to the Commissioner of Public Works of California in 1895. It was accepted by the United States when the report of Capt. Thos. H. Jackson of the Engineers Corps of the U. S. Army who gave shape to the project features some 13 or 14 years later, was approved by Congress.

The flood control project of the Sacramento River is now well advanced. It has been carried out under a plan of co-operation between the State of California, the United States and the landowners.

The first relief outlet, known as Tisdale weir was constructed by the State of California before there had been any general approval of project features, about 1892. This is a concrete structure about 1150 feet in length. Another relief outlet is located near the junction of the Feather and Sacramento rivers and is now nearing completion. This has a crest length of about 8000 feet. The third relief outlet is near the City of Sacramento being also a structure of the weir type with a crest length of 1667 feet. The river below this point with levees as high as appears practicable will have a discharge capacity of about 100,000 second feet. Under the conditions as they will obtain when the flood control project is completed, according to engineer's estimates, there may at times be 500,000 to 600,000 second feet of water flowing down the valley. What the river can not carry must be accommodated by the by-passes into which the relief outlets deliver their water.

The elimination of the river's natural overflow or flood basins, has accelerated the rate at which flood waters flow down the valley. These basins originally acted as retarding basins filling on a rising and full river and discharging gradually, thereby holding down the peak discharge of the river. Under original conditions the lower Sacramento River had a maximum flood discharge which was probably less than one-half of that now required to meet the changed conditions.

Enlargement of the river channel in its lower reaches is one of the project features. There is still some question as to whether or not it has been wise to withdraw as much land from overflow as is being attempted under this project.

The enlarging of the lower section of the river is about one-half completed. Work is in progress now.

If there are any questions you would like to ask, I would like to try to answer them. I thank you very much, indeed.

Discussion.

MR. COLEMAN: I am sure we have all enjoyed listening to Mr. Grunsky's valuable and instructive paper on the history of the engineering profession, and also his talk on the Sacramento river problem. Now this question is open for discussion.

MR. KLORER: I wonder if it would be presuming too much to ask Mr. Grunsky to give us a brief description of the character of the Weir construction, discussing just what provision is made to prevent the undermining of these weirs.

MR. GRUNSKY: The first weir known as the Tisdale Weir is a weir on clay and alluvial formation not very favorable for the support of such structures. The water flows over a crest dropping into a box to break its force. This box is about four feet in depth, six or eight feet in width with vertical sides and with no special protection of the ground beyond the weir. It has been in service some 30 years and has served satisfactorily. The Sacramento weir near Sacramento has a series of openings, carries a railroad and highway on piers. On top of a concrete structure is a movable section made up of needles which drop out of place whenever the movable portion is tripped by the rising water. At

this weir too a box is provided to break the erosive force of the overflow.

MR. KEMPER: How deep are they?

MR. GRUNSKY: From the crest of the weir to the bottom of the box may be seven or eight feet.

MR. KEMPER: And the drop?

MR. GRUNSKY: From high water in the river to the surface of the ground beyond the weir the fall may be 12 feet or more. From the water in the river to the water below the weir when the same begins to function perhaps 7 or 8 feet.

MR. KEMPER: Have any of them washed out?

MR. GRUNSKY: We have had practically no high water to test the recently constructed weirs.

MR. KEMPER: Is it one continuous weir, or in sections?

MR. GRUNSKY: I have not seen the Fremont weir, second in position down stream, which is the one described as having a length of about 8000 feet. The Sacramento weir is in sections.

MR. KEMPER: What space?

MR. GRUNSKY: Twenty-four feet.

MR. KEMPER: And you have a depth as much as seven feet with a drop as much as eight feet?

MR. GRUNSKY: Yes, at the Sacramento weir about that. There has not, however, yet been such a river stage as to give this weir a full test; but the water below these structures rises to a considerable elevation and passing through or across the box its force is much reduced.

MR. KEMPER: Do you not expect them to blow out soon?

MR. GRUNSKY: Weirs for this purpose can be built to stand.

MR. KEMPER: Is there very much sediment in that water?

MR. GRUNSKY: There is not much difference in the character of Sacramento river water and that of the Mississippi. The Sacramento River below Feather River was for many years very muddy, because of the hydraulic mining operations, but now it would not be classed as a very muddy water.

MR. KEMPER: After passing through these by-passes, does it give you considerable trouble?

MR. GRUNSKY: Not much can yet be said of their behavior in this respect.

MR. KEMPER: About what velocity will be maintained in those by-passes. After taking the drop, it loses its force, does it not?

MR. GRUNSKY: The velocity is of course less beyond the weir.

MR. KEMPER: Could you give us the approximate velocity there?

MR. GRUNSKY: I could not. It depends on the volume of the water going over the weir and the depth at which it flows beyond the weir.

MR. KEMPER: My idea is to know whether it would carry it on, or whether this sediment would cause the filling up of the by-passes?

MR. GRUNSKY: It may to some extent have that effect, but where the relief outlets come into action only infrequently, as on the Sacramento, this is not feared. When a levee breaks there is usually a large amount of the river's bed load of sediment carried out through the crevasse, but when water is permitted to go out under control over a weir crest there will only be sediment carried off which is carried in suspension, and but little if any of the river's bed load.

MR. KEMPER: What do you think the maximum length should be?

MR. GRUNSKY: I do not think any two conditions are the same. I can conceive of a relief outlet for a large river being five or six miles in length.

MR. KEMPER: The longer the better?

MR. GRUNSKY: Yes, a great length is desirable.

MR. KLOER: Is the space between the levees of the by-pass very much wider than the length of the weirs? What is the size of the openings generally?

MR. GRUNSKY: That is a question answered differently for each outlet. My recollection is that the Sacramento river near the Sacramento weir is about 700 feet wide.

MR. KEMPER: Do you use a very large portion as a reservoir?

MR. GRUNSKY: A broad area between two embankments which form a by-pass. These embankments in the lower valley are as much as two miles apart in some places.

MR. KEMPER: It serves the double purpose of by-pass and storage basin?

MR. GRUNSKY: Yes, that is the purpose.

MR. KEMPER: You have a combination by-pass and storage basin?

MR. GRUNSKY: Yes.

MR. KEMPER: You have great floods of short durations?

MR. GRUNSKY: Yes, in comparison with those of the Mississippi.

MR. KEMPER: You take care of short duration floods and therefore do not need such large reservoirs?

MR. GRUNSKY: I think the excess of flow at Cairo plus tributaries over the discharge at New Orleans will fill your storage basins in about ten days. In the case of Sacramento River as regulated it will take only a day or two to bring the lower river to a full flood state.

MR. KEMPER: It takes Cairo stage register nearly three weeks to register its equivalent here.

MR. COLEMAN: I think we should give Mr. Grunsky a rising vote of thanks not only for his paper, but for the additional information he has given us.

A rising vote of thanks was extended Mr. Grunsky amid applause.

REPORT ON THE NATURAL GAS SITUATION AS APPLIED TO THE CITY OF NEW ORLEANS.

By Frank T. Payne, C. E.

Engineer, Department of Conservation, State of Louisiana.

Read Before the Society, May 12, 1924.

In order to fully discuss the matter of Natural Gas supply for the City of New Orleans, there are many factors to be taken into consideration in the making of such a report, but the outstanding questions are:

1. Feasibility.
2. The Gas Fields of the State.
Their present use and future possibilities.
3. Pipe Line—Location and Cost.
4. Cost of gas delivered to the City of New Orleans.
5. Distributing Plant in the City of New Orleans.
Cost of and operation.
6. Cost of distributing gas in the City to consumer.
Total cost to consumer.
7. Finances.

Feasibility.

The answer to the first question is in the affirmative. Feasibility, however, does not alone apply to the actual laying of the pipe line and the delivery of gas to the consumer, but also to the enterprise being a success financially.

The Gas Fields of the State.

Their Present Use and Future Possibilities.

After careful study of the situation by both State and National Geologists, it has been determined that the Monroe Gas Field, located in Ouachita, Morehouse and Union Parishes, is the only one to which New Orleans may turn for its supply of Natural Gas. The other producing areas of the state are now doing their full duty in supplying gas to other sections of the state and to neighboring states.

Much has been said and written about the possibilities of piping gas from the Terrebonne Field to New Orleans, but the history of drilling reveals repeated failure in the actual finishing of wells for prolonged production. In practically all of

the wells are found large volume of gas of varying depth, but due to encroachment of salt water, and other causes, they have one by one been flooded and abandoned, with the exception of two. The field has not shown sufficient stability to warrant an expenditure of a million or so of dollars, necessary for the enterprise; therefore, the piping of gas to New Orleans would be out of the question from an investment stand point.

That there is an enormous quantity of gas available in this territory is borne out by a report of Mr. Arthur Knapp, Petroleum Engineer, who operated in this field for several years, and which in part states:

“We have but one well that gives gas in commercial quantity. This well produced less than one million cubic feet per twenty-four hours, and lasted but about thirty days, producing in all not more than five million feet.

In my opinion, the art of drilling and producing will have to reach a much higher degree of perfection before a reliable supply of natural gas may be produced in Terrebonne Parish. That an enormous quantity is available seems to be without question.”

Reports made by Messrs. H. W. Bell and R. A. Cattell, Petroleum Engineers of the U. S. Bureau of Mines, in 1921, and by Messrs. Ben K. Stroud and Frank T. Payne, Engineers of the Department of Conservation, in 1922, show conclusively that the Monroe Gas Field is the only field that can be relied on to supply the City of New Orleans with natural gas. Bell and Cattell estimated the life of this field to be forty-three years, allowing the consumption of gas at the rate of one hundred and fifty million cubic feet per day. Stroud and Payne estimate it to be forty years with the same ratio of gas being withdrawn daily.

Mr. H. W. Bell, formerly with the U. S. Bureau of Mines and now Supervisor of Minerals for the Department of Conservation, in his letter, quoted below, substantiates the report of Bell and Cattell (in 1921) and of Stroud and Payne (in 1922), providing the consumption is held to one hundred and fifty million as originally contemplated.

“January 28, 1924.

Mr. Frank T. Payne,
Division of Engineering,
Department of Conservation,
New Orleans, Louisiana.

Dear Mr. Payne:

I have your letter of the 25th inst. and am giving you my impressions as to the life of the Monroe Gas Field. I feel sure that you and Mr. Stroud undershot in your Pipe Line Report when you gave the field 18 years at 150 million per day. In fact, Mr. Stroud admitted to me that he had underestimated on purpose for conservation reasons, and had disregarded entirely the second gas rock. We have not been able to figure out satisfactorily the importance of the second gas rock as yet, but we are counting on it for a small amount of gas over a limited area.

The performance of the Swartz area is interesting but not conclusive. Taking ten sections there in the closely drilled territory and the assumptions of Bulletin 9, it should produce 112 billion cu. ft. It has already produced over 48 billion and as far as we can guess the rock pressure is about one-half of the original. The estimate of equilization of pressure into this area from all sides except possibly the South is problematic.

I think the field will average more than 10 million per acre recoverable. Assuming that figure and 300 square miles, the field would last 13 years longer at the rate of 400 million per day or 35 years longer at 150 million per day. There has already been removed up to February 1, 1924, about 200 billion feet and considering the underground waste, it would no doubt total 250 billion. Assuming 60% recovery this would make a drop of 83 lbs. in rock pressure, which checks out reasonably well. The present rate of production is about 370 million per day. Of course the big uncertainty is the thickness of the gas rock carrying 23 percent porosity. The recovery factor is less uncertain this I would say. The final extraction of this amount of gas would call for putting pumps and consequent vacuum on the wells. The price for which gas will be sold before the field is exhausted is another thing to consider. I believe that domestic consumers can always afford to pay enough to run out the carbon plants.

The trouble with the Swartz area is that too many wells are drilled there, and it is not a fair sample of the future performance of the field. The high gasoline content was the cause of the intensive drilling in that area. There is much water being produced now in this part of the field and some of the wells are wide open in order to get their quota, but it will produce considerable gas yet.

These are my present impressions on the field. In case I find reason to change my opinion I will be glad to let you know. My report would be that the field would have about 13 years life at the present rate of production. If a pipe line is once in there and supplying New Orleans I see no reason why we could not reserve the gas for that purpose when the field was nearing depletion, and thus extend the life of the pipe line service.

I might add that in some parts of the field other than Swartz where the wells are thinly spaced the rock pressure is holding up around 1,000 lbs. I may be fooled on the amount of equalization that is taking place on Swartz, but the ratio of rock pressure and volume taken out of that area seems to hold as you would expect it.

If there is anything else that I can do for you in this matter I will be glad to write you further.

Yours very truly,

(Signed)

H. W. BELL,

HWB:C

Supervisor of Minerals Division."

Pipe Line Location and Cost.

LOCATION: The following is taken from report of surveys made by the writer for the Department of Conservation:

The selection of a pipe line route from the Monroe Gas Field to New Orleans is contingent upon these factors—

Feasibility and length of route.

Population to be served (gas to be sold).

Acting with these in view, surveys and examinations were made of three different routes.

ROUTE 1. From Monroe along highway paralleling the Vicksburg, Shreveport and Pacific Railroad to a point near the west bend of the Mississippi River and opposite to the upper

end of the Race Track towhead; thence to the upper end of the Race Track Towhead; thence leaving the railroad and running to the west bank of the River to the upper end of Race Track Towhead; thence across the River to the upper end of Race Track Towhead; thence across the River at this point; thence continuing on a tangent to the Yazoo and Mississippi Railroad along said railroad and highways to New Orleans. Total length, 311 miles.

ROUTE 2. From Monroe along the Missouri Pacific Railroad and highways paralleling same to Alexandria, crossing Red River at Pineville-Alexandria; thence paralleling the Texas and Pacific Railroad to Livonia, 81 miles, crossing the Atchafalaya River at Melville; thence along the New Orleans Texas and Mexican Railroad to Baton Rouge for 27 miles; crossing the Mississippi River at Baton Rouge; thence to New Orleans paralleling the Yazoo and Mississippi Railroad, as in Route 1 to New Orleans. Total distance, 294 miles.

ROUTE 3. From Monroe along the Vicksburg, Shreveport and Pacific Railroad and highways paralleling same to Rayville, 21.2 miles; thence to Vidalia, paralleling the Missouri Pacific Railroad to Vidalia, 74.4 miles; thence crossing the Mississippi River at Natchez Island, four miles south of Natchez; thence across country, Natchez to Gloster, Mississippi, 33 miles; thence to Baton Rouge and New Orleans as in Route 1. Total distance, 275 miles, including 2.5 miles additional for crossing the Mississippi River.

The continued swamp lands on the Louisiana side of the Mississippi River below Natchez and on down to Baton Rouge would make the cost of laying the line very expensive. To avoid this expense, the line was carried across the Mississippi River at Natchez Island, which averages a depth of about forty feet (40') and offers a very desirable place for crossing.

The distance traversed on Mississippi soil by this line would be 52.5 miles or 19.1 per cent of the entire distance. The high ground on the Mississippi side will greatly simplify construction of the line.

The State of Mississippi has recently enacted a law which exempts pipe lines from taxation for five (5) years and gives

them the right of eminent domain. The usual troubles in securing rights of way are thus eliminated.

The ideal river crossing at Vicksburg, Mississippi, at first led to the assumption that Route 1 would prove the most feasible, but the distance of 311 miles in Route 1 made the cost of the pipe line prohibitive from an investment stand point.

Route 2, a distance of 294 miles, was found to have several objections, principally the crossing of the Atchafalaya River. The crossing of rivers is an expensive and hazardous undertaking at best, and the Atchafalaya is possibly the worst river in the South. It is swift and treacherous and is continually deepening its channel. Breakage of lines means costly repairs and interrupted service—a source of annoyance to both the pipe line company and the consumer.

South of Alexandria much of the route is swamp and a further cost of several thousand dollars per mile would have to be reckoned in order to figure a concrete covering for the line. If the line were not encased in concrete, the depreciation would have to be figured on a four year basis, as replacement would be necessary that often.

The logical route for the line, therefore, is via Natchez, through Monroe, Rayville, Vidalia, Natchez Crossing, Gloster, Centerville, Wilson, Zachary, Baton Rouge, St. Gabriel, Geismar, Timberton, Convent, Litcher, Garyville, Reserve, LaPlace, St. Rose, Kenner to New Orleans.

Cost: After taking into consideration the many factors in a problem of this kind, it was decided that a sixteen inch (16") gas line would best meet the all around requirements.

275 miles or 1,452,000 feet—Capacity 30,000,000 cubic feet per day. 1,452,000 feet of 16 inch outside diameter, 47.215 pounds weight per foot, 550 lbs. test, plain end line pipe.

Freight on 68,556,280 lbs.

1,452,000 ft. @ \$2.26 per ft.

Pittsburg\$3,281,520.00

Freight on 68,556,280 lbs.

from mills @ 1c per lb. 685,562.00 \$3,967,082.00

Right of Way.....\$ 50,000.00

Field gathering lines..... 400,000.00

Hauling and stringing line.....	140,000.00	
Trenching, laying, back-filling, painting, etc., @ 70c per foot.....	1,016,400.00	
Couplers 0 81,000@\$.180.....	388,800.00	
Gate Valves — 46@\$.650.00 each, in place.....	30,000.00	
Fittings for line.....	30,000.00	
Mississippi River Crossing.....	400,000.00	
Other crossings.....	450,000.00	
Telephone line.....	140,000.00	
Regulator station at New Orleans	15,000.00	
Other regulator stations.....	12,000.00	
One compressor station.....	500,000.00	3,572,200.00
Total.....		\$7,539,282.00
Supervision, engineering, etc., 10%		753,928.00
Total cost.....		\$8,293,210.00
In round figures.....		\$8,300,000.00
275 miles.....	\$30,000.00 cost per mile.	

Operating Charges on Pipe Line. Per Year.

Capital Account.....	\$8,300,000.00	
Interest 5%	\$	415,000.00
Risk 3%		249,000.00
Amortization 12½%		1,037,500.00
Transportation charges.....		160,000.00
General charges, overhead, etc.....		150,000.00
Maintenance charges.....		50,000.00

Total Operating.....\$2,061,500.00

There is here shown a fixed yearly charge of twenty and one-half per cent (20½%) on capital invested for interest, risk and amortization of the pipe line. The three per cent (3%) risk is made to cover unusual losses, such as legal suits and damages, expensive breaks in the line and other general uncertainties of the business.

Many people will believe that a twelve and one-half per cent (12½%) amortization charge on the investment is excessive. At this rate, cost of the line would be retired in eight (8) years. It is reasonable to expect the line to last longer than eight (8) years; in fact, it will last possibly twice eight years, but there are other factors to be considered.

Throughout the general history of pipe line enterprises one of the outstanding facts has been failure of companies to get their investment back before the gas supply began to fail. On top of a large part of the investment being still left in the line, has come the necessity for further expenditures in drilling wells, larger compressor stations and repairs to a line which has been in service for several years.

In a like manner, a pipe line project must have the full advantage of the "flush" gas production if the venture is to be a successful one, and it must be given the opportunity during this period to retire its investment so as to be ready for repairs to lines, installing additional compressors, etc., when the decline comes. Returning cost of line in eight years is therefore not excessive.

The transportation and general charges here given are intended to cover all costs of piping gas, including labor of all kinds, repairs to pipe line and telephone lines, tool equipment, rentals on property and for offices, salaries and general overhead.

Cost of Gas Delivered to the City of New Orleans.

FIELD COST: The cost of gas to the pipe line has been figured at eight cents per thousand cubic feet, which is about four times what is now being paid. This charge will permit well owners to make a reasonable profit on wells already drilled and will, in addition, build up a reserve sufficient to drill the further wells necessary to keep production constant, as the older wells decline in flow.

CONSUMPTION OF GAS IN NEW ORLEANS IN 1923: Number of meters in service.....57,862
Annual sales of artificial gas.....2,185,369,000 cu. ft.

New Orleans artificial gas manufactured by the New Orleans Gas Company in 1923 totalled 2,505,154,000 cubic feet, according to this company's report. This is an average of 6,864,000 cubic feet per day.

NATURAL GAS REPLACING ARTIFICIAL GAS: Whenever natural gas replaces artificial gas at an invariably lower rate, the consumption is always increased. The ratio between the two is much as five or six to one in Northern cities, where the long win-

ters mean long heating periods. In the South, under milder climatic conditions, the ratio is lower and varies greatly with price, but in general the ratio would be not less than two to one.

GAS CONSUMPTION: The following figures, therefore, are believed to represent the amounts of Natural Gas which will be consumed per year during the early life of the line:

	Per Year	
Domestic—New Orleans, only.....	4,200,000,000	cu. ft.
Other Towns.....	450,000,000	“ “
	4,650,000,000	“ “
Industrial	1,825,000,000	“ “
Total Consumption.....	6,475,000,000	“ “

The industrial consumption here shown is at the rate of 5,000,000 cubic feet per day and the New Orleans Domestic consumption is at the rate of 11,500,000 cubic feet per day. The industrial figure is intended to reflect the amount of industrial gas that will be used by smaller industries until it is absorbed by growing domestic consumption.

CAPACITY OF LINES: The present consumption of 6,864,000 cubic feet per day could be easily served through a fourteen inch line, but there is not enough provision made for future growth in the capacity of this sized line. (About 11,000,000 cubic feet per day net, counting line losses and peak loads). On the other hand, an eighteen inch line with a carrying capacity of 40,000,000 cubic feet per day would be too large for domestic needs only, and domestic consumption is all that can be considered by the proposed pipe line in New Orleans. This amount of gas, at 70,000 cubic feet per meter per year, would mean over 100,000 domestic meters, on a basis of 25,000,000 cubic feet per day (being the average daily consumption on a ratio of 1.6 and the further deduction of line losses.) One hundred thousand domestic meters would mean a population of over 650,000 people and the 1930 census will probably show less than this by 200,000 people.

(The 1910 population was given at 339,075, while the 1920 census showed a population of 387,129, an increase of 14% at the same rate of growth, the 1930 population will be about 445,000.

Such factors as good times or bad times, desirability of a city for new manufacturing enterprises, the discovery of a new resource, or the bringing together at a common point of several resources for conversion, etc., all have their influences upon the growth of a community. The deep water port of New Orleans will also be an important factor in increasing the population.)

A sixteen inch, delivering a maximum of about 30,000,000 cubic feet per day will take care of present needs and future expansion as well. There will be a large volume of surplus gas at the start, over domestic consumption, but the latter will gradually be expanded until it takes somewhere near the normal capacity of the line.

PIPE LINE AND DISTRIBUTION LOSSES: In addition to gas figured as actually delivered and paid for are the line losses and distribution losses that occur regardless of how well a line is constructed. A figure of 10 per cent line loss was taken for the 275 mile pipe line. Pipe line men will generally agree that ten per cent is a fair estimate for line loss.

City distribution losses are here figured in accordance with average losses of other cities.

Taking the 6,475,000,000 cubic feet and adding thereto city distribution losses and pipe line losses, we have 8,175,000,000 cubic feet total consumption. Considering all losses, 8,175,000,000 cubic feet of gas per year must be purchased to actually deliver 6,475,000,000 cubic feet per year to consumers. At eight cents per thousand the annual cost would be \$654,000.00. Adding this to total operating yearly expense of \$2,061,500.00, we have a total of \$2,715,500.00 or 41.94 cents per thousand cubic feet, which represents all pipe line charges on gas at the city gates.

MUNICIPAL OWNERSHIP: To secure the most satisfactory results and the maximum of efficiency, municipal ownership of both pipe line and distributing system in New Orleans is essential. One must co-ordinate with the other.

**Distributing Plant in the City of New Orleans.
Cost of and Operation.**

COST OF PLANT:

Capital account of present distributing company, including gas generating plant.....	\$9,000,000.00
Proposed extensions to lines.....	2,000,000.00

Total Capital Account.....	\$11,000,000.00
----------------------------	-----------------

YEARLY CHARGE:

Interest 5% on \$11,000,000.00.....	\$ 550,000.00
Amortization 5%.....	550,000.00
Yearly cost of distribution—60,000 meters @ \$9.00 each.....	540,000.00
General expense and overhead.....	150,000.00

Total Yearly Charges.....	\$1,790,000.00
---------------------------	----------------

Cost of Distributing Gas in the City to Consumer.**Total Cost to Consumer.**

Taking the yearly charges, as above shown, of \$1,790,000.00 on 6,475,000,000 cubic feet of gas sold, we have a cost of 27.65 cents for distribution within the city.

COST OR SELLING PRICE TO CONSUMER:

Cost of gas to city gates.....	41.93 cents
Cost of distribution within city.....	27.65 cents

Total cost or selling price to consumer.....	69.58 cents
--	-------------

Recapitulation.

Cost of Pipe Line.....	\$ 8,300,000.00
Cost of Distributing Plant.....	11,000,000.00

Total Outlay.....	\$19,300,000.00
-------------------	-----------------

Yearly Operating Expenses**Including Interest Charge and Amortization.**

Pipe Line.....	2,061,500.00
City Distributing Plant.....	1,790,000.00
Purchase of 8,175,000,000 cu. ft. of gas at 8c per thousand feet.....	654,000.00

Total.....	\$ 4,505,500.00
------------	-----------------

Revenues from Natural Gas.

Taking the \$4,505,500.00 total charges on 6,475,000,000 cubic feet of gas sold, we have a cost of 69.58 cents at meters. The next question is getting the necessary revenues from sales to meet these charges.

If the 4,650,000,000 cubic feet of gas used for domestic purposes in New Orleans and towns en route sells for 75 cents per thousand, then the industrial gas—1,825,000,000 cubic feet—must sell for 56 cents to supply the balance of the revenue. Carrying the ratios from 75 cents to 90 cents, domestic.

If Domestic is				Then Industrial must sell for			
75c	per	thousand	cubic feet	56c	per	thousand	cubic feet
80c	"	"	"	43c	"	"	"
85c	"	"	"	30c	"	"	"
90c	"	"	"	18c	"	"	"

It is evident that towns en route must pay about the same domestic rate as New Orleans and that this rate must of necessity be around 75 cents to 90 cents per thousand cubic feet. This is a far lower rate than any of the present artificial users of gas are now paying. At the present time the ordinary household of New Orleans is paying \$1.30 per thousand cubic feet for artificial gas that has only about sixty per cent of the heating value of the gas from the Monroe Field. If a domestic rate of 75 cents were established for the Monroe gas, the actual cost for heat value would be only thirty-five per cent of the present cost, or forty-five cents (45c) per thousand cubic feet.

**Price Equivalent for Different Fuels as Compared With
Natural Gas.**

Gas at 1000 B. T. U. cents per 1000 cubic feet	Oil at 135,000 B. T. U. per Barrel	Coal at 13,000 B. T. U. per Ton	Coke at 12,000 B. T. U. per Ton
14.7.....	0.80.....		
15.5.....	0.85.....	\$4.00.....	
16.5.....	0.90.....		
17.4.....	0.95.....		
18.3.....	1.00.....		
19.2.....	1.05.....		
20.1.....	1.10.....		
21.0.....	1.15.....	5.50.....	\$5.00
22.0.....	1.20.....		
23.8.....	1.25.....		
24.7.....	1.35.....	6.50.....	
25.6.....	1.40.....		6.50
26.5.....	1.45.....		
27.8.....	1.50.....	7.50.....	
32.7.....		8.50.....	8.00
38.4.....		10.00.....	9.00
41.6.....			10.00
45.8.....			11.00

There are 75,000 to 90,000 tons of high grade coal burned every year for domestic heating purposes in addition to the gas consumed. Natural gas will replace all, or nearly all the coal now used in the houses for heating and also the present consumption of artificial gas for cooking and water heating.

Large consumers of coal in New Orleans are paying from \$4.00 to \$5.00 per ton; the extra handling, bunkering space necessary, firemen's labor, relining of furnaces, removal of ashes, etc., would probably raise the price to around \$5.50 to \$5.00. Smaller consumers are paying on the same basis, from \$6.00 to \$7.50 per ton.

To compete with a large bulk of the industrial coal a price of 20 to 22 cents per thousand cubic feet in terms of heat units only would have to be made for natural gas, but it must be remembered that natural gas is at least ten per cent more efficient in delivering heat than coal, and a price of 28 to 30 cents for natural gas would be a fairer comparison under actual working conditions.

The question of natural gas competition with fuel oil in New Orleans is still more difficult. Fuel oil is an excellent fuel, and at present price of \$1.35 to \$1.45 per barrel, supplanting it by natural gas is impossible.

To meet these conditions, however, would necessarily mean the loading of price on domestic gas to carry the increased burden until such times as a demand can be created among the smaller industrials for medium priced natural gas. The right kind of salesmanship by the distributing company will undoubtedly increase this class of service, thus effecting a gradual decrease in price to domestic consumers.

It is not at all unreasonable to expect that the domestic business of all the communities under consideration will gradually increase, resulting in the entire capacity of the sixteen inch line being drawn on for domestic gas before the end of the second year. The average yearly consumption through a sixteen inch line could be 5,442,000,000 cubic feet considering line losses and peak loads, or about 15,000,000 cubic feet per day average.

Finances.

It has been shown that the outlay required to finance this project would amount to \$19,300,000.00, which includes the cost of the pipe line (\$8,300,000.00) and the purchase of the present distributing gas plant in the City of New Orleans (\$11,000,000.00), and that the revenue derived from the sale of natural gas would be sufficient to justify such an expenditure; in other words, a safe investment.

Therefore, it is recommended that a Board, modeled along that of the Dock Board of the Port of New Orleans, as presently constituted (Act No. —70 of 1896, and as amended by subsequent Acts 44 of 1904, 180 of 1908, 133 (Joint Resolution) of 1910, and 103 (Joint Resolution of 1920) be created by Legislative amendment, to be designated as "Lighting and Heating Board of New Orleans;" that this Board be composed of five (5) members, three of whom are to be practicing engineers—two, civil and one, mechanical—and two business men; and that it be authorized to issue bonds in the amount necessary to cover cost of construction of a pipe line and the acquisi-

tion of the present distributing plant of the New Orleans Gas Light Company in the City of New Orleans.

Interest payments on bonded indebtedness during the interim of pipe line construction, covering a period of at least eighteen months, must also be considered and taken care of. This can be solved by purchase of the New Orleans Gas Light Company plant, a going concern, operating it as at present and the net revenues applied to interest obligations.

Summary.

1. The Monroe Gas Field, if properly protected, will furnish supplies of natural gas for the proposed line for many years. Steps must be taken, however, to eliminate waste and to curtail activities of the carbon black interests by strict law enforcement.

2. The proposed sixteen inch (16") line via Natchez, a distance of about 275 miles, will cost \$8,300,000.00, or about \$30,000.00 per mile. It will have a capacity of about 30,000,000 cubic feet per day and can deliver an average daily load, less peak loads and line losses of 15,000,000 cubic feet per day. It is admitted that engineering difficulties will be encountered in the pipe line construction. This, however, is to be expected. Much longer lines, which traverse a territory equally if not more difficult to negotiate than that of the proposed line between New Orleans and Monroe, are now being operated successfully.

3. Municipal ownership of the present New Orleans Gas Light Company plant is issential to the success of the enterprise. \$9,000,000.00 has been allowed for valuation of the plant with \$2,000,000.00 additional to be used in extensions and improvements when the property is taken over.

4. The gas will cost delivered to the consumer from 75 cents to 90 cents per thousand cubic feet, depending upon the expansion of the domestic business in future years. At 90 cents per thousand cubic feet, the price would be far below that now being paid for artificial gas, based on heat units. As the volume of gas consumed increases, the price could be lowered with justice to all concerned.

Conclusions.

There is no question but what the whole enterprise of piping gas and marketing gas in New Orleans is entirely feasible from an investment stand point.

Domestic consumption, however, is the only basis upon which the line can be constructed. It is impossible to pipe gas to New Orleans and there compete with cheap steam coal and fuel oil, except possibly to a very limited extent. The bulk of the revenue must be sought from domestic sale.

On the other hand, the price of gas can undoubtedly be reduced if the citizens will co-operate in the up-building and expansion of the business. The same operating costs and overhead expenses will apply regardless of whether the line is operated to full capacity or to only a part of capacity.

It therefore remains for the citizens of New Orleans to determine, by their active support and co-operation, as to just what degree of success the enterprise will have. No extra taxation is involved. The sale of gas at much lower rate than that now being paid will absorb all charges and this feature should appeal to all, especially those interested in cheap fuel.

The cheapest thing we have in New Orleans is water, which is furnished by an admirably managed board and executives, and similar conditions will prevail in the natural gas situation if operated on the same high plane of efficiency.

A survey made of towns of Baton Rouge, La., Natchez, Miss., and Rayville, La., showed a natural gas consumption of about 450,000,000 cubic feet per year.

This report is written from an unbiased viewpoint after careful and thorough analysis of the subject.

Acknowledgments.

The information contained in this report is based on surveys and data obtained from reliable and authentic sources.

Special reference is made to the valuable information contained in the reports of Messrs. H. W. Bell and R. A. Cattell, Petroleum Engineers, U. S. Bureau of Mines, in 1921, on the Monroe Gas Fields, and that of Ben K. Stroud, Petroleum Engineer and Supervisor of Minerals Division, Department of

Conservation, State of Louisiana, and Frank T. Payne, Civil Engineer, Engineer of the Department of Conservation, State of Louisiana, in 1922, on Proposed Gas Pipe Line from the Monroe Gas Fields to New Orleans.

Thanks for price on pipe, and other data, are due to Mr. Hugo Weidmann of the National Tube Company.

Thanks are tendered to the offices of the New Orleans Gas Light Company for information relative to consumption of gas in 1923, and other data.

Supplement.

I have addressed communications to quite a number of cities to draw comparisons between their growth and that of New Orleans.

The City of Dallas has been selected in view of the fact that it is located in an agricultural section, similar to New Orleans, with the exception that Dallas is supported by its cotton and grain crop and New Orleans by its sugar, cotton and rice. Dallas as New Orleans is not a manufacturing town in a true sense of the word.

New Orleans with her seaport and unexcelled port facilities has a greater advantage over Dallas, yet other conditions are similar.

The population of Dallas in 1900 was 42,638, and that of New Orleans, 287,104. Dallas in 1910 was 92,104 an increase over 1900 of 49,466 or 116%. New Orleans in 1910 was 339,075, an increase of 51,971 or 18%. The population of Dallas in 1920 was 158,976, an increase over 1910 of 66,872 or 73%. The population of New Orleans in 1920 was 387,219, an increase over 1910 of 48,144 or 14.2%.

Dallas has 10 railroads entering the city—3 are trunk lines and the remainder are short and branch lines.

New Orleans has 12 railroads, which have terminals in the city and 8 are trunk lines.

The City of Dallas has two 16-inch and one 8-inch gas pipe lines entering the city, bringing gas a distance of 120 miles. Average delivery of gas to the city is about 14,500,000 cubic feet per day and the peak delivery about 37,000,000 cubic feet.

The City of New Orleans has no natural gas lines, depending on artificial gas, the average used being 6,864,000 cubic feet daily with a maximum peak load of 16,000,000 cubic feet.

You will note the disparity between Dallas and New Orleans in this respect. New Orleans having two and a half times as great a population and using a little less than one-half the amount of gas as compared with Dallas.

New Orleans with a population of 387,219 has 873 industries of all kinds.

Dallas with a population of 158,975 has 457 industries or one-half that of New Orleans.

The total number of internal combustion engines used for manufacturing purposes in New Orleans is 846—Dallas 1,395.

Value of manufacturing products—New Orleans, \$182,798,-561.00; Dallas, \$93,649,654.00 or one-half of that of New Orleans.

To what is attributed the phenomenal growth of Dallas? No doubt one of the principal factors is cheap domestic and commercial fuel.

Industries.

	New Orleans	Dallas
Automobile bodies and parts.....	7.....	17
Automobile repairing.....	20.....	25
Bags, other than paper, not including bags made in textile mills.....	5.....	None
Bookbinding and blank-book making.....	7.....	None
Boxes, cigar.....	3.....	None
Boxes, paper, not elsewhere specified.....	6.....	None
Boxes, wooden packing, except cigar boxes.....	10.....	None
Bread and other bakery products.....	114.....	39
Brooms, from broom corn.....	6.....	None
Carriage and wagon materials.....	3.....	None
Carriages and wagons, including repairs.....	7.....	None
Cars and general shop construction and repairs by steam-railroad companies.....	5.....	3
Chemicals.....	None.....	4
Clothing, men's.....	16.....	9
Clothing, women's.....	12.....	3
Coffee and spice, roasting and grinding.....	22.....	None

Confectionery and ice cream.....	24.....	15
N. O. Confectionery 16—ice cream 8		
Dallas Confectionery 9—ice cream 6		
Cooperage, hogsheads and barrels.....	12.....	None
Copper, tin and sheet-iron work.....	18.....	14
Food preparations, not elsewhere specified.....	33.....	6
N. O.—Breadstuffs, macaroni, vermicelli, needles and sweetening sirups. All other food preparations for human consumption	28	
Prepared food for animal and fowl consumption	5	
Foundry and machine-shop products.....	38.....	19
Flavoring extracts.....	4.....	None
Furniture	17.....	None
N. O.—Wood furniture other than rattan and willow.....	12	
Metal furniture, and store and office furniture	5	
Ice, manufactured.....	20.....	11
Iron and steel, welding.....	None.....	4
Jewelry	7.....	7
Lumber, planing mill products.....	28.....	10
Marble and stone monuments and tombstone works	9.....	6
Mattresses and spring beds, not elsewhere specified	8.....	None
Mineral and soda waters.....	14.....	7
Oil and cake, cottonseed.....	None.....	4
Optical goods.....	None.....	4
Patent medicines and compounds.....	14.....	None
Printing and publishing, newspapers and periodicals	36.....	108
N. O.—Printing and publishing.....	6	
Printing, publishing and job print- ing	4	
Publishing without printing.....	26	
Dallas—Job printing.....	54	
Book publishing without printing.....	6	
Linotype work, typesetting, etc.....	4	
Printing, publishing and job print- ing	10	
Publishing without printing.....	34	

Discussion.

THE PRESIDENT: You have heard the interesting discussion by Mr. Payne. Is there anyone who wishes to ask any questions? If so, I am sure Mr. Payne will be glad to answer them.

MR. GREGORY: Col. Payne has given us a paper of great interest not only to the Engineers of this city but to every user of gas, and I am sure we all want it discussed very fully. In order to start the discussion, I am going to ask a few questions and raise a few points. Of course we will be glad to have gas containing a thousand heat units per cubic feet and pay 75 to 90 cents per thousand for it, rather than have artificial gas costing \$1.30, which only contains five to six hundred thermal heat units. The question which comes to me first is that of the single line. Are we to rely on the Monroe field to furnish this gas through a single line, that line crossing the Mississippi River and many other points, requiring difficult construction?

The cutting off of gas supply while a single line is being repaired, would be almost a catastrophe.

I notice Mr. Payne told us that the city of Dallas is supplied with three lines and supplied from different fields. It would seem to me that would be a much safer proposition than one of having a single line from the Monroe fields.

The question of a municipally owned gas distribution has also been suggested, and the Sewerage and Water Board of this city is referred to as an example of a well managed institution. It is often said in this city that water is the cheapest thing we have. I believe that is true, but we sometimes overlook the fact that there was a large Bond issue, on which the property owners of this city are paying taxes, in addition to the amount we pay for our water. Talking today with a man who lives in our city, who owns no property, he said he was delighted with the water here, and that it was very cheap, but he paid nothing toward the Bond indebtedness, such as the property owners here have to pay.

MR. ROBERT: Is there anyone else that has anything to say?

COL. GARSAUD: In case of a breakdown of the single gas line on the Monroe fields you would rely on the supply of the consumers from the artificial plant?

COL. PAYNE: Yes.

COL. GARSAUD: Have you also taken into consideration putting into the mains of the artificial gas that of the natural gas, could both be contained in those mains?

COL. PAYNE: The mixture of the two would not affect anything. The richness of the gas would simply be reduced. This is being done in quite a number of cities.

MR. GARSAUD: How long do you estimate it would take for the artificial gas to be turned into the mains?

COL. PAYNE: You could do it very shortly, because you have a certain amount of gas in your reservoir.

MR. ECKSTEIN: Then in addition to the charges on this natural gas line, we would have to pay the interest charges on the artificial gas plant. How would that effect the total cost of the natural gas?

COL. PAYNE: It would add some to the cost of the natural gas, to pay interest charges on the main pipe line.

MR. ECKSTEIN: Then here is this other question that Prof. Gregory brought up; why would it be cheaper to have municipal ownership than private ownership. I am interested because I am employed by the New Orleans Public Service.

COL. PAYNE: A well managed municipal owned plant has the advantage, for the reason that no excess profits are required to meet the demands of stockholders, which is generally paramount in privately owned corporations.

MR. ECKSTEIN: I don't like to debate on private ownership, but it is a well known fact that private ownership under Government regulations, is more efficient than municipal ownership.

COL. PAYNE: That is a question I cannot answer.

MR. LANPHIER: Is it possible to use artificial gas in the same manner as natural gas, or would it not require the changing of burners from one to the other?

COL. PAYNE: A good man to answer that question would be Mr. John Lewis Porter.

MR. PORTER: I was just waiting to see how many questions would be answered before they came to me at all. Col. Payne very kindly brought this paper up to Mr. Earl's office about two weeks ago and gave us first opportunity to go over it and then he came later and we had quite a discussion over the whole paper, and Mr. Earl and I feel that the data covered in the paper and

his construction costs are very well presented and are very fair in amounts.

Our estimate we made some three or four years ago, first in connection with natural gas proposition from Houma, and later from Monroe, and it checked out closely with the figures Col. Payne has worked out from his present paper.

