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PRESIDENT DONALD DERICKSON

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

VOL. VIII

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EDITORIAL NOTES AND COMMENT

The New President. At the Annual Meeting in January, Donald Derickson, Head of the School of Civil Engineering in Tulane University, was elected president of the Society for 1922.

Professor Derickson was born at Meadville, Pennsylvania, in 1878, his parents being descendants of the early pioneers of Scotch-Irish stock, who settled the Valley of Virginia and extended on up into the southern and western part of Pennsylvania.

His early education was received from private tutors and he graduated from the preparatory department of Allegheny College. In 1902 he received the degree of Civil Engineer from the Thayer School of Civil Engineering of Dartmouth College, and went from there to Cornell University for graduate work.

Professor Derickson has had wide experience in the practice of his profession extending over a period to date of almost twenty years. His tendency has been to specialize somewhat along the lines of bridge and structural engineering, in which line of work he has served in the many different capacities of detailing draftsman and inspector, designer, superintendent of construction and consulting engineer. He has also engaged to a limited extent in municipal work, and was connected for two years with the United States Coast and Geodetic Survey, one season having been spent in Alaska in connection with the Boundary Survey.

He is a member of the American Society of Civil Engineers, the Council of National Advisors and Member of Division of Bridges, National Highway Association. He is also a member of the Sigma Alpha Epsilon fraternity and of the Sons of the American Revolution.

About ten years ago Professor Derickson was called to Tulane University from Cornell, where he was Assistant Professor of Structural Engineering in charge of Reinforced Concrete, to take charge of the work in Civil Engineering. He is now Head of the School. For a number of years he has been a prominent member of the Louisiana State Board of Engineering Examiners and has given a great deal of his time and attention to the problem of raising the standards of the profession in this community.

Professor Derickson is firmly convinced of the value of well organized local engineering societies, and it is confidently predicted that the Louisiana Engineering Society will enjoy a year of great development and prosperity under his administration.

The Greater Agricultural College. This expression, one of the slogans of the last gubernatorial campaign, has now been translated into a reality by the final passage and inclusion in

the state constitution of Governor Parker's Severance License Law. At its December meeting the members of the Society had the pleasure of hearing an address by Prof. W. R. Dodson on the general subject of education in agriculture and the plans for the development of the Greater Agricultural College. The address is printed in this issue of the Proceedings.

Modern agriculture is a form of scientific engineering and man should be trained and educated therefor, as is being done in other branches of practical science and engineering. Louisiana is pre-eminently an agricultural state, and if she is to keep abreast of modern progress and in touch with modern methods, she must have an agricultural college, and all that goes with such a college, equal to the best in the country.

It must not be overlooked, however, that scientifically trained farmers cannot be produced overnight, so to speak, but must be developed by giving to the young men who attend our schools and agricultural colleges thorough training and sound education in those fundamentals which are of application in the science of agriculture. Prof. Dodson emphasizes this point when he says the farmer has no scientific vocabulary.

Further than this, it is an unfortunate fact that so many of our farmers lack the sort of sound fundamental education that would enable them to take their proper places in their communities and to become factors in shaping the policies of the state and thereby developing a grade and type of citizenship so much needed throughout the agricultural districts of the South.

The solution of this problem is sound education all along the line, and for the prospective farmer the Greater Agricultural College is to be the capstone of his system of training. With the resources and income provided by the severance tax and the subsequent half mill property tax, it would seem that the future development and success of the institution were absolutely assured. It is to be hoped that the Board of Supervisors will keep prominently before them the agricultural college idea and not be tempted to restrict its activities and development by branching out into other fields which may be already provided for from other sources.

The Smoker. Another annual function with its characteristic features of entertainment has passed into history and added one more tally to the long score of hits made by Messrs. Moses, Olsen and Robert, Amusement Purveyors in ordinary and extraordinary to the Louisiana Engineering Society. There was very much the same good old time we usually have, but one thing we missed. Our gentle friend and devoted disciple of the terpsichorean art, being cast for the part of toastmaster, had to sit at the head of the table outside the ring and thus forego the pleasure of jazzing with the lady vaudeville stars.

Some of the old members of this Society keep remembering the "good old days" when we used to put on a boiled shirt and attend a dignified banquet as the function of our annual meeting. Some of them even have the temerity to suggest that we go back and try the annual dinner again.