The first question that comes up in connection with this paper, is the question of the life of the gas field and any effect that it may have on the amortization of the pipe line. Col. Payne has figured that the pipe line should be amortized in eight years in order to be safe on any shutting down on the supply of gas or any failure to get natural gas during such a period. It seems very proper in view of the unknown factor in connection with the Louisiana Gas fields, to take a short life for that pipe line. It would be absolutely useless at the end of the period when we can get gas from that source, and on that basis eight years seems to be a very fair period to take. That makes a total charge of about twenty percent on the capital, as capital charges. He then takes the price of gas at eight cents per thousand cubic feet at the field, which is in line with what we feel is the proper charge.

In order to make any connections with owners of gas wells with consumers of gas in New Orleans, there must be a price put on the gas sufficient to make it interesting for them to allow that gas to be sold over a long period of time, rather than sell it in a short period of time to carbon black manufacturers; so eight cents per thousand feet for the gas at the fields seems a very fair price for that. Then he has figured out that the consumption for New Orleans would reach an amount of 4,200,000,000 cubic feet per year and the other towns along the route something like 450,000,000. The industrial load for New Orleans is 1,800,000,000.

That has been a well-defined feeling here all along, that there is no possibility of developing an industrial consumption of gas in New Orleans to amount to anything whatsoever, so that the whole burden of pipe line charges and distribution of gas must be borne by the consumer. I have data on gas consumption in New Orleans from 1918 down to the present time. They show an average increase in consumption of about

seven percent per year. The total increase in average consumption being about forty-five percent, but the peak load has increased something over seventy percent in that same time. In other words, there has been developed in New Orleans a big heating load in the winter time for a few days, a very few days, in fact, which has increased the average very greatly.

If you will take the ten or twelve days in the winter for the last two or three years when consumption has gone up anywhere from twelve to fifteen million cubic feet, and take those out of the average you will find the ordinary normal condition, six million cubic feet per day. In other words, seven percent covers these big load increases.

Now to anticipate the possibility of cheaper gas, if we can assume that the increase in gas consumption can be made equal to ten percent per year, over an average period of five years, we would then reach an average daily consumption of about ten million cubic feet, or say, 3,700,000,000 cubic feet per year. On that basis, and taking Col. Payne's figures for pipe line costs, his figures for the New Orleans Gas Company's plant, and his figures for the distribution of gas, and scaling them on a basis of ten million cubic feet per day consumption, plus ten percent for pipe line loss, and simply purchasing the equivalent amount of gas at the field instead of the six or eight billion cubic feet, should show, I find, a maximum cost for gas for New Orleans of \$1.15 per thousand cubic feet on ten million cubic feet in five years.

Taking, however, some figures, Mr. Earl and I worked out four years ago on the Houma Gas proposition, I find it amounts to \$1.26. The charges for distribution of gas and handling gas in the city, I think, are somewhat larger than the figures Col. Payne used. That is based on the same consumption relation of one thousand B. T. U. gas as against 600 B. T. U. gas, which would mean that people would be wasting, for the same results, roughly sixty-five percent of the gas they are getting, if they burned the same amount of one thousand B. T. U. gas as six hundred B. T. U. gas.

With reference to a single pipe line from any of the gas fields to New Orleans, we feel it would be absolute suicide to depend on such a single line as the sole supply of fuel for the

city. There is only one way that can be properly taken care of, and that is to maintain the plant of the gas company as a standby plant, ready to go into operation on a few hours notice, so that with a single pipe, with a manufacturing plant maintained as a standby plant, you have an alternative source. You can not burn natural and artificial gas in the same burners without readjusting the burners. It would mean a thousand men running around changing burners. There is only one thing to do, and that is to make your gas of such a quantity that it can be burned in the same burner, whether coming from the Gas Company, or the natural gas fields. That can be done by diluting the natural gas to a point where it has approximately seven hundred units. That is simple and can be done, and in that case would mean no waste of gas through the handling of higher B. T. U. gas than people are accustomed to. No readjustment of any burners, would be required and you could shift from artificial to natural gas, or make any change whatever without notifying the consumer.

That would enable you to operate the gas plant as a standby plant and result in a six or seven cents per thousand cubic feet reduction in the price of gas. The gas would be brought to the city in the natural state and diluted before furnishing it to the consumer.

MR. ECKSTEIN: How much would it cost?

MR. PORTER: It shouldn't cost anything except a small amount for mixing. Dilute it with air. If you reduce it at a reducing station, you probably would have to use a blower in that case.

MR. ECKSTEIN: Wouldn't you lose the advantage of the natural gas, making 600 B. T. U. gas out of 1,000 B. T. U. gas? Could you give people the same kind of gas they had been using with just as many heat units as before?

MR. PORTER: The question of heating load has been discussed everywhere that natural gas has been exploited, and Col. Payne brought out some data with reference to Dallas. Dallas has considerable use for natural gas, and last winter they were so low, that the only way was to shut down the facilities for using the gas. Wherever natural gas has been used,

where there is a heavy demand for heating they have had trouble.

If we should develop in New Orleans a consumption of gas up to 37,000,000,000 feet, the figures for Dallas last year, we would practically have to double our distribution system. We have trouble every year getting gas for consumption. It is nobody's fault except the consumer who wants gas for heating. It is almost criminal to allow the indiscriminate use of gas for heating. I understand Dallas has a sliding scale for gas used in heating. Several of the cities have a sliding scale. They pay 85c for the first thousand feet and 95c for the second thousand feet and so on up. Furthermore, in commenting on the increase in the consumption of natural gas in the northern cities, Col. Payne says it runs from two to five times what it had been for artificial gas. That was clearly explained at the Annual Gas Conservatoin Congress held in Washington in 1920. At that meeting they brought out the fact that the average natural gas heating apparatus, whether cook stoves or heating furnaces, consumed ultimately only 25 percent of the heat units, whereas the average of the same in artificial gas was 75c. In other words, natural gas appliances on the market were wasting two-thirds of the gas they burned, and they advocated the raising of the price of natural gas. In other words, while they were using three times as much, they were wasting two-thirds of it.

Really there is very little room for the extension of gas. If the gas is made a little cheaper, people use a little more for heating water and a little more for cooking. The people in all portions of the city today are fairly well supplied with gas and the only increase that can be expected is the extension into new territory.

Another factor to be considered, under the present conditions of the Public Utilities arrangement in New Orleans, is that if the city acquired the gas company and took it out of the hands of the Public Service Company, the latter becomes a competitor of gas, through the sale of electricity for heating purposes. There are on the market now numbers of electrical heating devices which would become strong competitors of gas, if the electricity were supplied at a low rate. Rapid

progress is being made in the development of apparatus for heating water by electricity. Competition between gas furnished by the city, and electricity furnished by the Public Service Co., for heating purposes is a factor which should not be lost sight of. All boiled down, it doesn't seem that we could get gas into New Orleans from Monroe cheaper than at present. With that in mind and those figures as a basis we have to consider the desirability of getting natural gas. It does seem an awful shame that we cannot get natural gas in New Orleans for our use.

COL. PAYNE: The Department of Conservation has definite information that a 20-inch pipe line is to be constructed from the Louisiana gas fields to Texas points which will handle 120,000,000 cubic feet of gas per day. Only one pipe is to be used for this enormous quantity of gas.

MR. GARSAUD: Would houses now equipped with artificial gas appliances be able to use the natural gas?

COL. PAYNE: Yes, if you used the diluted gas.

MR. BARELLI: Doesn't the big load come from the same reservoir?

MR. PORTER: Largely. Take a cold day, you can't get enough gas to cook your breakfast. You must take into consideration that probably not five percent of the houses are equipped with either system.

MR. BARELLI: What about these plants being equipped with fuel oil and kerosene, wouldn't they go to natural gas?

MR. PORTER: If they could get it cheap enough, not at 75c or 50c even.

MR. BARELLI: You mean to say that 75c gas would not be cheaper?

MR. PORTER: That depends on how you want to handle it, \$1.50 oil is equivalent to 28 cents gas.

COL. PAYNE: I wish to state that a bill along the lines as represented in this paper, read by me before you, is now being drawn up by Mr. Maloney, Commissioner of Public Utilities of the City of New Orleans, to be presented to the Legislature.

MR. LANPHER: I am well acquainted with the Houston, Port Arthur and Beaumont gas fields and if the City of New Orleans

has as much vision as they have, we will have natural gas whether the burners burn it or not.

MR. LOCKETT (By Letter): I am sorry that it will not be practicable for me to be present at the reading of the paper of Mr. Frank T. Payne on the subject of the Natural Gas Situation as Applied to the City of New Orleans, and to hear the interesting discussion which will, no doubt, take place.

Of course, all of us are concerned in seeing natural gas brought to New Orleans by reason of the material benefits to be derived, but I am peculiarly interested by reason of the fact that several years ago I served on a citizens committee, appointed by Mayor Behrman, to study the proposition.

I have no special knowledge of this subject. I have never been connected in any capacity with the production, distribution or financing of a natural gas project. Such information as I possess consists only of that which I have gained from reading reports made by men who have first hand knowledge and such conclusions as I have reached have been those which appeared to me to be common sense deductions.

The principle difficulty which has stood in the way of natural gas being brought to New Orleans has been due to the inability of the public to appreciate the actual value of the gas and the consequent unwillingness to entertain seriously the idea of paying such prices as would justify private enterprise in undertaking the work.

The value of natural gas for domestic and industrial purposes as compared with manufactured gas, coal and oil, is for all practical purposes in the ratio of the heat units available on combustion.

If manufactured gas has a value of \$1.30 when containing approximately 600 heat units, natural gas, with 1000 heat units, will be worth \$2.17 and any price natural gas might be offered to the consumers of New Orleans less than \$2.17 would mean a saving to the users.

At the time the question of natural gas from the Houma field was being considered, by reason of the uncertainty of the supply, it seemed to me that the company proposing to bring this

Mr. John H. Dunlap, Secretary of the American Society of Civil Engineers then gave an interesting address on the "Educational Requirements and Development in Engineering Courses."

A rising vote of thanks was given to Messrs. Grunsky and Dunlap and the meeting adjourned to the usual collation.

FRANK A. MUTH, Secretary.

Regular Meeting of the Board of Direction—May 12, 1924.

The meeting was called to order with President Robert in the Chair and the following members present: Messrs. Moses, Kerr, Barelli, Lanphier, Garsaud and Muth.

The minutes of previous meeting were read and approved and bills on hand were ordered paid.

The Minutes of the Library Committee for its meeting of April 25th were read and received.

Several communications were read then the Secretary was instructed as to replies to be made.

Letter of March 18th from the Editor of the Proceedings was read and the various features of the two editorials on pages 8 and 10 of the February issue were covered by action as follows:

- (a) Relative to removal of the Library to some other part of the city, on motion duly seconded, it was voted that no action be taken on this matter at the present time.
- (b) Relative to withdrawal from membership in the Federated American Engineering Societies, on motion duly seconded it was voted that the matter be referred to the Society.
- (c) Relative to the discontinuance or change in method of charging costs of the Annual Smoker, on motion duly seconded it was voted that no action be taken at this time.
- (d) In regard to the Proceedings, it is the earnest desire of the Board that the Proceedings be continued because it is one of the most important activities carried on by the Society.

There being no further business the meeting adjourned.

FRANK A. MUTH, Secretary.

Regular Meeting of the Society—May 12, 1924.

The meeting was called to order about 8:10 p. m., with President Robert in the Chair, F. A. Muth, Secretary and present 47 members and guests.

The reading of minutes of previous meeting was dispensed with.

It was with deep regret that the death of Major Frank M. Kerr was announced and the President appointed a Committee as follows to prepare Resolutions also an obituary of Major Kerr: Sidney F. Lewis, Chairman; Geo. W. Lawes and Geo. C. Schoenberger.

It was announced that keys for the library can be secured from the Secretary by making a deposit of fifty cents.

Letter from the Secretary and Curator of the State Museum relative to increased appropriation for the maintenance and repair of the State Museum was read, and on motion of Mr. Lawes, duly seconded, it was decided that the State Legislature be informed that it is the sense of the members of the Louisiana Engineering Society present at this meeting that the Legislature be asked to realize the obligations of the State to this Institution and to provide adequate means of support and repairs for the next two years.

The matter of withdrawal from the F. A. E. S. was brought up and after some discussion the Secretary was instructed to call attention of members on post card notices that at the next meeting the matter will be discussed and perhaps decided.

The technical exercises of the evening consisted of an interesting paper by Major Frank T. Payne on "The Natural Gas Situation as Applied to the City of New Orleans." The paper was discussed by several members from the floor and the Secretary read the discussion of Mr. A. M. Lockett, who could not be present. A rising vote of thanks was tendered the speaker and the meeting adjourned to the usual collation.

FRANK A. MUTH, Secretary.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

JUNE, 1924

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

	PAGE
Lester F. Alexander & Co.....	4
Allis-Chalmers.....	6
The American Cement Machine Co., Inc.....	5
American Creosote Works, Creosoted Timber.....	14
American Creosoting Co., Inc.....	12
The Anchor Packing Co.....	17
H. Bodenheimer & Sons.....	9
Brook Tarpaulin Co., Inc.	14
Columbian Iron Works.....	17
Concrete Steel Company.....	9
W. G. Coyle & Co.....	9
Creosoted Materials Co., Inc.....	10
Dixie Mill Supply Co., Inc.....	15
Doullut & Williams Co., Inc.....	11
Eugene Dietzgen Co., Surveying Instruments.....	16
Gaiennie Company.....	5
Geo. J. Glover.....	7
Gray Artesian Well Company	6
Harry Bros. Co. of I.a., Galvanized Iron Tanks, etc.....	12
Hattiesburg Creosoting Company	10
Robert W. Hunt & Co., Engineers, Chemists, Inspectors.....	10
Jahncke Service, Inc.	17
Kittredge-Waters Supply Co., Ltd.....	5
A. M. Lockett & Co., Ltd.....	8
The Lufkin Rule Co.....	3

INDEX TO ADVERTISEMENTS—Continued.

	PAGE
The Manhattan Rubber Mfg. Co.....	13
Albert A. Martinez, Southern Yellow Pine.....	Inside Front Cover
Guy R. Molony & Co.	13
John H. Murphy Iron Works	8
N. O. Coal and Bisso Towboat Co.	19
Ole K. Olsen, Concrete and Structural Steel.....	7
Pacific Flush-Tank Co.....	13
Profit Island Gravel and Sand	3
Shakspeare Iron Works	3
Standard Oil Co. of Louisiana	11
The Tulane University of Louisiana.....	4
The Tulane University Press, Printing.....	6
Turnerized Roofing Co.....	Outside Back Cover
Westinghouse Electric & Manufacturing Co.....	18
Woodward, Wight & Co., Railway and Mill Supplies.....	16

This Journal reaches the officials with whom rests the responsibility for the bulk of the municipal, state and industrial works in Louisiana and the surrounding territory. Its advertising pages afford you an effective and dignified means of cultivating a wider acquaintance among prospective buyers.

WHEN
YOU BUY
A

LUFKIN

Measuring Tape

YOU MAY BE SURE THAT

You have an ACCURATE and DURABLE tape of a brand that has given universal satisfaction for years and that the maker guarantees direct to you.

Send for catalogue.

Saginaw, Mich.

THE LUFKIN RULE CO.

New York,
London, Eng.
Windsor, Can.



PROFIT ISLAND GRAVEL AND SAND

(Sized, Washed and Mixed)

(Concrete and Screened)

Also Carry a Complete Line of

Building Materials

Including

Portland Cement, Plaster, Brick, Lime, Clay
Products, Laths, Finishing Plaster, etc.

J. W. Thompson

708 Commercial Bank Bldg.

(FORMERLY HENNER BLDG.)

Phones Main 1165-1166

New Orleans, La.

Phone Main 541

913 Girod Street

SHAKSPEARE IRON WORKS JULIAN M. SWOOP, Proprietor

Machinery Repairs Given Prompt Attention

Grey Iron Castings, Brass Castings

Plantation Sugar Mill Repairs a Specialty

Blacksmith Work of all Kind

Pattern Making Grate Bars—ordinary or circular

WE WELD ANY PARTS OF BROKEN MACHINERY

PHONE MAIN 541

NEW ORLEANS, LA.

LESTER F. ALEXANDER,
M. La. Engr. Soc.
M. S. A. M. E.

J. L. DICKEY,
M. Am. Soc. C. E.
M. La. Engr. Soc.
M. S. A. M. E.

LESTER F. ALEXANDER & CO.

CIVIL ENGINEERS and CONTRACTORS

**River and Harbor Improvements
River and Gulf Towing**

Barges, Derricks and Pile Drivers

830-32-34 Maison Blanche Annex. New Orleans, La.

Phones—Main 4195-1967

TUGS—Boswell, H. H. Colle, Wm. F. Flanders, Panther.

TULANE UNIVERSITY OF LOUISIANA NEW ORLEANS

Located in the choicest residential section of the South's leading city, with climatic and other advantages enjoyed by no other institution of equal rank, offers superior instruction in standard college courses, and in Engineering, Law, Medicine, Pharmacy, Dentistry, Art, Music, Domestic Science, Household Economy, Commerce and Business Administration. Separate department for women in the Newcomb College. Extensive laboratories, many scholarships in under-graduate colleges for men and women. Board and accommodation in dormitories at low rates. Twenty-four buildings. Campus of 100 acres. Full descriptive catalog, or a bulletin of any college sent free upon application. Address The Registrar, Tulane University, New Orleans, La.

Telephones Main 1495-1496

Kittredge-Waters Supply Co., Ltd.

Machine Shop

Engineer and Mill Supplies

422-424 Common Street

New Orleans



CONTRACTORS' EQUIPMENT

All Sizes from 5 ft. to 22 ft. Gas, Steam or Electric.
Ask about the BOSS High Drum two-bag Mixer.

THE AMERICAN CEMENT MACHINE CO. (Inc.) Keokuk, Ia.

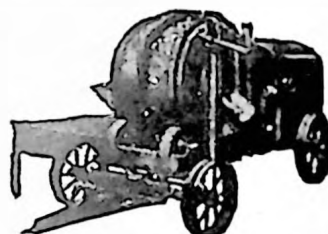
CARRIED IN STOCK BY

OLE K. OLSEN

822 Perdido Street, New Orleans, La.

Pavers, Grouters, Building
Mixers, Hoists, Back - Fillers,
Elevators, Pumps, Carts

Low Prices—Cash or Terms



\$325 Buys Low Charger

Gaiennie Company

STEAM HEATING
HOT WATER HEATING
MOIST AIR HEATING
GAS STEAM HEATING
PLUMBING
PLUMBING SUPPLIES

ESTIMATES FURNISHED UPON APPLICATION

Howard Avenue and Baronne Street

Phone Main 4020

ENGINEERS

We are Official Printers of the
Louisiana Engineering Society,
and make a specialty of the
PRINTING needs of Engineers

Tulane University Press

QUALITY PRINTERS

PHONE WALNUT 82



POWER, ELECTRICAL and INDUSTRIAL MACHINERY

ELECTRICAL Machinery, Steam Engines, Steam Turbines,
Condensers, Gas Engines, Oil Engines, Hydraulic Tur-
bines, Pumping Engines, Centrifugal Pumps, Mining
Machinery, Metallurgical Machinery, Crushing Machinery,
Cement Machinery, Flour Mill Machinery, Saw Mill Machinery,
Air Compressors, Air Brakes, Steam and Electric Hoists, Farm
Tractors, Power Transmission Machinery, Perforated Metals,
Timber Preserving Machinery.

COMPLETE POWER
UNITS WITH ANY
TYPE OF
PRIME MOVER

ALLIS-CHALMERS
MILWAUKEE, WIS. U.S.A.

Gray Artesian Well Company

Water Supply Contractors

PENSACOLA, FLORIDA

Send your Specifications to us.

We Guarantee Water

BACKED BY BOND

Ask Your Friends About
The Concrete Engineer

OLE K. OLSEN

822 PERDIDO STREET
Phone Main 2104. New Orleans.

Geo. J. Glover

General Contractor

*Member: American Society for Testing Materials
Contractors & Dealers Exchange of New Orleans*

Whitney-Central Building New Orleans, La.

PHONE MAIN 1276

*Office Buildings, Railway Buildings, Manufacturing
Plants, Heavy Masonry, Pile Foundations*

AT YOUR SERVICE

To engineers we offer our services and the services of the manufacturers of high-grade equipment whom we represent; some of whom are as follows:

Babcock & Wilcox Co; Boilers and Superheaters. **Worthington Pump & Machinery Corporation;** Pumps, Compressors, Oil Engines, Condensers, etc. **American Blower Co;** Fans and Blowers and Air Conditioners. **Nash Engineering Co;** Vacuum and Steam-heating Pumps. **Spray Engineering Co;** Spray Cooling Ponds. **Frick Co;** Refrigeration Equipment. **Diamond Power Specialty Co;** Soot Blowers. **Diamond Rubber Co;** Mechanical Rubber Goods. **Robins Conveyor Co;** Conveyors and Handling Equipment. **Griscom-Russell Co;** Heat Exchange Apparatus. **A. M. Lockett & Co;** Oil-Burning Equipment.

Each of these has in its employ engineers who represent the highest talent in their respective lines; and the engineer whose client's requirements call for equipment covered by any of these lines, can count on the advice of these specialists, as well as that of our own engineering organization, in selecting proper equipment for a wide variety of service.

A. M. LOCKETT & CO., Ltd.
Contracting Mechanical Engineers and Machinery Merchants
NEW ORLEANS
Houston, Dallas, San Antonio, Texas

JOHN H. MURPHY IRON WORKS

MANUFACTURERS AND CONTRACTORS

Vacuum Pans, Coil and
Calandria

Webre Multiple Effects

Centrifugals and Mixers

Crystalizers, any type

Return Current Juice Heaters

Oil Storage Tanks, all sizes and shapes

Internally Fired Boilers

High Pressure Boilers Fitted
with Steel Casings

Quinn Flat Top Bagasse
Furnaces

Juice and Syrup Tanks

Main Office, 643 Magazine St.
New Orleans, La., U. S. A.
Phone Main 160

Foundry and Machine Works
A. J. Naquin, Manager
Alexandria, La.

Boiler and Tank Works
Broad and Perdido Sts.
Phone Main 161

Machine Shop, Copper and
Brass Works
Magazine and Girod Sts.

W. G. COYLE & CO.

(INCORPORATED)



Bunker Coal and Towing BARGES, LIGHTERS, ETC.

High Grade Coals

Competent Tugs

Telephone Main 4429

Main Office: 1322 Whitney-Central Bldg.

New Orleans, La.

H. BODENHEIMER & SONS

Everything Pertaining to

INSURANCE

810 UNION STREET

Phones Main 1817-1818

NEW ORLEANS, LA.

SPECIFY

HAVEMEYER BARS

For Your Reinforced Concrete Work.
The Most Efficient and Economical Bar.
Rolled to same weight as plains.
Round—Square—Flat.

"EVERY POUND PULLS."

PROMPT SHIPMENTS—MILL OR WAREHOUSE

Concrete Steel Company

42 Broadway

NEW YORK

SOUTHERN OFFICE

Birmingham,

::

Ala.

OLE K. OLSEN, Sales Agent
New Orleans.

Hattiesburg Creosoting Co.

Plants at Hattiesburg, Miss. and Slidell, La.
Main Office, Hattiesburg, Miss.

CREOSOTED MATERIAL

— INCLUDING —

Lumber, Timbers, Piles, Telephone and Telegraph
Poles and Cross-Arms, Paving Blocks,
Cross-Ties, Etc.

CAPACITY, 70,000,000 FEET B. M. PER ANNUM

Facilities for Shipping by Rail or Water

Creosoted Materials Co., Inc.

1403 HIBERNIA BUILDING

Phone Main 3818

New Orleans, La.

— DEALERS IN —

Creosoted Materials of All Kinds

Robert W. Hunt Co.

Engineers, Chemists, Metallurgists, Inspectors

Inspection and Tests of Steel and Cement for Bridges, Buildings
and Other Structures. Inspection of Rails and Fastenings.
Creosoted Block, Timber and Ties. Paving Brick and Asphalt.

General Office, Chicago, 2200 Insurance Exchange.
New Orleans, 919 Carondelet Bldg.

Stanocola Mexican Asphalt

FOR
Sheet Asphalt

Asphaltic Concrete

Brick and Block Filler

Penetration Macadam

Surface Treatment

Standard Oil Co. of Louisiana

NEW ORLEANS

W. HORACE WILLIAMS,
 Pres. and Gen'l Mgr.

J. P. EWIN,
 Secty-Treas. and
 Managing Engineer

PAUL DOULLUT,
 Vice-Pres.

Doullut & Williams Co., Inc.

Engineers and General Contractors

NEW ORLEANS, LA.

CAPITALIZED AT \$1,000,000.00

Competent Engineers in charge of Departments covering design and construction of the following:

Docks, Wharves and Bulkheads of Concrete or Timber.
 Industrial Plants, Bridges, Pipe Lines, Levees and Roads.
 Electrical and Steam Power Plants, Water Works Systems.

Tugs, Barges, Derricks, Pile Drivers, Dredges, Diving Outfits
 for Sale or Charter

CREOSOTED

TIMBERS - PILING
CROSS TIES - POLES

LUMBER - PAVING BLOCKS

AMERICAN CREOSOTING COMPANY

COLONIAL
CREOSOTING
COMPANY
INCORPORATED



GEORGIA
CREOSOTING
COMPANY
INCORPORATED

LOUISVILLE - KENTUCKY

SALES OFFICES

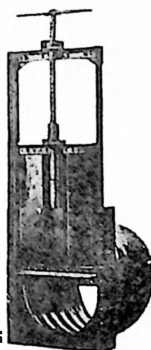
220 MADISON AVE. NEW YORK CITY - 431 W. MAIN ST. LOUISVILLE, KY.
DOCALUSA, LA. BRUNSWICK, GA.



Louisiana Engineers should have
in their files our catalog of Galva-
nized Iron Tanks, Sectional Steel
Towers, All Metal
Sectional Buildings,
Garages, Silos Cul-
vert, Water Tight
Pipe Gate Valves,
Etc.

¶ We are prepared to
submit blueprints and
specifications on the
above or on any kind
of metal buildings.

ASK FOR CATALOG



HARRY BROS. CO. of LA. New Orleans, La.

The Manhattan Rubber Mfg. Co.

HIGH GRADE
MECHANICAL RUBBER GOODS



500 CAMP STREET, :: New Orleans, La.

Miller Flushtank Siphons



Simple, Reliable, Automatic

Also Sewage Disposal
Apparatus, Automatic
Sewage Ejectors, Centri-
fugal Pump Outfits,
Sewer Jointing Com-
pounds.

PACIFIC
FLUSH-TANK CO.
CHICAGO NEW YORK

GUY R. MOLONY & CO.

General Drayage

418 GRAVIER STREET

Phone Main 6281

NEW ORLEANS, LA.

American Creosote Works

INCORPORATED

CREOSOTED

**Cross Arms, Lumber, Paving
Blocks, Piles, Poles, Ties**

Private Wharf for Ocean Vessels at NEW ORLEANS, LA.

Capacity 115,000,000 Feet B. M. Per Annum

Branch Plants:

Louisville, Miss.
Winnfield, La.

STATION "B"

NEW ORLEANS, LA.

COTTON DUCK

TARPAULINS

TENTS

DISTRIBUTORS FOR

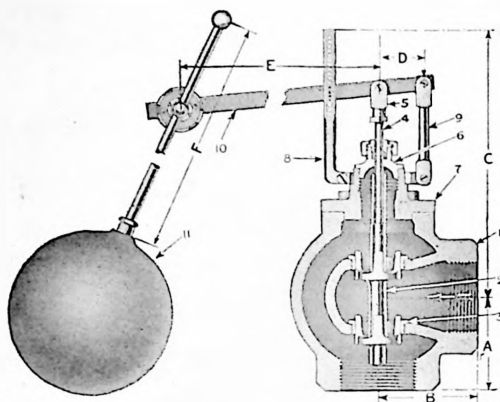
WHITLOCK MANILA ROPE

Brook Tarpaulin Company, Inc.

(ESTABLISHED 1840)

429 Celeste Street

New Orleans, La.



VALVES

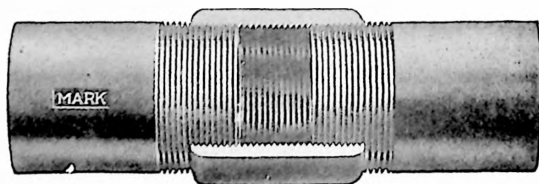
Pipe and Fittings

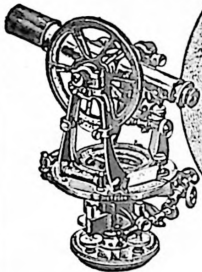
PIPE—Cast Iron

PIPE—Wrought Steel

PIPE—Wrought Iron

Dixie Mill Supply Co., Inc.
New Orleans





Transits and Levels

that will give perfect
service under all conditions
of use are manufactured by
DIETZGEN
—the firm with the quality reputation. *Catalog on request.*
EUGENE DIETZGEN CO.
Manufacturers
Chicago New York San Francisco
New Orleans Pittsburgh
Philadelphia

WOODWARD, WIGHT & CO.

— LIMITED —

Largest General Supply House South Since 1867

EXCLUSIVE SOUTHERN SELLING AGENTS FOR

LIDGERWOOD Hoisting Engines, Cableways and Log
Handling Machinery.

HAYWARD Orange Peel and Clam Shell Buckets.

GENERAL ELECTRIC CO. Apparatus and Supplies.

ROEBLING'S Wire Rope.

Heavy Hardware; Mill Supplies; Marine Hardware;
Cordage; Elevating, Conveying and
Power Transmitting Machinery.

OPEN DAY AND NIGHT

Howard Avenue, Constance
and St. Joseph Streets

NEW ORLEANS

SAND

GRAVEL

JAHNCKE SERVICE Inc.

NEW ORLEANS

Concrete and Builders' Materials
Dredging

SHELLS

CEMENT

**COLUMBIAN
IRON WORKS**

CHATTANOOGA, TENN.

Manufacturers of

Fire Hydrants, Valves,
Valve Boxes, Sluice
Gates, Meter Boxes,
Water Works Supplies

New Orleans Representative:

J. S. BARELLI

612 Godchaux Bldg.

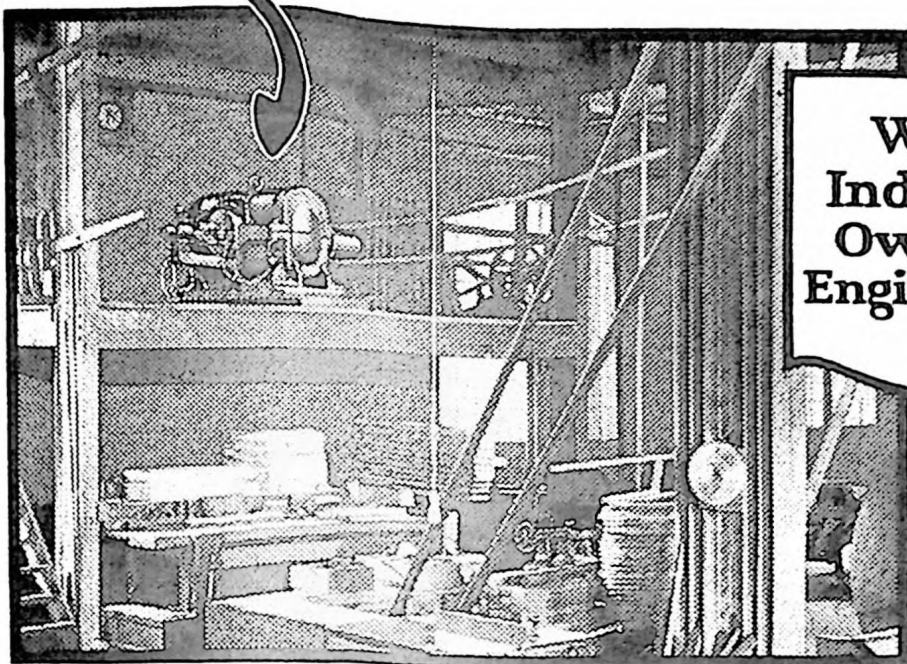


COMPLIMENTS

The Anchor Packing Company

418 COMMON STREET

NEW ORLEANS, LA.



What Industry Owes to Engineering



After many years of service as a direct-current generator, this original application in the steel industry in 1891—in the Edgar Thomson Works of the Carnegie Steel Co., Bessemer, Pa.—ended its days as a motor in the pattern shop.

First in Electrification of Industry

Where Westinghouse Blazed the Trail

Steel Industry
Textile Manufacturing
Paper Making
Rubber Industry
Material Handling
Motion Picture Industry
Meat Packing
Railroading
Ship Building
And Others

In 1891 the first electric motor was put to work in a steel mill. In 1905 the first large rolling mill motor, and in 1906, the first reversing mill motor were also installed in steel mills. These motors—all Westinghouse Motors—were history-makers in the steel industry.

Other industries too have profited by Westinghouse engineering pioneering.

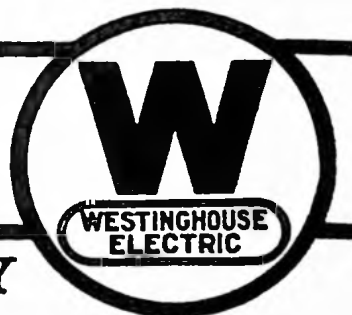
--In the textile industry, individual motor drive became a reality in 1902, in the Sauguoit Silk Co., Philadelphia, Pa.

--In the rubber industry, Westinghouse ideas as originally applied in 1900, are today the standard method of application in plants throughout the world.

--In the handling of materials at the world's great shipping centers, in the manufacturing of paper, in the motion picture industry, in coal mining, in meat packing, railroading, ship building—in fact, in every branch of human activity can be found progress and profits traceable directly to the pioneering of Westinghouse Engineers.

Westinghouse

ACHIEVEMENT & OPPORTUNITY



Facilities for Handling Coal in River, Tug Boats, Tow Boats, Barges
and Modern Coal Colliers

New Orleans Coal and Bisso Towboat Company

W. A. BISSE, President and General Manager

MAIN OFFICE: 606 United Fruit Company Bldg.

BRANCH OFFICE: Cor. Walnut and Levee

75 Ton Marine Steel Derrick, Marine Divers, and Flush-Deck Lighters

TELEPHONES: Main 2752, Main 233; Walnut 29, Walnut 20, Walnut 410

COLLIERS: Uncle Jim, Uncle Bill

TUGS: W. A. Bisso, J. A. Bisso, A. L. Bisso, Barranca, Independent, Captain Bud
Leo, L. E. Patton, Joe.

NEW ORLEANS, LA., U. S. A.

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

VOL. X.

AUGUST, 1924

No. 4

CONTENTS

EDITORIAL NOTES AND COMMENT:	PAGE
New Underground Electric Service for New Orleans.....	171
The Work of the American Engineering Council.....	172
Louisiana State Board of Engineering Examiners.....	173
An Important Note.....	174
American Institute to Hold Big Exposition of Inventions.....	176
A Correction.....	177
OBITUARY.....	178
PAPERS AND DISCUSSIONS:	
Alternating Current Underground Distribution for New Orleans. <i>By W. R. Bullard</i>	179
Discussion.....	199
The Work of the American Engineering Council. <i>By L. W. Wallace</i>	203
MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.....	214

EDITORIAL NOTES AND COMMENT

New Underground Electric Service for New Orleans. Mr. W. R. Bullard's paper, published in this issue, gives a very interesting technical description of the details of the new underground alternating current system of distribution to be installed in the business section of the city. It is to replace the present direct current system of distribution. The outstanding advantages of alternating current for long distance transmission and for distribution for general purposes have long been recognized and the most intensive use has been made of the system. For distribution within the business and industrial areas of many cities, however, the Edison three-wire system with direct current has been the prevailing method. The direct current is supplied from conveniently located sub-sta-

tions supplied with rotaries or motor-generator sets. This is the system now in use in New Orleans, the motor-generator sets receiving A. C. at 6600 volts through underground feeders.

As pointed out by Mr. Bullard the chief reason for the extensive use of direct current in metropolitan centers has been its great reliability, coupled also with the fact that D. C. motors have in most cases proven to be more adaptable to the great variety of purposes found in such centers. The A. C. motor, however, is rapidly being adapted to many of the uses formerly served only by the D. C. motor, and the new A. C. system for New Orleans makes use of a low voltage network similar to that of the ordinary D. C. system. This latter arrangement is made possible by the use of a recently developed automatic network switch, fully described in the paper.

The main purpose of this switch is to automatically disconnect from the low voltage mains all the transformer banks which may be connected to a particular high voltage feeder when that feeder becomes short circuited, thus preventing the network from feeding back into the short circuit.

Alternating current substations will receive power at 13,200 volts where it will be stepped down to 4000 volts 3-phase 4-wire or 2300 volts Y, which will be the distribution voltages to be further stepped down at the distribution transformer to the utilization voltages of 110/220 for lighting and 220 volts 3-phase for power service.

Mr. Bullard claims that the reliability of this new system will be greater than that of the present D. C. network. The investment will be approximately half that for the D. C. system, and the comparative figures for efficiency and economy are largely in favor of the new A. C. system.

It is estimated that about thirty years will be required for the completion of the system, making allowance for the future growth of the business and industrial area of the city.

The Work of the American Engineering Council. The much debated question as to the withdrawal or continuance of our connection with the Federated American Engineering Societies

was again before the Louisiana Engineering Society at its June meeting. This occasion brought us the pleasure of a visit from Mr. L. W. Wallace, Executive Secretary of the Council, who delivered a very interesting address on the work which the Council has accomplished as well as its plans for the future.

The Louisiana Engineering Society has always gladly borne its share of responsibility in any of the larger co-operative movements for the welfare of the engineer and his profession. The doubts which have arisen from time to time as to the advisability of our retaining membership in the Council have been based on the fact that the annual dues to the same constitute one of the largest items of expense in our annual budget. As it appears to many of our members the Society gets very little in return. Mr. Wallace's address, printed in this issue, explains very clearly both phases of the question, what the Society may get out of its membership in the Council, and, what is really the more important of the two, what the Society may contribute to the general cause.

When a vote was taken at the close of Mr. Wallace's address, it was unanimously in favor of retaining our membership in the Council.

Louisiana State Board of Engineering Examiners. The Editor recently received a copy of the official report of this very active and efficient organization. As presently constituted its officers are Professor B. W. Pegues, President; Mr. W. B. Robert, Vice-President; Professor Donald Derickson, Secretary; Mr. C. C. Sandoz, Assistant Secretary. These officers with Mr. Frank H. Waddill and Col. Mareel Garsaud constitute the membership.

The report contains a very important ruling by Attorney-General A. V. Coco on the interpretation of the state law as it affects the employment of engineers by Towns, Police Juries and other legally constituted boards. His opinion is to the effect that no such board may legally employ an engineer or surveyor who is not duly registered under the laws.

There is also a statement of the arrangements for reciprocal registration with other states, an important step which has recently been taken by the Board.

This is followed by the official list of licensed Civil Engineers and Surveyors entitled to practice in the State of Louisiana. Incidentally this list of names furnishes fine material for a campaign for new members to the Louisiana Engineering Society. There are many of them who are not, but who should be, members of this Society. The Editor has already had this list carefully checked up and furnished the Secretary with the names of all those who are residents of New Orleans, but are not members of the Society. Out of a list of nearly 400 licensed engineers and surveyors there are 155 who are residents of New Orleans, over half of whom are not members of the Louisiana Engineering Society. And in this connection it is to be remembered that this list includes only *civil* engineers.

The report further contains a copy of Act No. 242 of the General Assembly, which is an amendment and re-enactment of the original act for the regulation of the practice of Civil Engineering and Surveying.

An Important Note. The report above referred to is prefaced by a brief statement from Professor Pegues which is worthy of the consideration of all engineers interested in the proper regulation of the practice of their profession. It is short and to the point and is quoted here with in full:

PRESIDENT'S NOTE.

Since January, 1916, the Louisiana State Board of Engineering Examiners have maintained offices at 815-17 Audubon Building, New Orleans, where the records, information, etc., belonging to the Board are kept and all business transacted. These records are open to inspection during business hours and the Board will be pleased, upon request, to furnish such information as it may have in its files at any time.

The Louisiana State Board of Engineering Examiners is an examining board, but it stands ready to co-operate with the proper authorities in enforcing observance of the existing law regulating the practice of Civil Engineering and Surveying in Louisiana.

In this respect, the Board requests the active co-operation of all, especially Civil Engineers, Surveyors, and State, Parochial and Municipal authorities.

The duty of prosecuting infractions of the law devolves upon the District Attorneys of the various parishes, but unless they or this Board are furnished with concrete information, no action can be taken.

The cause of most frequent complaint to this Board is that various governmental authorities employ Engineers who have not qualified before this Board. The question has been raised as to whether said authorities can legally pay money to a man for doing that which the law makes a misdemeanor. This question has been answered negatively by the Attorney General in an opinion printed in full on the following page.

City and town authorities, and their legal advisers, are frequently taken in by slick-tongued quasi-professionals, who promise much and deliver little in the way of professional service, and are led into either plain violation of the law or devious ways of dodging it—and that in the face of the Attorney General's plain logic.

There is no real reason or excuse for this, because any competent engineer can register by one of three ways—by examination, by diploma or by reciprocity. Should a specialist be required he can be called in consultation with the City Engineer and is then exempt from registration.

Some cure must be found for this ill. Every registered engineer who has witnessed violations of this kind should make a careful study of all data concerning the contract with the city or town, the design, the construction and costs and report to this Board in full. With a sufficient knowledge of this kind a way may be found to put a stop to it. It can not be done by merely cultivating a grouch.

B. W. PEGUES,
President.

New Orleans, La., April, 1924.

American Institute to Hold Big Exposition of Inventions. Contracting and other engineers will be interested in the Exposition of Inventions to be held, December 8th to 13th inclusive, 1924, in the famous Engineering Societies Building, New York City. The American Institute of the City of New York is handling this display through its Inventors' Section, with behind it an experience of ninety-six years in fostering and portraying American industrial life.

A feature of the Exposition will be exhibits from the leading American industries showing developments of various machines, utilities and processing methods. In all fields the ingenuity of the inventor and the part he has played in the progress of America will be emphasized.

In this display of American inventions the American Institute will be continuing with a new emphasis almost a century's encouragement of inventors and introduction of their works to the public. Among inventions now used throughout the world that were first displayed to the public at earlier All-American fairs of the Institute are the Morse telegraph, the Hoe lightening printing press, the McCormick reaper, the Howe sewing machine, the Bell telephone, the Colt revolver, the Francis metallic life boat, and many others.

The American Institute also established the first permanent exhibit—an idea later adopted in various industries—where “machines, models, specimens and drawings” were displayed to the public. Great annual fairs of the Institute, begun in 1828 and held at such widely known places in their times as Niblo's Garden, Castle Garden, Crystal Palace, Palace Garden, the Academy of Music and Madison Square Garden, in New York City, portrayed year after year the advancements in agriculture, commerce, manufactures, science and the arts until, with the expansion of the country's business in the last quarter century, the idea developed into the more famous world fairs and national and international industrial expositions under various auspices and managements.

Arrangements for the display of working models or actual devices at the Exposition of Inventions can be arranged through a Committee of the American Institute at 47 West 34th

Street, New York City. All proposed displays are subject to approval by the Institute, it being the desire to show only those things of sound worth.

A Correction. It appears that the remarks of Mr. Lanphier in the discussion of Mr. Payne's paper on the Natural Gas Situation in New Orleans were slightly misquoted. What Mr. Lanphier actually said was:

"I am well acquainted with the people of Houston, Port Arthur and Beaumont, and if the people of New Orleans had as much vision as they have, we would have natural gas whether the present burners burn it or not."

OBITUARY.

DUNCAN BUIE.

WHEREAS, On Thursday, June 5th, Nineteen Hundred and Twenty-four, the Honorable Duncan Buie, former State Highway Engineer of Louisiana, former member of the State Highway Commission, and Member of the Louisiana Engineering Society, died suddenly in Baton Rouge, Louisiana.

BE IT RESOLVED, That the Louisiana Engineering Society be placed upon record as deeply deploring his being taken away from our midst while still at the height of his usefulness. We who have been thrown in close personal contact with him realize fully the extent of his loss, both to us personally and to the great work of highway improvement that he had dedicated his life to. He was intimately connected with the State Highway Department of Louisiana for many years of his life, and much of the success of that Department is due to his constant and efficient efforts. His death has removed a valued servant of the State and a gentleman whose friendship was treasured by a host of friends, who miss him and his kindly personality.

BE IT FURTHER RESOLVED, That these resolutions be spread upon the minutes of the Louisiana Engineering Society, and a copy sent to his family as an expression of the esteem in which we held him.

CHAS. M. KERR,
Chairman.

GEO. C. SCHÖENBERGER,
GERVAIS LOMBARD,
Committee.

PAPERS AND DISCUSSIONS

ALTERNATING CURRENT UNDERGROUND DISTRIBUTION IN NEW ORLEANS.

General.

BY W. R. BULLARD,

Assistant Engineer, Electric Bond & Share Company.

Read Before the Society, June 9, 1924.

In connection with an extensive program of system improvement and construction which the New Orleans Public Service Inc., is now carrying out, it was recently found to be desirable to completely rehabilitate the underground distribution system of this company. Before starting upon this program of rehabilitation, however, it was decided that a thorough study of up-to-date practice in underground distribution should be made and that the selection of a system to form the basis for the rehabilitation should depend upon this study. The results of the study indicated that a large economic saving could be made and service to the customers improved by establishing a particular type of A-C system in the underground district of New Orleans, and gradually transferring load to this system, thereby eventually displacing the present D-C system entirely.

The results of the study have been accepted as a basis for the future construction program in the underground district, and it is the purpose of this paper to describe the various features of the distribution system which has been adopted, and to set forth the reasons for which these features were selected.

Brief Description of Present and Proposed Systems.

The underground district of New Orleans is bounded roughly by Howard Avenue, Esplanade Avenue, North and South Peters Streets, Saratoga Street, N. Franklin Street and St. Claude Avenue. The present distribution system of the New Orleans Public Service Inc., which serves this district, consists of a network of direct current three wire 120/240 volt mains supplied in the usual manner by low voltage D-C feeders

radiating from converting substations. The substations contain motor generator sets which convert 6600 volt 3 phase A-C energy to the 120/240 volt D-C supply mentioned above. The 6600 volt supply is obtained from the main generating station of the company located at Market and South Peters Streets, this energy being carried to the substations by 6600 volt underground feeders. Although the generating voltage is now entirely 6600 a portion of the generating station bus will be changed to 13,200 volts in the near future, all new generators being purchased for this voltage.

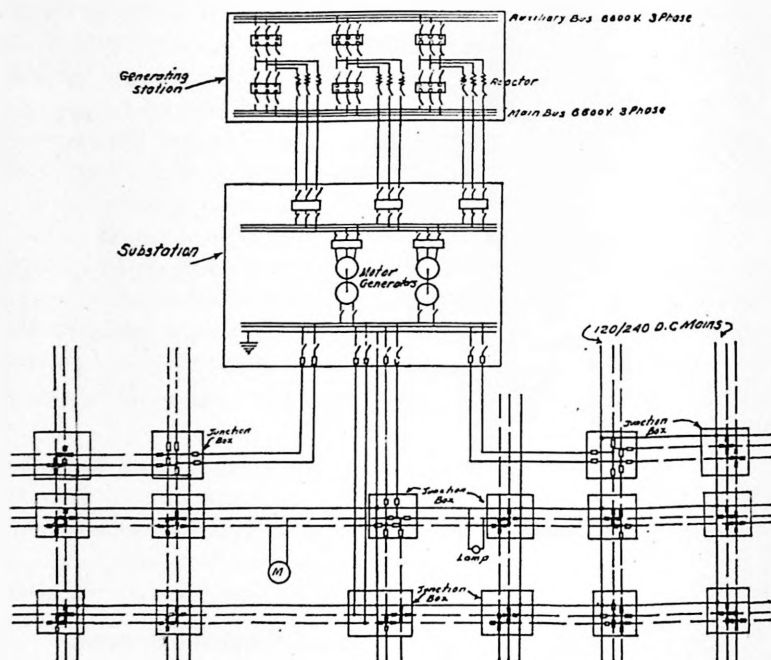


Fig. 1. DIAGRAM OF PRESENT D.C. SYSTEM

Fig. 1 shows diagrammatically the various elements of the present system, and particular attention is called to the large number of various pieces of apparatus through which the energy passes before entering the D-C mains. After leaving the generating station bus, energy passes into a number of 6600 volt feeders which are supplied with circuit breakers at

each end. After leaving these feeders, the energy passes to the substation high tension bus and through more circuit breakers, then to the A-C side of the motor generator sets. From the D-C side of the motor generator sets the energy passes into the D-C feeders through fuses and disconnecting switches. D-C junction boxes are located at the points where the feeders connect to the D-C mains. Fuses are inserted in the terminals of the feeders and in the terminals of the mains going in each direction.

In order to illustrate the differences between the usual type of A-C distribution and the distribution system which has been adopted for New Orleans, Fig. 2 has been included. In the

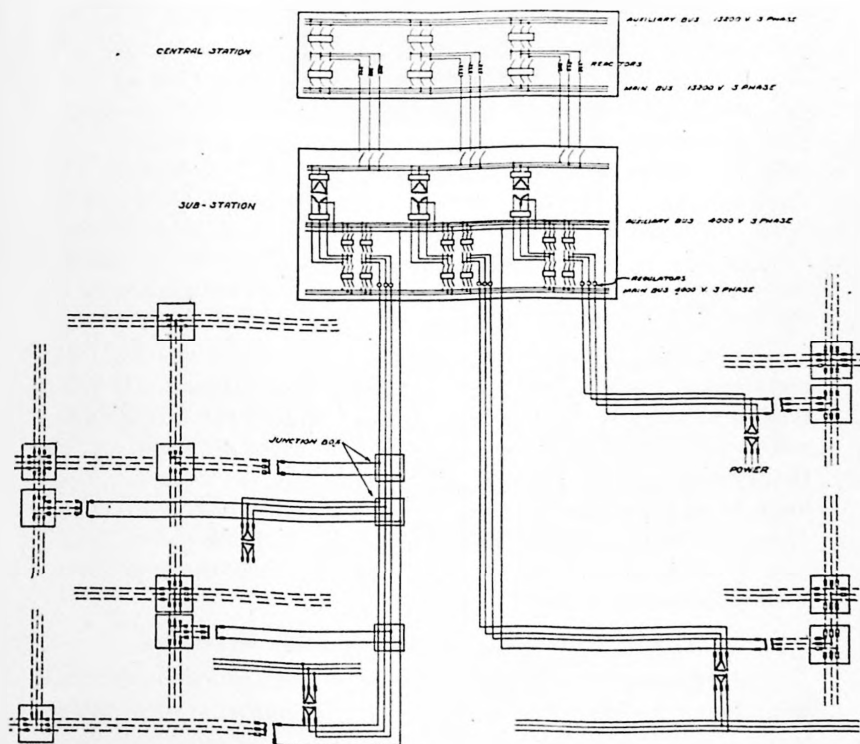


FIG. 2. DIAGRAM OF 400-VOLT A.C. RADIAL SYSTEM.

system shown here we have a A-C substations instead of the D-C substations shown in Fig. 1, and these substations are of course used to transform the energy from the generating station voltage to the distribution voltage which may be, for instance, 4000 volt 3 phase 4 wire. From the station out to the low voltage mains the system shown in Fig. 2 is known as the radial system of distribution. 4000 volt 3 phase feeders extend from the substation to the various centers of distribution in the district served. From these centers, branches of the 4000 volt circuits radiate in different directions in much the same manner that the branches of the tree radiate from the trunk. At the terminals of the various branches and also distributed along the branches are distribution transformers which serve to step down the voltage from 4000 delta or 2300 Y to the utilization voltage of 110/220 in case of lighting service and 220 volts 3 phase in case of power service. Separate low voltage mains are used for power and lighting service. Junction boxes are used at various points in the branches of the 4000 volt cable as well as at various points in the power and lighting mains. Distribution transformer banks are fused on both the primary and secondary sides. It will be noted that this system has just about the same complications as regards the system of protection and number of pieces of apparatus as the D-C system described above.

Fig. 3 shows diagrammatically the A-C system which will be installed in the underground district of New Orleans. In comparing this system with those of Figs. 1 and 2 the first striking difference which will be noted is the extreme simplicity of the system shown in Fig. 3. Substations of whatever kind have been eliminated. One set of low voltage mains is used. Junction boxes of all kinds have been eliminated, and only one step of transformation is interposed between the generating station bus and the low voltage mains.

The A-C Low Voltage Distribution Network.

The present D-C system of the New Orleans Public Service, Inc., does not differ greatly from the distribution systems which serve the underground districts of other large cities. In fact, for many years this type of system has been considered as the

standard system for serving large business districts. The question which will be immediately asked is, "Why has not A-C distribution come into more general use in business centers if large economic savings can be effected thereby?" There

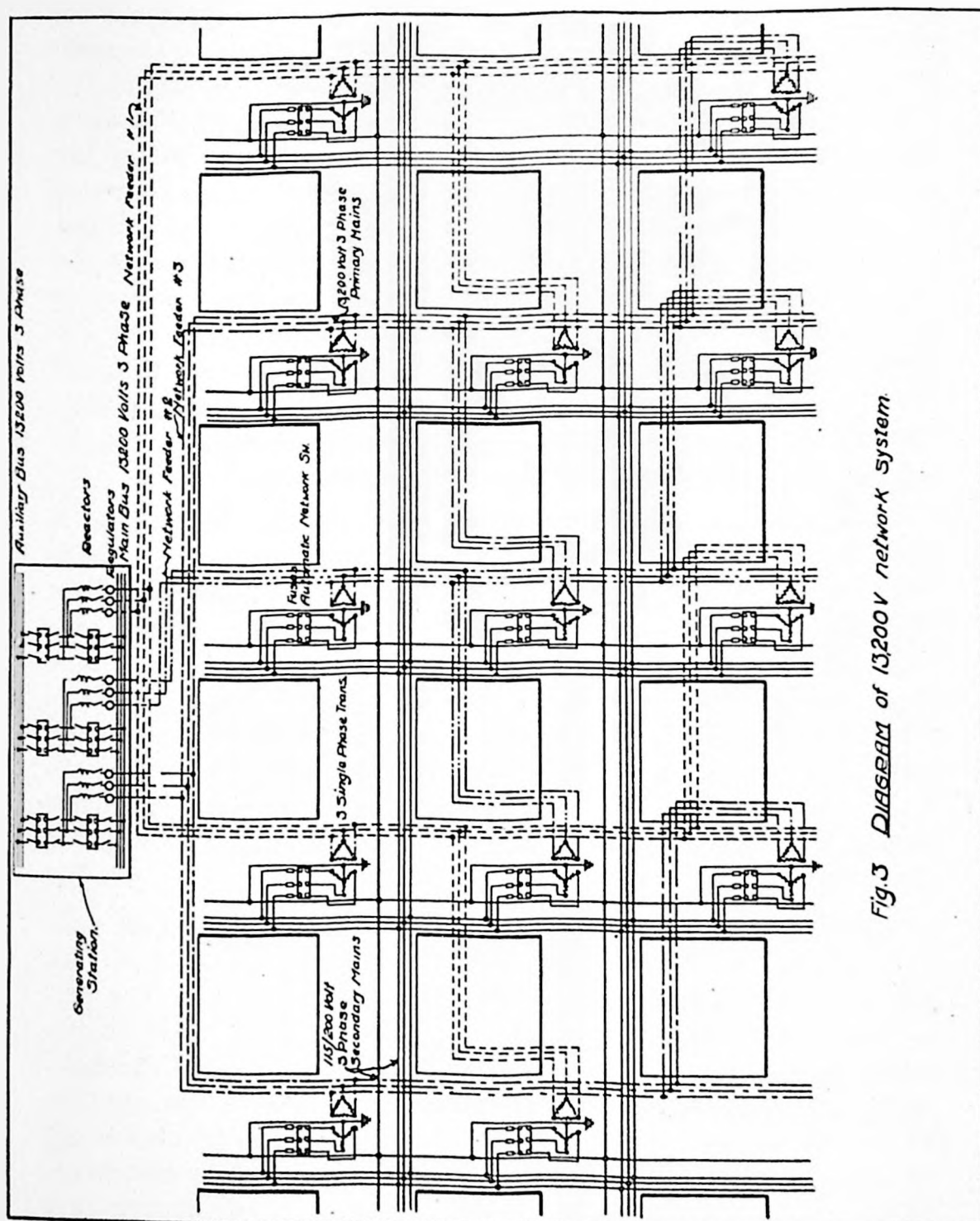


Fig. 3 DIAGRAM of 13200 V network System

are a number of answers to this question. For instance, up to within the past year or two A-C elevators have not been available for the high speed service necessary for business districts. D-C motors used for other purposes have in certain cases proved to be more satisfactory than A-C motors. There are a number of minor considerations of this kind which enter into the problem. However, the chief reason for the consistent use of D-C distribution in metropolitan centers has been the matter of reliability. A D-C network served by a large number of low voltage feeders offers a means of obtaining a high degree of reliability of service, since the loss of any one feeder, or perhaps of even a substation, does not necessarily mean a service interruption, because the network in this case will continue to be served by the remaining substations and the remaining D-C feeders. Coupled with this is the possibility of utilizing on such a system standby storage batteries which can be called upon to supply the load even in case of complete shut-down of the generating station.

During past years it has not been considered feasible to interconnect the low voltage mains of an A-C system so as to form a network similar to the D-C network mentioned above. The reason for this is to be found in the use of the high voltage cable between the substation and the distribution transformers. A short circuit on this cable can usually not be burned off as can a low voltage short circuit, and furthermore the higher voltage means large capacity. A high voltage cable failure will result in short circuit current being fed into it from a large number of points in the network, thereby making selective fuse action very difficult.

Referring again to Fig. 3 the New Orleans A-C system overcomes the above mentioned difficulties and utilizes a low voltage network similar to the ordinary D-C network. The particular piece of apparatus which makes this arrangement possible has just recently been developed and is called the automatic network switch. One of these switches is inserted between the secondary terminals of each transformer bank and the low voltage mains. The main purpose of these switches is to disconnect from the low voltage mains all the transformer

banks served by any particular high voltage feeder when that high voltage feeder becomes short circuited. There are other features made possible by these switches, which will be explained in the following:

Each switch is controlled by simple induction type relays which cause the switch to open upon a flow of energy in the reverse direction—that is, in the direction from the low voltage mains toward the transformer. However, when the switch is open, it is still subject to automatic control in that as soon as the trouble is cleared and voltage is restored to the faulty feeder the switch will automatically reclose. It will not close, however, if the cables have become twisted in repairing the fault or if the voltage of the transformer after its having been made alive, is not of the proper amount to feed energy into the network. The relays which control the switch are furthermore so sensitive to the reversal of the energy flow that they will cause the switch to open when the high voltage feeder has been de-energized, causing the low voltage mains to supply the magnetizing losses of the distribution transformer. This feature enables the station operator to disconnect a number of distribution transformers from the line at light load periods merely by opening the station circuit breaker of one or more high tension feeders. This results in reducing the over-all iron losses of the distribution transformers. When the load increases all that is necessary in order to put the disconnected transformers in service is to close the station circuit breaker and adjust the voltage to the proper amount.

Fig. 4 is a wiring diagram of a single phase network switch. This switch is solenoid operated. A no voltage relay is used to complete the closing coil circuit of the switch in the closing operation. The main contacts are broken in air, these contacts being equipped with arcing tips as is usually the case with air break switches.

The "brains" of the switch, so to speak, are contained in the two master relays. These are of the induction type very similar in operation to the ordinary watt hour meter. Each relay contains a potential coil and a current coil. A part of the main line current passes through the latter when the switch

is closed and this controls the opening operation, depending upon whether the line current is flowing into the network or in the reverse direction. In addition to the current coils, there is a set of so-called "phasing coils" in each relay. These coils control the operation when the switch is open, being connected

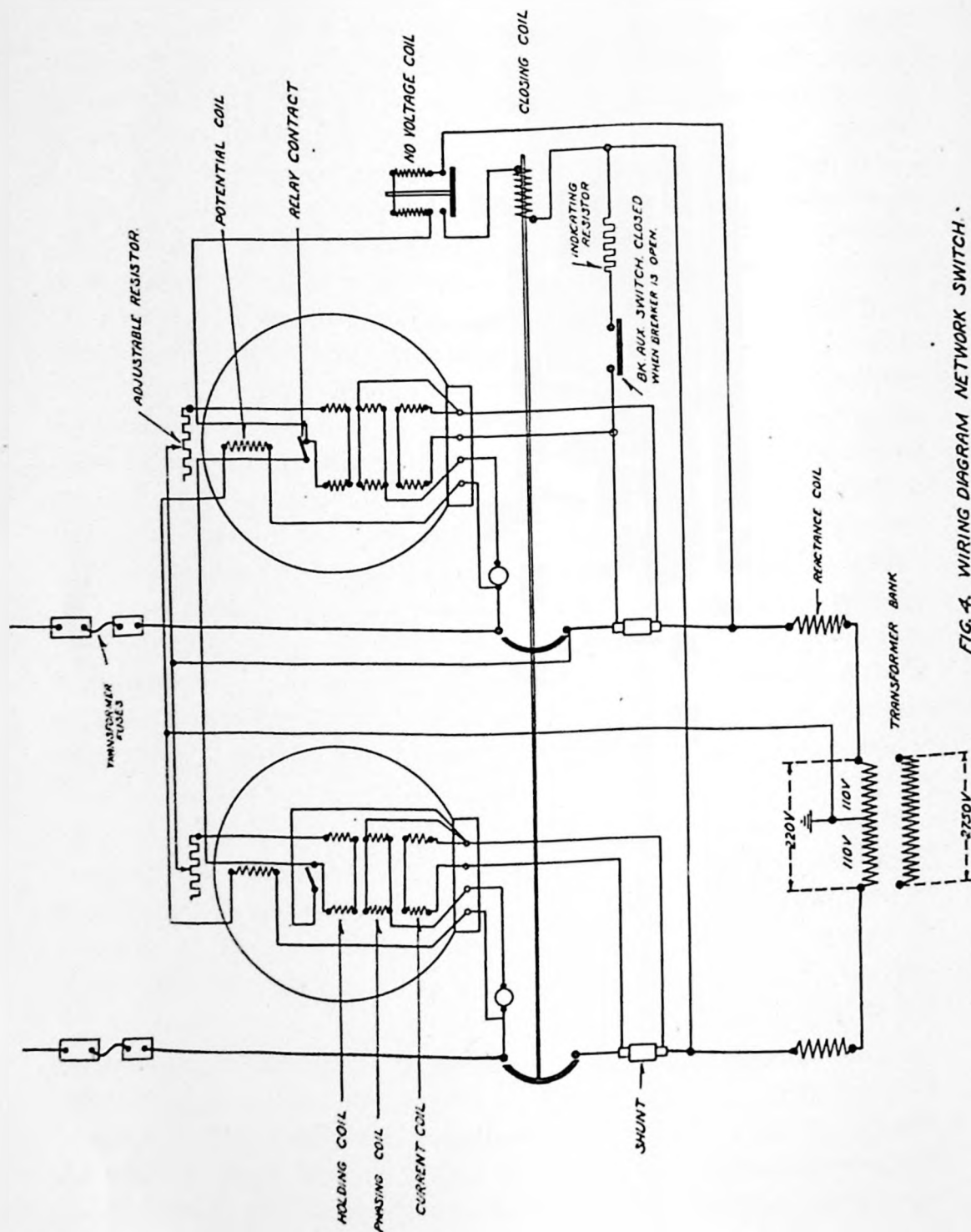


FIG. 4. WIRING DIAGRAM NETWORK SWITCH.

across the open contacts of the switch. The operation in this case depends upon whether the transformer voltage is more or less than the network voltage and also upon whether the phase relations are correct. The function of the so-called holding coils in each relay is to give the relay a slightly additional closing torque after the contacts have closed, thereby giving positive action to the relay and preventing the contacts from again opening until there is actually a small amount of current in the reverse direction in the current coils. The operation can be described briefly as follows:

Assume the switch closed and the transformer normally feeding energy into the low voltage network. Under these conditions the contacts of the reverse energy or master relays will be closed, making the no voltage relay alive. This relay will in turn complete the circuit of the closing coil of the switch which will hold the switch closed.

Now the occurrence of a short circuit or an open circuit on the primary mains will cause a reversal of energy flow in the main circuit and a corresponding reversal of relay torque, causing the relay contacts to open. This will open circuit the coils of the no voltage relay, causing the contacts of the latter to open. The switch itself will then open.

As soon as the main circuit is opened the phasing circuits of the master relays will be excited with one-half full line voltage. This is due to the fact that the impedance of the distribution transformer on open circuit is much less than that of the phasing circuit, thereby giving approximately zero voltage across the transformer terminals. The action of the phasing coils under these conditions is to produce a torque in the master relay, tending to keep contacts open.

As soon as the trouble has been cleared and normal voltage has been restored to the primary mains, the phasing circuits will be excited with a slight amount of voltage in the opposite direction tending to close the relay contact, thereby energizing the no voltage relay. The contacts of this relay will complete the closing coil circuit of the switch causing the switch to close. This latter cycle of operations, however, will not take place unless the voltage of the primary mains is of the proper phase

relation and slightly above normal in magnitude. If the phases are crossed or if the voltage of the primary mains is of an amount equal to or less than the corresponding voltage in the secondary network, the contacts of the master relay will remain open and the switch will therefore also remain open.

Sensitivity of the relays for the opening operation is secured by the use of reactive shunts to supply current to the current coils. These are nothing more than bundles of iron laminations stacked up on copper bars. The reactance of these shunts decreases as the line current increases due to saturation of the iron, and the current through the relay is, therefore, much greater in proportion at low values of line current than it is at high values. The same effect is secured in the phasing circuits by the use of a tungsten lamp in series with each of these circuits. The resistance of the tungsten lamp is from ten to twelve times as much hot as it is when the filament is cold, thereby insuring larger proportionate values of current through the circuit at low voltages than at high voltages.

For simplicity in the above description it has been assumed that the closing coil remains energized while the switch is in the closed position. Actually there is a mechanism coupled with the motion of the main contacts of the switch which opens the closing coil circuit after the switch is closed. The main contacts are then held closed by a mechanical latch, which is tripped by the dropping of the no voltage relay core in the opening operation of the switch.

The above description applies to a network switch designed for single phase operation and equipped with only two relays. The switch which will be used in New Orleans will be entirely similar except that there will be three relays instead of two, one relay being used for each live conductor of the 3 phase 4 wire circuit.

Each network switch will be equipped with low voltage fuses of a capacity some three or four times the full load current rating of the distribution transformers. In case of the failure of any switch to operate when a high voltage short circuit occurs, these fuses will blow and disconnect the faulty

unit from the network. These fuses will be the only ones used in the whole system.

Experience has shown that in large interconnected low voltage networks, either D-C or A-C, a short circuit will clear itself in nearly every case by burning off the conductors at the point of contact. However, in case a short circuit should occur which will not burn itself clear, the fuses in the network

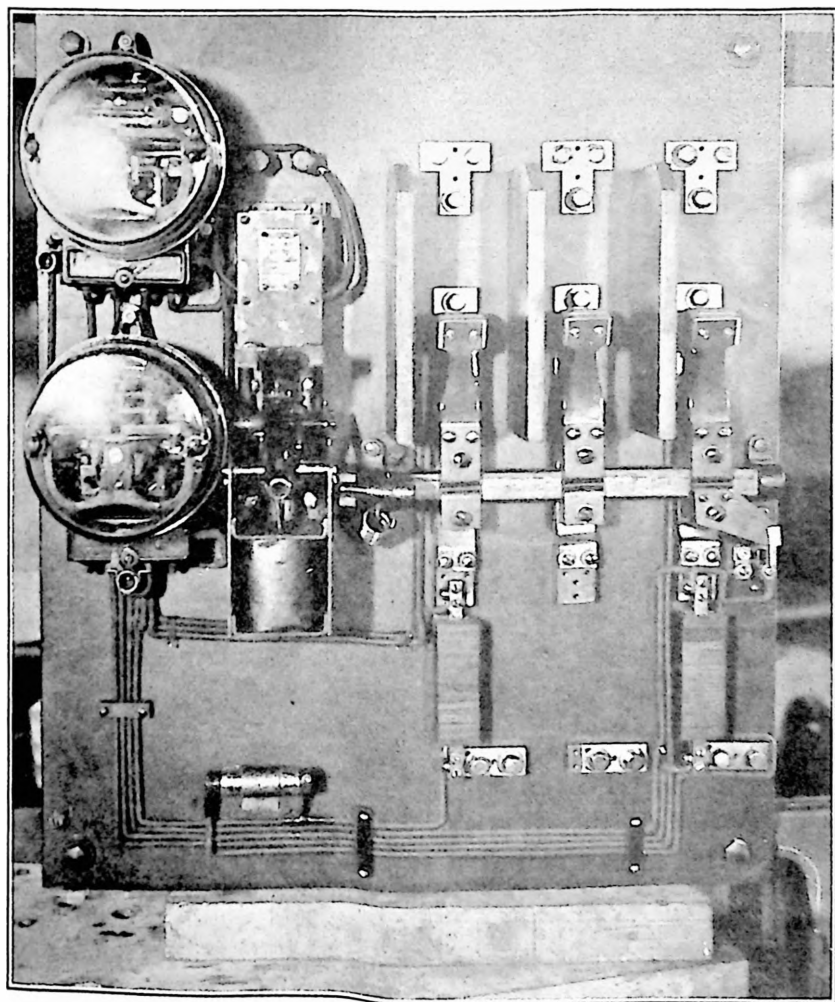


FIG. 5—Photograph of Automatic Network Switch

switches nearest the fault will blow, while those in the other switches will remain intact, thereby maintaining service on the greater portion of the network until the fault can be cleared by cutting the cables. This feature is entirely similar to the present practice in certain large D-C systems.

Fig. 5 is a photograph of one of the network switches in an early stage of development. The two master relays will be seen on the left of the panel, and the operating mechanism of the switch in the center and the main switch contacts to the right. For use in New Orleans these switches will be equipped with watertight metal covers or cases.

The development of a low voltage multiple feed A-C network has involved a number of problems besides that of the arrangement of protective apparatus described above. Not the

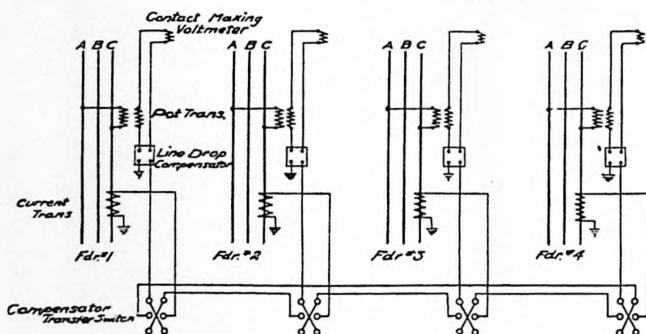


Fig. 6.

METHOD OF CROSS COMPENSATION
FOR
INTERCONNECTED NETWORK FEEDERS

least important of these is the matter of operating automatic induction regulators, having line drop compensation, in parallel on the network system. The operation of regulators under these conditions can be made stable only if some method of cross compensation similar to cross compounding of D-C generators be used. Otherwise under certain conditions one regulator may have a tendency to raise its voltage up to the maximum possible point and another at the same time lower its voltage to the lowest point, thereby causing a large amount of circulating current.

Fig. 6 shows the method of cross compensation which will probably be used in New Orleans. This method consists simply of taking the line current from one high tension feeder and using it to compensate the control voltage of the adjacent feeder. Small automatic switches have to be provided for rearranging the current circuits when one of the main feeders is cut out of service and these switches will be seen at the lower part of the figure.

Still another feature of the low voltage network arrangement in the New Orleans system will be the use of a large amount of internal reactance in individual distribution transformers. In Fig. 4 reactance coils were shown external to the transformer but this arrangement refers to an earlier installation in New York where a large number of standard transformers were available and had to be used. The effect of the high transformer reactance is to distribute the network load very nearly equally between the various distributions transformers regardless of where the load may actually be located on the low voltage mains. Fig. 7 will illustrate this effect. Two cases are shown, one where distribution transformers have normal reactance and the other where they have 10% reactance, the load being the same and being located at the same point in each case. It will be noted that the transformer which is located some distance from the load takes a much larger proportion of this load when the high reactance is used. Saying this a little differently, if the impedance of the transformers is high in comparison with the impedance of the low voltage mains, the low voltage mains will have little effect in determining the distribution load between the transformers, whereas if the impedance of the low voltage mains is large in comparison with that of the transformers the reverse will be true. This is an important feature of the network system since one of the savings that can be secured by the use of the network is a reduction in transformer capacity due to taking advantage of the diversity factor. Since the load is continually shifting from one point to another in the network it is necessary to provide sufficient transformer capacity in each bank to take care of the maximum load that may be concentrated at any particular point. But when the load

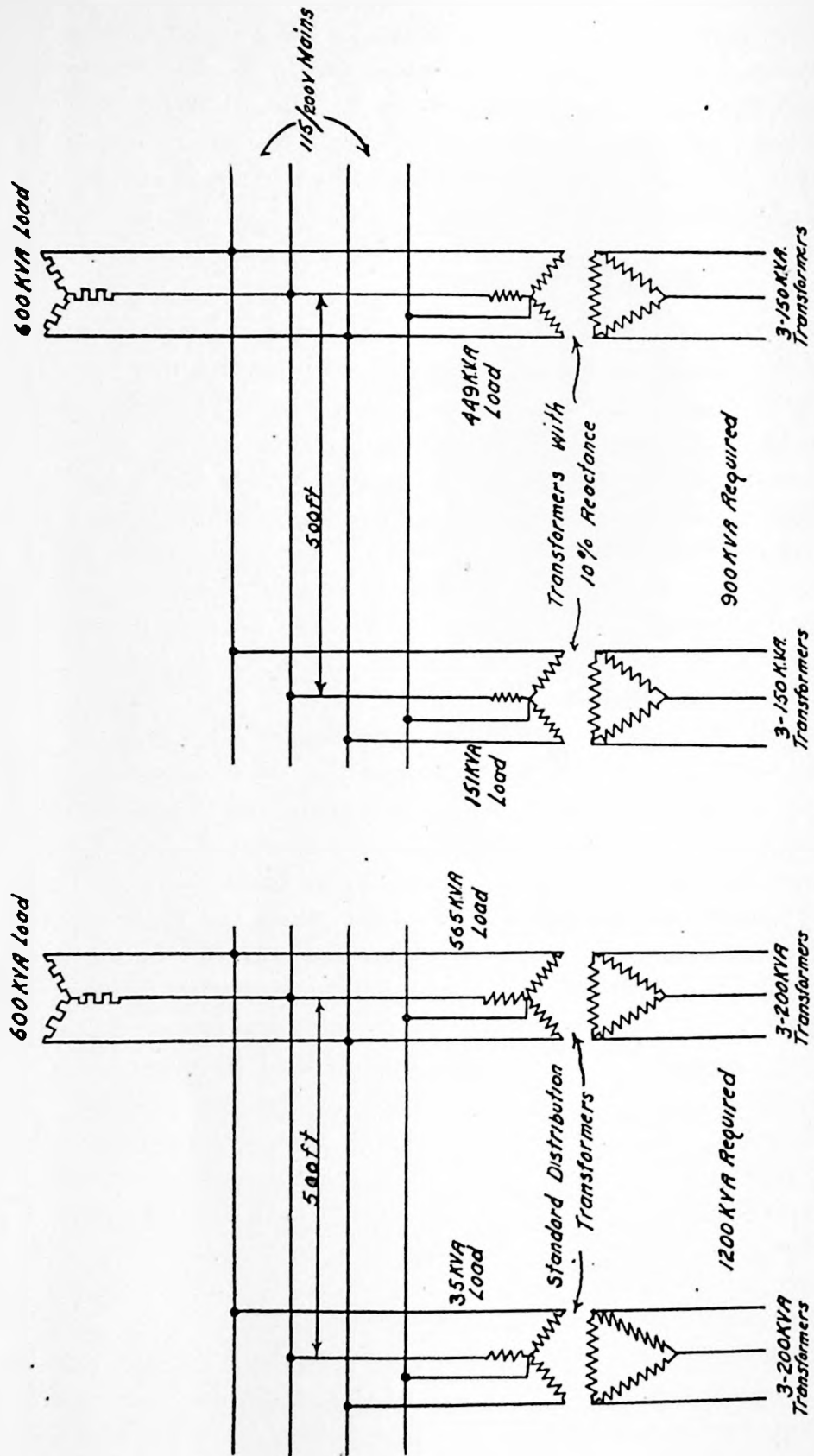


FIG. 7. DIAGRAM SHOWING EFFECT OF INCREASED REACTANCE

is well distributed between the various banks, regardless of its location in the network, the capacity of each bank can be considerably reduced.

The above features of the A-C network system have all been tried out in actual service in a distribution system which serves an important district in Manhattan, New York City. This latter installation was placed in service in April, 1922.

13,200 Volt Primary.

One of the chief features of the New Orleans system is the elimination of all distribution substations. This is made possible by the use of 13,200 volt distribution transformers, these being served directly from the generating station over underground cable. The use of this system is really made possible by the adoption of the low voltage multiple feed network, the reasons being as follows: First,—if it were not for the use of the network (that is, if a straight radial system were used) the higher voltage would involve such large blocks of power feeding from each individual feeder that a short circuit on one of these feeders would mean an interruption of service to an exceedingly large number of customers, thus tending to make this system impracticable. There of course will be no interruption under such circumstances in the case of the network system. Second, at the present time there is no fusing and sectionalizing apparatus available on the market for use in such high voltage underground distribution systems. The use of the network system eliminates the necessity of using fuses and sectionalizing equipment, since it makes possible the de-energizing of any particular feeder; when work is to be done, without interrupting service. Furthermore in this case it is not necessary to clear the transformer from a feeder in case of short circuit. The whole feeder may be disconnected from the bus in such cases without inconvenience to the customer. Simplicity is the keynote of the New Orleans system, and by referring to Figs. 2 and 3 it can easily be seen what the use of 13 kv. primary means in accomplishing the desired result.

3-Phase, 4-Wire, 115/200 Volt Distribution.

Not the least important feature of the New Orleans system is the elimination of one of the two sets of low voltage mains

and corresponding distribution transformers which are ordinarily used for serving power and lighting loads separately. In the New Orleans system both power and lighting loads will be served from the same set of low voltage mains and from the same set of distribution transformers. Fig. 8 is a diagrammatical sketch of this arrangement. Distribution transformers are connected delta on the primary side and Y on the secondary side, the voltage of transformation being 13,200 to 115.

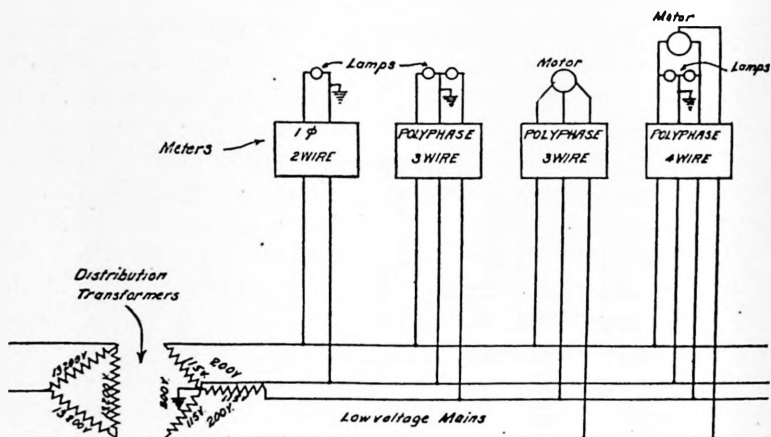
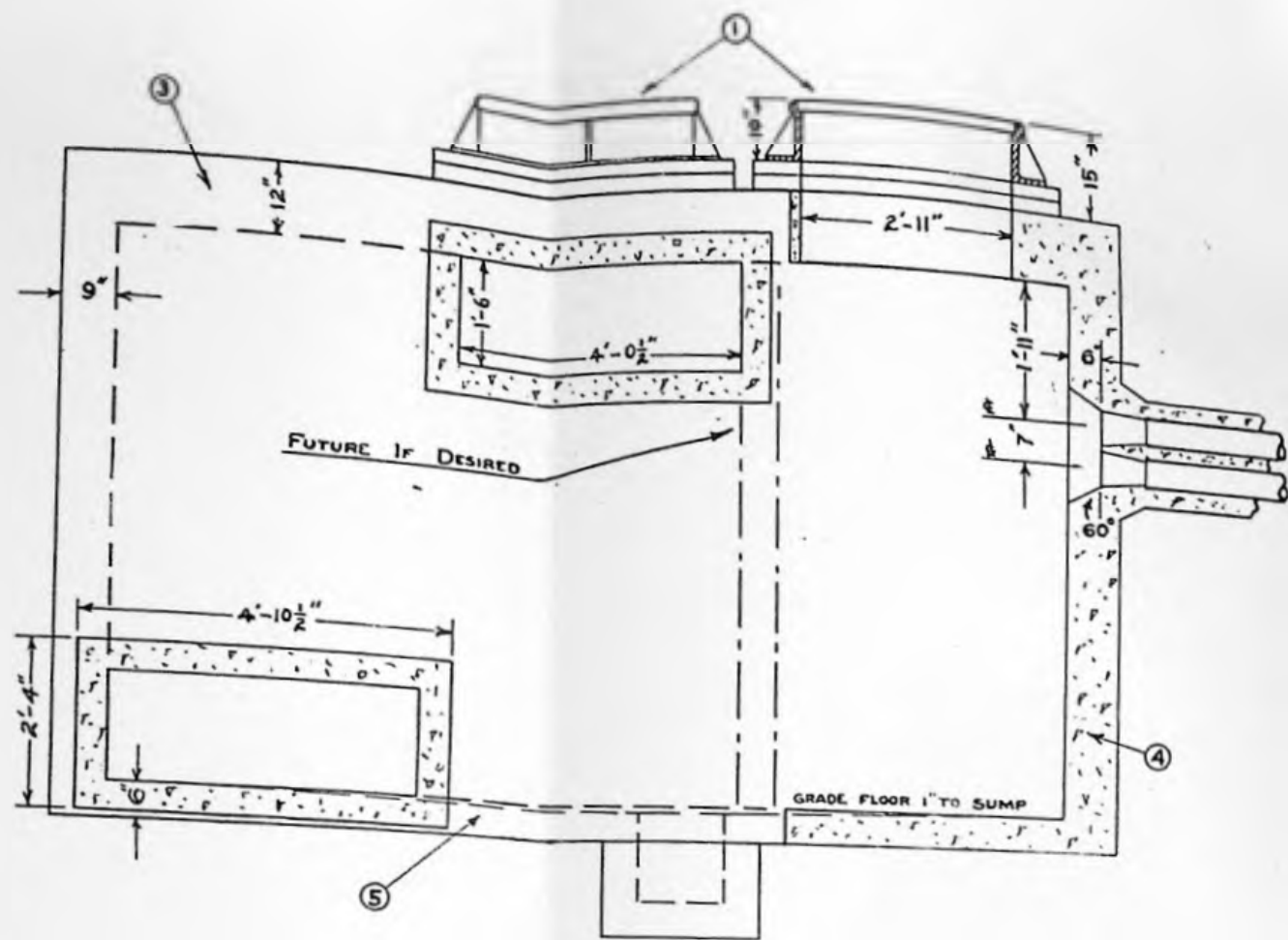


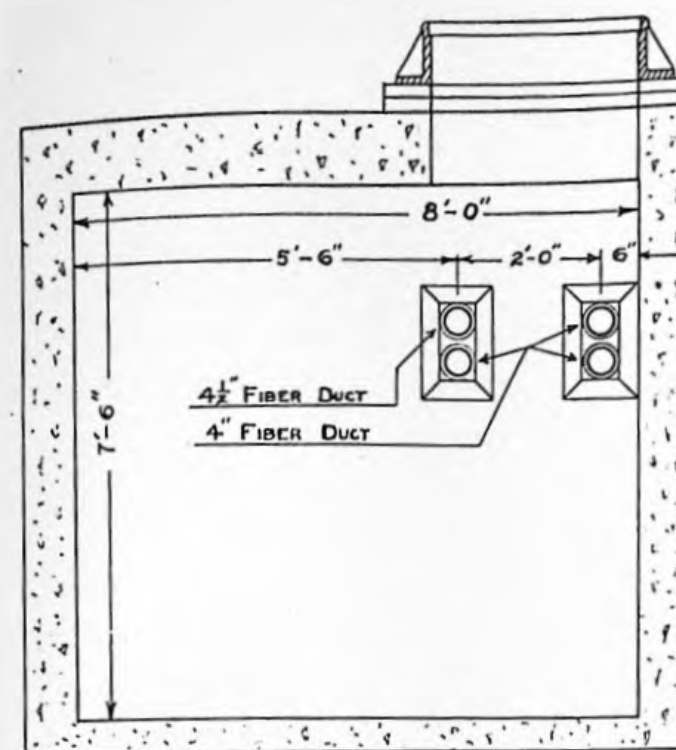
Fig. 8 3 PHASE 4 WIRE SERVICE

Simple 2 wire lighting services will be fed from any one of the live conductors and neutral; 3 wire lighting service will be fed from two live conductors and neutral; 3 wire power service will be fed from the three live conductors. In the first case the meter is a simple 2 wire 115 volt unit. In the second case a simple polyphase meter with 115 volts on each element is used, and in the third case a polyphase meter with 200 volts on each element is used. In case power and lighting are to be taken from the same meter, a 3 phase 4 wire meter as shown in the sketch will be used.