What do you think about it?

The Address of the Retiring President. Mr. Manley with his customary modesty refrained from making a formal address, but he did offer in a few brief words a suggestion which gives us food for thought. He said he thought it was time for the Louisiana Engineering Society to consider the proposition of having its own building, and that he would be willing to subscribe \$500.00 to the project.

It does seem unfortunate that this Society cannot have the facilities of club life in connection with its other activities. Perhaps one of the reasons is that a large number of our members are already connected with social clubs which afford them the desired business and social contacts. Such clubs are expensive to maintain and their annual dues are far above those of this Society. But it would certainly be a desirable thing to have the Louisiana Engineering Society housed in more accessible and more commodious quarters where members could drop in and meet each other oftener and in a more informal way than is now possible.

The Federated American Engineering Societies. [Report of Professor Donald Derickson, delegate from the Louisiana Engineering Society.] On the 5th and 6th of this month there was held in Washington the first annual meeting of the Council of the Federated American Engineering Societies. As the Louisiana Engineering Society is a member of this organization, and as some ignorance prevails among our membership, in which I, myself, have shared, as to the aims and achievements of the Federation, it might prove of interest if I were to give in a brief manner some of the impressions which I formed as a representative of our Society.

In brief, I would say that the F. A. E. S. is a welfare society. It concerns itself with the co-relation of the engineering profession to public affairs. It seeks not the advancement of any individual or group, but rather is proposes to create a better understanding in the public mind as to the value of the engineer in our present-day civilization. Through unselfish service and the proper publicity the Federation will establish a greater appreciation of the engineer than has heretofore existed.

Membership in the Federated American Engineering Societies is now composed of the American Institute of Chemical Engineers, The American Institute of Electrical Engineers, The American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, The American Society of Agricultural Engineers, The American Society of Safety Engineers, The Society of Industrial Engineers, Five State Societies and some sixteen or seventeen local societies, comprising in all a membership which represents some forty-five thousand engineers. It is variously estimated that there are about two hundred thousand engineers of one sort or another in this country, and it is the hope of the Federation that eventually they may become members through some affiliated organization. The office of the Federation is in Washington. Mr. L. W. Wallace is the Executive Secretary.

The Federated American Engineering Societies was established a year ago and has passed through its formative period. It has maintained an employment bureau through which it has placed over a thousand engineers. It has concerned itself with

certain bills before Congress of importance to the engineering profession, and has taken under advisement the question of licensing or registration of engineers. The report of its committee on the Elimination of Waste in Industry is regarded as a work of great public benefit. One of the important measures now under consideration is the Kenyon Bill, S 2794, relating to cyclical depression and the alleviation of conditions by the placing of public works during such periods.

I believe that nowhere is to be found a finer or higher type than the gentlemen who direct the affairs of the Federated American Engineering Societies, and I believe that given the proper financial assistance and moral support, the Federation will be a great force for good both to the country and the engineering profession. Mr. Hoover stated that its service to the country during the first year of its organization is small compared with that which it will accomplish in the future.

Lack of information as to the activities of the Federation by the individuals composing the member societies has in some instances caused criticism. It is hoped that this will be corrected through the medium of a Bulletin or Publication, the details of which have as yet not been determined.

The President, Dean Mortimer E. Cooley, will visit us next month. The time of our regular monthly meeting will be adjusted to coincide with his visit. I hope that we may have a full representation at the meeting in order that each member may form his own opinion concerning the Federated American Engineering Societies, of which he constitutes a part through our membership as a constituent organization.

Licensing of Engineers. As the official representative of the Louisiana Engineering Society at the first annual meeting of the Council of the Federated American Engineering Societies, Professor Derickson took a prominent part in the discussion of the question: Does the American Engineering Council approve of the principle of licensing or registering engineers? Professor Derickson warmly supported the affirmative side against the pronounced opposition of a number of representa-

tives from various parts of the country. No definite action was taken, but the Council directed the appointment of a committee to report at the next meeting of the Executive Board.

In this same connection the following comment from the American Association of Engineers may be of interest:

"Licensing engineers and architects as provided by laws enacted in many states within the past two years is an important factor in the protection of the public from disasters such as the failure of the roof of the Knickerbocker Theatre in Washington, D. C., on the night of January 28, 1922, when more than 110 people were killed. The failure of the roof of this theatre was due to a heavy snow load, but since no other large roofs in Washington failed from this cause the disaster was evidently due to either faulty design or construction, which would not have existed had licensed engineers or architects supervised the work.

"Laws licensing engineers and architects who design and supervise the construction of buildings have been passed in the following states: Arizona, Colorado, Florida, Indiana, Illinois, Iowa, Louisiana, Michigan, Minnesota, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Tennessee, Virginia, and West Virginia, in all, seventeen states. Such laws are now before the legislatures of Kentucky, Mississippi, and South Carolina. There is no licensing law for the protection of the public in the District of Columbia.

"The movement for the enactment of adequate licensing laws for the protection of the public from the activities of dabblers and quacks who formerly had only to hang out a shingle in order to qualify for business, has been actively supported by the American Association of Engineers, an organization of 24,000 professional engineers. It is to the credit of professional engineers that they are seeking to purge the profession of incompetents and protect the public from engineers-for-a-day."

Dean Cooley's Mission. Rounding out a career of almost half a century in the service of the state, of education and of his profession, Mortimer E. Cooley, at the age of sixty-seven,

will on February 5 turn aside from his labors at the University of Michigan, and embark on a series of tours that will carry him from coast to coast as the herald of the new world force moulded by the American engineer.

In Texas, Oklahoma, Alabama, Georgia, Louisiana, Tennessee, Missouri, Kansas and Kentucky the idea of engineering unity is said to be making rapid progress. With prominent engineers in these states Dean Cooley will take up plans to foster this unity in both the local and national interest, the American Engineering Council, the executive organ of the Federation, being the link which is to bind the organization of all the states and cities into one coherent whole.

Successor of Herbert Hoover as president of the American Engineering Council of the Federated American Engineering Societies, and as such the spokesman of a profession which has made greater strides in America than any other country in the world, Dean Cooley goes to bring to completion the gigantic task, undertaken by Mr. Hoover, of welding practically a quarter of a million engineers in every state into a single unit capable of voicing its oneness of mind in questions affecting the national interest and of swiftly joining its immense technical power to the other resources of the republic in peace or war.

Dean Cooley, it is held by engineers, sets out as an apostle of a new order in public affairs, and when he makes his first speech on Monday night, February 6, before the Engineers Club of Kansas City, Mo., he will have sounded a note that will gradually swell until it becomes the full and powerful expression of the engineering and technical talent of the United States. In the speeches which he is to deliver, Dean Cooley will tell of the patriotic impulses of the engineer, stirred by war, and of the purposes of the engineer to translate those purposes to the works of peace and reconstruction. Immediately, he will dwell on projects of national assistance now under way, including the establishment of a National Department of Public Works, to wipe out millions of loss annually through inefficiency and dissipation of federal energies; reform of the Patent Office, to stimulate industry and invention; elimination of in-

dustrial waste, now causing billions loss annually; promotion of better relations between capital and labor; plans to consolidate the enormous electrical power of the country, as advocated by Mr. Hoover, and a wide range of other projects into which engineering and technical skill enter and which are vital to the industrial and economic progress of the nation.

Heads of the great national engineering societies, which are embraced in the Federated American Engineering Societies, will make supplementary tours to aid in the work of more intensive engineering organization. Dean Dexter S. Kimball of Cornell, president of the American Society of Mechanical Engineers, will start in May for the Pacific Coast to promote closer harmony between the engineers of the east and west in the attainment of engineering ideals.

Elaborate preparations have been made for the reception of Dean Cooley by the engineers of many cities. On Tuesday, February 7, he will address an assemblage at the University of Kansas. He will be introduced by Perley F. Walker, dean of engineering, who is the representative of the Kansas engineers on the American Engineering Council. On February 8, Dean Cooley will address the Kansas Engineering Society at Topeka. In Kansas City, Mo., he will confer with leading engineers regarding the movement to organize the various engineering branches in that city into one central body. In Lawrence and Topeka Dean Cooley will take up with the leaders of organized engineering in Kansas plans to extend the scope of the Federation in that state. He will also receive reports on engineering work being carried out at the University of Kansas with the cooperation of the state.