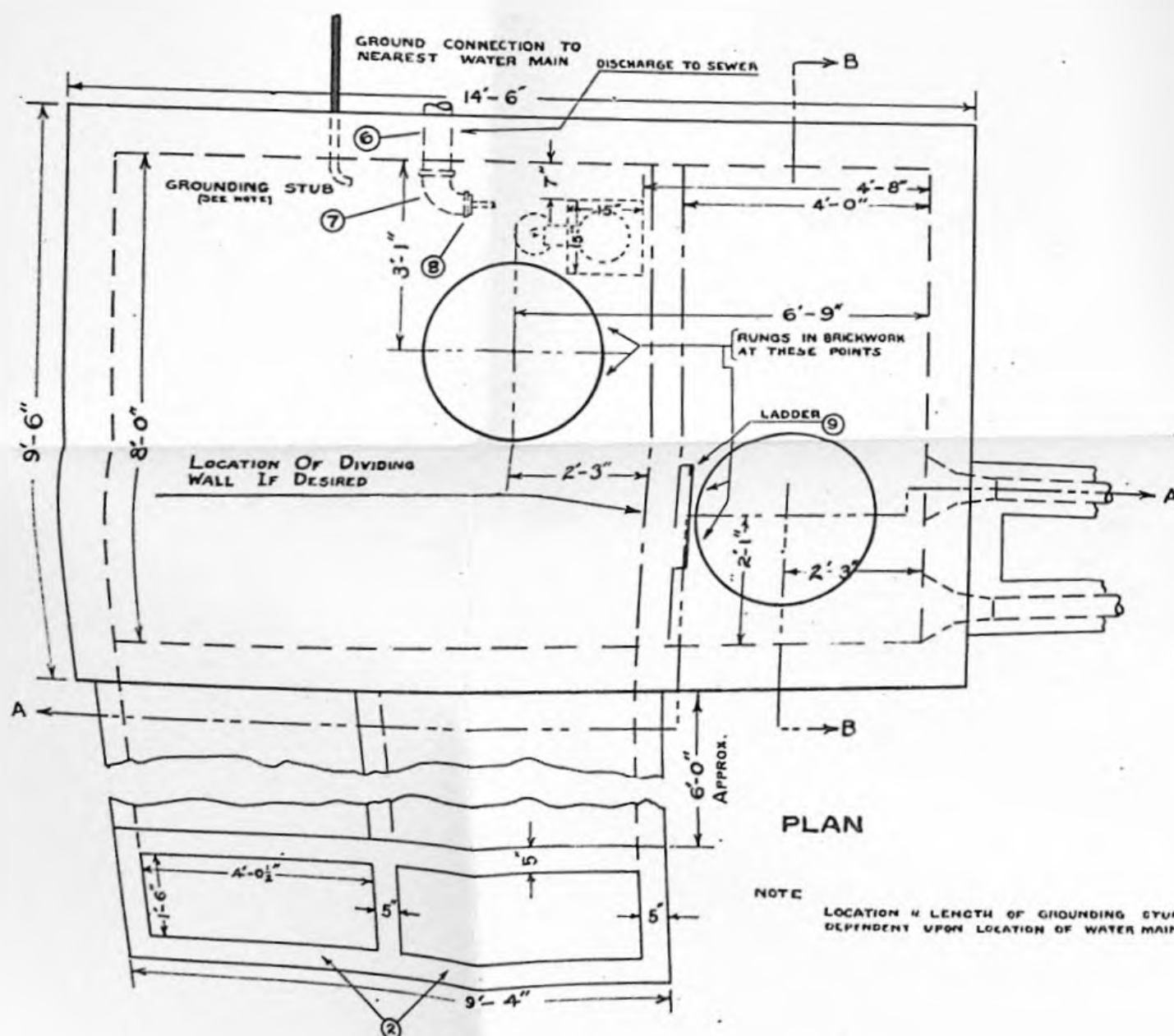
The first question that is usually asked in connection with this system is, "How can the customers get motors to operate on the 3 phase 200 volt system?" The answer is simple. In the majority of cases standard 220 volt motors will operate on the lower voltage without difficulty. The effect of the low



SECTION A-A

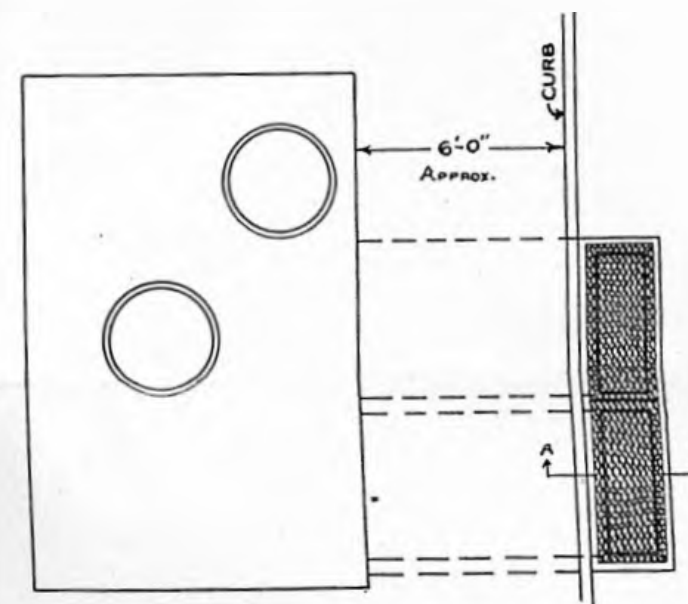


SECTION B-B

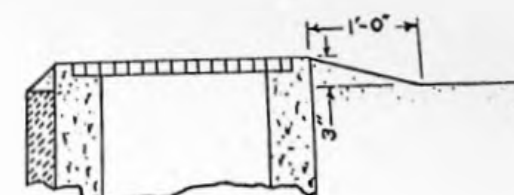


PLAN

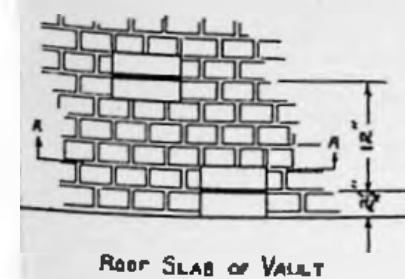
NOTE
LOCATION & LENGTH OF GROUNDING STUB
DEPENDENT UPON LOCATION OF WATER MAIN



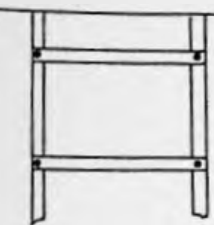
PLAN
SHOWING LOCATION OF VAULT
WITH RESPECT TO CURB
SCALE - 1/2" = 1'-0"



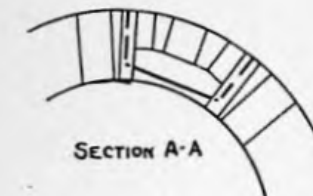
SECTION A-A
SHOWING 3" RAMP
SCALE - 1/2" = 1'-0"



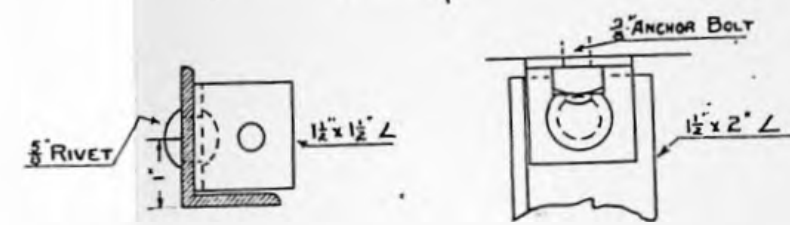
ROOF SLAB OF VAULT



LADDER ARRANGEMENT
SCALE - 1/2" = 1'-0"



SECTION A-A



METHOD OF FASTENING
LADDER TO ROOF AND FLOOR
SCALE - HALF SIZE

BILL OF MATERIAL			
ITEM	QUANT	DESCRIPTION	REMARKS
1	2	35" MANHOLE CASTING	SEE DWG. D-15473
2	5 CU. YD.	CONCRETE FOR VENTILATOR JAMTS	1:2:4 MIXTURE
3	5 CU. YD.	CONCRETE FOR ROOF	1:2:4 MIXTURE
4	9 CU. YD.	CONCRETE " WALLS	1:2:4 MIXTURE
5	3 CU. YD.	CONCRETE " FLOOR	1:2:4 MIXTURE
6	1	4" CAST IRON PIPE	15" LENGTH
7	1	4"x3" REDUCING ELBOW	CAST IRON
8	1	3"x1" REDUCING BUSHING	GALVANIZED
9	1	STEEL LADDER	SEE DWG. L A 8065

NOTE -
QUANTITY OF ITEM 2 DEPENDENT
UPON LOCATION OF VAULT

Fig. 9.

NEW ORLEANS UNDERGROUND SYSTEM
CONSTRUCTION DETAILS OF
PROPOSED TRANSFORMER MANHOLES
NEW ORLEANS PUBLIC SERVICE
APRIL 11, 1924.
SCALE - 1/2" = 1'-0"

L D-8013

NO.	DATE	REVISION	BY	CH	APP
3	6-9-24	ADDITIONAL MANHOLE OPENING	MM	MM	
2	6-3-24	LADDER ADDED	MM	MM	
1	5-27-24	MISCELLANEOUS CHANGES	MM	MM	

DRAWN	MM	6-4-24
TRACED	MM	6-10-24
CHECKED		
APPROVED		

voltage is to somewhat reduce the rating of the motor and in the majority of cases will have no deleterious effect since it has been found in practice that the majority of A-C motors in service at present are underloaded. In fact, generally speaking, unless the motor is heavily loaded, the low voltage will actually have a beneficial effect by increasing the power factor and in some cases even increasing the efficiency. However, where it is desired to load the motor right up to its nominal rating, motors designed for 200 volt operation can be obtained without great difficulty since the change only involves the winding of the motor and not the frame, punchings, etc.

Aside from the above, it is to be expected that a few cases may be encountered where an existing motor designed for 220 volt operation will not operate satisfactorily on the new system. Such cases can be taken care of by simply installing a small auto transformer at the customer's service to step up the voltage to the proper amount.

Another fear that is sometimes expressed with regard to combining power and lighting load on the same low voltage mains is that flickering of lights may be caused by the starting current of motors. No difficulty is expected from this source in the New Orleans system due to the liberal amount of copper planned for use in the low voltage mains, and due to the fact that interconnecting the various distribution transformers will tend to stiffen up the system and hold the voltage of the mains constant.

The above comments with regard to 3 phase 4 wire low voltage service are all borne out by actual operating experience with a large existing distribution system exactly similar to the above, except for the automatic features of the network. The system which is referred to here has been in service some eleven years.

Transformer Manholes.

Wherever possible, transformer vaults, which are to contain the 13,200 volt distribution transformers and the network switches, will be located in the basements of large buildings. Unfortunately, however, there are comparatively few buildings in New Orleans which have basements and it will therefore

be necessary to house the greater majority of transformer installation in manholes underneath the street. Fig. 9 shows plan and profile of the type of transformer manhole which will be used. Provisions will be made in the arrangement of the apparatus to eventually divide the manhole into two compartments if this is found to be desirable. One compartment will then contain the transformers and the other will contain the network switch. The purpose of the partition in this case will be to protect the network switch and outgoing cables from damage in case of transformer fire, so that in case of transformer trouble the conditions will not be such as to prevent the protective switch from functioning or such that the trouble will not be communicated to the outgoing network cables. Two openings in the roof will be necessary, if this partition is ever installed and provision will be made for this in construction at the start.

Each of these transformer manholes will eventually be required to house three 100 kva. transformers. In a northern climate it would hardly be necessary to provide any great amount of ventilation for a transformer manhole of this size, but in this climate it has been considered advisable to play safe and provide ample ventilation. In the proposed method of ventilation, as shown in Fig. 9, two rectangular ventilating ducts, one entering the manhole near the top and the other near the bottom, will be carried from the transformer manhole over to the sidewalk, and gratings placed in the sidewalk over the openings.

The depth of the manholes will be such that in a number of cases it will be impracticable to use natural drainage into the sewer. In such cases a small sump pump controlled by a float switch will probably be used. This pump is shown in the drawings.

Fig. 10 is an exploded view of the completed manhole showing the arrangement of apparatus and the racking of cables on the walls. Nothing could illustrate the simplicity of the system better than this drawing. The primary cables (shown in light lines) enter the manhole from one end and rack around one side of the manhole entering the transformers at the other

END ELEVATION

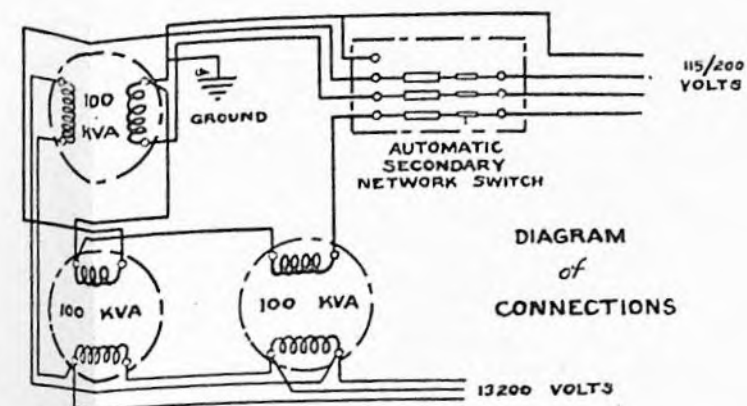
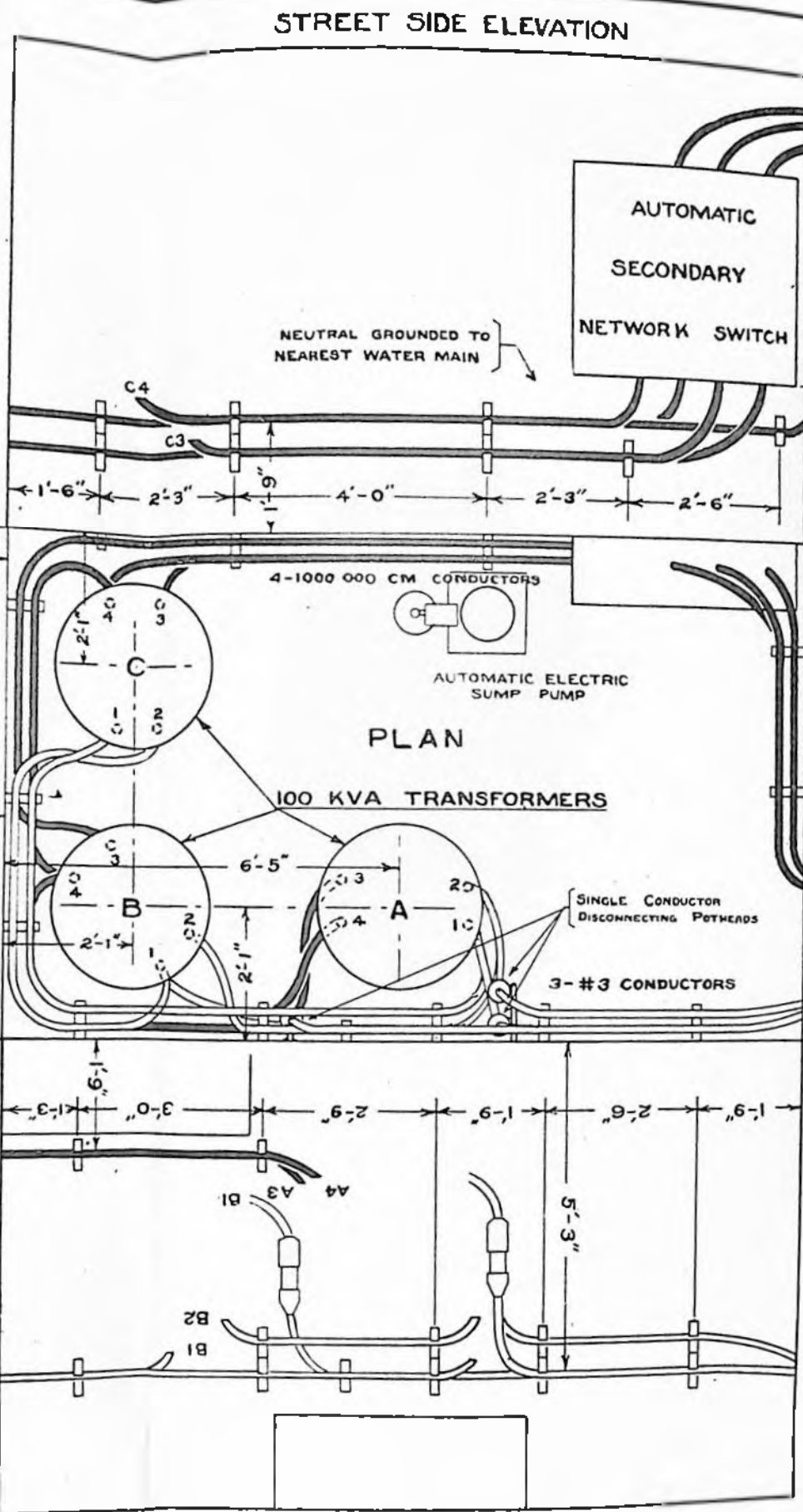
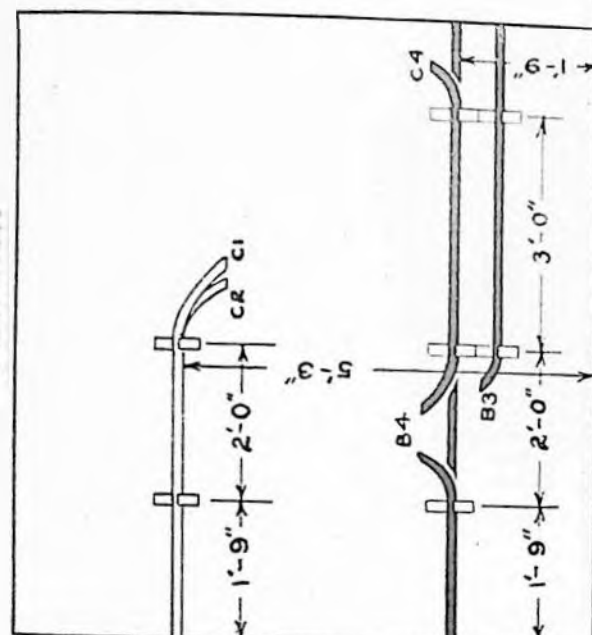
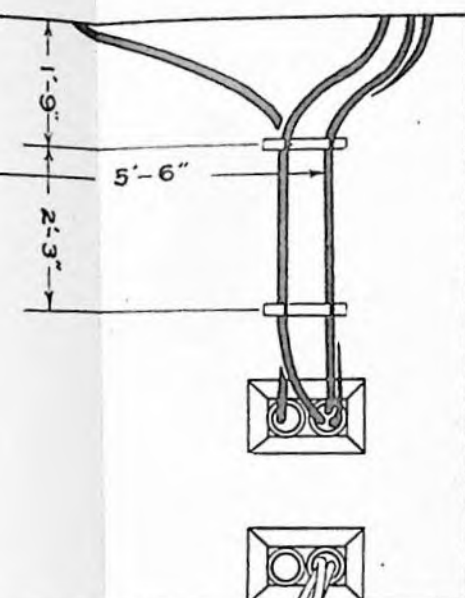


DIAGRAM
of
CONNECTIONS



END ELEVATION

PRIMARY CABLES
SECONDARY CABLES

NOTE:-
POTHEADS NOT TO BE INSTALLED IN MANHOLES
AFTER THREE FEEDERS ARE IN OPERATION.

FIG. 10.

NEW ORLEANS UNDERGROUND SYSTEM
PROPOSED RACKING OF CABLE IN
TRANSFORMER MANHOLES
NEW ORLEANS PUBLIC SERVICE
APRIL 11, 1924. SCALE $\frac{1}{2}$ " = 1'-0"

L C-8009

DRAWN	M.M.	4-9-24
TRACED	M.M.	4-11-24
CORRECT		
APPROVED		

1	5-28-24	MISCELLANEOUS CHANGES	M.M.	M.M.
NO	DATE	REVISION	BY	CH APP

end. Secondary cables leaving the transformers rack around the opposite side of the manhole then pass through the network switch and finally leave the manhole by the same end through which the primary cables enter.

Advantages of the New System.

As previously mentioned, one of the chief advantages of the system is the matter of reliability. This feature is due to the simplicity of the system and to the special provisions which have been made for clearing high voltage short circuits. It is expected that the reliability of this system will be greater than that of the present D-C network. This is of course an advantage which applies to the customer more than to the central station company. However, the latter will also secure a number of advantages from the use of the system, some of which may be easily understood by referring to Fig. 11. This

Fig. 11. TABLE OF COSTS AND EFFICIENCIES.

	Network 13,000V	Radial 13,000V	Network 4,000V	Radial 4,000V	Combined D.C. & A.C.
Total Annual Charges	\$246,010	\$283,220	\$390,810	\$410,890	\$562,486
Total New Investment	\$1,378,700	\$1,666,300	\$1,982,300	\$2,189,600	\$2,394,800
Annual Efficiency	94.7	93.7	90.0	89.3	76.7
Efficiency of System at peak load	94.8	95.6	91.7	92.2	79.7

Note:—

The above is based on a ten year period of growth and includes only the distribution system, namely that portion of the system between the generating station bus, and the customers' service laterals.

is a table showing a comparison of costs and efficiencies of several different types of distribution systems which have been considered for use in the underground district of New Orleans. There are five systems included in this table. The first is that which we have just described—namely, the 13,200 volt interconnected network system. The second is a 13,200 volt system without the network feature. The third is the familiar 4,000 volt 3 phase 4 wire system with the network

feature added. The fourth is the usual radial type of 3 phase 4 wire system, and the fifth is the present D-C system except that in this system the D-C would be retained only in the main business portion of the district, the outlying portions being served by the 4,000 volt radial A-C system. It will be seen from this table that the 13,000 volt network system is the most economical of all, both as regards first cost, annual operating charges, and efficiency. The investment for this system, for instance, will be approximately half of that for the D-C system, and this is in spite of the fact that the D-C system has the advantage of the present existence of a complete network of low voltage mains in the underground district. That is, for the A-C systems, it was assumed that a complete new set of mains would have to be installed whereas this cost was not considered in figuring the cost of the D-C system. Comparing the efficiencies of the 13,000 volt A-C system with those of the D-C system, a large difference will be noted in favor of the A-C service. The figures showing the total annual charges include fixed charges on investment, charges for the losses in the different systems and operating charges such as substation operators salaries, etc. These figures are the best criterion which can be set up as to economy, and here again it will be noted at once that the cost of A-C service is sufficiently below that of the D-C service as to provide a substantial saving. These figures, of course, represent only the distribution cost from the generating station bus to the customers' service laterals and do not include the cost of generation, metering, etc.

In conclusion it may be well to add a few figures as to the sizes and capacities of the various pieces of apparatus and cables which will make up the system. The plans contemplate three 100 kva. transformers in each transformer vault as the maximum. At the beginning, three 50 kva. transformers will be used in some cases, and three 25 kva. units in other cases. The network switches will be designed to correspond with the current output of the transformers. That is, the switches for 25, 50 and 100 kva. transformers will be of 250, 500 and 1000 ampere capacity respectively. The main 13,000 volt feeders from the generating station to the edge of the underground district will consist of 3 conductor cable, the size of the con-

ductors being 4/0 AWG. Regulators at the generating station will be of 150 ampere capacity, three single phase regulators being installed in each feeder. From the edge of the underground district the 13,000 volt feeders will branch out in various directions, the cable used in this case being single conductor 2/0 for the trunk lines, and No. 3 for the short laterals. One conduit will be used to contain all three of the single conductor cables, forming any one branch. The cable connecting the transformers with the low voltage mains will consist of single conductor 1,000,000 cm. cable. The cable for the low voltage mains will be 500,000 cm. single conductor for the uptown section and 4/0 AWG. for the French Quarter. The neutral will be the same size as the live conductors in each case.

Discussion.

THE PRESIDENT: Gentlemen, you have heard the paper, which I am sure is one of the most technical, and one of the most explanatory that we have had here in a long while. Is there anyone who feels that he would like to discuss it or to ask any questions?

PROFESSOR ANDERSON: I would like to ask a question, which was probably brought out in the reading of the paper, but which I did not hear on account of coming in late. Just what portion of the city is this new system to cover? Is it to cover simply that portion which is now D. C., or the whole of the present A. C. system, as well as the D. C. system?

MR. BULLARD: It is to cover only the underground district, from Esplanade to Howard Avenue.

PROFESSOR ANDERSON: The remaining part will be operated as now?

MR. BULLARD: Yes.

PROFESSOR ROBERT: Is it contemplated to start the new system in the city at once?

MR. BULLARD: Yes, the apparatus has been already ordered; it has not been installed yet.

PROFESSOR ROBERT: Why then has the Public Service gone to the expense very recently of installing some brand new D. C. sub-stations.

MR. BULLARE: You see, we have to take care of the customers until we can get this system into operation. I wouldn't be surprised if we would have to install some more D. C. equipment even after the new system gets into operation. Of course, we hope we won't have to go into that very deeply.

A MEMBER: I would like to ask how many transformer man-holes will be located in one block?

MR. BULLARD: Most of my calculations are based on a ten-year period of growth and at the end of that period they will be located one at each corner in the main portion of the district, that is a bank of 00 100-K. V. transformers.

A MEMBER: That would mean that you would feed only half a block in any direction by low voltage mains?

MR. BULLARD: Yes. Of course, there will be fewer transformers at the start than later when the load has had a chance to grow.

MR. BARELLI: When the system is changed from D. C. to A. C. will the consumer be expected to sell his old motors and purchase new ones, or will the Public Service Company take care of that?

MR. BULLARD: That is a matter of policy. My work is practically all technical, but we have had a great many discussions on that subject, and I have no doubt that the company will inconvenience the customers as little as possible. I have no doubt that, in most cases, the motors will be replaced where they are existing. At the present we will probably try to prevent any new motors coming into the district. Of course this is based on a long period of time. The whole system will not be changed over immediately. According to my calculations it may take about thirty years to do it. That is in ten years we figure on taking up only one-third of the existing load. Getting one-third in in ten years, if we can actually go that fast, we might have the whole system changed over in thirty years. At any rate I feel sure that the company will take care of its customers.

MR. BARELLI: The present motors would probably be obsolete by that time.

MR. BULLARD: Yes.

PROFESSOR ANDERSON: You mentioned a point that I want to bring up as a matter of information. Did I understand you to say that this system had been tried out in some portion of New York City?

MR. BULLARD: This system is a combination of the novel features of several different systems that are in actual operation now. The network system is in operation in New York. It doesn't have exactly this voltage and this arrangement. I have spent a good deal of time working out that system. The 115-200 volt system is in operation in Memphis, Tennessee, and has been about eleven years. There is only one other high voltage system in the country, and that is in San Francisco. When we were going into the proposition, I made a trip all the way around the outer edge of the country, and visited some of these places and looked over the features that we are now preparing to use here.

PROFESSOR ANDERSON: In that same connection, there is another question. Is there any extensive use of high speed elevators where this A. C. system is in operation?

MR. BULLARD: Yes, and they have proven entirely satisfactory. There is one in Toledo. In that case, the elevator motor is connected directly to the supply, in other words, an A. C. motor is used. A number of engineers from all over the country have visited it, because it is one of the first of the kind. It has proven entirely satisfactory, and the speed is equal to that of some of the highest speed elevators in the country. The Westinghouse Company is putting out a different type A. C. elevator, in that case getting the A. C. supply from a motor generator set. This is really very little more expensive than an A. C. elevator. The control is a field control, that is the generator field resistance controls the voltage to the motor and the usual large control resistances are eliminated.

PROFESSOR ANDERSON: What will you do in case a customer needs D. C. only? Will he have to buy a motor generator?

MR. BULLARD: I can't answer that off-hand. That is a matter to be worked out in a number of years. I think I can say that the customer won't suffer any particular inconvenience because of the new system. In fact I think they will be very well pleased with it.

PROFESSOR ROBERT: Is the A. C. motor a three-phase induction motor directly connected to the elevator gear?

MR. BULLARD: Yes.

MR. MANN: Will it take thirty years to complete the system?

MR. BULLARD: The plan is to install complete A. C. mains paralleling the D. C. mains. They will be extended all over the district, probably not this year, or next year, but within two or three years they will be extended all over the district. Then, when new buildings are put up they will be connected to the A. C. system, instead of the D. C.

MR. MANN: The streets, therefore, would have to be torn up for a period of thirty years?

MR. BULLARD: I didn't get your question at first. That That can be answered best in this way. You actually will have to tear up the streets more if you keep the present D. C. system than if you take A. C., because the D. C. system requires a large number of feeders, and this system requires only six feeders in ten years; that is in comparison to perhaps 100 D. C. feeders. As long as you have the D. C. system and allow it to grow you will be tearing up the streets.

PROFESSOR GREGORY: Mr. President, I move a rising vote of thanks to Mr. Bullard for his very instructive paper.

The motion was duly seconded and carried unanimously.

THE WORK OF THE AMERICAN ENGINEERING COUNCIL.

An Address Delivered Before the Society, June 9, 1924.

BY L. W. WALLACE, Executive Secretary,

Mr. President and Fellow Engineers:

I came all the way from Washington to talk to you tonight about American Engineering Council. I came because of my conviction, and that of my associates in American Engineering Council, that the task which Council has undertaken in the name of the engineers of the United States is one of the greatest and most important movements ever started in this country by the engineering profession; a movement that promises a good deal for the prestige and influence of the profession as such, and a movement that promises a great deal for the people of the United States. The engineers of this country formed American Engineering Council in order to have an agency through which they might bring to bear upon national questions of an engineering aspect the experience, knowledge, and point of view of the engineers of the United States. And it has been my observation, gentlemen, for a number of years, and especially the last three, since I have been Executive Secretary of this organization, that there are very few questions of great moment which come before the Executive and Legislative branches of our Federal Government, but what are charged with engineering aspects. Furthermore, it has been my observation that there are very few questions of this modern day which come before the executive and legislative branches of the State government or even before our city government that are of real moment to the people of the State, or of the City, but what are charged with engineering aspects.

This subject which you have before you tonight, so ably presented by Mr. Bullard, is a matter of great importance to the people of New Orleans, and consequently is a matter to which the administrative part of your city must give consideration.

Furthermore, your President tonight has referred to your participation in an effort being made in New Orleans to revise the city's building code, an extremely important civic question from the standpoint of economy, from the standpoint of social development, and from the standpoint of well being of the people of New Orleans.

So, if you will analyze the questions that come before your city government, your State government and your national government, you will find, as I have stated, that there are very few questions of real moment but what are charged with engineering aspects. If that be true, gentlemen, and I am just as convinced of it as I know that I am standing before you, then, what body of men in the United States is in a better position to advise intelligently regarding the solution of these questions than the engineers, the members of this great technical profession?

And furthermore, gentlemen, what body of citizens in the United States is under greater obligations to make their thoughts known concerning these complex and trying questions than are the engineers of the United States?

American Engineering Council was formed in order that the engineering profession might have an agency through which it could contribute to the solution of these national questions of an engineering aspect, the thought and experience and trainings of the engineering profession.

Let me say to you that American Engineering Council has, at all times, refrained from giving any time or thought, or devoting any effort to questions about which we, as engineers, could not speak from our own experience and training. The problem has not been one to find something to do. The problem has been to select wisely from the many things that have come up that which we might do, and to select those upon which we are in a position to act wisely and beneficially to all concerned.

Time will not permit me to give you many examples of the things we have been doing, and are doing, so I wish you to bear clearly in mind that I am going to give you only a perspective. I have not time to give you detailed plans and specifications, but I do hope that the illustrations I shall give you

will be sufficient to show you that American Engineering Council has a real mission to perform, and that, in its short life of three years, it has accomplished something worth while in the name of the engineering profession.

As I have said before, the purpose of the organization is to be an agency through which the engineering profession may render an essential public service. I wish you to understand that American Engineering Council was not formed, and it is not functioning, for the purpose of benefitting you and me as individual engineers; it is not functioning for the purpose of benefitting the engineering profession directly as such; but it is a public service organization, if you please, an agency through which we, as engineers, hope to discharge some of our responsibilities as highly trained and experienced citizens of the United States, and only to the degree that we meet the test of rendering an essential public service, and that directly, will the influence and the prestige of the profession be broadened and enhanced, and then only in an indirect way, will you and I as individuals benefit by the efforts we are making.

Let us turn for a few moments, and look at some of the things American Engineering Council has been doing, and is doing. We come first to the engineering society. The members of the American Engineering Council are engineering societies. Council is constantly rendering service to those organizations by securing speakers for them, by securing information for them from the several technical departments of the Federal Government at Washington, by making appointments for individual engineers that come to Washington for one purpose or another. In other words, we do a great deal of valuable investigation work which means a great deal to local and state societies such as you are. We have secured prominent men to appear at their annual banquets and talk.

In the matter of national legislation. Take for instance the Patent Office, a bureau in which the engineers of this country have a direct interest because a great many of the patents are the inventions of engineers. A number of engineers are interested in agriculture and in industry, and the very backbone of both of these industries in the United States is the

patent system. Something over two years ago, through our Patents Committee we came to the realization that the Patent Office was very much undermanned, that it did not have a sufficient number of competent examiners, and that it wasn't offering them sufficient compensation to hold them. About the time a young college man became a competent assistant examiner, some corporation would come along and take him over. The Committee became very active and, as a result, about two years ago a Patent Office relief bill was passed, which took care of that situation to some degree. Take the situation as it is tonight. The Patent Office is tremendously undermanned. If you pass through the building in which the Patent Office is housed you will find that the aisles, passageways, corridors and cellar are crowded with file cases roughly made out of rough lumber, a perfect fire trap. Furthermore, four patent examiners have a little room, screened off in what was formerly the lobby of that building. Those patent examiners, to do competent work, need to have before them books and desks, and they need working space where they may concentrate to do the work they are doing. Lawyers and engineers come in there to consult with them. How can those poor patent examiners do effective and safe work, working under those conditions? They cannot do it, and I do not wonder, gentlemen, that we are having so much patent legislation in our legal procedure regarding infringements of patents in the United States. If a fire started in that Bureau, nothing could save it. Think of the chaos in working industries and agriculture if the Patent Office records should burn up. So we are very active at present trying to secure appropriations to house the Patents Office adequately and securely.

Classification and Compensation of Government Employees.

You remember in the Congress just previous to the present one there was a bill pending in both Houses known as the Sterling-Lehlbach Bill which provided for reclassification of and more adequate compensation for government employees. American Engineering Council was very active in securing the passage of that bill. In the closing hours of that session of Congress that kind of legislation had been stopped. Be-

tween eleven and twelve o'clock of the day that Congress adjourned last March, a committee of American Engineering Council, knowing that the conferees of the Senate and the House had not met to discuss the bill sought to secure the passage of the bill.

Through the efforts of the Committee of Council, the conferees of the Senate and House met and came to an agreement relating to the provisions of the bill, including one which made it effective July 1, 1924. The bill passed both Houses of Congress and was signed by the President.

There has been some trouble in carrying out the provisions of the Sterling-Lehlbach bill. You will recall a Personnel Classification Board was appointed, and, in some respects, the Board has not adhered to the intent and purpose of that bill. I am sure, before that thing is settled, the government employees, both in the District of Columbia and in the field, will be able to work under much better conditions than have ever existed in the past. This will redound to an improvement in the government service and to our benefit from an engineering standpoint.

The United States is the only one of the great powers of the world whose area is not completely surveyed. Today only about thirty-five per cent of our area is so covered. At the rate at which that work has been, and is now going on, it will take from 80 to 100 years to complete it. It is not necessary for me to take the time to enumerate why we should have those topographic surveys and maps. We need them for drainage, floods and water supply, highway construction, irrigation and all similar problems. American Engineering Council has been actively supporting a bill which provides a plan to complete that work in from 20 to 25 years, instead of from 80 to 100 years. Only last week we succeeded in obtaining a hearing on that bill. Engineers were present from many parts of the United States, and such a large number of advantages were presented by those engineers that that committee did not leave its seat, but favorably reported that bill out. That is another measure we shall have to follow up in the next session of Congress.

Mr. John R. Freeman, in a number of addresses before engineering societies in recent years, has pointed out the great need for a national hydraulic laboratory, to be used in making adequate studies of the flood control problem. Doubtless many of you heard him read his paper at the Spring Meeting of the A. S. C. E. in New Orleans last Spring. Senator Ransdell has been very much interested in such legislation and has worked with us, and we with him, in the drafting and promoting of such a bill. Two hearings have been held. Strong documents in favor of establishing a laboratory have been built up. Only two or three weeks ago Senator Ransdell held a hearing to which American Engineering Council sent representatives. The bill has been reported out favorably.

Please let me digress long enough to say to you engineers in Louisiana that you have a United States Senator in Washington who appreciates what the engineer means to American life. I have found Senator Ransdell very responsive always to any thought that the engineers had to promote regarding engineering questions of a public character. I think you should know that, and I feel you should be gratified to have a Senator of that frame of mind. We do not find Senators of that frame of mind from all parts of the United States, but if that were true the Council would probably not have to work so hard.

Government Reorganization.

For a great many years, the engineers of the United States have pointed out that the organization of the Federal Government is very irregular and chaotic. As early as 1882 the American Society of Civil Engineers passed a resolution favoring the establishment of a department of public works in the Federal Government. In this department would be concentrated all of the engineering and construction work of the Federal Government. At intervals from that date to this the engineers of the United States have advocated and urged a reorganization of the Federal Government. The movement came to a climax some three years ago, and, as a result, Congress passed a joint resolution authorizing the formation of a Committee to make a study looking towards a reorganization of

the Federal Government. That Committee reported only last week, and has brought out a bill with its report. That bill, which I shall not discuss, does not meet the viewpoint of the engineers of the United States regarding public works. That is a matter for us to give further consideration to, and to devote a great deal of effort to. What I wish to say tonight is this: The Federal Government is very badly organized and administered; furthermore, we shall never realize the economies that might be realized through the establishment of the Bureau of the Budget until we have a reorganization of the Federal Government. No doubt, it will be a very active question in the next session of Congress. You men here in New Orleans, and in Louisiana, should secure copies of that bill on reorganization, and express to your Congressmen and your Senators, your viewpoint concerning that phase of the reorganization, at any rate, that which affects engineering phases of the Federal Government. In the last analysis, there is no group of men in the United States in a better position to advise Congress regarding administration and organization matters than engineers. It is our stock in trade. We are dealing with such questions every day. Many of us are experts in that line of operation, and this one thing will offer the engineers of the United States an unusually rich opportunity to render a real public service by bringing about a general reorganization of the Federal Government. There are some twenty-nine departments of the Government. Sixteen of these have authority to receive appropriations for the construction of highways, I could stand here for an hour and enumerate examples of this sort. If you wish to hunt black bears in Alaska you would have to obtain a permit from the Secretary of Commerce; if you wish to hunt brown bears you would have to obtain a permit from the Secretary of Agriculture. So much for national reorganization.