A statement quoting Herbert Hoover as to the aims of the Federated American Engineering Societies was given out in New York City in connection with the announcement of Dean Cooley's itinerary.

"The engineers of our country," said the quotation of Mr. Hoover, who was the first president of the Federation, "represent an intellectual possibility for service possessed by no other group. It is therefore an augury of real social development when the engineers of the United States join together for purposes of public service.

"This association has the unique value among the associations that it can not have any material interest for its purpose. No engineer can receive any material benefit from it. It can advance no economic interest. It can not therefore be charged with any ulterior motive. It is accepted by the whole American people who have become acquainted with its objectives as being clearly single-minded.

"The birth of this society marks the evolution of the engineer into an interest in public affairs. With his intelligence, his experience and training and the unique knowledge that he possesses not only of the material but the intangible values amongst our people, he is now organized so that his united voice may be heard outside of his profession."

Dean Cooley will leave Topeka on Thursday, February 9, for Oklahoma City where he will speak before the Oklahoma City engineers on Thursday evening. On Friday he will address Oklahoma University at Norman. From Oklahoma City he will go to Dallas Tex., where, on Monday, February 13, he will speak before the Southern Methodist University and the Technical Club of Dallas. Wednesday afternoon, February 15, he will speak at the University of Texas in Austin, and Wednesday evening he will address the Engineering Faculty of the University. The next day he will speak before the Agricultural and Mechanical College of Texas at College Station.

Friday, February 17, or Saturday, February 19, Dean Cooley will address the Houston Engineers Club. After spending Sunday in Houston he will go to New Orleans where he will speak before the Louisiana Engineering Society and Tulane University and the State University at Baton Rouge.

Dean Cooley will leave New Orleans on February 22, arriving in Montgomery, Ala., on February 23. While in Montgomery he will visit Governor Osborne's Camp at Ponland and Muscle Shoals.

The Affiliated Technical Societies of the City of Atlanta, and the Georgia School of Technology at Athens will hear Dean Cooley on February 28 and March 1, respectively. Friday, March 3, or Saturday, March 4, Dean Cooley will address the Alabama Technical Association in Birmingham.

During the week of March 5 Dean Cooley will address the Engineers Association of Nashville, speaking to them on March 6; and the Engineers and Architects Club of Louisville and Lexington University, on March 7. He will arrive in Chicago on his trip home on March 10.

New Members. It gives us great pleasure to publish the following names and to welcome these new members to the privileges and activities of the Society.

Resident Members.

JOHN H. BERNHARD, Consulting Engineer on Terminals and Transportation, Hibernia Bank Building, New Orleans.

ROBERT E. CRAIG, II, Engineer with Doullut & Williams, 1138 Third Street, New Orleans.

HERRICK J. LANE, Office Engineer and Auditor, Doullut & Williams, 5928 Hurst Street, New Orleans.

ROBERT K. MULNIX, Manager, Orleans Supply and Demolishing Co., care Chess, Checkers & Whist Club, New Orleans.

WILLIAM H. RHODES, Senior Highway Engineer, U. S. Bureau of Public Roads, 836 Maison Blanche Annex, New Orleans.

RALPH R. TINKHAM, Assistant Superintendent, Eighth Light-house District, 7801 Birch Street, New Orleans.

FREDERICK G. TUPPER, Member of Firm French & Tupper, 1201 Carondelet Bldg., New Orleans.

JOHN H. WALSH, Manager for Board of Port Commissioners, The Bienville, Lee Circle, New Orleans.

JOHN K. WOOLF, Managing Engineer, Doullut & Williams, 5926 Hurst Street, New Orleans.

Non-Resident Members.

FREDERICK McH. HILL, Assistant Parish Highway Engineer, Ouachita Parish, Monroe, La.

SAMUEL A. HONAKER, Good Roads Engineer, Arcadia, La.

JOSEPH F. ROSS, Louisiana State Highway Department, Arcadia, La.

Associate Members.

JOHN JURGENSEN, 6039 Coliseum Street, New Orleans.

STUART O. LANDRY, President, The Chambers Agency, 614
Maison Blanche Bldg., New Orleans.

Junior Member.

JOHN E. EBAUGH, JR., Instructor in General Chemistry, Tulane University.

Doullut & Williams Company, Inc. At the close of the year just passed the above named corporation was organized, this being a consolidation of the formerly existing companies known as Doullut & Williams, Southern Lighterage & Wrecking Co., and Shell Beach Land and Improvement Co.

In addition to specializing in the design and construction of docks, wharves and industrial plants, as in the past, this Company has extended its operation to provide for the undertaking of various kinds of construction with a department for each class of work.

W. Horace Williams is president and general manager, Paul Doullut is vice-president, and J. P. Ewin is secretary-treasurer and managing engineer.

The engineering department will be under the supervision of Mr. Williams and Mr. Ewin; the building department under Mr. C. G. Cappel; the municipal and highway department under Mr. R. E. Gosa; wharf and dock department under Mr. L. C. Smith. Frank T. Copp will be in charge of the electrical department, H. J. Lane in charge of the statistical department and A. T. Gomila of the lighterage and wrecking department.

PAPERS AND DISCUSSIONS

THE GREATER AGRICULTURAL COLLEGE.

By Professor W. R. Dodson of Louisiana State University.

Read before the Society, December 12, 1921.

I hope you will not think it extraordinary that an agricultural talk is to be inflicted upon a society of distinguished engineers.

In explanation of the change in the program that you had hoped to carry out, I wish to say that when you invited Governor John M. Parker to address you, on the Greater Agricultural College, in which he has been so much interested, he found it impossible to comply with your desires. The governor, as you know, was recently appointed a member of the Advisory Committee of twenty-one, to the Disarmament Conference at Washington. He asked me to serve as his substitute here tonight and discuss whatever phases of this subject I thought would be of most interest to you. I am sure that no one here would be so unreasonable as to expect me to discuss this subject as entertainingly as would the Governor. At the same time we are all so rejoiced to have Louisiana so signally honored by his appointment to this important position, that we are willing to suffer substitutions for his addresses for at least a few occasions. I feel quite sure that I am among my friends, and that you will be gracious in your criticisms of my shortcomings.

In presenting this subject, I shall make four principal divisions of the discussion:

First: A review of some of the reasons for giving special attention to the subject of agricultural education at this time, or at this period of our economic development.

Second: A brief history of the origin and activities of the Greater Agricultural College Association;

Third: A discussion of some phases of the adversities and the final triumph of the severance license measures, and

Fourth: A presentation of the main features of the building plans for the new University and Agricultural and Mechanical College.

These plans were delivered last Friday afternoon. I had hoped it would be possible for me to bring the architect's sketch and plans here, but that was not possible, and I will have to use some very poor lantern slides, which were made by a local photographer today. They will serve, however, to give you a general idea of the plan that is now before us for the construction of the new equipment for the Louisiana State University and Agricultural and Mechanical College.

These plans have been anticipated for some time. I may call your attention to the fact that the question of agricultural education and the Agricultural College has been in the public mind for about two years and a half, through the activities of the press, through political campaigns, through the discussions of the Legislature and the Constitutional Convention.

Some of the Reasons for Stressing Agricultural Education.

There has never been a period in our history when the opportunity or the necessity for applying the developments of science to practical agriculture, was as great as it is now. The necessity of dealing with increasingly intricate problems of cost of production, quality of product, marketing and distribution, the use of modern machinery, means of combatting insect and fungus pests and animal diseases, seem to multiply as our commerce with distant countries is developed and we come to a period of universal exchange of foods, fabrics, raw materials and manufactured products.

The farmers of other States are being educated, and our farmers if untrained cannot successfully compete in the markets with those of other sections who are better able to deal with their problems, through the aid of modern science. If they are not able to make as much or live as well on the farm as they can in the industrial centers, the time will come when they will move to the industrial centers. If we don't have the industrial centers in this State, they will go to other states.

The people who use machinery and the most productive methods are the ones that stay in the business when periods of

over production come. Let me give a single illustration of how this principle works in gradually modifying our industrial life.

I have read the statement, from good authorities, that our first agricultural census was taken in 1780. At that time ninety two per cent of the people that were engaged in gainful pursuits were engaged in farming. Today only thirty two per cent of the men engaged in gainful pursuits are working on the farms. That has come about by improvements in the application of machinery and the development of new enterprises, the improvement of our animals and crops, things that have made the output of farm work more productive, so that we can spare men from the fields to work in building railroads and railroad equipment, telephones and telephone equipment, and the manufacture of all articles we see about us here today. If we were to have to go back to the reap hook to harvest our wheat, and to the wooden plow we used to scratch the soil with in 1780, we couldn't spare men to build and operate railroads or to build and operate telephone lines or to build automobiles, or to make gasoline or a thousand and one other products that are essential to modern life.