These are not all of our activities. We have rendered much service to the Department of Commerce. Mr. Hoover, as you will recall, was instrumental in forming the American Engineering Council, was its first President, and served until he went into the Cabinet. Mr. Hoover established in the Depart-

ment of Commerce a division known as the Division of Simplified Practice to carry out certain recommendations of the Waste Report pertaining to the manufacture of excess varieties. That division has been doing a very large piece of work. We made suggestions as to the personnel; we have named numbers of engineers on committees formed, not only in that division, but in the Department of Commerce.

Some time after General Dawes went to Washington he realized that the contractual procedure of the Federal Government was of such a character that many of the most trusted contractors and manufacturers of commodities used by the Federal Government had ceased to bid for government business, due to the red tape and delays connected with government business. He built up what is known as the Interdepartmental Board of Contracts and Adjustments, which Board was authorized to make a thorough study of the subject. Mr. Ramsey, an attorney of Chicago, was made Chairman of that Board. He called upon Council to help him and we have helped in many directions. I shall take time to enumerate only one instance. When the contract for construction was formed, we gave Mr. Ramsey the names of two hundred engineers located in various parts of the United States who through experience, were competent to pass upon a proposed contract form for construction. Preceding the formation of this contractual board, we found there were over 300 federal statutes relating to the contractual procedure of the federal government. The Secretary of Commerce could enter into one kind of contract. If the Secretary of the Interior entered into the same kind of contract he would be subject to investigation. There is a big piece of work to be done there, in which we have had some part.

You will recall that last June—about the middle of June—Mr. Arthur P. Davis, then Director of Reclamation Service, who had rendered a great service for thirty years in the government, was called in to the Secretary's office and told to hand in his resignation effective as of July first. As a reason for doing that, the Secretary of the Interior said that he had come to the conclusion that an engineer was not competent to direct the reclamation work. That was a charge,—an indictment

of the engineering profession. A high government official said he had come to the conclusion that an engineer was not competent to manage a big piece of engineering work. American Engineering Council at once went on record in opposition to that position. We did not do that to get Arthur F. Davis reinstated, but we did take the position upon the indictment laid down by the Secretary of the Interior, I want to say to you that the engineering societies all over the United States, if I may be pardoned for using a slang phrase, "went to the bat," and Secretary Wok had many complaints from them. When it was announced that Mr. D. W. Davis was replaced it was said in Washington by Commissioner Mead that the engineering position in regard to that episode had been fully sustained. If American Engineering Council had not done anything else on behalf of the profession than that one thing, it has justified itself, because it has said to the American people the Reclamation Service is an engineering project, and there is no one as competent to direct it as an engineer. The man who had taken the former position had to reverse himself.

We have worked with the United States Coal Commission, and, upon the suggestion of the Commission, we undertook the study of storage of coal. That report left my office last Friday night for the publishers. We organized sub-committees in ninety cities of the United States, and something like four hundred engineers have had a part in preparing this report on the storage of coal. So far as I know, it is going to be the only document yet produced that includes a consideration of all the engineering possibilities and economical aspects of the storage of coal. That report will be found to be very valuable in solving completely the great coal question which is confronting the United States. It will be on a par with the Waste Report. The Waste Report is going down in history as one of the most profound pieces of work that the profession has ever accomplished. It has had a tremendous influence, not only in the United States, but in several countries in Europe. Six weeks after the Waste Report was off the press it was translated and sent to two foreign governments. They have distributed six thousand volumes in Czecho-Slovakia. There is to

be a Management Conference in Czecho-Slovakia in July from the 21st to the 24th to be participated in by 25 or 30 American engineers. This invitation was extended to all engineering societies in the United States through American Engineering Council, and the invitation for American engineers to participate in that conference came not only from Czecho-Slovakia, but from the officer of its Cabinet, who corresponds to the President of the United States. The engineers are going over there as official guests of the government of Czecho-Slovakia.

In the last three weeks I have had three cablegrams from Count Lubienski of Poland asking for the names of competent engineers working in railway shops and cotton mill industries. We have worked up sentiment among the officials of Poland to the extent that they want to employ American experts to advise along administrative and productive lines in Poland. All of this has been stimulated by the Waste Report.

I mention that to you as indicating that the Council has a real mission to perform; that, in its three years of activity it has done some things truly worth while; that it has brought before the public, as never before, the meaning of the engineering profession. That is evidenced by the large number of comments that appear in the daily press from time to time regarding the activities of the engineering societies and of engineers. We are co-operating, and, as a result, the benefits of the engineering societies, of the engineers of the United States, have been brought before the public mind. You will find in such standard periodicals as *World's Work*, the *Literary Digest*, and the *Saturday Evening Post*, comments regarding what the engineers are doing and thinking about. Most significant of all this is the amount of editorial comment you see from time to time regarding the engineering capacity of this country. We are bringing the editorial minds to the realization that what the engineers think about and do is of real moment to the American people. It is my privilege, as a result of my contacts in the last three years, not only with the engineers, but with public officials, financial men and men in other walks of life, to learn that they look upon this movement of the engineering profession as the herald of a new

system. The American people are in a frame of mind to accept the leadership of the engineers. They have confidence in the ability of the engineer, and his integrity. All that the profession needs to do is to accept the leadership the United States would give it, and I believe when that is done the engineers will have an unusual opportunity to render a great public service, not only to the people of the United States, but to the people in many other countries. Furthermore, I believe that we as engineers and American citizens have a great obligation to discharge, and we should take advantage of our opportunity for the benefit of the public, and that as we increase our influence and prestige, there will come to this profession that we love the everlasting gratitude of the American people.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, June 9, 1924.

The meeting was called to order with President Robert in the Chair and Messrs. Moses, Kerr, Barelli, Hamilton, Lanphier, Garsaud and Muth were present.

The Minutes of previous meeting were read and approved and bills on hand were ordered paid.

A communication from Mr. J. F. Villavasso, President of the Engineers' Club relative to licensing of other engineers besides civil engineers and surveyors, was discussed and the President was authorized to appoint a Committee to meet with a Committee of the Engineers' Club to consider the matter.

The following resignation was accepted with regret:

E. A. Rose.

There being no further business the meeting adjourned.

F. A. MUTH, Secretary.

Regular Meeting of the Society—June 9, 1924.

The regular meeting was called to order with President Robert in the chair, F. A. Muth, Secretary and present 54 members and guests.

The minutes of previous meeting were read and approved.

Announcement was made with deep regret of the death of Mr. Duncan Buie, on June 5, 1924. The President announced the following Committee to submit resolutions on the death of Mr. Buie:

Chas. M. Kerr, Chairman,
Gervais Lombard,
G. C. Schoenberger.

One copy of the resolutions to be furnished the family of Mr. Buie and the other copy to be spread upon the book of the minutes.

On motion duly seconded it was voted to have a recess during the summer months of July and August.

The Technical Exercises of the evening consisted of an interesting paper on "The Underground A. C. Distribution System in New Orleans" by Mr. W. R. Bullard, Engineer with the Phoenix Utility Co. The paper was followed by considerable discussion. A rising vote of thanks was tendered Mr. Bullard.

The Society had the pleasure of listening to an address on "The Work of the American Engineering Council" by Mr. L. W. Wallace, Executive Secretary.

On motion duly seconded it was voted to continue membership in the American Engineering Council.

The meeting then adjourned to the usual collation which was served in the corridor of the museum building.

F. A. MUTH, Secretary.

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

AUGUST, 1924

“PATRONIZE OUR ADVERTISERS”

INDEX TO ADVERTISEMENTS

	PAGE
Lester F. Alexander & Co.....	4
Allis-Chalmers.....	6
The American Cement Machine Co., Inc.....	5
American Creosote Works, Creosoted Timber.....	14
American Creosoting Co., Inc.....	12
The Anchor Packing Co.....	17
H. Bodenheimer & Sons.....	9
Brook Tarpaulin Co., Inc.....	14
Canal-Commercial Trust & Savings Bank.....	3
Columbian Iron Works.....	17
Concrete Steel Company.....	9
W. G. Coyle & Co.....	9
Creosoted Materials Co., Inc.....	10
Dixie Mill Supply Co., Inc.....	15
Doullut & Williams Co., Inc.....	11
Eugene Dietzgen Co., Surveying Instruments.....	16
Gaiennie Company.....	5
Geo. J. Glover.....	7
Harry Bros. Co. of La., Galvanized Iron Tanks, etc.....	12
Hattiesburg Creosoting Company.....	10
Robert W. Hunt & Co., Engineers, Chemists, Inspectors.....	10
Jahncke Service, Inc.....	17
Kittredge-Waters Supply Co., Ltd.....	5
A. M. Lockett & Co., Ltd.....	8
The Lufkin Rule Co.....	3
The Manhattan Rubber Mfg. Co.....	13

INDEX TO ADVERTISEMENTS—Continued.

	PAGE
Albert A. Martinez, Southern Yellow Pine.....	Inside Front Cover
Guy R. Molony & Co.	13
John H. Murphy Iron Works	8
N. O. Coal and Bisso Towboat Co.	6
Ole K. Olsen, Concrete and Structural Steel.....	7
Pacific Flush-Tank Co.....	13
Shakspeare Iron Works	3
The Tulane University of Louisiana.....	4
The Tulane University Press, Printing.....	6
Turnerized Roofing Co.....	Outside Back Cover
Westinghouse Electric & Manufacturing Co.....	18
Woodward, Wight & Co., Railway and Mill Supplies.....	16

This Journal reaches the officials with whom rests the responsibility for the bulk of the municipal, state and industrial works in Louisiana and the surrounding territory. Its advertising pages afford you an effective and dignified means of cultivating a wider acquaintance among prospective buyers.

WHEN
YOU BUY
A

LUFKIN

Measuring Tape

YOU MAY BE SURE THAT

You have an ACCURATE and DURABLE tape of a brand that has given universal satisfaction for years and that the maker guarantees direct to you.

Send for catalogue.

Saginaw, Mich.

THE LUFKIN RULE CO.

New York,
London, Eng.
Windsor, Can.



OLDEST BANK IN THE SOUTH

When considering new banking connections,
remember to consult with the

CANAL - COMMERCIAL TRUST & SAVINGS BANK

New Orleans

SAVINGS - COMMERCIAL - TRUST

Capital and Surplus - - - \$7,000,000.00

MEMBER FEDERAL RESERVE SYSTEM

Phone Main 541

913 Girod Street

SHAKSPEARE IRON WORKS

JULIAN M. SWOOP, Proprietor

Machinery Repairs Given Prompt Attention

Grey Iron Castings, Brass Castings

Plantation Sugar Mill Repairs a Specialty

Blaksmith Work of all Kind

Pattern Making Grate Bars—ordinary or circular

WE WELD ANY PARTS OF BROKEN MACHINERY

PHONE MAIN 541

NEW ORLEANS, LA.

LESTER F. ALEXANDER,
M. Ia. Engr. Soc.
M. S. A. M. E.

J. L. DICKEY,
M. Am. Soc. C. E.
M. Ia. Engr. Soc.
M. S. A. M. E.

LESTER F. ALEXANDER & CO.

CIVIL ENGINEERS and CONTRACTORS

**River and Harbor Improvements
River and Gulf Towing**

Barges, Derricks and Pile Drivers

830-32-34 Maison Blanche Annex. New Orleans, La.

Phones—Main 4195-1967

TUGS—Boswell, H. H. Colle, Wm. F. Flanders, Panther.

TULANE UNIVERSITY OF LOUISIANA NEW ORLEANS

Located in the choicest residential section of the South's leading city, with climatic and other advantages enjoyed by no other institution of equal rank, offers superior instruction in standard college courses, and in Engineering, Law, Medicine, Pharmacy, Dentistry, Art, Music, Domestic Science, Household Economy, Commerce and Business Administration. Separate department for women in the Newcomb College. Extensive laboratories, many scholarships in under-graduate colleges for men and women. Board and accommodation in dormitories at low rates. Twenty-four buildings. Campus of 100 acres. Full descriptive catalog, or a bulletin of any college sent free upon application. Address The Registrar, Tulane University, New Orleans, La.

Telephones Main 1495-1496

Kittredge-Waters Supply Co., Ltd.

Machine Shop

Engineer and Mill Supplies

422-424 Common Street

New Orleans



CONTRACTORS' EQUIPMENT

All Sizes from 5 ft. to 22 ft. Gas, Steam or Electric.
Ask about the BOSS High Drum two-bag Mixer.

THE AMERICAN CEMENT MACHINE CO. (Inc.) Keokuk, Ia.

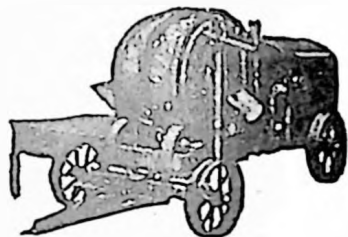
CARRIED IN STOCK BY

OLE K. OLSEN

822 Perdido Street, New Orleans, La.

Pavers, Grouters, Building
Mixers, Hoists, Back - Fillers,
Elevators, Pumps, Carts

Low Prices—Cash or Terms



\$325 Buys Low Charger

Gaiennie Company

STEAM HEATING

HOT WATER HEATING

MOIST AIR HEATING

GAS STEAM HEATING

PLUMBING

PLUMBING SUPPLIES

ESTIMATES FURNISHED UPON APPLICATION

Howard Avenue and Baronne Street

Phone Main 4020

ENGINEERS

We are Official Printers of the
Louisiana Engineering Society,
and make a specialty of the
PRINTING needs of Engineers

Tulane University Press

QUALITY PRINTERS

PHONE WALNUT 82



COMPLETE POWER
UNITS WITH ANY
TYPE OF
PRIME MOVER

POWER, ELECTRICAL and INDUSTRIAL MACHINERY

ELECTRICAL Machinery, Steam Engines, Steam Turbines,
Condensers, Gas Engines, Oil Engines, Hydraulic Tur-
bines, Pumping Engines, Centrifugal Pumps, Mining
Machinery, Metallurgical Machinery, Crushing Machinery,
Cement Machinery, Flour Mill Machinery, Saw Mill Machinery,
Air Compressors, Air Brakes, Steam and Electric Hoists, Farm
Tractors, Power Transmission Machinery, Perforated Metals,
Timber Preserving Machinery.

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

Facilities for Handling Coal in River, Tug Boats, Tow Boats, Barges
and Modern Coal Colliers

New Orleans Coal and Bisso Towboat Company

W. A. BISSE, President and General Manager

MAIN OFFICE: 606 United Fruit Company Bldg.

BRANCH OFFICE: Cor. Walnut and Levee

75 Ton Marine Steel Derrick, Marine Divers, and Flush-Deck Lighters

TELEPHONES: Main 2752, Main 233; Walnut 29, Walnut 20, Walnut 410

COLLIERS: Uncle Jim, Uncle Bill

TUGS: W. A. Bisso, J. A. Bisso, A. L. Bisso, Barranca, Independent, Captain Bud,
Leo, L. E. Patton, Joe.

NEW ORLEANS, LA., U. S. A.

Ask Your Friends About
The Concrete Engineer

OLE K. OLSEN

822 PERDIDO STREET

Phone Main 2104. New Orleans.

Geo. J. Glover

General Contractor

*Member: American Society for Testing Materials
Contractors & Dealers Exchange of New Orleans*

Whitney-Central Building New Orleans, La.

PHONE MAIN 1276

*Office Buildings, Railway Buildings, Manufacturing
Plants, Heavy Masonry, Pile Foundations*

AT YOUR SERVICE

To engineers we offer our services and the services of the manufacturers of high-grade equipment whom we represent; some of whom are as follows:

Babcock & Wilcox Co; Boilers and Superheaters. **Worthington Pump & Machinery Corporation;** Pumps, Compressors, Oil Engines, Condensers, etc. **American Blower Co;** Fans and Blowers and Air Conditioners. **Nash Engineering Co;** Vacuum and Steam-heating Pumps. **Spray Engineering Co;** Spray Cooling Ponds. **Frick Co;** Refrigeration Equipment. **Diamond Power Specialty Co;** Soot Blowers. **Diamond Rubber Co;** Mechanical Rubber Goods. **Robins Conveyer Co;** Conveyors and Handling Equipment. **Griscom-Russell Co;** Heat Exchange Apparatus. **A. M. Lockett & Co;** Oil-Burning Equipment.

Each of these has in its employ engineers who represent the highest talent in their respective lines; and the engineer whose client's requirements call for equipment covered by any of these lines, can count on the advice of these specialists, as well as that of our own engineering organization, in selecting proper equipment for a wide variety of service.

A. M. LOCKETT & CO., Ltd.
Contracting Mechanical Engineers and Machinery Merchants
NEW ORLEANS
Houston, Dallas, San Antonio, Texas

JOHN H. MURPHY IRON WORKS

MANUFACTURERS AND CONTRACTORS

Vacuum Pans, Coil and Calandria Webre Multiple Effects Centrifugals and Mixers Crystalizers, any type Return Current Juice Heaters	Internally Fired Boilers High Pressure Boilers Fitted with Steel Casings Quinn Flat Top Bagasse Furnaces Juice and Syrup Tanks
Oil Storage Tanks, all sizes and shapes	

Main Office, 643 Magazine St.
New Orleans, La., U. S. A.
Phone Main 160

Foundry and Machine Works
A. J. Naquin, Manager
Alexandria, La.

Boiler and Tank Works
Broad and Perdido Sts.
Phone Main 161

Machine Shop, Copper and Brass Works
Magazine and Girod Sts.

W. G. COYLE & CO.

(INCORPORATED)



Bunker Coal and Towing

BARGES, LIGHTERS, ETC.

High Grade Coals

Competent Tugs

Telephone Main 4429

Main Office: 1322 Whitney-Central Bldg.

New Orleans, La.

H. BODENHEIMER & SONS

Everything Pertaining to

INSURANCE

810 UNION STREET

Phones Main 1817-1818

NEW ORLEANS, LA.

SPECIFY

HAVEMEYER BARS

For Your Reinforced Concrete Work.
The Most Efficient and Economical Bar.
Rolled to same weight as plains.
Round—Square—Flat.

"EVERY POUND PULLS."

PROMPT SHIPMENTS—MILL OR WAREHOUSE

Concrete Steel Company

42 Broadway

NEW YORK

SOUTHERN OFFICE

Birmingham,

::

Ala.

OLE K. OLSEN, Sales Agent
New Orleans.

Hattiesburg Creosoting Co.

Plants at Hattiesburg, Miss. and Slidell, La.

Main Office, Hattiesburg, Miss.

CREOSOTED MATERIAL

—INCLUDING—

Lumber, Timbers, Piles, Telephone and Telegraph
Poles and Cross-Arms, Paving Blocks,
Cross-Ties, Etc.

CAPACITY, 70,000,000 FEET B. M. PER ANNUM

Facilities for Shipping by Rail or Water

Creosoted Materials Co., Inc.

1403 HIBERNIA BUILDING

Phone Main 3818

New Orleans, La.

—DEALERS IN—

Creosoted Materials of All Kinds

Robert W. Hunt Co.

Engineers, Chemists, Metallurgists, Inspectors

Inspection and Tests of Steel and Cement for Bridges, Buildings
and Other Structures. Inspection of Rails and Fastenings.
Creosoted Block, Timber and Ties. Paving Brick and Asphalt.

General Office, Chicago, 2200 Insurance Exchange.

New Orleans, 919 Carondelet Bldg.

W. HORACE WILLIAMS.
Pres. and Gen'l Mgr.

J. P. EWIN.
Secty-Treas. and
Managing Engineer

PAUL DOULLUT,
Vice-Pres.

Doullut & Williams Co., Inc.

Engineers and General Contractors

NEW ORLEANS, LA.

CAPITALIZED AT \$1,000,000.00

Competent Engineers in charge of Departments covering design
and construction of the following:

Docks, Wharves and Bulkheads of Concrete or Timber.
Industrial Plants, Bridges, Pipe Lines, Levees and Roads.
Electrical and Steam Power Plants, Water Works Systems.

Tugs, Barges, Derricks, Pile Drivers, Dredges, Diving Outfits
for Sale or Charter

CREOSOTED

TIMBERS - PILING
CROSS TIES - POLES

LUMBER - PAVING BLOCKS

AMERICAN CREOSOTING COMPANY

COLONIAL
CREOSOTING
COMPANY
INCORPORATED



GEORGIA
CREOSOTING
COMPANY
INCORPORATED

LOUISVILLE - KENTUCKY

SALES OFFICES
350 MADISON AVE. NEW YORK CITY - 401 W. MAIN ST. LOUISVILLE, KY.
BOKALUSA, LA. BRUNSWICK, GA.



Louisiana Engineers should have
in their files our catalog of Galva-
nized Iron Tanks, Sectional Steel
Towers, All Metal
Sectional Buildings,
Garages, Silos Cul-
vert, Water Tight
Pipe Gate Valves,
Etc.

¶ We are prepared to
submit blueprints and
specifications on the
above or on any kind
of metal buildings.

ASK FOR CATALOG



HARRY BROS. CO. of LA.

New Orleans, La.

The Manhattan Rubber Mfg. Co.

HIGH GRADE

MECHANICAL RUBBER GOODS



500 CAMP STREET, :: New Orleans, La.

Miller Flushtank Siphons



Simple, Reliable, Automatic

Also Sewage Disposal
Apparatus, Automatic
Sewage Ejectors, Centri-
fugal Pump Outfits,
Sewer Jointing Com-
pounds.

PACIFIC
FLUSH-TANK CO.
CHICAGO NEW YORK

GUY R. MOLONY & CO.

General Drayage

418 GRAVIER STREET

Phone Main 6281

NEW ORLEANS, LA.

American Creosote Works

INCORPORATED

CREOSOTED

**Cross Arms, Lumber, Paving
Blocks, Piles, Poles, Ties**

Private Wharf for Ocean Vessels at NEW ORLEANS, LA.

Capacity 115,000,000 Feet B. M. Per Annum

Branch Plants:

Louisville, Miss.
Winnfield, La.

STATION "B"

NEW ORLEANS, LA.

COTTON DUCK

TARPAULINS

TENTS

DISTRIBUTORS FOR

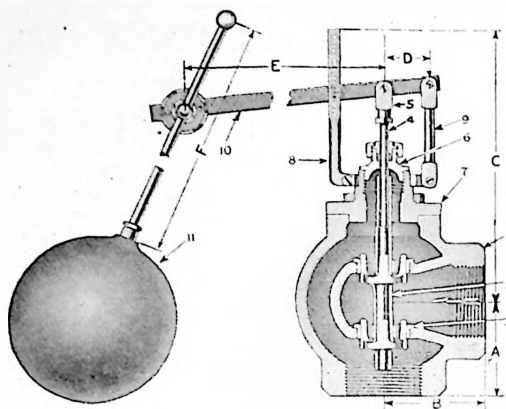
WHITLOCK MANILA ROPE

Brook Tarpaulin Company, Inc.

(ESTABLISHED 1840)

429 Celeste Street

New Orleans, La.



VALVES

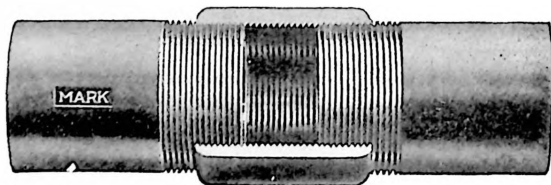
Pipe and Fittings

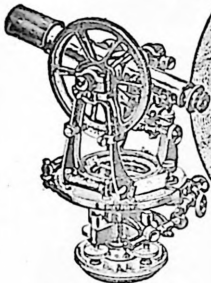
PIPE—Cast Iron

PIPE—Wrought Steel

PIPE—Wrought Iron

Dixie Mill Supply Co., Inc.
New Orleans





Transits and Levels
 that will give *perfect*
service under all conditions
 of use are manufactured by
DIETZGEN
 —the firm with the quality rep-
 utation. *Catalog on request.*
EUGENE DIETZGEN CO.
Manufacturers
 Chicago New York San Francisco
 New Orleans Pittsburgh
 Philadelphia

WOODWARD, WIGHT & CO. — LIMITED —

Largest General Supply House South Since 1867

EXCLUSIVE SOUTHERN SELLING AGENTS FOR

LIDGERWOOD Hoisting Engines, Cableways and Log
 Handling Machinery.

HAYWARD Orange Peel and Clam Shell Buckets.

GENERAL ELECTRIC CO. Apparatus and Supplies.

ROEBLING'S Wire Rope.

Heavy Hardware; Mill Supplies; Marine Hard-
 ware; Cordage; Elevating, Conveying and
 Power Transmitting Machinery.

OPEN DAY AND NIGHT

Howard Avenue, Constance
 and St. Joseph Streets

NEW ORLEANS

SAND

GRAVEL

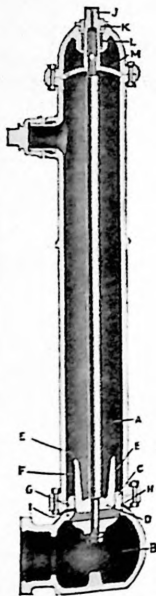
JAHNCKE SERVICE Inc.

NEW ORLEANS

Concrete and Builders' Materials
Dredging

SHELLS

CEMENT



COLUMBIAN IRON WORKS

CHATTANOOGA, TENN.

Manufacturers of

Fire Hydrants, Valves,
Valve Boxes, Sluice
Gates, Meter Boxes,
Water Works Supplies

New Orleans Representative:

J. S. BARELLI

612 Godchaux Bldg.



COMPLIMENTS

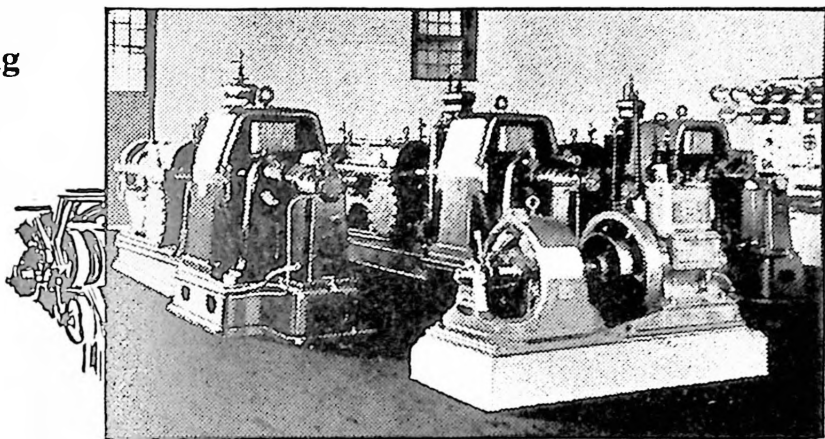
The Anchor Packing Company

418 COMMON STREET

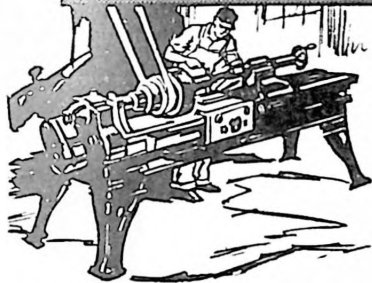
NEW ORLEANS, LA.

The Great Engineering Achievement of 1899

What
Engineering
Owes to
Initiative



*Daddy of All Large
Commercial Turbines
Began Operation at
Wilmerding*



PRIOR to 1899 the works of the Westinghouse Airbrake Company was cooperated by reciprocating engines distributed in various parts of the plant. While this source of power was inefficient in many respects, it was the best known commercial motive force of the day.

By 1899, however, remarkable developments had been made in the design and construction of steam turbines and electric generating equipment. Called to the attention of the Airbrake officials, it was decided to give the new machines a chance, and three Westinghouse Steam Turbines were installed without delay. This was the first large installation of its kind, anywhere.

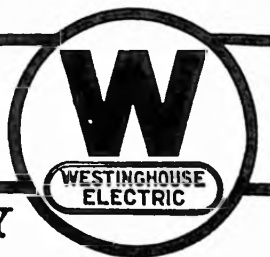
It required *initiative* to take this step—someone had to be first. And, as in all important pioneering achievements, there was much skepticism as to results.

However, the new units quickly proved their practicability. Although of only 400 K. W. capacity they proved much more efficient and economical than the old reciprocating engines. Their economy was particularly conspicuous because by careful test they showed a fuel saving of approximately 36 per cent.

Steam turbine development thus received its first real impetus in 1899, the Wilmerding, Pa., performance definitely establishing this electrical unit as a *better* method of turning the wheels of industry.

Westinghouse

ACHIEVEMENT & OPPORTUNITY



The Proceedings of the Louisiana Engineering Society

Published bi-monthly, February, April, June, August, October, December,
under the auspices of the Committee on Publication.

DOUGLAS ANDERSON, Editor.

The Louisiana Engineering Society is not responsible for any
statement made or opinion expressed in this publication.

Subscription, \$2.00 per annum

Single copy, 35 cents

ADVERTISING RATES

	ONE YEAR	HALF YEAR	ONE ISSUE
Full page	\$50.00	\$28.00	\$10.00
Half-page	28.00	15.00	6.00
Quarter-page	15.00	10.00	4 00
One-eighth page	10.00	6.00	2.00

For the back outside cover add 50 per cent to the above
rates. For the inside covers add 25 per cent to the above
rates.

Address all communications to
Douglas Anderson, Editor, Tulane University,
New Orleans, La.

Entered as second-class matter July 27, 1916, at the Post Office at
New Orleans, Louisiana, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in section 1105,
Act of October 3, 1917, authorized August 1, 1918.

LOUISIANA ENGINEERING SOCIETY

OFFICERS FOR 1924

President, JAMES M. ROBERT, Tulane University.
Vice-President, MARCEL GARSAUD, 515 Whitney Building.
Secretary, FRANK A. MUTH, 7705 Poplar Street.
Treasurer, WALTER B. MOSES, 640 S. Peters Street.

DIRECTORS

CHARLES MCD. KERR, 1403 Hibernia Building.
F. P. HAMILTON, 1403 Hibernia Building.
E. S. LANPHIER, Room 224 Custom House Building.
JOHN S. BARELLI, 612 Godchaux Building.

STANDING COMMITTEES

On Technical Papers

W. B. Gregory, Chairman
I. O. Mall
A. M. Shaw

On Library

D. S. Elliott, Chairman
Marcel Garsaud
W. T. Hogg
Ralph Earl

On Publications—Division "A"

Douglas Anderson
Frank A. Muth

On Publications—Division "B"

P. J. Dromgool, Chairman
Lester Alexander
Paul F. Jahncke
Geo. A. Seaver
J. P. Ewin
C. A. Favrot

On Entertainments and Outings

Charles M. Kerr
L. F. Alexander
Ole K. Olsen
C. H. Stem

On Membership—Division "A"

H. E. Crump, Chairman
W. T. Hogg
F. G. Frost
B. H. Grehan
Cecil N. Bean
L. C. Smith
George Hammett
Ira W. Sylvester
T. B. Smith
J. L. Henning
B. W. Pegues
Merrill Bernard

On Membership—Division "B"

F. P. Hamilton, Chairman
J. F. Coleman
Jacques de Tarnowsky

On Employment

R. H. Batmbach, Chairman
R. Baccich

On Civic and Industrial Affairs

John Klorer, Chairman
A. T. Dusenbury
John H. O'Neill

The headquarters of the Society are in the State Museum
Building, Jackson Square.

All business communications should be addressed to F. A. Muth, Secretary,
7705 Poplar Street, New Orleans, La.

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

VOL. X.

OCTOBER, 1924

No. 5

CONTENTS

EDITORIAL NOTES AND COMMENT :	PAGE
A Correction	215
John H. Dunlap	216
The September Meeting	216
Drainage and Flood Control in Louisiana	217
Hydraulic Laboratory Hearings Distributed	218
Revision of the Building Code	218
New Members	219
PAPERS AND DISCUSSIONS:	
Engineering Education and the Industries <i>By John H. Dunlap</i>	220
MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY	224

EDITORIAL NOTES AND COMMENT

A Correction.—In the editorial comment on Mr. Bullard's paper published in the August issue of the Proceedings, and entitled "Alternating Current Underground Distribution in New Orleans," the statement was made that A.C. sub-stations would receive power at 13,200 volts, there to be stepped down to 4000 3-phase 4-wire or 2300 volts Y, and then again stepped down by distribution transformers to 110/220 volts single phase and 220 volts three-phase.

This was, of course, wrong. The most striking feature in the new system, as a matter of fact, is the plan to transform directly from 13,200 volts to the low utilization voltages in one step, thus eliminating entirely the distribution substation.

John H. Dunlap.—The members will recall with pleasure the visit to New Orleans last April of Mr. Gruinsky and Mr. Dunlap, on the occasion of their trip South in the interest of the local section of the American Society of Civil Engineers. It was with deepest regret, therefore, that we heard of his death last June, as a result of injuries received in a train collision. Mr. Dunlap was returning from Boulder, Colorado, where he had been in attendance upon the annual meeting of the Society for the Promotion of Engineering Education. A number of the delegates to this meeting were returning to their homes on the same train, and two others were killed, President F. W. McNair of the Michigan School of Mines, and Professor F. W. Ives of Ohio State University.

Mr. Dunlap had been Secretary of the A. S. C. E. for a number of years. He was born in New Hampshire in 1882 and graduated from Dartmouth College with the degree of A.B. in 1905. In 1908 he graduated from the Thayer School of Civil Engineering of the same college. He was an exceedingly efficient officer, a man of forceful character, and possessed of a vigorous and pleasing personality which endeared him to all his friends and associates.

On the occasion of his last visit to New Orleans he gave a short impromptu and informal talk to a joint meeting of the Louisiana Engineering Society and the local section of the A. S. C. E. It consisted of a few thoughts upon the subject of engineering education and the relation of the engineering school to the industries. The stenographer's report of Mr. Dunlap's remarks was preserved and is published elsewhere in this issue of the Proceedings.

The September Meeting.—The Society's program for the season of 1924-25 was opened with the meeting of September 8th, on which occasion a film entitled "The Story of the Motor Truck" was shown by Mr. E. R. Greenlaw of the Greenlaw Truck and Tractor Company. In addition to his description of the film and his discussion of the development of the modern motor truck, Mr. Greenlaw, by way of lagniappe, entertained the members present at the meeting with his views on the spill-

way problem and with his impressions of the utter uselessness and futility of engineers, particularly when they attempted to write specifications for the purchase of motor trucks.

There was also scheduled for this meeting a general discussion on the subject of "Licensing of Engineers." Owing, however, to the absence from the city of the leader of the discussion, it was postponed to a subsequent meeting.

Drainage and Flood Control in Louisiana.—Under this title there was published in the June-July issue of the National Reclamation Magazine a paper by Mr. A. T. Dusenbury, prominent member of this Society and well known for his extensive activities in the field of irrigation and drainage. Mr. Dusenbury's paper is in effect a strong appeal for a closer co-ordination of activities and projects which have to do with the utilization and control of our national waterways. History and experience show that no one phase of the problem can be solved without introducing one or more of its other phases. For example, in certain portions of the West irrigation was the pressing need. When the irrigation problem was solved it was found that this very solution had brought with it a new problem of drainage. In many places drainage and flood control are inseparably connected with each other.

Mr. Dusenbury sums up his conclusions with this statement:

"There is, therefore, to my mind, no escape from the conclusion that if we are ever to work out an intelligent plan whereby the conservation and proper use of water may be made possible, we must bring into harmonious co-operation and co-ordination the various federal, state and local agencies that are very vitally interested in the entire problem, but which are as yet only hammering away at some particular angle of it. This present type of action, in the end, usually results in much fruitless work and the main object to be obtained is thus long delayed."

Hydraulic Laboratory Hearings Distributed.—The October issue of the A. E. C. Bulletin contains the following note on this matter:

“The hearing which was given the engineers on the question of the establishment of a National Hydraulic Laboratory last spring has been printed by the Senate Commerce Committee and is now available for distribution. It can best be secured from the office of Senator Ransdell, Senate Office Building, Washington, D. C.

This report contains, practically in its entirety, the paper delivered by John R. Freeman before the American Society of Civil Engineers at their southern meeting early in the year. Special arrangements were made to include all of the cuts and drawings which accompanied Mr. Freeman's paper.

In addition to this, the testimony of Commissioner Meade, of the Reclamation Service, and N. C. Grover, of the Geological Survey, also appears.”

Revision of the Building Code.—It is characteristic of the spirit of the Louisiana Engineering Society that it always stands ready to lend its co-operation and assistance to any public movement for the good of the city and community. It is not surprising, therefore, to find that the membership of the Society is well represented upon the committees which have charge of the work of revising the building code of the City of New Orleans. Mr. F. A. Muth, Secretary of the Society, and engineer with the Lighthouse Department of the United States, has been given a temporary release from the latter position in order to enable him to serve as secretary and technical expert of the Advisory Committee on Revision of the Code. Col. Marcel Garsaud is Chairman of this Committee, and the following Society members are on the committee: A. S. Montz, R. G. Malone, Donald Derickson.

Professor Derickson is also Chairman of the Sub-Committee of the Louisiana Engineering Society, which consists of the following members: A. M. Shaw, J. F. Coleman, G. A. Seaver, A. B. Davis, W. T. Hogg, C. G. Cappel, G. P. Rice, John Riess, J. de Tarnowsky, E. F. Delery, J. L. Porter, F. A. Muth.

Douglas Anderson is also Chairman of the Electrical Subcommittee which is handling that particular phase of the revision.

New Members.—At the September meeting of the Board of Direction the following engineers were elected members of the Society. As they all live in New Orleans they are classified as Resident Members:

Frank P. Elizardi, with Engineering Department, A. M. Lockett & Co.

Roland W. French, Electrical Department, New Orleans Public Service, Inc.

David W. Godat, Assistant Engineer in City Engineer's Office, New Orleans.

Dan Hallaron, Jr., Distribution Department, New Orleans Public Service, Inc.

Allan J. Harris, Sales Engineer with Walter Castenado.

Ralph G. Malone, Chief Engineer, Louisiana Fire Prevention Bureau.

PAPERS AND DISCUSSIONS

ENGINEERING EDUCATION AND THE INDUSTRIES.

(BY THE LATE MR. JOHN H. DUNLAP)

A brief talk delivered before the Joint Meeting of the Louisiana Engineering Society and the Local Section of the American Society of Civil Engineers, April 14th, 1924.

Mr. Chairman and Friends:

I hardly expected to be called upon. I was told the meeting was a very attractive one, and after the main paper of the evening certain things happen that were never allowed to be interfered with. So when I stood up to vote my thanks for Mr. Grunsky's paper, I thought the second part would not happen.

I remember Mr. Grunsky said at the end of his paper, before he started talking about the Sacramento River, that he felt an engineer should have a liberal as well as technical education.

That reminds me of a project which now is under way in this country—the project of studying engineering education. The four national engineering societies are all concerned in this study, they have all appointed counsels on the board which has to study this proposition.

The Board has a long name called The Board of Investigation and Co-ordination for the Society for the Promotion of Engineering Education, this committee being composed of men high in the profession, now connected with our universities, and myself representing the American Society of Civil Engineers. After all, we are coming to see, I think, that education has something to do with the mind.

You know engineering education has had a great change come over its status in the last generation. In the year 1900 Prof. Baker was delivering his presidential address on the subject "Engineering Education at the close of the 20th Century." He was very proud to point out the engineering course at that time. He pointed out in the year preceding, so far as standards of entrance were concerned, 88% of the engineering schools

required a four-year course, compared with 33% of the law schools. The engineering schools compared with others as regards high standards of entrance, very favorably.

Also the length of course was greater. 91% medical colleges had four-year courses averaging 28 months, as compared to 98% engineering schools averaging 35 months in attendance, almost an academic year of education.

We find the position Prof. Baker discussed twenty-four years ago are to-day reversed. We find the engineering schools, instead of being at the top, are now at the bottom. The medical schools are at the top with their six-year courses, and some already requiring the seventh year as an interne; the law schools, the best of them, require five years; the best dental colleges require five-year courses, and their next step will be to make it seven years. For generations the best theological colleges have required a liberal education for entrance. The medical schools, theological schools, the dental schools and law schools are all ahead of the engineering schools in this respect. That situation may be entirely proper and entirely scientific, but this board is investigating this problem among others.

We all realize the changes which are taking place in our system of education. Young men may see in the engineering courses at the present time the easiest cut to a profession, a better job. And perhaps we will find, when we investigate the engineering schools to-day, that the body of students do not compare with those we got twenty years ago. That is a possibility. Some observers think it is correct; others doubt it.

Another phases of the whole problem is this: Those of you who read the recent bulletin of the National Industrial Conference Board may recall an article on the subject of industry's realization of the future need of men of technical training, a need which looms large in the very near future. It points out that by the year 1930 there will be needed in positions of responsibility about 400,000 more men than in 1923, and a majority of them would be of greater usefulness with a good engineering training.

Divide these 400,000 by ten years, you have 40,000 a year. The engineering schools are graduating about 9,000 each year,

and the present lack of co-ordination between the engineering schools and industry is seen as a most important phase of the problem which needs adjustment.

Industry sees in the coming generation an intensity of competition this country has never experienced. Germany having taken her wealth away from her middle class, and thrown it into her industrial classes, stands ready to give us and the rests of the nations a degree of competition severer than she was able to give us prior to the war.

It sees France entering more seriously into industry due to the experiences of the war, and sees France eager to give greater competition in the future.

It sees England bothered with labor troubles; it sees the yellow man actively engaged in manufacture. From China reports already come of two million cotton spindles in operation. Steel mills, two or three already in operation, are giving our own steel mills far more competition than ever before experienced in that part of the world.