This wonderful transformation in the industrial life of the nation has come about step by step, in which the productiveness of farm labor has been increased so that it has required a smaller and smaller percentage of our population to produce enough food and clothing to supply the national necessities; and yet, we have never been so well fed and so well clothed as we are now. Our further development is dependent upon our ability to still further increase the efficiency of man's labor on the farm and to improve the quality of his output.

The City Man's Interest in Farm Practice.

Let me give you an illustration of how all of the people are concerned in the utilization of modern science in farm practice. The people of New Orleans are vitally concerned in getting good, clean, wholesome milk, free from harmful bacteria, because the health of their families is dependent upon it. In order that he may secure such a supply of milk, the farmer must have a working knowledge of the meaning of sanitation as applied to milk production, and he must protect his cows from tuberculosis, typhoid fever and other diseases, the water supply must be

kept free of contamination and the barns and milk vessels must be kept in a sanitary condition. The cost of the production of milk too must be translated into the cost to the consumer. Inefficient feeding, poor cows and poor management on the farm, mean increased cost of milk to the man in the city. The city man is, therefore, directly interested in the type of education that will bring about scientific feeding and care of cows and the best available knowledge for improving the breeds of dairy cattle.

You, as engineers of the City of New Orleans, are therefore, interested and your welfare is involved in the development of an agricultural college in this State that will help put the dairy industry on a modern scientific basis. You cannot do that unless you educate the dairyman, the man that is going to handle the cows and who must handle the milk that comes to you in the form of clean, wholesome, safe, nutritious food.

Elimination of Waste in Farm Practice.

Let me give you one illustration of an economic waste that agricultural education could eliminate. Investigations have shown that potash as an ingredient of fertilizer is practically without value in most of the soils of Louisiana, when applied to sugar cane, rice, cotton and corn. The potash ingredient of our fertilizers that we purchased during one year of the war, amounted to over \$600,000 in Louisiana. This ingredient, which would have been worth probably twice as much in North Carolina, was an absolute waste in Louisiana. If our people had known more about the effect of potash on plant life, they would not have purchased fertilizer carrying this ingredient. As we grow in agricultural education, we will buy and use our fertilizers much more wisely.

Need of an Agricultural Vocabulary for Farmers.

I am talking now to an organization of professional men. You were trained for your work through a course of study, laboratory exercises and practical work. You studied mathematics, physics, chemistry and mechanics and acquired a technical vocabulary that enabled you to gradually come to a clear conception of the more intricate problems of your profession. You acquired the vocabulary and a working knowledge of its

use that has enabled you to think in engineering terms. Through your journals, technical papers and personal contact with one another, you are in constant touch with the thoughts of the best engineers of the country. A man who studies medicine acquires a medical vocabulary that will put him in touch with the best thought in medicine, and the experience of the best men that are making progress in the application of science to medicine. And so with a lawyer; he acquires a legal vocabulary; he is able to read the decisions of the judges of the Supreme Court, and of the most distinguished men in this country on their interpretation and the application of law. But the *farmer has no scientific vocabulary*; he is not in touch with the thought that is affecting the application of science to agriculture. There isn't one in a hundred in this State that has a vocabulary that will enable him to give comprehensive, and clear-cut views on what you are talking about when you talk about such simple things as protein, carbohydrates and fat in the nutrition of an animal, or the phraseology of modern agronomy in discussing soil fertility. When you talk about toxins and anti-toxins and things of that kind it is all Greek to the small farmer. That is the reason they don't make more progress in the introduction of science into agriculture. The only way to overcome this is by a broad dissemination of agricultural education, and we are realizing that more and more.

Need of Agricultural Education in Louisiana.