It sees Japan giving us competition we have never experienced before. The report is that Japan, opened to the world only as far back as 1865, has a ship dock five times as large as our largest; we find in that country a spirit of national team-play which is most surprising.

Some people say that Japan has been set back by the earthquake, but with her economical methods of operation and the determination to overcome this handicap, she will redouble her efforts to capture the world's markets.

We are looking ahead to properly providing industry with men who have had the right sort of training. And now by the aid of this \$108,000 given by Carnegie for three years, we hope to take into account all of those facts I have related, and many others. A study is to be made, not only of the industrial cities the world over, but also of the educational processes in other civilized countries, so that we, as engineers, may be trained to take that part in the world that the future destiny of this country demands.

In the future M. I. T., that great engineering school must do more than give its graduates a technical training. And its

graduates go on to occupy the larger field. You remember at the opening of Columbia University last fall President Butler selected as his subject "Can Men Learn?" Some think he should have restricted his subject to this: "Can Columbia Men Learn?" At any rate, he pointed out the distressing conditions in the world at large and the comparatively small degree to which man had learned the lesson of the past generations, and he raised the question of how much they were really learning. I wonder what the answer to that question is?

I wonder what contribution this study of engineering education is going to make to the solution of the problem of man learning by the experience of the past. Will he learn to control the destinies of the future which is just ahead and in which the stakes and problems are going to be almost beyond the imagination of man?

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Meeting of the Board of Direction, August 11th, 1924.

The meeting was called to order at 5:00 p. m. by President Robert, with the following members present: Messrs. Hamilton, Moses, Kerr and Muth.

The minutes of the previous meeting were read and approved, and bills on hand were ordered paid.

The resignations of the following members were accepted with regret:

Geo. C. Estill,
Mason J. Young.

On motion, duly seconded, the following names were ordered to ballot:

Resident Members:

Frank P. Elizardi
Roland Woodward French
David W. Godat
Dan Hallaron, Jr.
Allan J. Harris
Ralph G. Malone.

There being no further business the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Board of Direction, September 8th, 1924.

The meeting was called to order with President Robert in the chair, with the following members present: Messrs. Moses, Garsaud, Lanphier, Kerr, Hamilton and Muth.

The minutes of the previous meeting were read and approved and bills on hand were ordered paid.

The resignation of Mr. W. E. Penfield was accepted with regret.

The result of the ballot for members was canvassed and there were 76 formal and 5 informal ballots cast.

On motion, duly seconded, the following were elected:

Resident Members:

Frank P. Elizardi
Roland W. French
David W. Godat
Dan Hallaron, Jr.
Allan J. Harris
Ralph G. Malone.

A communication was read from the American Engineering Council requesting that one representative and one alternate be appointed to serve for two years from January 1, 1925, and the following were elected by the Board of Direction:

Professor James M. Robert, Representative.

Colonel Marcel Garsaud, Alternate.

The editorial in the Proceedings relative to the holding of a social meeting of the members at some near-by restaurant in lieu of the regular collation was discussed. The Secretary referred to tentative rearrangements that had been made, and it was voted that at next meeting a trial be made of the plan suggested by the Editor of the Proceedings in the June issue, to substitute such a social luncheon for the usual collation.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Regular Meeting of the Society, September 8th, 1924.

The meeting was called to order with President Robert in the chair, F. A. Muth, Secretary, and 41 members and guests present.

The minutes of the previous meeting were read and approved.

Professor Donald Derickson reported that the Sub-committee of the Louisiana Engineering Society on Building Code Revision had completed the sections of the code assigned to that committee and had submitted an unanimous report. The names of the membership of that committee were announced.

Colonel Marcel Garsaud stated that considerable progress had been made in the preparation of the Building Code and that the Sub-committee of the Louisiana Engineering Society, with Professor Derickson as Chairman, had performed an excellent service to the city. Mention was also made that the work of the Electrical Sub-committee was in progress, and that Professor Douglas Anderson had been appointed Chairman of that Committee, with several members thereon who were not members of the Society, but who were selected at large.

A very interesting and instructive moving picture was shown, with the title 'The Story of the Motor Truck.' Mr. E. R. Greenlaw, representing the Greenlaw Truck and Tractor Company, made interesting remarks in connection with the pictures, and stated that they had been prepared by the Department of the Interior in collaboration with the General Motors Co.

Upon conclusion of the pictures, a rising vote of thanks was tendered Mr. Greenlaw.

There then followed a brief discussion of the "Licensing of Engineers," with reference to the proposed plan of legislation, which will include other professional engineers as well as civil engineers and surveyors. This discussion was led by President Robert, several members taking part.

Announcement was made that upon conclusion of the next regular meeting the Society will adjourn to a restaurant not more than one block distant from the Society room, where the collation will be served, instead of within the museum. Further announcement will be made at the October meeting.

The meeting then adjourned to the regular collation.

F. A. MUTH, Secretary.



Put yourself on your Christmas list

YOU can give to yourself at Christmas time, and yet be as unselfish and as charitable as you like to be. Buy Christmas Seals.

Everywhere there are men and women whose only hope for life and health is in the Tuberculosis Associations. Christmas Seals furnish the funds to bring these men and women sufferers from tuberculosis back to health. When you buy Christmas Seals, it is *you* who are giving them the greatest gift that lies within the reach of man—the gift of life.

Every life you save from tuberculosis means additional protection for you and your family. Funds from the sale of Christmas Seals have eliminated half the deaths from tuberculosis. Help stamp out the dread disease. Buy Christmas Seals.



STAMP OUT
TUBERCULOSIS
WITH
CHRISTMAS
SEALS

The National, State, and Local Tuberculosis Associations of the United States

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

OCTOBER, 1924

“PATRONIZE OUR ADVERTISERS”

INDEX TO ADVERTISEMENTS

	PAGE
Lester F. Alexander & Co.....	4
Allis-Chalmers	6
The American Cement Machine Co., Inc.....	5
American Creosote Works, Creosoted Timber.....	14
American Creosoting Co., Inc.....	12
The Anchor Packing Co.	17
H. Bodenheimer & Sons.....	9
Brook Tarpaulin Co., Inc.	14
Canal-Commercial Trust & Savings Bank.....	3
Columbian Iron Works.....	17
Concrete Steel Company.....	9
W. G. Coyle & Co.....	9
Creosoted Materials Co., Inc.....	10
Dixie Mill Supply Co., Inc.....	15
Doullut & Williams Co., Inc.....	11
Eugene Dietzgen Co., Surveying Instruments.....	16
Gaiennie Company.....	5
Geo. J. Glover.....	7
Harry Bros. Co. of La., Galvanized Iron Tanks, etc.....	12
Hattiesburg Creosoting Company	10
Robert W. Hunt & Co., Engineers, Chemists, Inspectors.....	10
Jahncke Service, Inc.	17
Kittredge-Waters Supply Co., Ltd.....	5
A. M. Lockett & Co., Ltd.....	8
The Lufkin Rule Co.....	3
The Manhattan Rubber Mfg. Co.....	13

INDEX TO ADVERTISEMENTS—Continued.

	PAGE
Albert A. Martinez, Southern Yellow Pine.....	Inside Front Cover
Guy R. Molony & Co.	13
John H. Murphy Iron Works	8
Ole K. Olsen, Concrete and Structural Steel.....	7
Pacific Flush-Tank Co.....	13
Shakspeare Iron Works	3
The Tulane University of Louisiana.....	4
The Tulane University Press, Printing.....	6
Turnerized Roofing Co.....	Outside Back Cover
Westinghouse Electric & Manufacturing Co.....	18
Woodward, Wight & Co., Railway and Mill Supplies.....	16

This Journal reaches the officials with whom rests the responsibility for the bulk of the municipal, state and industrial works in Louisiana and the surrounding territory. Its advertising pages afford you an effective and dignified means of cultivating a wider acquaintance among prospective buyers.

WHEN
YOU BUY
A

LUFKIN

Measuring Tape

YOU MAY BE SURE THAT

You have an ACCURATE and DURABLE tape of a brand that has given universal satisfaction for years and that the maker guarantees direct to you.

Send for catalogue.

Saginaw, Mich.

THE LUFKIN RULE CO.

New York,
London, Eng.
Windsor, Can.



OLDEST BANK IN THE SOUTH

When considering new banking connections,
remember to consult with the

CANAL - COMMERCIAL TRUST & SAVINGS BANK

New Orleans

SAVINGS - COMMERCIAL - TRUST

Capital and Surplus - - - \$7,000,000.00

MEMBER FEDERAL RESERVE SYSTEM

Phone Main 541

913 Girod Street

SHAKSPEARE IRON WORKS JULIAN M. SWOOP, Proprietor

Machinery Repairs Given Prompt Attention

Grey Iron Castings, Brass Castings

Plantation Sugar Mill Repairs a Specialty

Blaksmith Work of all Kind

Pattern Making Grate Bars—ordinary or circular

WE WELD ANY PARTS OF BROKEN MACHINERY

PHONE MAIN 541

NEW ORLEANS, LA.

LESTER F. ALEXANDER,
M. La. Engr. Soc.
M. S. A. M. E.

J. L. DICKEY,
M. Am. Soc. C. E.
M. La. Engr. Soc.
M. S. A. M. E.

LESTER F. ALEXANDER & CO.

CIVIL ENGINEERS and CONTRACTORS

**River and Harbor Improvements
River and Gulf Towing**

Barges, Derricks and Pile Drivers

830-32-34 Maison Blanche Annex.

New Orleans, La.

Phones—Main 4195-1967

TUGS - Boswell, H. H. Colle, Wm. F. Flanders, Panther.

TULANE UNIVERSITY OF LOUISIANA NEW ORLEANS

Located in the choicest residential section of the South's leading city, with climatic and other advantages enjoyed by no other institution of equal rank, offers superior instruction in standard college courses, and in Engineering, Law, Medicine, Pharmacy, Dentistry, Art, Music, Domestic Science, Household Economy, Commerce and Business Administration. Separate department for women in the Newcomb College. Extensive laboratories, many scholarships in under-graduate colleges for men and women. Board and accommodation in dormitories at low rates. Twenty-four buildings. Campus of 100 acres. Full descriptive catalog, or a bulletin of any college sent free upon application. Address The Registrar, Tulane University, New Orleans, La.

Telephones Main 1495-1496

Kittredge-Waters Supply Co., Ltd.
Machine Shop

Engineer and Mill Supplies

422-424 Common Street

New Orleans



CONTRACTORS' EQUIPMENT

All Sizes from 5 ft. to 22 ft. Gas, Steam or Electric.
 Ask about the BOSS High Drum two-bag Mixer.

THE AMERICAN CEMENT MACHINE CO. (Inc.) Keokuk, Ia.

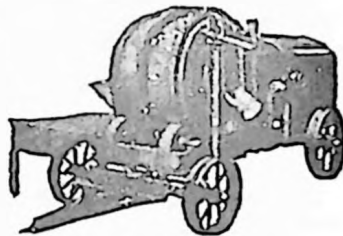
CARRIED IN STOCK BY

OLE K. OLSEN

822 Perdido Street, New Orleans, La.

Pavers, Grouters, Building
 Mixers, Hoists, Back - Fillers,
 Elevators, Pumps, Carts

Low Prices—Cash or Terms



\$325 Buys Low Charger

Gaiennie Company

STEAM HEATING
 HOT WATER HEATING
 MOIST AIR HEATING
 GAS STEAM HEATING
 PLUMBING
 PLUMBING SUPPLIES

ESTIMATES FURNISHED UPON APPLICATION

Howard Avenue and Baronne Street
 Phone Main 4020

ENGINEERS

We are Official Printers of the
Louisiana Engineering Society,
and make a specialty of the
PRINTING needs of Engineers

Tulane University Press

QUALITY PRINTERS

PHONE WALNUT 82



POWER, ELECTRICAL and INDUSTRIAL MACHINERY

ELECTRICAL Machinery, Steam Engines, Steam Turbines,
Condensers, Gas Engines, Oil Engines, Hydraulic Tur-
bines, Pumping Engines, Centrifugal Pumps, Mining
Machinery, Metallurgical Machinery, Crushing Machinery,
Cement Machinery, Flour Mill Machinery, Saw Mill Machinery,
Air Compressors, Air Brakes, Steam and Electric Hoists, Farm
Tractors, Power Transmission Machinery, Perforated Metals,
Timber Preserving Machinery.

COMPLETE POWER
UNITS WITH ANY
TYPE OF
PRIME MOVER

ALLIS-CHALMERS
MILWAUKEE, WIS. U.S.A.

7

Ask Your Friends About
The Concrete Engineer

OLE K. OLSEN

822 PERDIDO STREET
Phone Main 2104. New Orleans.

Geo. J. Glover

General Contractor

*Member: American Society for Testing Materials
Contractors & Dealers Exchange of New Orleans*

Whitney-Central Building New Orleans, La.

PHONE MAIN 1276

*Office Buildings, Railway Buildings, Manufacturing
Plants, Heavy Masonry, Pile Foundations*

AT YOUR SERVICE

To engineers we offer our services and the services of the manufacturers of high-grade equipment whom we represent; some of whom are as follows:

Babcock & Wilcox Co; Boilers and Superheaters. **Worthington Pump & Machinery Corporation;** Pumps, Compressors, Oil Engines, Condensers, etc. **American Blower Co;** Fans and Blowers and Air Conditioners. **Nash Engineering Co;** Vacuum and Steam-heating Pumps. **Spray Engineering Co;** Spray Cooling Ponds. **Frick Co;** Refrigeration Equipment. **Diamond Power Specialty Co;** Soot Blowers. **Diamond Rubber Co;** Mechanical Rubber Goods. **Robins Conveyer Co;** Conveyors and Handling Equipment. **Griscom-Russell Co;** Heat Exchange Apparatus. **A. M. Lockett & Co;** Oil-Burning Equipment.

Each of these has in its employ engineers who represent the highest talent in their respective lines; and the engineer whose client's requirements call for equipment covered by any of these lines, can count on the advice of these specialists, as well as that of our own engineering organization, in selecting proper equipment for a wide variety of service.

A. M. LOCKETT & CO., Ltd.
Contracting Mechanical Engineers and Machinery Merchants
NEW ORLEANS
 Houston, Dallas, San Antonio, Texas

JOHN H. MURPHY IRON WORKS

MANUFACTURERS AND CONTRACTORS

Vacuum Pans, Coil and Calandria Webre Multiple Effects Centrifugals and Mixers Crystalizers, any type Return Current Juice Heaters Oil Storage Tanks, all sizes and shapes	Internally Fired Boilers High Pressure Boilers Fitted with Steel Casings Quinn Flat Top Bagasse Furnaces Juice and Syrup Tanks
---	---

Main Office, 643 Magazine St.
New Orleans, La., U. S. A.
Phone Main 160

Boiler and Tank Works
Broad and Perdido Sts.
Phone Main 161

Foundry and Machine Works
A. J. Naquin, Manager
Alexandria, La.

Machine Shop, Copper and Brass Works
Magazine and Girod Sts.

W. G. COYLE & CO.

(INCORPORATED)



Bunker Coal and Towing BARGES, LIGHTERS, ETC.

High Grade Coals

Competent Tugs

Telephone Main 4429

Main Office: 1322 Whitney-Central Bldg.

New Orleans, La.

H. BODENHEIMER & SONS

Everything Pertaining to

INSURANCE

810 UNION STREET

Phones Main 1817 - 1818

NEW ORLEANS, LA.

SPECIFY

HAVEMEYER BARS

For Your Reinforced Concrete Work.
The Most Efficient and Economical Bar.
Rolled to same weight as plains.
Round—Square—Flat.

"EVERY POUND PULLS."

PROMPT SHIPMENTS—MILL OR WAREHOUSE

Concrete Steel Company

42 Broadway

NEW YORK

SOUTHERN OFFICE

Birmingham,

::

Ala.

OLE K. OLSEN, Sales Agent
New Orleans.

Hattiesburg Creosoting Co.

Plants at Hattiesburg, Miss. and Slidell, La.

Main Office, Hattiesburg, Miss.

CREOSOTED MATERIAL

—INCLUDING—

Lumber, Timbers, Piles, Telephone and Telegraph
Poles and Cross-Arms, Paving Blocks,
Cross-Ties, Etc.

CAPACITY, 70,000,000 FEET B. M. PER ANNUM

Facilities for Shipping by Rail or Water

Creosoted Materials Co., Inc.

1403 HIBERNIA BUILDING

Phone Main 3818

New Orleans, La.

—DEALERS IN—

Creosoted Materials of All Kinds

Robert W. Hunt Co.

Engineers, Chemists, Metallurgists, Inspectors

Inspection and Tests of Steel and Cement for Bridges, Buildings
and Other Structures. Inspection of Rails and Fastenings.
Creosoted Block, Timber and Ties. Paving Brick and Asphalt.

General Office, Chicago, 2200 Insurance Exchange.
New Orleans, 919 Carondelet Bldg.

11
W. HORACE WILLIAMS.
Pres. and Gen'l Mgr.

J. P. EWIN,
Secty-Treas. and
Managing Engineer

PAUL DOULLUT,
Vice-Pres.

Doullut & Williams Co., Inc.

Engineers and General Contractors

NEW ORLEANS, LA.

CAPITALIZED AT \$1,000,000.00

Competent Engineers in charge of Departments covering design and construction of the following:

Docks, Wharves and Bulkheads of Concrete or Timber.
Industrial Plants, Bridges, Pipe Lines, Levees and Roads.
Electrical and Steam Power Plants, Water Works Systems.

Tugs, Barges, Derricks, Pile Drivers, Dredges, Diving Outfits
for Sale or Charter

CREOSOTED

TIMBERS - PILING
CROSS TIES - POLES

LUMBER - PAVING BLOCKS

AMERICAN CREOSOTING COMPANY

COLONIAL
CREOSOTING
COMPANY
INCORPORATED



GEORGIA
CREOSOTING
COMPANY
INCORPORATED

LOUISVILLE ~ KENTUCKY
SALES OFFICES

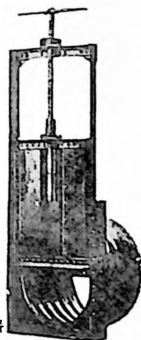
350 MADISON AVE. NEW YORK CITY - 401 W. MAIN ST. LOUISVILLE, KY.
BOCALUSA, LA. BRUNSWICK, GA.



Louisiana Engineers should have in their files our catalog of Galvanized Iron Tanks, Sectional Steel Towers, All Metal Sectional Buildings, Garages, Silos Culvert, Water Tight Pipe Gate Valves, Etc.

¶ We are prepared to submit blueprints and specifications on the above or on any kind of metal buildings.

ASK FOR CATALOG



HARRY BROS. CO. of LA. New Orleans, La.

The Manhattan Rubber Mfg. Co.

HIGH GRADE
MECHANICAL RUBBER GOODS



500 CAMP STREET, :: New Orleans, La.

Miller Flushtank Siphons



Simple, Reliable, Automatic
Also Sewage Disposal
Apparatus, Automatic
Sewage Ejectors, Centri-
fugal Pump Outfits,
Sewer Jointing Com-
pounds.

PACIFIC
FLUSH-TANK CO.
CHICAGO NEW YORK

GUY R. MOLONY & CO.

General Drayage

418 GRAVIER STREET

Phone Main 6281

NEW ORLEANS, LA.

American Creosote Works

INCORPORATED

CREOSOTED

**Cross Arms, Lumber, Paving
Blocks, Piles, Poles, Ties**

Private Wharf for Ocean Vessels at NEW ORLEANS, LA.

Capacity 115,000,000 Feet B. M. Per Annum

Branch Plants:

Louisville, Miss.
Winnfield, La.

STATION "B"

NEW ORLEANS, LA.

COTTON DUCK

TARPAULINS

TENTS

DISTRIBUTORS FOR

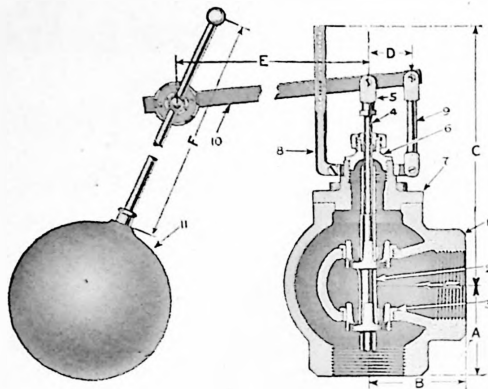
WHITLOCK MANILA ROPE

Brook Tarpaulin Company, Inc.

(ESTABLISHED 1840)

429 Celeste Street

New Orleans, La.



VALVES

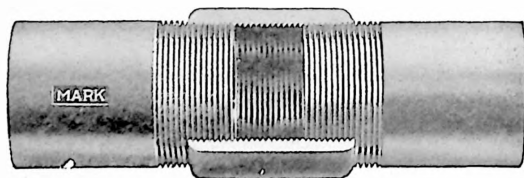
Pipe and Fittings

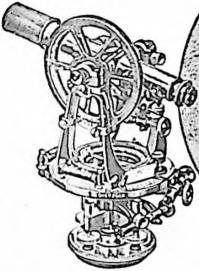
PIPE—Cast Iron

PIPE—Wrought Steel

PIPE—Wrought Iron

Dixie Mill Supply Co., Inc.
New Orleans





Transits and Levels

that will give *perfect*
service under all conditions
of use are manufactured by

DIETZGEN

—the firm with the quality reputation. *Catalog on request.*

EUGENE DIETZGEN CO.

Manufacturers
Chicago New York San Francisco
New Orleans Pittsburgh
Philadelphia

WOODWARD, WIGHT & CO.

—LIMITED—

Largest General Supply House South Since 1867

EXCLUSIVE SOUTHERN SELLING AGENTS FOR
LIDGERWOOD Hoisting Engines, Cableways and Log
Handling Machinery.

HAYWARD Orange Peel and Clam Shell Buckets.

GENERAL ELECTRIC CO. Apparatus and Supplies.

ROEBLING'S Wire Rope.

Heavy Hardware; Mill Supplies; Marine Hardware;
Cordage; Elevating, Conveying and
Power Transmitting Machinery.

OPEN DAY AND NIGHT

Howard Avenue, Constance
and St. Joseph Streets

NEW ORLEANS

SAND

GRAVEL

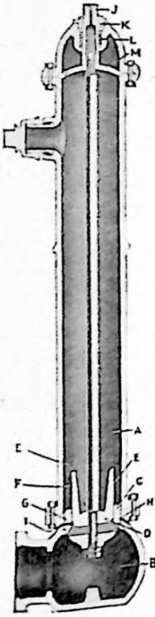
JAHNCKE SERVICE Inc.

NEW ORLEANS

Concrete and Builders' Materials
Dredging

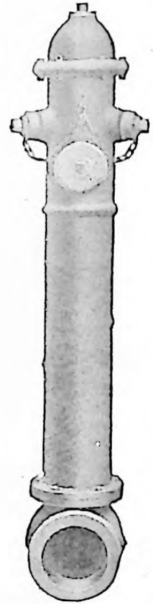
SHELLS

CEMENT

**COLUMBIAN
IRON WORKS**

CHATTANOOGA, TENN.

Manufacturers of

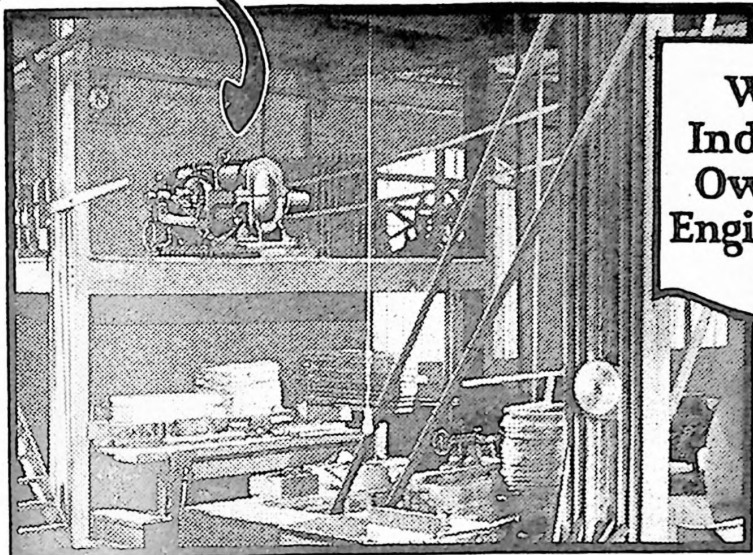
Fire Hydrants, Valves,
Valve Boxes, Sluice
Gates, Meter Boxes,
Water Works SuppliesNew Orleans Representative:
J. S. BARELLI
612 Godchaux Bldg.

COMPLIMENTS

The Anchor Packing Company

418 COMMON STREET

NEW ORLEANS, LA.



What Industry Owes to Engineering



After many years of service as a direct-current generator, this original application in the steel industry in 1891—in the Edgar Thomson Works of the Carnegie Steel Co., Bessemer, Pa.—ended its days as a motor in the pattern shop.

First in Electrification of Industry

Where Westinghouse Blazed the Trail

Steel Industry
Textile Manufacturing
Paper Making
Rubber Industry
Material Handling
Motion Picture Industry
Meat Packing
Railroading
Ship Building
And Others

In 1891 the first electric motor was put to work in a steel mill. In 1905 the first large rolling mill motor, and in 1906, the first reversing mill motor were also installed in steel mills. These motors—all Westinghouse Motors—were history-makers in the steel industry.

Other industries too have profited by Westinghouse engineering pioneering.

—In the textile industry, individual motor drive became a reality in 1902, in the Sauguoit Silk Co., Philadelphia, Pa.

—In the rubber industry, Westinghouse ideas as originally applied in 1900, are today the standard method of application in plants throughout the world.

—In the handling of materials at the world's great shipping centers, in the manufacturing of paper, in the motion picture industry, in coal mining, in meat packing, railroading, ship building—in fact, in every branch of human activity can be found progress and profits traceable directly to the pioneering of Westinghouse Engineers.

Westinghouse

ACHIEVEMENT & OPPORTUNITY



PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

VOL. X.

DECEMBER, 1924

No. 6

CONTENTS

EDITORIAL NOTES AND COMMENT :	PAGE
Water Purification	227
Surface Indicators of Oil in Louisiana	228
Silicon Steel	229
Member-Societies of American Engineering Council	230
PAPERS AND DISCUSSIONS:	
Water Purification. <i>By John L. Porter</i>	232
Discussion	251
Surface Indicators of Oil. <i>By R. A. Steinmayer</i>	257
Discussion	268
MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY	273

EDITORIAL NOTES AND COMMENT

Water Purification.—In the opening paragraphs of his paper bearing this title, Mr. Porter traces the attempts of some of the earlier civilizations to secure supplies of water which were both adequate in quantity and unpolluted in quality.

An interesting comment upon the use of water during the middle ages is contained in the statement that in the year 1550 the per capita consumption was one quart, and that by the end of the 17th century it amounted to only about two and one-half quarts. History tells us that there were mighty men in those days, and that they were mighty drinkers,—but they did not drink water. It would be safe to assume also that they belonged in the category of what, in these days, we are wont to call “the great unwashed.”

For purposes of the discussion of purification, waters which reach the surface of the earth are classified as flowing surface waters, impounded surface waters and underground waters.

Natural impurities are classified as dissolved, suspended, microscopic plant and animal life and bacteria.

Bacteria are present in all natural waters and the greater percentage of them are of a beneficial character in the processes of nature. In the question of water purification it is only those organisms capable of producing pathological conditions in man that are of interest. These forms usually reach natural water supplies through the attempt to dispose of sewage and manufacturing wastes by turning them into our natural streams.

Water purification has in general the problem of securing good water for two purposes, drinking and domestic use on the one hand, and industrial use on the other.

As indicated above, some of the impurities are in suspension and some in solution, which naturally gives rise to two classes of treatment.

Sedimentation and filtration, sometimes in conjunction with chemical treatment, are the fundamental processes. The more advanced phases of water purification involve distillation, sterilization by chemical or physical means, and disinfection.

The paper gives considerable space to the discussion of the processes of sedimentation and sand filtration as being dependent upon the colloidal character of the suspended matter and upon the colloids formed on or between the grains of sand.

A thorough discussion is given of the design and control of sand filters, perhaps the most important step in the series of processes which make up a modern system of water purification.

Surface Indicators of Oil in Louisiana.—Under this title, Mr. Steinmayer, Assistant Professor of Geology in Tulane University, presented a paper at the November meeting of the Society. The traditional method of prospecting for oil in the past was based upon observations upon the outcrops of folded sedimentary rocks. But such outcrops in Louisiana are like

unto the proverbial snakes in Ireland, and so the oil geologist must look for other indicators.

The principal ones of these surface indicators may be classified as:

- Natural Gas Seeps.
- Oil Seeps or Oil Springs.
- Salt Domes or Salt Islands.
- Mud Lumps or Mud Volcanoes.
- Sulphur.
- Mineral Springs.
- Structural Streams.
- Other Indicators of Minor Importance.

The paper then proceeds with the discussion of the respective indicators and their relative occurrence and importance in Louisiana.

Silicon Steel.—"Research Narratives" the very interesting little monthly issued by The Engineering Foundation contains an account of the invention of silicon steel by Sir Robert A. Hadfield and its very great importance in the electrical industry.

The cores of transformers are now made almost exclusively of this steel in the form of sheets. In all cases there is a loss of energy in the iron core due to the phenomenon of hysteresis.

Silicon Steel, first produced by Sir Robert A. Hadfield in commercial quantities in 1906, has in eighteen years saved in its electrical use alone, more than enough money to build the Panama Canal. Reductions in waste of energy in electrical equipment is estimated to save now more than five million tons of coal a year.

The first silicon steel transformer made for service in England has been in successful use since 1905. Its core weighs 830 pounds; if made of the best transformer iron available, it would have weighed 1120 pounds and its initial energy losses would have been more than 30% greater than for the silicon steel core. In its "ageing" process the losses with silicon steel decreased, while with the other transformer iron they increased.

Silicon steel was not an accidental discovery, nor was it the result of a "hunch" or a "happy thought." It came

through systematic research as the result of which Hadfield discovered how to combine large percentages of silicon with iron and make a special steel for much needed purposes, and the steel, when appropriately treated, developed the desired magnetic and other physical qualities.

Member-Societies of American Engineering Coouncil.—In connection with the question of duplication of dues in cases where an engineer belongs to two societies, both of which are members of the American Engineering Council, the following list of member societies may be of interest.

National Societies.

American Institute of Chemical Engineers, John G. Olsen, Secretary, Polytechnic Institute, Brooklyn, New York.

American Institute of Electrical Engineers, F. L. Hutchinson, Secretary, 33 West 39th Street, New York City.

American Society of Agricultural Engineers, Raymond Olney, Secretary, Mt. Clemens, Michigan.

American Society of Mechanical Engineers, Calvin W. Rice, Secretary, 29 West 39th Street, New York City.

State Societies.

Alabama Technical Association, Howard Duryea, Secretary, Alabama Power Company, Birmingham, Alabama.

Indiana Engineering Society, Charles Brossman, Secretary, Merchants Bank Building, Indianapolis, Indiana.

Iowa Engineering Society, John S. Dodds, Secretary, Box 202, Ames, Iowa.

Kansas Engineering Society, Ernest Boyce, Secretary, Water & Sewage Laboratory, Lawrence, Kansas.

Louisiana Engineering Society, Frank A. Muth, Secretary, 7705 Willow Street, New Orleans, Louisiana.

Vermont Engineering Society, Prof. A. E. Winslow, Secretary, Norwich University, Northfield, Vermont.

Local Societies.

Engineering Society of Buffalo, John R. Owen, Executive Secretary, Hotel Statler, Buffalo, New York.

Engineers Club of Columbus, I. D. McGuire, Secretary, Box 383, Columbus, Ohio.

Technical Club of Dallas, James B. Fowler, Secretary, 606 Central State Bank Building, Dallas, Texas.

Detroit Engineering Society, E. L. Brandt, Executive Secretary, 478 West Alexandrine Avenue, Detroit, Michigan.

Duluth Engineers Club, H. W. Richardson, Secretary, U. S. Weather Bureau, Duluth, Minnesota.

Grand Rapids Engineering Society, H. McCarty, Secretary, 625 Pleasant Street, S. E., Grand Rapids, Michigan.

Engineers and Architects Club of Louisville, George W. Hubley, 402-403 Norton Building, Louisville, Kentucky, Secretary.

Engineers Society of Milwaukee, Robert Cramer, Secretary, 1105 Vliet Street, Milwaukee, Wisconsin.

Mohawk Valley Engineers Club, Walter F. Hudson, Secretary, 222 Genesee Street, Utica, New York.

Engineers Association of Nashville, William Fitzgerald, Secretary, Commercial Club Building, Nashville, Tennessee.

Associated Engineering Societies of St. Louis, Miss C. B. Adams, Secretary, 3817 Olive Street, St. Louis, Missouri.

Engineers Society of St. Paul, G. L. Nason, Secretary, 107 E. 3rd Street, St. Paul, Minnesota.

Associated Engineers (of Spokane), A. D. Butler, Secretary, City Hall, Spokane, Washington.

Washington, (D. C.) Society of Engineers, W. G. Hoyt, Secretary, 3703 Northwest 35th Street, Washington, D. C.

Engineering Society of York, G. S. Amies, Secretary, Pollock Building, York, Pennsylvania.

PAPERS AND DISCUSSIONS

WATER PURIFICATION.

By
JOHN L. PORTER

Read before the Society October 13, 1924.

Good water for drinking purposes has doubtless been appreciated by the human race from time immemorial. Among primitive people the question of water supply was never of pressing importance except in dry regions. In these regions provision for securing and storing a supply of water became necessary. Consequently springs were sought for, wells were dug, and cisterns constructed in order that a supply of water might at all times be available.

Wells were common in ancient Egypt, Greece, Assyria, Persia and India, and from a sanitary point of view they probably furnished a safer water than could have been otherwise obtained.

Where turbid surface waters had to be employed for drinking purposes, domestic filters of unglazed earthenware or of sand stone were known to have been used by the ancient Egyptians and Japanese. Clarification of muddy water by the syphoning of water from one vessel to another by the capillary action of porous material, such as a strip of cloth, and a consequent separation of the water from this suspended matter, was well known to the ancients

As population became more dense and people began to congregate, centers of population sprang up near those places where an abundant supply of potable water was readily available and great expenditures of labor and treasure were made to collect, and to convey it to the towns.

Not only was a generous daily per capita allowance sought for, but it is to be noticed that there was unmistakable evidence of a keen appreciation of the dangers of a polluted supply. Hypocrites, for instance, who wrote upon the value of pure water some four hundred years B. C., advised boiling and filtering a polluted water before using it for drinking.

The ancient water tanks of Aden in Arabia, probably built 500-600 B. C., for the collection of surface water from the gorges of the volcanic crater at the bottom of which the old city was located, afford an example of early impounding reservoir of an elementary type.

The infiltration galleries for collecting ground water at Athens in Greece were probably constructed over 2000 years ago, and the same method is used to obtain a pure and satisfactory water supply today.

Probably no more elaborate system of water supply was provided for any ancient city than that for Rome.

Until 312 B. C. the Romans took their supply from the river Tiber, and from springs and wells in the vicinity of the city.

The increasing pollution of the river water as well as the need for a greater volume of water evidently induced the Romans to seek elsewhere for a supply.

In consequence, four groups of springs were made use of and aqueducts totaling nearly four hundred miles in length were constructed at different times during the next 600 years.

The Romans recognized the difference in purity of the several waters and used but one of them for drinking purposes. Although some of the aqueducts were destroyed at various times, some of these sources of supply were used up until the abandonment of the city in the 14th century, and even today four of the ancient sources still supply the city with water.

At various points along the course of some of the aqueducts were chambered tanks called "Castella."

These consisted of from four to twelve compartments and were called "Filtering places" by some of the earlier writers.

It is more probable that they were mainly for the purpose of reducing the head of the water and consequently causing some sedimentation. Some of these near the city served as distributing reservoirs.

During the middle ages, with the increasing density of population the quality as well as the quantity of water used in the centers of population seems to have been much reduced.

As late as 1550 Paris used only one quart of water per capital, per day, and at the end of the 17th century but two and one-half quarts per capita per day.

The resulting sanitary conditions may well be imagined.

London was first supplied in small quantities with spring water conducted through lead pipes and masonry conduits.

By the invention of the steam engine, pumping machinery of adequate power and capacity became possible. The growth of water works plants really dates from the 18th century, but little advance was made until the latter half of the 19th century.

Iron water mains came into general use early in the century. The methods employed in securing and maintaining pure water supplies have been, in a large measure, governed by local conditions.

In different countries where like physical conditions prevailed similar lines of development have not always been followed.

Mr. Allen Hazen in his book on Filtration of Public Water Supplies, states that "it is really marvelous how each country has met its problems of water supply from its own resources without much regard to the methods which have been useful elsewhere."

England has secured magnificent water supplies mainly by impounding the water of small streams in reservoirs, while in Continental Europe such supplies are hardly known. Germany has spent millions upon millions in purifying turbid and polluted river waters, while France and Austria have built hundreds of miles of costly aqueducts to secure mountain spring waters.

In the United States an abundant supply of some liquid was too often the objective point, and as a result American works are unrivaled in the volume of their supplies.

While the various tanks and reservoirs constructed by the ancients in connection with their water supply systems give evidence of their knowledge that sedimentation improved the physical appearance of the water, if not its healthfulness, still the first real step toward purification may be regarded as the

application of the straining action of sand and gravel as applied about 1829 in London and also at some of the continental cities of Europe.

In order to understand intelligently the methods employed in water purification processes it is necessary that we have a general knowledge of the composition of the various classes of natural water which require treatment. Rain water and snow before precipitation are relatively pure, but in falling through lower strata of air acquire some impurities in the form of dissolved gases and dust.

These impurities are, however, small in amount when compared with those acquired after the water reaches the earth.

Waters that reach the surface of the earth may be divided into several classes:

(1) *Flowing surface waters* consisting mainly of that water which on reaching the earth's surface flows more or less directly into streams, with some admixture of water which has soaked into the earth to reappear at lower levels as springs, which eventually join either the rivers or lakes and ponds. Such waters may be characterized as those which contain relatively small amounts of mineral compounds, more or less suspended matter and variable amounts of vegetable matter.

(2) *Impounded surface waters*, consisting of those flowing surface waters collected in natural depressions with more or less admixture of underground waters which emerge from the earth as springs, thus producing waters intermediate between those of the flowing streams and the underground waters. As a result of their lack of flow the suspended matter is largely removed in them by sedimentation.

(3) *Underground waters*. The water which soaks into the earth penetrates more or less deeply according to the geological conditions and in doing so loses all of its suspended matter, but, on the other hand, in flowing through the earth it takes into solution varying amounts of chemical compounds. For convenience the impurities in water may be divided into classes according to the sources from which they are derived. The first broad classification separating those impurities resulting from natural agencies from those produced by human life or activity.

Natural impurities may be again divided into dissolved impurities, suspended impurities, microscopic plant and animal life and bacteria. The solvent action of water upon the seemingly insoluble constituents of the earth's crust is enormous, aside from its erosive action, although erosion frequently assists the solution of the mineral compounds by reducing them to a finely divided state.

Disintegration of minerals, like orthoclase for example, gives Sodium and Potassium; dolomitic limestones may furnish Calcium and Magnesium, and clay ironstone and pyrites may give up Iron, Aluminum and Silica. The acids with which the above bases are usually associated are Carbonic, Hydrochloric and Sulphuric Acids, and are derived in the same way from the disintegration of the minerals in the rock strata. More or less Carbonic Acid is derived from the air and from the oxidation of carbonaceous matter in the breaking down of organic matter.

Minute quantities of Nitric Acid are obtained in the same way.

The oxidation of Sulphur in minerals produces Sulphuric Acid in many cases. Sulphates, Chlorides, Nitrates, Carbonates and Silicates exist as such in enormous quantities in the earth's crusts and are dissolved directly by water with which they come in contact. Suspended impurities in natural waters consist of fine sand and silt and a large class of so-called colloidal suspensions, which possess peculiar properties and which are of considerable importance in connection with water purification problems.

For example: Silica is found in this State in many natural waters, especially those containing Sodium and Potassium Carbonates. The Silica compounds characteristic of the clays show a marked tendency toward the colloidal state, and render the problem of the purification of turbid waters of this class almost a study by itself.

Compounds of Iron and Manganese are not infrequently met with in the colloidal state in natural waters and offer some of the most interesting phases of water purification work.

Organic matter found in natural waters is probably always present in this form to a greater or less degree. In many of our

natural waters a luxuriant growth of algae and diatoms is found at certain seasons of the year. They occur in both still and running water. Accompanying the growth and also the decay of certain of these organisms, bad odors and tastes frequently develop. It is not probable, however, that impurities of this nature in natural waters produce disease in human beings when swallowed in drinking water, but their presence frequently renders the water unpalatable.

Even lower in the scale of plant life than the diatoms and algae are found the bacteria. They are present in all natural waters, being the most numerous in surface waters, and much less so in ground waters. By far the greater number of bacteria play a beneficent role in the economy of nature, and appear absolutely essential to many of the normal processes of development of both plants and animals.

A few species, however, are associated with disease in animals and human beings. So far as the contamination of water is concerned, it is only the organisms capable of producing pathological conditions in man that are of interest. These virulent forms usually reach natural waters through the medium of domestic sewage and manufacturing waste. Impurities derived from waste material in natural waters are the results of the attempts of man to dispose of sewage and manufacturing waste in the easiest manner possible; i. e., to turn it into the natural water courses. In this way much of the surface water in thickly settled land areas has become polluted with material dangerous to the health of human beings who may drink the water thus contaminated.

Ground water as well as surface water may become polluted by sewage. In many industries waste materials are produced which in many cases are likewise turned into the streams and lakes, frequently rendering them totally unfit for human consumption. The purification of water by natural agencies is to some degree at least an established fact. Sedimentation by lowered velocities in a flowing stream or comparatively quiet lake or pond may remove considerable suspended mineral and organic matter. Sunlight is a powerful germicide and also a bleaching agent and many highly colored waters are rendered

lighter colored when exposed to the sun and air in natural lakes or artificial reservoirs. Oxidation of carbonaceous matter also probably occurs.

Many dissolved salts may be deposited from solution by a change in physical conditions under which solution was effected, or by the mixture and interaction of different waters.

Natural purification is also largely effected by the lower forms of both animal and plant life in their life cycle.

The isolation of the specific organisms of many water-borne diseases and the tracing of many epidemics of such diseases to the use of polluted waters is so well established through many years of study and observation that I will not take it up at this time further than to state that it has been the main incentive to the development of the various methods of water purification now in general use throughout the world.

In general, water purification is resorted to for two general purposes, i. e., drinking and culinary purposes, and industrial purposes. The impurities in water which it is necessary to remove are in suspension, and solution and purification methods fall naturally into two classes in consequence.

For the removal of matters in suspension, two processes are employed, namely, sedimentation and filtration. When properly controlled these processes are able to purify waters of very poor quality with a certainty that has established these methods upon a scientific basis. Mineral matter in suspension can be entirely removed as well as practically all of the organic matter, which latter includes the bacteria.

Chemical agents may or may not be employed to facilitate either or both of these processes. The chemical compounds used in this connection are mechanical agents exclusively, and merely assist and hasten in bringing together finely suspended matter into larger masses which will settle and filter out with greater ease.

For the removal of dissolved impurities such as salts of lime and magnesia, chemical agents are usually resorted to. Oxidation by aeration is effected in precipitating easily oxidizable soluble salts such as those of iron and less frequently manganese. Filtration usually follows sedimentation and is carried

out in various ways. Sand, gravel, coal, coke, charcoal, porous tile, and sponges have been and are still used for filtering media.

Only sand and gravel, however, are commonly employed in large filtration plants. Other methods of purification employed are those of distillation and sterilization by chemical or physical means. Distillation is obviously the most perfect method of purification, but not necessarily the most desirable. Its cost makes it prohibitive for all large supplies.

Disinfection and sterilization present the most advanced phase of water purification and furnish methods of great practical value for supplementing other methods, as well as some cases furnishing themselves all the purification needed.

The very practical importance of sedimentation in water purification has caused the conditions which influence this apparently simple phenomenon to be carefully studied and much has been written on this phase of the problem. Particles of different size and weight have different subsiding values which are in turn affected by temperature, velocity of flow through the settling basins, wind, area of bottom surface exposed to receive sediment, etc.

The result of these studies has been that settling basins should be designed and arranged so as to prevent, as far as possible, the mixing of incoming water containing suspended matter with the partially clarified water in the basin. This is best obtained by proper baffling and further, the size of the basins should be sufficient to prevent scouring action, i. e., the picking up and carrying along of particles of sediment already deposited.

The collection of minute particles of suspended matter into larger aggregates is a process which appears to occur only to a limited extent in natural water, although it may be artificially produced by the addition of certain chemical compounds. Since the deposition of these finely divided particles is an essential step in most purification processes, the phenomenon is of much practical interest and importance in water purification.

The analogy between the physical properties of liquid suspensions of certain chemical compounds and those of turbid

clay-bearing waters is so marked that some description of these properties is of interest.

Dr. A. A. Mayes described colloidal mixtures as non-viscous, non-gelatinizing, but readily coagulable as "colloidal suspensions." He regarded them as really suspensions of minute particles and not true solutions. He differentiates further by describing those mixtures in which the particles may be visible under the microscope as "microscopic suspensions," reserving the term "colloidal suspensions" for those containing particles beyond the limit of microscopic visibility.

Natural waters furnish many examples of colloidal suspensions. Most turbid waters in their natural condition may be considered as mixtures of microscopic and colloidal suspensions. A beam of light passed through a natural clay-bearing water, even after the water has stood for many weeks, is plainly visible in the same manner as when a sunbeam passes through the air. This is a fairly good proof of the presence of minute particles in suspension which reflect the light from their surface. Colloidal suspensions of gold and arsenious sulphide artificially prepared act in a similar way to a ray of light.

Another property of colloidal and microscopic suspensions apparently depending upon the presence of electric discharges upon them is seen in the migration of the colloidal particles by the passage of an electric current through the mixture.

Turning now to another important property of colloidal suspensions in the general, viz., their coagulation, we find that turbid natural waters possess similar properties to colloidal suspensions artificially prepared. Non-electrolytes do not have the power of coagulating colloidal suspensions, but all electrolytes will do so with the proper degree of concentration of the latter and a sufficient length of time. Acids, bases, and salts, therefore, will coagulate colloidal suspensions all being more or less disassociated in the aqueous solution and capable of conveying an electric current. In a similar manner Hydrochloric Acid, Caustic Soda, Caustic Lime or an ordinary salt solution will each, if of the proper concentration, coagulate the colloidal clay of a naturally turbid water. It must be remembered in dealing with the natural waters that we are working

with extremely dilute solutions of salts, even in those waters which we commonly speak of as high in soluble compounds, in other words, the concentration of the electrolyte is very low.

The similarity between artificially prepared colloidal suspensions and the very small suspended particles characteristic of turbid waters seems to warrant the classification of the latter mixtures with the former. If we seek further analogies in the coprecipitation or absorption by colloids of other substances in solution and suspension with them, when these colloids are coagulated the true character of turbid waters seems more apparent.

When a turbid water containing carbonates of lime and magnesia in solution is treated with sulphate of alumina, for example, a reaction results setting free aluminum hydroxide. The liberated aluminum hydroxide absorbs or mechanically traps the finely divided material in suspension, and in the course of time the finer particles come together to form larger particles which settle out readily. This process of coagulation of the colloidal clay suspensions and coprecipitation of the larger suspended particles appears to be started by the coagulation of the aluminum hydrate.

The time factor in the coagulation of turbid waters is an important one. The length of time required to bring about the proper degree of coagulation varies with the different waters. It is influenced by the character of the suspended colloids, by the kind and amount of salts in the solution, by the quantity of coagulating chemical used, by the temperature of the water, and by the agitation to which the mixture is subjected. The presence of much organic matter may retard the formation of the floc. Observations of different natural waters have shown a variation in time from ten minutes to four or six hours as necessary to produce satisfactory coagulation.

Another phenomenon common to the coagulation of turbid waters in the absorption of the applied chemical compound by the flocculent material produced by the reaction and the associated suspended matter. The particular significance of this fact in water purification was early recognized, since it entails some loss of chemical on account of this property.

The "schmutzdecke" or gelatinous surface which forms on the top of the slow sand filters is doubtless a true colloid, and by its absorptive power removes the organic and inorganic suspended matter. Where the amount of suspended inorganic matter is small, the natural colloid formed on the surface of the sand grains in the upper section of slow sand filters is usually able to remove all the suspended matter, but where the amount of clay is larger this does not always suffice and frequently it fails entirely to produce a clear effluent.

When this type of water is met with, some means must be resorted to to reduce the turbidity to a point where a natural colloid produced on the slow sand filters can handle it, or coagulation and sedimentation must be resorted to before filtration.

It was very early found that where artificial colloids were produced by coagulation with chemicals much more rapid rates of filtration and coarser sands could be used than with waters which were susceptible of filtration without preliminary treatment. This has resulted in two distinct types or systems of water purification, the older one, which has been developed largely in Europe with relatively clear waters and consisting in filtration of the water, with or without previous plain subsidence, being called the English or slow sand filtration system, and the other or newer one developed almost entirely in this country being known as the American or rapid sand filtration method.

Later an intermediate type has been used somewhat, using relatively small amounts of coagulants at times of high turbidity with the slow sand filters. Slow sand filters are usually operated at rates of from 2,500,000 to 3,500,000 gallons per acre per 24 hours, although as low a rate as 1,500,000 gallons per acre per 24 hours is sometimes used and occasionally as high a rate as 6,000,000 or 8,000,000 gallons per acre per 24 hours.

The rates at which rapid sand filters are operated vary widely, the usual rate being about 125,000,000 gallons per acre per 24 hours, although it may be 40% less or 25% more in some cases.

The primary function of a filter is that of mechanically straining out suspended particles. These particles may and

usually do vary greatly in size. It can be readily understood how particles larger than the interstices of the sand bed will be strained out. It is not so easy to understand how particles with diameters of perhaps .0001 MM, and even much smaller, are removed. The submicroscopic particles are much smaller than the bacteria and yet a filter is able to strain them out of a water in which they are suspended.

The filtering action of the sand bed must, therefore, be attributed to the properties of the colloids deposited or formed on and between the sand grains composing it. The colloidal state of matter can be considered as a mesh structure, or a sort of porous framework built up within the sand bed. Through it water diffuses readily, but suspended colloids contained in the water will be held back. Thus bacteria and inorganic suspended solids are unable to pass through the mesh-like structure of the colloids attached to the sand grains or are held back by adhering to the surface of the colloidal matter upon the sand.

There must, therefore, come a time in the operation of any filter when the interstices of the sand becomes so clogged with suspended matter that water can only pass through it at a much reduced rate, or, on the other hand, when the colloids within the sand bed are unable to restrain further any suspended matter in the applied water and it passes through the filter producing turbid effluent. Both of these conditions are commonly met with in filter operation with both slow and rapid filters.

Slow sand filters as usually constructed are water-tight basins on the bottom of which are laid terra cotta pipes with open joints leading to a main effluent pipe provided with some means of controlling the rate of flow. Around and over these under-drains is placed a layer of graded gravel and over this, in turn, is placed the sand layer consisting of particles of high insolubility such as quartz sand to a depth of 30 to 40 inches. The size of the said grains as well as their uniformity is of prime importance and must usually be adapted to the particular water being handled for best results. Sands generally used for filter purposes have an effective size varying from .20 to .50 millimeters in diameter, i. e., the size of that group of

sand grains than which 10% of the entire sand is smaller. The variation of the size of sand grains in a given filter or group of filters should not be too great, i. e., the uniformity coefficient should be low.

In slow sand filters when the sand becomes too clogged to permit the passage of a sufficient quantity of water, or when the quality of the effluent falls below the required standard, it becomes necessary to remove this material in order to maintain the quality and quantity of the effluent. This is done by scraping off the surface layer of sand, usually from $\frac{1}{2}$ inch to 1 inch in thickness and removing it for future washing, or washing it and returning it immediately to the bed, thus providing a fresh surface layer of sand to collect and retain the suspended matter. This washing is now usually effected by passing the sand through water ejectors.

Rapid sand filters or mechanical filters, as they are sometimes called, are used almost exclusively in this country since most of the waters to be purified carry more or less clay and silt, and frequently require softening.

The question of land values is another important factor in the tendency towards the use of rapid sand filters, as they require only from 2% to 3% as much area as the slow sand filters.

The development of the whole method of rapid sand filtration really dates from the Louisville investigations in 1896-97, although several filter companies had been building small plants for a number of years previously.

In the development of the modern rapid sand filter purification plant, many problems in Mechanics and Hydraulics, as well as in Physics and Chemistry, have had to be solved, and the present type plant is the result of the studies and investigations of many men.

As previously stated rapid sand filters are operated at rates vastly higher than slow sand filters, and consequently become ineffective in far shorter periods of time, necessitating much more frequent cleanings.

Obviously the methods used in renovating slow sand filters would be inapplicable and other means must be employed; the method adopted being to wash the sand bed in place by forcing

clean water up through it at a relatively high velocity, accompanied in some cases by some form of agitation, either air or mechanical stirrers or rakes.

In the earlier plants built rates of about four (4) times the normal rate of filtration or a vertical rise of 1-14 inches per minute were used, usually with the agitation. Later, higher rates, 7 to 8 times the normal rate of filtration, were used, and no other means of agitation of the sand bed was found necessary.

The high rate of filtration and washing necessitated very radical changes in methods of filter construction from those employed in slow sand filters.

Tight under-drain systems had to be employed so designed as to give a uniform distribution of wash water over the whole filter area; more elaborate rate controllers had to be designed to regulate the rate of filtration; and wash-water gutters or troughs had to be provided to carry away the waste water from the wash containing the accumulated sediment of the period of operation.

These high wash rates also necessitated some means of preventing the gravel layers from being displaced and mixed with the sand and then allowing the sand to pass through the under-drain system and thence into the effluent.

The first type of filter bottom designed consisted of a pipe manifold beneath the floor of the filter tank with bell-mouth openings into the filter to further distribute the water. Over these gutters were perforated plates, the number and size of the perforations being carefully designed to provide the necessary uniformity of wash rate. Above these plates were relatively shallow layers of graded gravel in valleys formed in the bottom of the filter. Over the top of the ridge blocks forming these valleys was bolted down a layer of bronze screen cloth to hold the gravel in place; and on this was placed the layer of filter sand from 24 to 20 inches in depth.

This type of filter bottom, while very efficient, was relatively expensive, and in some plants, where softening was not resorted to, was found of insufficient durability.

The first step to eliminate these troubles was to employ a much thicker layer of gravel, using gravel at the bottom, and to leave off the bronze screen cloth entirely. This proved entirely satisfactory.

The next step has been to simplify the under-drain system and has been handled in various ways in recent designs. In general the tendency has been back towards the perforated pipe manifold on top of the filter bottom similar to that used by the filter companies in their commercial units. In some cases at least it would appear that uniformity of distribution of wash water was being sacrificed to simplicity of design and cheapness.

In the design for the extensions at the Carrollton plant in New Orleans, attempts have been made to insure better distribution of pressures with the pipe grid system by using curved inlets utilizing the velocity head of the flow in the main passage and laterals.

In the earlier installations, hand set constant rate controllers were used, which within their limits gave very satisfactory results. In most cases they depended on maintaining a fixed head over an orifice with its attendant absorption of head. The need for variable rate control soon caused the development of controllers which could automatically change the rate of filtration to meet operating conditions; and the relatively high loss of head in the orifice type of controller led to the development of the Venturi type of controller, which is the most generally used today.

In all of the variable rate controllers, as first constructed, there was a greater or less tendency to overreaching or pulsation at each cycle, which was considered objectionable by many engineers, and finally led to the design of a non-overreaching or non-pulsating type of controller.

At New Orleans, however, with variable rate controllers designed by Mr. Earl, which had a marked tendency to pulsation, excellent results have been obtained. In fact, it is felt from the results of observation covering many years, and comparison of results obtained at New Orleans with results at other cities in the matter of economy, i. e., length of run and per-

centage of wash water required, that pulsation of rate is distinctly desirable in that it prevents the sand bed from packing too much and consequently clogging too rapidly.

At the Algiers plant, where non-pulsating Venturi type controllers were recently installed, this effect seems to be demonstrated, as somewhat shorter runs are the rule with the new filters as against the old filters, other conditions being the same.

In filter operation at plants where softening is resorted to, another condition develops which requires attention, viz., the growth of the individual sand grains by accretion of the hardening constituents being removed from the water, which coarsens the sand bed and eventually requires its renewal.

The coarser sand will pass more water between washes and consequently results in economy of wash water, but will not satisfactorily remove all traces of turbidity from water that is not for any reason perfectly prepared for filtration, or from a water carrying an excessive amount of coagulated material.

The normal rate of filtration of 125,000,000 gallons per acre per 24 hours is frequently being exceeded somewhat today in many plants. At New Orleans during the past few years, due to the increased consumption of water, particularly during the summer months, this rate has been continuously exceeded on an average by 10% and frequently for months at a time by 25 and 30% and occasionally for several days by 50%, with daily peaks of 75%.

The early completion of the new filter units, construction of which is now well under way, will afford ample capacity at more reasonable rates for many years to come.

Although most water purification plants today follow filtration with some sterilization, generally using chlorine gas or one of its compounds, filtration is usually considered the final step in most water purification processes, the success and economy of which depends equally upon the proper preparation of the water for filtration, whether coagulation alone, or softening, either wholly or in part, is resorted to.

No two waters from different sources behave the same under the same conditions of treatment, i. e., using the same type and size of settling basins and using the same chemical treatment,

and frequently water from the same source if treated in different types or sizes of basins will require somewhat different chemical treatment, and even then give quite different results.

In designing plants for economy of operation and efficiency of results, it is therefore essential that a thorough knowledge of the water to be handled be obtained. Where coagulation of muddy waters alone is desired the question of the action of the several commercial coagulants must be ascertained and the most economical treatment applied. Where softening is desired, accurate knowledge of the variation and limits of the hardening constituents is necessary, as well as the character of this hardness.

The proper treatment of water with chemicals depends upon the reliability of apparatus for applying the chemicals, particularly where a variable rate of purification is used. Two distinct types of apparatus have been developed for feeding the chemicals to the water in proper proportion, known generally as dry feed and wet feed. In dry feed the finely powdered chemicals are fed from storage hoppers to feeding hoppers, where mechanisms operated in various ways measure volumes of the chemicals and discharge them into a funnel where a small stream of water dissolves and carries them into the main body of water to be treated. In the wet feed process relatively large amounts of the chemicals are weighed out and placed in tanks, where they are dissolved or made into suspensions and fed as a liquid through apparatus which regulates their flow in proportion to the amount of water being treated. Both systems have their advantages and disadvantages, and many plants employ each method.

The wet or solution method has always been used at the New Orleans plants with good satisfaction, and it is planned to continue its use in the new units.

The method and time, or order, of adding chemicals is of considerable importance also. Most plants using Lime and Iron Sulphate as chemicals apply the Iron first, while at New Orleans much better results have always been obtained by applying the Lime first. Where Soda is used for more complete softening it is added with the Lime. The effect of Hydrogen

Iron concentration is of considerable importance and attention is being paid to it quite generally today.

It was early recognized in plants using Lime that an over-treatment with that chemical produced much more efficient coagulation with the same amount of coagulant than when just the proper amount was used. This has led to another variation of treatment in some of the more recent plants, when part of the water is very much overtreated and then mixed with the untreated or undertreated balance of the water.

The proper design of settling reservoirs is of great importance in order to afford the maximum available settling capacity, cut down scouring action, and short cutting of the water and afford economical means of sediment removal, particularly in plants handling very muddy waters. Most plants have basins with sloping bottoms and one or two sumps connected by pipe lines to a lower point of discharge or to pumps which draw out the mud and discharge it wherever desired. This method, of course, means intermittent cleaning and reduced settling capacity during the later period of operation.

Some basins have been constructed with bottoms constructed in valleys and ridges with drain connections to each valley. Such basins are intended to be operated continuously, the mud sliding down the steep slopes of the valleys to the sumps very readily and without removing the supernatant water. This type of basin is, of course, relatively expensive, especially where soil conditions are unfavorable.

Recently another method of continuous basin operation has been developed using a specially designed basin with a power-driven scraper which draws the sediment continuously towards the center, where it can be drawn off either continuously or intermittently by the usual methods. This method is in use at present at several small plants and is being included in the design of several large plants.

Water treated with Lime and a coagulant, or if it contains much Sulphates with Lime, Soda and Iron has been found entirely satisfactory for most domestic and industrial uses until comparatively recently.

The use of such water for certain purposes, such as hot water and ice water systems in hotels, office buildings, etc., and for ice making without distillation, as well as for use as a boiler water in the more modern types of water tube boilers has not, however, been entirely satisfactory, and means have had to be developed to remove more of the scale-forming ingredients than the ordinary methods of softening can do.

Dr. R. Gens, in his studies on soils, found that certain compounds called zeolites, more especially that class which he described as Aluminate-Silicates, had marked absorptive powers for exchange of bases when hard waters were filtered through them. He was able to produce artificial zeolites which showed even greater absorptive power than the natural.

Under the trade name of Permutite this compound has been placed on the market as a water softening agent, with marked success. Waters containing salts of Calcium and Magnesium interchange these bases for the Sodium of the permutite, thus becoming free from these hardening constituents, while containing an equivalent amount of Sodium salts, which are relatively more soluble and do not form scale in boilers or hot-water pipes or precipitate out when the water is chilled to below 40 degrees in cold-water systems.

These softeners will not satisfactorily handle waters with any turbidity nor waters containing any caustic lime. They are regenerated by treatment with salt solution.

Special permutites have been developed for removal of manganese from certain waters; although the more common methods are similar to those used successfully for iron removal from some natural waters in which these troublesome elements sometimes exist, such as aeration, treatment with lime and aeration, and trickling and contact filters.

As an adjunct to the usual methods of purification and as an easily available means of making safe waters which may be occasionally polluted, but which are not normally treated in any other way, disinfection or sterilization has within the last decade been widely applied.

The most commonly used sterilizing agents today are chlorine gas, chloride of lime, ozone and ultra-violet rays.

Chlorine is by far the most generally used today in this country, though considerable chloride of lime and some sodium hypochlorite is also used. The last two methods are relatively expensive and are but little used.

The amount of chlorine necessary for efficient results is very small, 15 to 35 parts per million or $1\frac{1}{4}$ to 3 pounds of gas per million gallons of water treated.

DISCUSSION.

THE PRESIDENT: I told you water purification was important. You have heard the paper by Mr. Porter. Does anyone wish to discuss it? I would like to hear some discussion on this paper, because I will be frank to confess I did not understand all of it. I learned a lot though.

A MEMBER: I notice that at Rochester, New York, they are putting iodine in the water, and I would like to inquire if any is being used at New Orleans, or if its use is contemplated?

MR. PORTER: No salts of iodine have been used at New Orleans, and its use is not contemplated, as sea foods contain iodine, and there is not the need for it. Furthermore there is also a certain small amount of iodine which gets into the river water by sea water being picked up as spray and carried inland in the clouds and deposited as rain.

THE PRESIDENT: Mr. Porter, do they treat the city water with chlorine?

MR. PORTER: Yes; they use about a pound and three-quarters to a million gallons.

THE PRESIDENT: It doesn't add any taste to the water?

MR. PORTER: Not in the amounts generally used. The only time you get a taste is when oil gets into the water. Occasionally fuel oil gets into the river in an excessive amount, and sometimes causes a bad taste, in combination with the chlorine. The phenol compounds give, in combination with chlorine, a taste about a thousand times as powerful as the gas itself. In certain quantities, the oil in the water, in combination with the chlorine, produces the taste.

THE PRESIDENT: Oil, itself, wouldn't cause the taste, or chlorine itself, wouldn't?

MR. PORTER: Oil itself, wouldn't, or chlorine, itself, wouldn't in the quantities usually found; but, the two in combination would. Wherever we have any new pipes, we have that condition until the entire coating has been thoroughly extracted by the water. That taste is produced by the action of the chlorine treated water, on the tar coating of the pipes.

THE PRESIDENT: Is there any other question?

MR. RANTZ: I would like to find out, in the case where water is artificially cooled, and the salts precipitated in the pipe to a large extent, when the water is re-circulated, what remedy is suggested to clear these pipes. Is there anything we can do to clear them out?

MR. PORTER: It can be made all right by removing enough of the salts from the water so that the water is not affected by cooling and then it will start to pick up salts again.

THE PRESIDENT: It will actually take the scale out?

MR. PORTER: Yes.

MR. RANTZ: How are we going to get them to drink the water while we are taking it out?

MR. PORTER: The water you speak of isn't any worse than the water you see in the big buildings today. If we turned out that kind of water for people to drink we would be run out of town. The remedy is some further treatment of the water before putting it in the pipes, either where it is used in hot or cold water systems. All softening processes are based on the solubility or rather insolubility of the hardening constituents in the water. That is further dependent on temperature. If you change the temperature conditions you have one set of conditions which cause an excessive deposit in the pipes, tending to fill them up. In the matter of cold water in the pipes there is very little deposit in them, but there is a certain amount of a compound zinc-calcium carbonate produced in the water, which makes it turbid. I have seen water in office buildings down town with one hundred parts per million of turbidity. You must prevent precipitation, and that can be done in a number of different ways. It can be done in certain cases by introducing carbonic acid.

MR. WEIL: If you have seen some of that work you will find in a great many office buildings in the city or in hotels that they introduce Permutite filters for the prevention of scale in hot water lines, also in ice water tank systems. You will find that, in the Hibernia Bank Building, Bienville Hotel, Maison Blanche, they are getting away from the trouble you refer to. The things which causes the trouble are calcium and magnesium salts, and in softening the water these salts are completely removed from it. That method is being used both in boiler plants and hotels, wherever deposits in pipe lines and boiler tubes is to be avoided.

MR. RANTZ: Do I understand you to say that they have eliminated it in the Hibernia Bank Building?

MR. WEIL: In the Hibernia Bank and Maison Blanche buildings softeners were recently installed, and no longer than a week ago I was talking to the Managers of the Hibernia Bank Building and the Maison Blanche, and I understand from them that the principal trouble they are having is the clogging of the lines, due to the throwing down of the scale. Mr. Porter can tell you that it prevents the further formation of the scale. In these buildings you will find that the cutting down of the scale is along those lines.

MR. RANTZ: They go along with very nice water, and eventually some of the scale peels off and gets down into the water, and we have real turbid water; then a general kick goes up, and the old water is run out, and we have it cleaned out and we have very clear water for a few days, or maybe a week or two, and then the same thing would happen over again. I saw some of the pipes that were taken out of there that were very nearly closed up, and often times the opening in the pipe wasn't over a quarter of an inch. I would like to ask also if it forms quicker in galvanized pipe than in black steel pipe. It has been my observation that it has been much greater in galvanized pipe.

MR. PORTER: It takes place more in galvanized pipes than in black pipes. While the water is approximately neutral there is some slight corrosive tendency of the water, which acts continuously on black iron pipes and, where there is a tendency to corrosion, there is no tendency to deposit. Galvanized pipes are not subject to corrosion by the constituents in the water, but

there is a tendency to form at first a compound salt with the zinc coating in the galvanized pipe, and the calcium carbonate that remains in the water, and that coating gradually causes the further deposition of salts which in an open vessel, would not be withdrawn from the water. Where the service pipes are not subject to heavy enough draught, that deposit goes on rapidly. I have seen, in office buildings downtown, galvanized pipes nearly closed up where cold water passed through them. We have hundreds of feet of galvanized pipe around the plant carrying water in enormous quantities, and there is relatively very little deposit in these pipes. It was attempted to design the pipe lines for the amount of water they were to carry. Where there was a specific flow it appears pretty much to prevent an excessive deposit. In a house pipe, where the flow is very small, and for hours at a time there is no flow at all, there is a tendency to cause it. Another cause of stoppage in the pipes is not the choking of the pipe as a whole, but the closing of the pipes where joints are made. No matter how well the pipe is galvanized, when it is cut off and threaded the galvanizing is destroyed at that point, and some corrosive action takes place. They brought me, some time ago, pieces of hot water pipes from the St. Charles Hotel that were stopped, as they said, with scale. There was a piece of inch and a half, and one inch pipe. The coating didn't look like a filling up with scale, such as I had often seen. I took those pieces of pipe to the machine shop and split them in two, and found that the filling up was not continuous. I found in every one of them where a rust tubercle was completely filling the pipe, and there was not a thirty-second of an inch of scale on top of the rust. That was due to defective galvanized iron. The galvanizing blistered, and rust formed and filled the pipe and choked down velocity to a point where deposition could take place.

THE PRESIDENT: Is there any other question, or discussion?

A MEMBER: What velocity is necessary in any pipe to prevent scale?

MR. PORTER: I don't think they have any definite figures. We always aim to get as high velocity as we can, without producing more friction than we can stand for. I should say two or three feet per second is all that is necessary to prevent the scale.

THE PRESIDENT: It is fact, isn't it, Mr. Porter, that the scaling takes place much quicker where the water stands in the pipe?

MR. PORTER: Yes.

THE PRESIDENT: Even though there is a less amount of water coming in contact with the pipe?

MR. PORTER: Yes. The trouble in cold water pipes is, in a number of these big buildings, intensified very much by the fact that, in order to keep the water cool, it is circulated back and forth through some sort of a cooling device. I figured it out in the case of the new Post Office, that they were circulating that water over forty times a day. If they were consuming a thousand gallons a day, they were pumping forty thousand gallons. It went through the pipe lines forty times before it was used, and any tendency to pick up any material in the pipe line was multiplied. While the water might have been good at the end of a week, that water has picked up a good deal of sediment. The water is good for some days, then the people complain, and they wash it out and start over again. That condition, in cold water systems, can be taken care of by putting in some type of a small sand filter between the circulating pump and the circulating system. The permutite system is undoubtedly the best commercial system available today for such work. The minute you get rid of the scale forming material, you start in on your corrosion. The complete softening of water by the permutite system is not producing perfect water however. The fact must be recognized that, the minute you stop scale formation, you start corrosion. It will be more pronounced in a black pipe than it will in a galvanized pipe.

THE PRESIDENT: Is there anything else anyone wants to say?

MR. WEIL: We would like to hear from Mr. Adams about the installation in the new power station.

MR. ADAMS: In our case we evaporate water that we want for boiler water and don't want any soluble salts. The old method of treating the water was fairly effective, by removing incrustants, but not as effective as we wanted it to be so that we could see that water in the boiler without getting too high a concentration. Our present system is to evaporate. That allows us to cut down insoluble salts and scale forming ingredients,

and we can take care of the small amount of scale forming material that comes in through our raw water. But it is an entirely different problem from either industrial softening of water, or water for office buildings, because we have an entirely different set of conditions. We have less failing of boiler tubes with our evaporating system, and there is very little heat loss because heat is obtained in condensing the steam, and returned to the system. So that really, the only heat lost is lost through radiation. There is not so much loss inflicted by the water. We have practically eliminated priming, and any scale formation in the boilers, except in cases where we have to handle city water. Of course, at times we have a very small amount. We evaporate water at a very high rate per square foot of heating surface, and it is absolutely necessary to have our scale forming material as low as two-three grains per gallon. A thirty-second of an inch of scale will bag a tube in our oil-burning boilers. We are putting in an additional treatment now to take care of the raw water that gets into the condensers, by using a filter. We have cut our tube loss down to a comparatively small amount, about seventy-five per cent, by that process. We have less trouble with the salts. We are improving our process a little all the time.

PROFESSOR GREGORY: Gentlemen, I wish to say that one of the reasons why we have such a large crowd tonight is that the Senior class of Tulane in engineering is here. When they heard of this paper, like all the rest of us, they wanted to come down and hear what Mr. Porter had to say. I am sure they have enjoyed it. Of course, when they came to me and begged to be allowed to come here tonight, I told them to come as guests of the Society. That is the reason they are here. Ordinarily they spend Monday nights studying hydraulics. On this occasion they came down here to hear the work of a master, and that accounts for them being here.

THE PRESIDENT: We are glad to see them all here.

COL. GARSAUD: I move a rising vote of thanks to Mr. Porter for his very interesting paper.

THE PRESIDENT: You have heard the motion. All in favor of that will please rise. Mr. Porter, you are well thanked.

"SURFACE INDICATORS OF OIL" IN LOUISIANA.

BY

R. A. STEINMAYER

Read Before the Society, November 10, 1924.

In view of the fact, that many Louisiana engineers are constantly in the field, engaged in land surveys, drainage, flood control irrigation, and related engineering projects, they have had in the past and may have in the future opportunities to observe, recognize, and study some of these so-called "Surface Indicators of Oil," indicative of the occurrence of oil. Thus the scope of this paper is to present to the engineers some of the fundamental physical characteristics of these so called "Surface Indicators of Oil," which may have a definite or relative bearing upon the commercial accumulations of oil in the adjoining or immediate locality of their occurrence, in order that they may recognize them. Many times new oil and gas fields have been discovered by engineers co-operating judiciously with reputable geologists.

The fundamental prerequisite of the field man, in search of "Surface Indicators of Oil," whether geologist or engineer, is a mind trained to think and eyes trained to see; eyes to note the topographic forms and the mind trained to recognize their significance, in as much as, generally, surface indicators and surface folding are indexes to underground conditions. Conversely one is the causation and the other is the accompanying physical effect. This fact is accepted, as generally, the basis upon which the science of Oil Geology has been founded. And, therefor, the field man whether geologist or engineer, in search of "Surface Indicators of Oil," must look for the topographic expression of the physical effect.

In the past much has been said and written about the surficial structural conditions under which commercial accumulations of oil may be found in nature. And assuming that outcrops of folded sedimentary rocks were present, the work of the oil geologist simplified itself into the problem of observing the rocks and noting their structural arrangement for the reasons that,

1.—“Commercial oil and gas deposits occur in the higher parts of folds or wrinkles of the earth's surface called anticlines, domes, monoclines, etc.”

2.—“Water is always found in the same stratum as the oil but in the lower part of the fold.”

3.—“All commercial deposits so far have occurred in sedimentary or water laid deposits such as sands, sandstones, conglomerates, shales, and limestones.”

4.—“All oil and gas deposits, so far as known, are capped or covered by practically impervious beds of shale, sandstone, or limestone, also such deposits are underlaid by impervious beds.”

But, the almost complete absence of outcrops of the common type of indurated stratified rocks in Louisiana, with the exception of a limited area in the northwestern part of the state, where the younger Cretaceous rocks have been pushed near the surface by a prehistoric secular movement, eliminates the possibility of making a detailed surficial study of the rocks and their structural arrangement, and the field man must seek other Surface Indicators of Oil.”

The principal, “Surface Indicators of Oil,” of this state may be classified as follows:

- 1—Natural Gas Seeps.
- 2—Oil Seeps or Oil Springs.
- 3—Salt Domes or Salt Islands.
- 4—Mud Lumps or Mud Volcanoes.
- 5—Sulphur.
- 6—Mineral Springs.
- 7—Structural Streams.
- 8—Surface Indicators of Minor Importance.

Natural Gas Seeps

In some localities in Louisiana, especially in the broad flood plains of the Mississippi, bubbles of gas arise in minute quantities through silt and water to the surface of streams. Although gas, in itself, does not always constitute a criteria as to the proof of the existence of oil in a locality, it does show, however, that conditions are favorable for oil. Very frequent-

¹Practical Oil Geology-Hager.

ly non-hydrocarbon gases, such as, sulphur dioxide and carbon dioxide, and gases or air bubbles arising from submerged amphibians, crustaceans, and reptiles are mistaken for natural gas. They may be easily identified as combustible gases in noting whether they are inflammable.

Marsh gas (Methane) taken from lake beds and swamps has often been considered a good sign of petroleum and led to oil excitement, but marsh gas, we know, exists at the present time, in many localities in Louisiana where petroleum does not exist.

Natural gas was first recognized, in this state, in seeps near Red river in Caddo parish, many years before wells were drilled there for oil or gas, the commercial development of which did not occur there until 1904.

Oil Seeps or Oil Springs.

Oil seeps and springs are commonly found in lowlands, swamps, springs, or along the banks of small bayous. Seeps and springs are differentiated from one another, in as much as, in the case of the former the fluid has no perceptible flow as it comes from the ground; while the latter does have a perceptible flow. Seeps and springs of oil have often been uncovered by engineers in excavating ditches and canals for irrigation and drainage purposes. The oil seum is usually found as an iridescent film on the water. Very often, however, investigators have found that novices have mistaken iron, manganese, or vegetable seum for oil seum. It is important to remember that a drop of oil in water will form as an iridescent film arranged in concentric circles expanding from the center. An oil seum is thin and very cohesive which upon being disturbed or agitated will not break into small particles characteristic of vegetable or inorganic seum. Generally, an iron film can be distinguished from an oil film either by its odor or taste.

The engineer will naturally ask why oil seeps are so seldom seen in Louisiana. The principal reason is that there has not been enough fissuring to permit the oil to reach the surface which is usually covered thickly with alluvium or other non-productive beds.

In 1915 a classification of seeps or oil springs was proposed by De Golyer, as follows:

- 1.—See pages associated with igneous intrusions.
 - (a) At contact zones of volcanic plugs and sedimentary rocks.
 - (b) At contact zones of dikes and sedimentary rocks.
 - (c) Through cracks and fissures in igneous rock itself.
 - (d) As intrusions in the igneous rock.
 - (e) From metamorphosed rock above an intrusion which does not outcrop.
- 11.—See pages not associated with intrusions.
 - (a) At crest of domes or anticlines.
 - (b) Along marked fault or fissure planes.
 - (c) From steeply dipping strata.
 - (d) Isolated occurrence of uncertain relationship.

In the bulletin of the Louisiana Geological Survey of 1899, G. D. Harris states that, "A spring formerly existed at the place now occupied by the saw-mill on Belle Isle, which furnished an oil that was highly esteemed in the neighborhood for its medicinal qualities. Capt. Lucas reported a slight amount of oil in several of the wells bored by him on this island."

Salt Domes or Salt Islands.

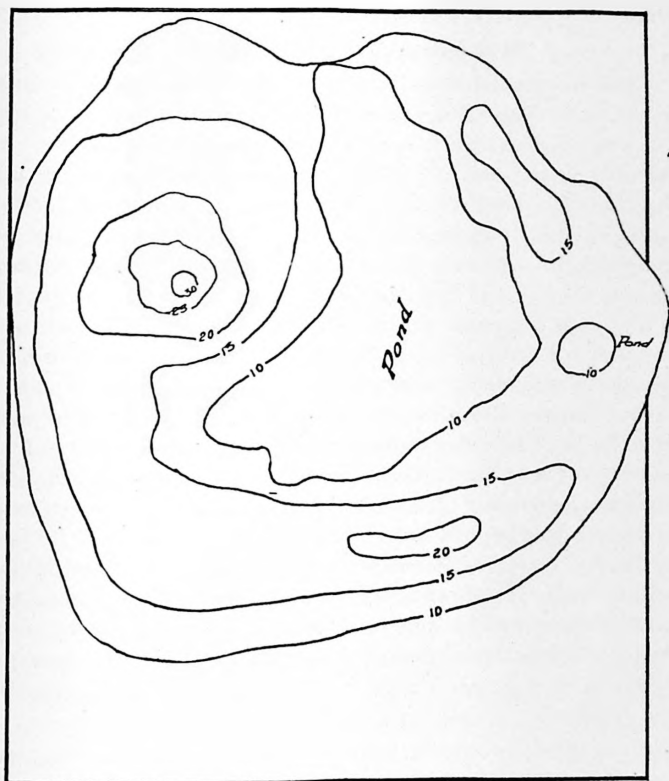
The surface relief of a salt dome is generally a circular or nearly circular mound rising above the general prairie or swamp. The mound in many cases has a marked central depression and they are sometimes partly or wholly obscured by erosion. The mean diameter of the mounds may vary from a few hundred feet to a number of miles. It is not uncommon in connection with salt domes to find ridges on either side or both sides of the dome, in most cases, the salt dome seeming to rise from the ridge. These ridges are broad and low and of a variable width; sometimes extending only a few feet above the surrounding country. And in a few cases they are known to connect salt domes.

The first salt dome in Louisiana was drilled in 1896 by Lucas, for Joseph Jefferson on the Jefferson estate now known

¹Bull. of the Louisiana Geol. Sur. 1899 p. 138.

as Jefferson Island. Because of the presence of mineral spring water at the surface, Jefferson conceived the idea of health giving water. Lucas discovered salt on this mound in varying

*Sketch-map showing Surface Topography
of the
Vinton Salt Dome*



depths from the surface. In 1897 Lucas extended his operations to Belle Isle and Grand Cote, where surface conditions were similar to those which he had seen at Jefferson Island. During explorations at Belle Isle, Lucas discovered, in the cap

rock above the salt, indications of petroleum and sulphur. And it was chiefly Lucas's interest in the sulphur that led him to continue his work in Texas, principally Spindle Top, where he found surface indications similar to those existing at Five Island, and after due exploration the first gusher came in at Spindle Top January 1900, at the rate of 125,000 barrels per day.

The accompanying sketch-map shows the surface topography of a typical oil producing salt dome.

Mud Lumps or Mud Volcanoes.

Conspicuous mud cones formed by the outwelling or extrusion of mud. The value of mud lumps or volcanoes, as an evidence of oil, has been frequently questioned; and as yet not definitely established. Mud lumps are known to exist in but one locality in the United States namely; at the mouth of the passes of the Mississippi river. And from reports made by geologists and engineers it is definitely known that gas is continually seeping, and this fact leads us to infer the association of oil. It is also quite probable that the mud lumps are not, necessarily, associated with natural gas or oil, but that they may occur secondarily where only small quantities of marsh gas are confined below the muddy strata. Shaw's hypothesis is¹, "The mud lumps are produced by a gentle seaward flow of layers of semi-fluid clay under the land and the shallow water nears the ends of the passes, where this flow is opposed by the comparative resistant foreset beds."

The full details as to the processes forming the mud lumps will not be fully known until much more field work in the nature of deep test borings have been made. And until then, the various hypothesis involving volcanism, faulting, the accumulations of rock salt (embryo salt domes), oil and sulphur are all plausible explanations as to their formation.

²It is definitely known, however, in foreign countries that there is a relation to mud volcanoes and oil, Mud volcanoes are found in the vicinity of the oil fields of the Apsheron, Crimean and Taman Peninsulas of Russia, in Venezuela, Colombia, at

¹Prof. paper 85-U. S. G. S.

²Day's Handbook of the Pet. Ind. Vol. I.

Mimbu and on the Island of Ramri in Burma, and also to some extent in Rumania and Poland.

Day says that in certain gas wells, of great volume, in the Caddo field in Louisiana, where the formations are comparatively soft, have broken loose and run wild for years, throwing water and mud into the air, and we may assume that these wells may be of similar internal structure to natural mud volcanoes but they are evidences of gas and not oil.

Sulphur.

In Louisiana oil has been found associated, in more than one instance, with sulphur. And in most cases calcium sulphate, (Gypsum) forms the cap rock for the greater majority of the salt domes, leading geologist and chemist to advocate some inorganic relation between oil and sulphur. According to their theory the action of hot water upon limestone and gypsum, which in nature are closely associated, give as products the constituents of petroleum. The exact chemical reaction, has as yet, not been definitely explained.

"In 1839 Dr. William M. Carpenter states that, 'in low lands bordering on the Calcasieu river there are numerous springs of petroleum.' These were the petroleum springs which finally led to the discovery of sulphur near Lake Charles. One of the wells at the sulphur mines yields a small quantity of petroleum which during sulphur operations was collected and barreled. About 1868 the Louisiana Oil Company was formed to exploit the oil and gas springs in the fresh water swamp at the head of Bayou Choupique, about 15 miles west of Lake Charles. The well which the company sunk was unsuccessful, so far as oil and gas was concerned, but revealed extensive deposits of sulphur."

Mineral Springs.

Mineral waters, especially those impregnated with a high content of chlorine and hydrogen sulphide gases, are frequently sought and used for "Surface Indicators of Oil." It is known that many of the saline springs in Louisiana from which much evaporated salt was obtained during the Civil War and earlier are now prolific oil producing fields. And several large oil producing companies are now making a practice of sampling all spring water.

Structural Streams.

Perhaps no oil field better illustrates the value of the topographic criteria than does the Gulf Coast field, where the earlier salt domes were located chiefly by the presence of low mounds or depressions and peculiar drainage lines.

The general laws governing the relationship between drainage and topography were aptly stated by V. E. Monett as follows:

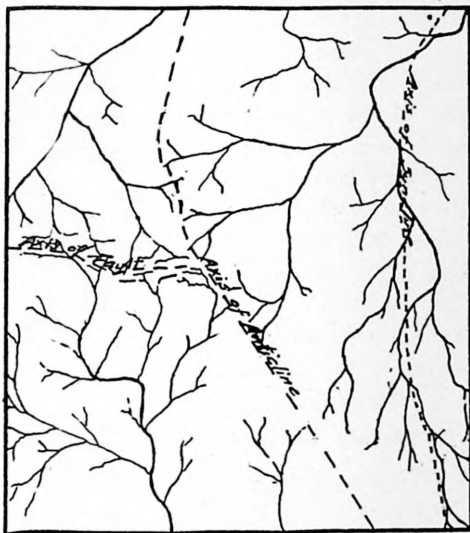
1. "A brief review of the physiographic laws governing the relation of the surface features to rock position shows that: (1) In region of horizontal or nearly horizontal sedimentary rocks, the relief may be slight or considerable, but the hills tend to be of uniform height and have uniform slopes. The streams are more or less equally developed and are dendriti (tree like) in appearance. (2) In gently folded sedimentary rocks (dips less than 20 degrees) the resistant rocks form low ridges with a gentle dip slope in the direction of dip of the rocks and a steeper slope in the opposite direction. The main streams flow in relatively straight lines following the formation in the direction of the strike. The hills may be of irregular shape and of different elevations; and may be either synclinal or anticlinal structure. (3) In closely folded sedimentary rocks the hills are all of the narrow ridge type and may be long straight ridges or zig-zag ridges. They are steep on one side and have gentler slopes in the direction of the dip of the rocks. The drainage is of the block type with small weak streams flowing at right angles to the strike and the main streams running parallel to the strike on the weaker rocks. The ridges are of unequal heights, and synclinal mountains are perhaps more common than anticlinal mountains.

Oil pools occur under all of the above three structural conditions. Rock outcrops and key horizons are usually abundant where dips are steep, so that topographic evidence is only made use of to the fullest extent where the type of folding is intermediate between case 1 and case 2 discussed above. A statement of the relation existing under such condition would

¹Topographic Criteria of Oil Field Structure, by V. E. Monett. Bulletin of The American Association of Petroleum Geologists. Vol. 6 page 37.

be about as follows: When a considerable vertical section of more or less homogeneous sedimentary rocks are thrown into very gentle folds and eroded, the anticlines and domes will

*Semi-Dendritic Drainage Pattern
in
Gently Folded Sedimentary Rocks
Showing the
Anticlinal Axis Corresponding with Topographic Highs
and the
Major Stream Following the Synclinal Axis.*



correspond approximately with higher topographic areas, and the streams will tend to follow the synclinal axes. True domes will give a radial drainage pattern."

In all probabilities all of the petroliferous structures in Louisiana are intermediate between the fore-mentioned case 1 or 2 or are true domes, and their characteristic drainage lines would either follow the synclinal axis or have a radial symmetry of pattern. See the accompanying sketch map.

Surface Indicators of Minor Importance.

A few of the, "Surface Indicators of Oil of Minor Importance," may be classed as follows:

- (A) Soil or Sands Impregnated or Stained With Oil.
- (B) Steeply Dipping Surficial Strata.
- (C) Surface Indicators of Uncertain Relationship.

A—Soil or Sands Impregnated or Stained With Oil.

Soil and sands impregnated and stained with oil are not commonly found in Louisiana, although they may occur in the drainage basin and areas of extinct oil seeps and springs. It is rarely probable that the soil and sands are visibly petroliferous, because of the evaporation and oxidation of the oil which has taken place. Occasionally when the evaporated oil has had an asphaltic base it is sometimes possible to note the brown or brownish black stain in the sand. And where the oil residue, mixed with sand or soil, is still moist the mixture is soft and plastic, and the odor of petroleum may be detected in the disturbed material. In any case of doubt as to the certainty of the stain being oil it is advisable to test for the same by what is known as the "Shaking out process," with chloroform or carbon tetrachloride.

B—Steeply Dipping Surficial Strata.

In a few instances, in Louisiana, structural folding favorable to the formation of oil is reflected at the surface in the steeply dipping strata of the overlying material. Precaution should be taken to note for certainty that the apparent structural dipping of the strata is not due to unconformities, cross bedding, or slumping of the overlying mass.

(C) Surface Indicators of Uncertain Relationship.

Under the general classification of Surface Indicators of Uncertain Relationship may be classified vegetation and fossils i. e., as to their presence, absence or character.

Summary of the Major Crustal Uplifts in Louisiana and Their Respective Oil and Gas Fields.

The occurrence of the oil fields in Louisiana on the flanks of the great centers or lines of uplifts, emphasizes the fact that all American oil fields occur on minor folds in regions contiguous to centers or lines of disturbances. The distinct uplifts and domes of this state may be placed in four groups and are classified as follows: (1) Sabine uplift, which occupies the northwestern part of the state, including Caddo, Bossier, DeSoto, and Red River parishes. On this uplift are the Caddo Oil and Gas Field, Shreveport gas field, Elm Grove gas field, DeSoto-Red River oil and gas field, Bethany gas field, and Bellevue oil field. (2) Ouachita uplift, not as pronounced structurally and less extensive really as the Sabine uplift. It includes part of Morehouse, Union and Ouachita parishes in the Northeastern part of the state. The Monroe gas field occurs on this uplift. (3) Isolated Domal Structure, which occur between the Sabine and the Ouachita uplifts and includes the Homer and Haynesville fields. (4) Saline Domes, which comprises all of the pronounced supposedly salt mounds which may or may not rise above the general level plain of the prairies or swamps where they occur. The majority of the Saline Domes in Bossier, Bienville, Natchitoches, and Winn parishes are eroded, non-productive, steeply dipping domes. However, in the Gulf Coast region of Louisiana and Texas, there are more than 40 productive low saline mounds, such as, the oil fields occurring at Vinton, Edgerly, Welsh, Jennings, and Anse La Butte.

The structure of the gas fields of Terrebonne and Lafourche parishes has never been definitely determined but are thought to be salt domes.

In general all surface indications brought about by two sets of processes, continually in operation on the surface of the earth, are favorable to the accumulation of oil. These two processes have been designated Diastrophism and Vulcanism. The former includes all movements of the outer part of the lithosphere, whether slow or rapid, gentle or violent, slight or extensive; and the latter with all processes concerned with the

movement of lava and other volcanic products, whether extruded or intruded into the outer part of the lithosphere. The two may be closely associated for local movements are often associated with volcanic eruptions.

And, it may be readily seen, that all of the so-called, "Surface Indicators of Oil in Louisiana," owe their existence or formation to crustal deformations of the outer part of the lithosphere, resulting either in: (1) Fissuring or faulting, which later become the avenues for the escaping gas, oil, or mineral waters, in the form of seeps or springs. (2) Underground folding which may be reflected at the surface in the form of domes, anticlines, synclines, or monoclines. Or (3) Complex Folding, which may have been caused primarily by secular movements followed by a secondary folding due the crystallization of salt brought by water through a fault or fissure resulting in so great an expansion that the formation overlying the salts is bowed upward forming domes.

DISCUSSION.

THE PRESIDENT: Gentlemen, you have heard the paper. Is there anyone that would like to discuss it, or ask Professor Steinmayer any questions?

PROFESSOR GREGORY: I would like to ask Professor Steinmayer about some mounds near Lake Charles. You can see them from the train; you can see them better from the rice fields I traveled over. They have a diameter varying from ten to fifty feet; they are almost absolutely circular, and the soil comprising those mounds is of a very different texture from that of the fields. The rice irrigators out there tell me that the water seeps into the earth through those mounds very readily, and they have been a source of wonder as to how they were formed, and whether they have anything to do with gas or petroleum.

PROFESSOR STEINMAYER: According to your description, if the mounds only have a diameter of ten feet, I think they are too small to be classified as salt domes.

MR. SCHWARTZ: May I ask you in what locality, that is, at what point of the vicinity of the salt dome they place their test hole?

PROFESSOR STEINMAYER: They found, by actual experience, that it takes forty holes to test a salt dome. Usually the place to find oil would be towards the outer flanks of the mound, because the center of the mound represents the structural high, and where you would expect to find oil is where the salt has been pushed up through the sedimentary rock. Where you will find that, depends on local conditions. It is a good idea, and the practice of drillers, to locate the test wells towards the outer edge or flanks of the mounds.

Q. Is it generally found above the deposit of salt?

A. At this juncture of sedimentary rock and the salt core, is where you may find oil.

Q. Was the Jefferson Island project of any value?

A. Not as far as the general idea of oil was concerned; it was originally drilled for the health giving water there.

Q. But for petroleum?

A. There is no petroleum on Jefferson Island. They found salt, but not petroleum. They are drilling at the present time a few miles northwest of Jefferson Island.

Q. Around Avery Island?

A. No, it is around Kaplan.

Q. May I ask you an amusing question,—is the famous Teapot dome a salt dome?

A. That is a question—I am sure the Teapot dome is not a salt dome; it is a structural dome, i. e., folded sedimentary rocks.

PROFESSOR ROBERT: Are there any other questions?

A MEMBER: Is there any relation between the deep well mounds and oil? I heard some discussion about the California fields?

PROFESSOR STEINMAYER: Yes. I think there would be some relation between the production of oil and sub-structural formation.

A MEMBER: Do you know whether or not the salt mounds in Louisiana check up on the California investigations?

PROFESSOR STEINMAYER: I couldn't say.

PROFESSOR ROBERT: Have any indications of oil ever been found around any of those mud lumps you speak of at the mouth of the Mississippi river?

A. I brought out the subject of mud lumps as a subject for discussion. The mud lumps may be surface indications of oil or gas, and may not be either. At the present time we have not had enough deep test borings to tell whether these lumps were formed by oil, gas, salt or sulphur, or whether they are due to the flow of the semi-fluid clay, and I wish some one would go down and drill on these mud lumps, because it would be of scientific value to all scientists, and the engineers.

PROFESSOR ROBERT: Speaking about those mud lumps, I remember an experience I had on one of them once. If Mr. Alexander were here he would remember this very vividly too. He and I started out over Southwest Pass to find a natural gas well. A shipwrecked sailor came in and told us there was one out there. We nearly lost our lives. We got out and found a peculiar thing. Of course, the water was shallow, not over three or four inches deep, and it was absolutely fresh water all around there, and we found this particular mud lump in the center of it, with a great big hole in the ground, about that big around, through which gas was boiling. I ran my arm down in that hole, and that water was as cold as ice, and it was salt water, and it left a trail of salt as it ran in the sea. Incidentally, that is the trip on which I shot my first pelican. I wanted to examine one, and I examined it about five minutes, and regretted it for twenty-four hours. I don't think there is any one thing in the world that has more lice on it than a pelican, unless it is another pelican.

PROFESSOR STEINMAYER: Engineers have found gas coming from places of this sort, and the gas has been analyzed. Of course, the question is, is it marsh gas or natural gas. There is such a wide variation between the two that is hard to state whether it is one or the other, without analyzing the gas.

MR. BURWELL: Have they had any indications of oil East of the Mississippi?

PROFESSOR STEINMAYER: I remember an occasion where a well was being drilled near St. Francisville. There are possibilities of finding oil, but just what the probabilities are remains to be told. All oil in here is found either on the flanks of the major uplift in isolated dome structures, or on salt domes.

PROFESSOR ROBERT: Are there any other questions?

MR. KLORER: What is your theory about the cause of the oil pond just off the coast of Texas, and West of the Sabine jetty? There is an area in the gulf, an oil pond half a mile long, and the pilot boat generally tries to get into this oil pond in rough weather. In stormy weather it is noticeable that there is always a smooth water surface in that particular section. Some people think it is connected with the Spindle Top area. I don't know whether it has ever been brought to your notice.

PROFESSOR STEINMAYER: That particular case has not been brought to my notice, but G. H. Harris predicted oil fields in the Gulf. (Refer to page 19 of the Bulletin No. 7 of the Louisiana Geological Survey). Just the exact locality, I can't recall at the moment. Of course there may be a seepage of oil there that comes to the surface, that accounts for the oil pond. Do you know whether the oil has ever been tested?

PROFESSOR ROBERT: It seems to have a very pronounced oil seum, and I think there is as much as eighteen feet of water there; between twelve and eighteen feet of water?

PROFESSOR STEINMAYER: I think it is due to an oil seepage, a marine oil seepage.

PROFESSOR ROBERT: Is there any other question that anyone wishes to discuss any further? Is there any other business to come before the meeting? I am sure we all appreciate Professor Steinmayer's paper.

PROFESSOR STEINMAYER: I would like to bring up another question. I want to ask the engineers whether, in their experience in sub-surface structures they have ever found any evidence of boring in the retaining piling and wall? In sea water or in fresh water? The reason I bring out this question, a short time ago we completed a classification of some fossil shells that were given to me by Professor Gregory, and they were entirely channeled by some boring animal. I would like to find out whether

these marine boring animals also bore in rock sub-structures of any nature. Of course we know they have in the case of wood, but have the engineers noticed any boring in concrete?

PROFESSOR ROBERT: If they could bore into wood, they might be able to bore into concrete.

MR. LANPHIER: There is a borer that bores in soft lime rock. It was noticed at West Rigolets Light Station.

MR. DELERY: Mr. Porter at the Purification Plant claims to have found a borer in concrete. I found, in the drainage operating department of the Sewerage and Water Board, we had a lead sheath cable, copper on the inside, and that was perforated by some borer pretty thoroughly in a half dozen places. That was at the New Basin.

PROFESSOR STEINMAYER: I was wondering whether we had a borer of concrete and limestone in this locality.

MR. LANPHIER: I think they had a case of that kind at Gulfport. I think some concrete over there was attacked similar to the teredo attacking wood.

PROFESSOR ROBERT: Is there any other question?

MR. GARSAUD: Mr. President, I move a vote of thanks to Professor Steinmayer for his very interesting paper.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Minutes of Board of Direction, October 13, 1924.

The meeting was called to order with President Robert in the chair, and Messrs. Moses, Hamilton, Kerr, Lanphier, Garsaud, Barelli and Muth were present.

The minutes of previous meeting were read and approved and bills on hand were ordered paid.

The Treasurer was authorized to purchase \$750.00 worth of Homestead Stock and the Secretary was instructed to write the Treasurer authorizing such purchase.

There being no further business the meeting then adjourned.

FRANK A. MUTH, Secretary.

Minutes of the Regular Meeting of the Society, October 13, 1924.

The meeting was called to order at 8:10 p. m. with President Robert in the chair; and 67 members and guests were present.

The minutes of previous meeting were read and approved.

• Professor Gregory made announcement of the work the Committee on Licensing of Engineers was doing indicating that the Committee was making substantial progress.

The technical exercises of the evening was an interesting and instructive paper on Water Purification, by Mr. John L. Porter, which was followed by considerable instructive discussion. A rising vote of thanks was tendered the speaker.

President Robert announced that the members of the Society and guests would proceed in a body to the Victor Restaurant, where arrangements had been made by the Secretary for a light luncheon which was enjoyed by all. This innovation was the result of an editorial in the Proceedings.

The meeting then adjourned.

FRANK A. MUTH, Secretary.

Minutes of Board of Direction, November 10, 1924.

The meeting was called to order with President Robert in the chair, and Messrs. Moses, Lanphier, Hamilton, Barelli and Muth present.

Minutes of previous meeting were read and approved and bills on hand were ordered paid.

Communications from the American Engineering Council were read and the Secretary was instructed as to reply to be made to each. With reference to the letter of November 8th, relative to duplication of dues the Secretary was instructed to furnish the American Engineering Council with the names of all members of the local chapter of the American Society of Mechanical Engineers who are members of the Louisiana Engineering Society and to request the Editor of the Proceedings to issue a notice inviting all members of our Society to advise the Secretary of the names of the member societies to which they belong.

There being no further business the meeting adjourned.

Minutes of the Regular Meeting of the Society, November 10, 1924.

The meeting was called to order at 8:10 p. m. with President Robert in the chair; 47 members and guests were present.

The minutes of previous meeting were read and approved.

Professor W. B. Gregory made report on the work being accomplished by his committee in conjunction with the Louisiana State Board of Engineering Examiners in regard to the licensing law for engineers. With this report as a basis of action, on motion duly seconded, it was voted that the Committee be requested to continue its labor and make further report.

The technical exercises of the evening consisted of a very interesting and instructive paper on "The Principal So-Called Surface Indicators and Their Relation to the Occurrence of Oil," by Professor R. A. Steinmayer.

An interesting discussion followed and the speaker was tendered a rising vote of thanks.

The meeting then adjourned to the collation served at the Victor Restaurant.

F. A. MUTH, Secretary.

Minutes of the Board of Direction, December 8, 1924.

The meeting was called to order by Mr. J. S. Barelli, who was requested to act in the absence of the President and the Vice-President and the following were present: Messrs. Hamilton, Moses, Lanphier and Muth.

The minutes of the previous meeting were read and approved and bills on hand were ordered paid.

The following members were dropped with the understanding that they can be reinstated by payment of dues: W. T. Drew, C. K. Dunbar, N. C. Erwin, H. H. Holloway, L. J. Fortier, Lee G. Bird.

The resignation of Mr. A. T. Gomila was accepted with regret.

On motion duly seconded, the following names were ordered to ballot after carefully considering the recommendations of the Committee on Membership:

Resident Members: Mr. Walter J. Barnes, Mr. Harry B. Bowles, Mr. Frank P. Broussard, Mr. Roger E. Chesnut, Mr. Charles Davis, Mr. George J. DeGarmo, Mr. Archibald L. Dunlap, Mr. Francis W. Gavin, Mr. Lafayette F. Griffith, Mr. George R. W. Lewis, Mr. Thomas Smith, Jr., Mr. Reinhard A. Steinmayer, Mr. Wayne D. Steward, Mr. Charles McD. Townsend, Mr. Bryson Vallas.

For Reinstatement Resident Members: Mr. Edward C. Hyatt, Mr. Charles Johnson.

For Resident Associate Member: Mr. Edward R. Greenlaw.

Junior Member: Mr. John S. Burke, Mr. John W. Emrich, Mr. Edwin Frank, Mr. Gilbert T. Gray, Mr. Robert J. Kuhn, Mr. Charles R. Maduell.

Student Member: Mr. Salvador di Benedetto, Mr. Percy L. Bernstein, Mr. Lester B. Clark, Mr. James M. Crocroft, Mr. Edwin E. Elam, Mr. Charles J. Fritchie, Mr. Vic. F. Hartel, Mr. Edmund F. Hughes, Mr. S. Lawes Kleinpeter, Mr. Francis A. Landrien, Mr. Leo. L. Lowentritt, Mr. J. F. Nunenmacher, Mr. Philip Phillips, Mr. Everett G. Roessle, Mr. Lewis M. Shelton, Mr. Joseph F. Thomson, Mr. John M. Walker, Jr., Mr. Albert G. Wyler.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of Regular Meeting of the Society, December 8, 1924.

The meeting was called to order about 8:10 p. m. by Mr. E. S. Lanphier, Director, who had been requested by the Board to act as chairman in the absence of the President and Vice-President, 49 members and guests being present.

The minutes of previous meeting were read and approved.

Report was made by Professor W. B. Gregory, Chairman of the Committee appointed in connection with proposed legislation concerning licensing of engineers and he gave details of work of the committee indicating substantial progress. On motion duly seconded, it was voted to permit the Committee to employ a stenographer to take minutes of their meetings when desired.

The next business was balloting for nomination of officers for the ensuing year. As a result of the ballot the following officers were nominated:

President, Col. Marcel Garsaud.

Vice-President, Mr. F. P. Hamilton.

Treasurer, Walter B. Moses.

Secretary, Frank A. Muth.

Director to serve three years, Orlando P. Adams.

The technical exercises of the evening consisted of a very interesting paper on "A General Discussion of Highway Location," by Mr. J. C. Carpenter, Assistant District Engineer, U. S. Bureau of Roads, Fort Worth, Texas. The paper was illustrated with a number of lantern slides. An interesting discussion followed the reading of the paper. A rising vote of thanks was tendered the speaker.

The meeting then adjourned to the collation served at the Victor Restaurant.

F. A. MUTH, Secretary.

PROCEEDINGS OF THE LOUISIANA ENGINEERING SOCIETY

DECEMBER, 1924

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

	PAGE
Lester F. Alexander & Co.....	4
Allis-Chalmers.....	6
The American Cement Machine Co., Inc.....	5
American Creosote Works, Creosoted Timber.....	14
American Creosoting Co., Inc.....	12
The Anchor Packing Co.....	17
H. Bodenheimer & Sons.....	9
Brook Tarpaulin Co., Inc.	14
Canal-Commercial Trust & Savings Bank.....	3
Columbian Iron Works.....	17
Concrete Steel Company.....	9
W. G. Coyle & Co.....	9
Creosoted Materials Co., Inc.....	10
Dixie Mill Supply Co., Inc.	15
Eugene Dietzgen Co., Surveying Instruments.....	16
Gaiennie Company.....	5
Geo. J. Glover Company, Inc.....	7
Greenlaw Truck and Tractor Co., Inc.....	11
Harry Bros. Co. of La., Galvanized Iron Tanks, etc.....	12
Hattiesburg Creosoting Company	10
Robert W. Hunt & Co., Engineers, Chemists, Inspectors.....	10
Jahncke Service, Inc.	17
Kittredge-Waters Supply Co., Ltd.....	5
A. M. Lockett & Co., Ltd.....	8
The Lufkin Rule Co.....	3
The Manhattan Rubber Mfg. Co.....	13

INDEX TO ADVERTISEMENTS—Continued.

	PAGE
Albert A. Martinez, Southern Yellow Pine.....	Inside Front Cover
Guy R. Molony & Co.	13
John H. Murphy Iron Works	8
New Orleans Bank and Trust Co.	11
New Orleans Blue Print and Supply Co., Inc.	13
Ole K. Olsen, Concrete and Structural Steel.....	7
Pacific Flush-Tank Co.....	13
Shakspeare Iron Works	3
The Tulane University of Louisiana.....	4
The Tulane University Press, Printing.....	6
Turnerized Roofing Co.....	Outside Back Cover
Westinghouse Electric & Manufacturing Co.	18
Woodward, Wight & Co., Railway and Mill Supplies.....	16

This Journal reaches the officials with whom rests the responsibility for the bulk of the municipal, state and industrial works in Louisiana and the surrounding territory. Its advertising pages afford you an effective and dignified means of cultivating a wider acquaintance among prospective buyers.

WHEN
YOU BUY
A

LUFKIN

Measuring Tape

YOU MAY BE SURE THAT

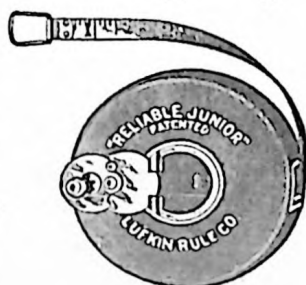
You have an ACCURATE and DURABLE tape of a brand that has given universal satisfaction for years and that the maker guarantees direct to you.

Send for catalogue.

Saginaw, Mich.

THE LUFKIN RULE CO.

New York,
London, Eng.
Windsor, Can.



OLDEST BANK IN THE SOUTH

When considering new banking connections,
remember to consult with the

CANAL - COMMERCIAL TRUST & SAVINGS BANK

New Orleans

SAVINGS - COMMERCIAL - TRUST

Capital and Surplus - - - \$7,000,000.00

MEMBER FEDERAL RESERVE SYSTEM

Phone Main 541

913 Girod Street

SHAKSPEARE IRON WORKS JULIAN M. SWOOP, Proprietor

Machinery Repairs Given Prompt Attention

Grey Iron Castings, Brass Castings
Plantation Sugar Mill Repairs a Specialty
Blaksmith Work of all Kind

Pattern Making Grate Bars—ordinary or circular

WE WELD ANY PARTS OF BROKEN MACHINERY

PHONE MAIN 541

NEW ORLEANS, LA.

LESTER F. ALEXANDER,
M. La. Engr. Soc.
M. S. A. M. E.

J. L. DICKEY,
M. Am. Soc. C. E.
M. La. Engr. Soc.
M. S. A. M. E.

LESTER F. ALEXANDER & CO.

CIVIL ENGINEERS and CONTRACTORS

**River and Harbor Improvements
River and Gulf Towing**

Barges, Derricks and Pile Drivers

830-32-34 Maison Blanche Annex. New Orleans, La.

Phones—Main 4195-1967

TUGS - Boswell, H. H. Colle, Wm. F. Flanders, Panther.

TULANE UNIVERSITY OF LOUISIANA NEW ORLEANS

Located in the choicest residential section of the South's leading city, with climatic and other advantages enjoyed by no other institution of equal rank, offers superior instruction in standard college courses, and in Engineering, Law, Medicine, Pharmacy, Dentistry, Art, Music, Domestic Science, Household Economy, Commerce and Business Administration. Separate department for women in the Newcomb College. Extensive laboratories, many scholarships in under-graduate colleges for men and women. Board and accommodation in dormitories at low rates. Twenty-four buildings. Campus of 100 acres. Full descriptive catalog, or a bulletin of any college sent free upon application. Address The Registrar, Tulane University, New Orleans, La.

Telephones Main 1495-1496

Kittredge-Waters Supply Co., Ltd.

Machine Shop

Engineer and Mill Supplies

422-424 Common Street

New Orleans



CONTRACTORS' EQUIPMENT

All Sizes from 5 ft. to 22 ft. Gas, Steam or Electric.
Ask about the BOSS High Drum two-bag Mixer.

THE AMERICAN CEMENT MACHINE CO. (Inc.) Keokuk, Ia.

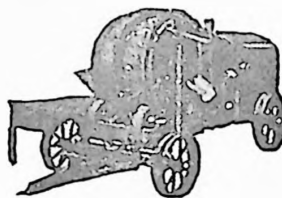
CARRIED IN STOCK BY

OLE K. OLSEN

822 Perdido Street, New Orleans, La.

Pavers, Grouters, Building
Mixers, Hoists, Back - Fillers,
Elevators, Pumps, Carts

Low Prices - Cash or Terms



\$325 Buys Low Charger

Gaiennie Company

STEAM HEATING
HOT WATER HEATING
MOIST AIR HEATING
GAS STEAM HEATING
PLUMBING
PLUMBING SUPPLIES

ESTIMATES FURNISHED UPON APPLICATION

Howard Avenue and Baronne Street
Phone Main 4020

ENGINEERS

We are Official Printers of the
Louisiana Engineering Society,
and make a specialty of the
PRINTING needs of Engineers

Tulane University Press

QUALITY PRINTERS

PHONE WALNUT 82



POWER, ELECTRICAL and INDUSTRIAL MACHINERY

ELECTRICAL Machinery, Steam Engines, Steam Turbines,
Condensers, Gas Engines, Oil Engines, Hydraulic Tur-
bines, Pumping Engines, Centrifugal Pumps, Mining
Machinery, Metallurgical Machinery, Crushing Machinery,
Cement Machinery, Flour Mill Machinery, Saw Mill Machinery,
Air Compressors, Air Brakes, Steam and Electric Hoists, Farm
Tractors, Power Transmission Machinery, Perforated Metals,
Timber Preserving Machinery.

COMPLETE POWER
UNITS WITH ANY
TYPE OF
PRIME MOVER

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

Ask Your Friends About
The Concrete Engineer

OLE K. OLSEN

822 PERDIDO STREET
Phone Main 2104. New Orleans.

Geo. J. Glover Co., Inc.
General Contractors

*Member: American Society for Testing Materials
Contractors & Dealers Exchange of New Orleans*

Whitney-Central Building New Orleans, La.

PHONE MAIN 1276

*Office Buildings, Railway Buildings, Manufacturing
Plants, Heavy Masonry, Pile Foundations*

AT YOUR SERVICE

To engineers we offer our services and the services of the manufacturers of high-grade equipment whom we represent; some of whom are as follows:

Babcock & Wilcox Co; Boilers and Superheaters. Worthington Pump & Machinery Corporation; Pumps, Compressors, Oil Engines, Condensers, etc. American Blower Co; Fans and Blowers and Air Conditioners. Nash Engineering Co; Vacuum and Steam-heating Pumps. Spray Engineering Co; Spray Cooling Ponds. Frick Co; Refrigeration Equipment. Diamond Power Specialty Co; Soot Blowers. Diamond Rubber Co; Mechanical Rubber Goods. Robins Conveyor Co; Conveyors and Handling Equipment. Griscom-Russell Co; Heat Exchange Apparatus. A. M. Lockett & Co; Oil-Burning Equipment.

Each of these has in its employ engineers who represent the highest talent in their respective lines; and the engineer whose client's requirements call for equipment covered by any of these lines, can count on the advice of these specialists, as well as that of our own engineering organization, in selecting proper equipment for a wide variety of service.

A. M. LOCKETT & CO., Ltd.
Contracting Mechanical Engineers and Machinery Merchants
NEW ORLEANS
Houston, Dallas, San Antonio, Texas

JOHN H. MURPHY IRON WORKS

MANUFACTURERS AND CONTRACTORS

Vacuum Pans, Coil and
Calandria

Webre Multiple Effects

Centrifugals and Mixers

Crystalizers, any type

Return Current Juice Heaters

Oil Storage Tanks, all sizes and shapes

Internally Fired Boilers

High Pressure Boilers Fitted
with Steel Casings

Quinn Flat Top Bagasse

Furnaces

Juice and Syrup Tanks

Main Office, 643 Magazine St.

New Orleans, La., U. S. A.

Phone Main 160

Foundry and Machine Works

A. J. Naquin, Manager

Alexandria, La.

Boiler and Tank Works

Broad and Perdido Sts.

Phone Main 161

Machine Shop, Copper and

Brass Works

Magazine and Girod Sts.

W. G. COYLE & CO.

(INCORPORATED)



Bunker Coal and Towing

BARGES, LIGHTERS, ETC.

High Grade Coals

Competent Tugs

Telephone Main 4429

Main Office: 1322 Whitney-Central Bldg.

New Orleans, La.

H. BODENHEIMER & SONS

Everything Pertaining to

INSURANCE

810 UNION STREET

Phones Main 1817-1818

NEW ORLEANS, LA.

SPECIFY

HAVEMEYER BARS

For Your Reinforced Concrete Work.
The Most Efficient and Economical Bar.
Rolled to same weight as plains.
Round—Square—Flat.

"EVERY POUND PULLS."

PROMPT SHIPMENTS—MILL OR WAREHOUSE

Concrete Steel Company

42 Broadway

NEW YORK

SOUTHERN OFFICE

Birmingham,

::

Ala.

OLE K. OLSEN, Sales Agent
New Orleans.

Hattiesburg Creosoting Co.

Plants at Hattiesburg, Miss. and Slidell, La.

Main Office, Hattiesburg, Miss.

CREOSOTED MATERIAL

—INCLUDING—

Lumber, Timbers, Piles, Telephone and Telegraph
Poles and Cross-Arms, Paving Blocks,
Cross-Ties, Etc.

CAPACITY, 70,000,000 FEET B. M. PER ANNUM

Facilities for Shipping by Rail or Water

Creosoted Materials Co., Inc.

1126 HIBERNIA BUILDING

Phone Main 3818

New°Orleans, La.

—DEALERS IN—

Creosoted Materials of All Kinds

Robert W. Hunt Co.

Engineers, Chemists, Metallurgists, Inspectors

Inspection and Tests of Steel and Cement for Bridges, Buildings
and Other Structures. Inspection of Rails and Fastenings.
Creosoted Block, Timber and Ties. Paving Brick and Asphalt.

General Office, Chicago, 2200 Insurance Exchange.

New Orleans, 919 Carondelet Bldg.

JOIN THE
CHRISTMAS CLUB
NOW
FOR 1925

We Pay
4%
Compound Interest
on Savings Accounts

Save
Part of Your
Christmas Check
and Deposit it
in the—

New Orleans Bank & Trust Company

"The Young Business Man's Bank"

Member Federal Reserve System

222 Carondelet

GREETINGS FROM
**Greenlaw Truck and Tractor
Company, Inc.**

GMC Trucks

C. T. Electric Trucks

Lee Trailers and Dump Bodies

Athey-Truss-Wheel Logging Wagons

424 Girod Street

New Orleans, La.

PHONES MAIN 3299 - 3322

CREOSOTED

TIMBERS - PILING
CROSS TIES - POLES

LUMBER - PAVING BLOCKS

AMERICAN CREOSOTING COMPANY

COLONIAL
CREOSOTING
COMPANY
INCORPORATED



GEORGIA
CREOSOTING
COMPANY
INCORPORATED

LOUISVILLE ~ KENTUCKY

SALES OFFICES

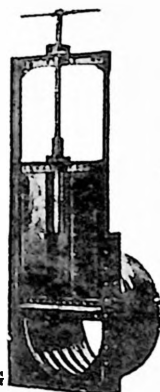
550 MADISON AVE. NEW YORK CITY ~ 401 W. MAIN ST. LOUISVILLE, KY.
BOCALUSA, LA. BRUNSWICK, GA.



Louisiana Engineers should have in their files our catalog of Galvanized Iron Tanks, Sectional Steel Towers, All Metal Sectional Buildings, Garages, Silos Culvert, Water Tight Pipe Gate Valves, Etc.

¶ We are prepared to submit blueprints and specifications on the above or on any kind of metal buildings.

ASK FOR CATALOG



HARRY BROS. CO. of LA. New Orleans, La.

The Manhattan Rubber Mfg. Co.

HIGH GRADE

MECHANICAL RUBBER GOODS



500 CAMP STREET, :: New Orleans, La.

Miller Flushtank Siphons



Simple, Reliable, Automatic

Also Sewage Disposal Apparatus, Automatic Sewage Ejectors, Centrifugal Pump Outfits, Sewer Jointing Compounds.

PACIFIC
FLUSH-TANK CO.
CHICAGO NEW YORK

GUY R. MOLONY & CO.

General Drayage

418 GRAVIER STREET

Phone Main 6281

NEW ORLEANS, LA.

TRANSITS

- LEVELS

ENGINEERING SUPPLIES

BLUE PRINTING

New Orleans Blue Print & Supply Co., Inc.

RAYMOND BASSICH, Mgr.

824 Union Street

Phones 7543-945

Agt. KEUFFEL & ESSER CO.

American Creosote Works

INCORPORATED

CREOSOTED

**Cross Arms, Lumber, Paving
Blocks, Piles, Poles, Ties**

Private Wharf for Ocean Vessels at NEW ORLEANS, LA.

Capacity 115,000,000 Feet B. M. Per Annum

Branch Plants:

Louisville, Miss.
Winnfield, La.

STATION "B"

NEW ORLEANS, LA.

COTTON DUCK

TARPAULINS

TENTS

DISTRIBUTORS FOR

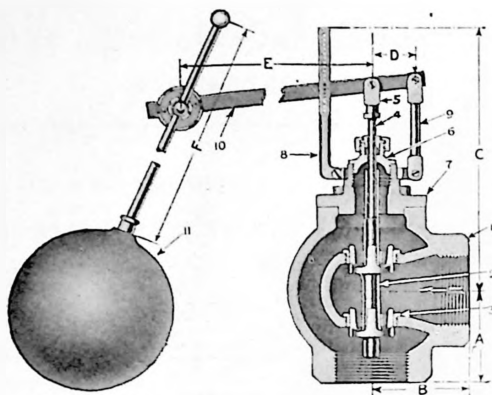
WHITLOCK MANILA ROPE

Brook Tarpaulin Company, Inc.

(ESTABLISHED 1840)

429 Celeste Street

New Orleans, La.



VALVES

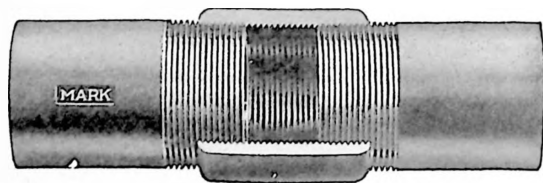
Pipe and Fittings

PIPE—Cast Iron

PIPE—Wrought Steel

PIPE—Wrought Iron

Dixie Mill Supply Co., Inc.
New Orleans





Transits and Levels

that will give *perfect*
service under all conditions
of use are manufactured by
DIETZGEN
—the firm with the quality rep-
utation. *Catalog on request.*
EUGENE DIETZGEN CO.
Manufacturers
Chicago New York San Francisco
New Orleans Pittsburgh
Philadelphia

WOODWARD, WIGHT & CO. —LIMITED—

Largest General Supply House South Since 1867

EXCLUSIVE SOUTHERN SELLING AGENTS FOR
LIDGERWOOD Hoisting Engines, Cableways and Log
Handling Machinery.

HAYWARD Orange Peel and Clam Shell Buckets.

GENERAL ELECTRIC CO. Apparatus and Supplies.

ROEBLING'S Wire Rope.

Heavy Hardware; Mill Supplies; Marine Hard-
ware; Cordage; Elevating, Conveying and
Power Transmitting Machinery.

OPEN DAY AND NIGHT

Howard Avenue, Constance
and St. Joseph Streets

NEW ORLEANS

SAND

GRAVEL

JAHNCKE SERVICE Inc.

NEW ORLEANS

Concrete and Builders' Materials
Dredging

SHELLS

CEMENT

**COLUMBIAN
IRON WORKS**

CHATTANOOGA, TENN.

Manufacturers of

Fire Hydrants, Valves,
Valve Boxes, Sluice
Gates, Meter Boxes,
Water Works Supplies

New Orleans Representative:

J. S. BARELLI

612 Godchaux Bldg.

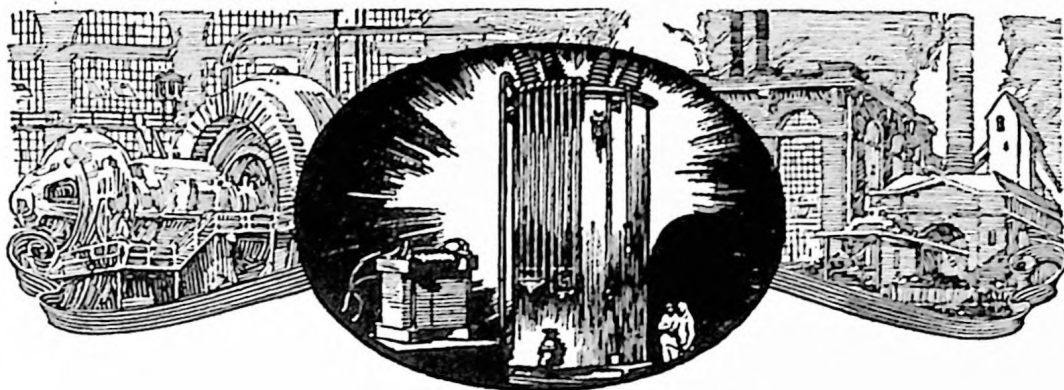


COMPLIMENTS

The Anchor Packing Company

418 COMMON STREET

NEW ORLEANS, LA.



A Toy—a Tool

THE first twenty days in December witnessed a big event in one man's life. They saw a toy grow into a tool—one of the most useful in all history.

On December 1st, 1885 there was brought to George Westinghouse, at Pittsburgh, an uncommercial "secondary generator"—a scientific toy. Westinghouse and associates lived with it day and night, and by December 20, 1885, in a flash of genius, had completed the essential conceptions of the modern transformer. Thus in twenty days they paved the way for alternating current, and the electrical era of the twentieth century

Here was a brilliant engineering feat—a feat that through the years has been a particular inspiration to a specialized group of "design engineers"

within the Westinghouse organization. These men are electrical and mechanical engineers who are attracted not merely by an engineering problem—but by the technical difficulties of "licking" that problem to narrow and exact practical limits.

These men work continuously with both sides of an equation. On one side are the needs of a customer. For the other side must be developed apparatus which exactly meets those needs. The apparatus may range from a complete system of electrification for a railroad to a new type of curling iron.

Engineering extends a welcoming hand to men qualified for designing. Many of the most constructive services of Westinghouse have been made possible by their leadership.

Westinghouse

ACHIEVEMENT & OPPORTUNITY