We have problems here in Louisiana that are peculiarly our own. We are cutting up our timber at an enormously rapid rate: about two and a half billions of board feet lumber are harvested a year; vast areas of land are left without value. Who is going to pay for the bonds that have been issued by many of these sections for good roads, for schools, courthouses and public improvements when the timber is gone? What is going to sustain the country in this territory over here just Northeast of New Orleans, tributary to this City, that, if built up would be a great market for your products? Around Bogalusa, for instance, the greatest sawmill in the world, is sawing forty acres of timber a day; what will become of that country? That is a part of our problem. In the harvesting of these natural resources the possibility of building some wealth, creating indus-

try that will be permanent, sustaining business, industry and education is a problem that we must solve.

I am calling attention to that now, because it lays the foundation for the Severance Tax Legislation. Agriculture seems to be the only industry that we can now plan for, to take the place of the industries dependent upon the harvesting of our natural resources, when these natural resources are gone. Some of the new plants that have been introduced, like the velvet bean, the Biloxi soy bean, the possibility of curing sweet potatoes that they may be shipped a long distance, or kept for months without deterioration, and the fact that many of these soils produce better soy beans and sweet potatoes than some of these rich alluvial lands suggest great possibilities in the development of the cut over pine lands of this State. It presents one of the rays of hope for development of a prosperous country over an area that has generally been considered as practically worthless, after the timber is gone. The application of science to agriculture will bring that about if it is to be realized. It is sufficient to call the attention of an intelligent audience like this to the general interest of the people at large to the need of intensification and expansion of the application of science to agriculture, and to emphasize the necessity of agricultural education, which has been sadly neglected in years gone by.

History of the Greater Agricultural College Movement.

The expansion of the work of our Agricultural College that is now assured through the funds of the severance license acts, really had its inauguration in 1918. In the early spring of that year, we purchased the Williams plantation of approximately 1100 acres, two miles below Baton Rouge, as a site for the development of an agricultural farm. Governor Ruffin G. Pleasant took special interest in securing the funds of \$82,000 for this purchase. Hon. Horace Wilkinson of West Baton Rouge fathered the appropriation measure. John M. Parker, T. H. Harris and a number of prominent farmers made speeches before the Legislature urging the purchase and equipment of the farm. In 1919 the farmers who were attending the summer short course in agriculture at the University, organized the Greater Agricultural College Association and began an active campaign for more liberal support of the Agricultural College

of the State University. The gubernatorial campaign was then just opening up. This association decided to aggressively go into the campaign to help educate the people of the State to the necessity for building up a strong agricultural college, properly equipped, for giving technical and practical instruction in agriculture. They called a great mass meeting at Garig Hall at the University and invited the three candidates for governor to address the farmers, and outline what would be their policy towards agricultural education, if elected. Mr. Phanor Brazeale, Colonel Frank P. Stubbs and Mr. John M. Parker responded to the invitation. Mr. Martin Behrman, Mayor of the City of New Orleans, Governor Ruffin G. Pleasant and State Superintendent of Education, T. H. Harris also addressed the meeting. They all pledged their support for the development of the Agricultural College of the University. Mr. Parker was most emphatic. He had always been an outspoken friend of progressive agricultural measures, but from this meeting until the close of his campaign, he never spoke from a public platform, so far as I know, without referring to the need of building a great agricultural college in Louisiana, that should provide practical instruction along lines that promote better farming throughout the State, that would give practical courses in the every day operations of the farm as well as in the sciences, and that would give an opportunity to the poor boy to secure a course of instruction regardless of the degree of his high school training, that would enable him to apply many of the modern methods of farm production.

I don't know, of course, how much this had to do with the election of Mr. Parker, but I am sure that the people of the State regarded the election in general as committing the State to a policy of liberal support to agricultural education far beyond what we had previously developed. The Legislature was, by a large majority, in favor of the greater agricultural idea, but they differed somewhat in the ideas as to the best way of securing funds. One thing, however, is very certain, the agricultural college idea, stressing the practical phases of instruction, has been "sold" to the people of Louisiana. The Greater Agricultural College Association, rendered a very great service in helping to bring this about. Dr. Roy Young of Youngville,

President, and W. P. Connell of Baton Rouge, Treasurer of the Association, were especially helpful in carrying on the campaigns, before the election, and in conducting the presentations of the arguments before the Legislature, and the constitutional convention.

The severance license fund represents practically no additional tax to the people of Louisiana, because the major portion of these products paying the tax is marketed outside the State, and if the tax is, transferred to the ultimate consumer, the bulk of this money comes from other States who buy our oil, who buy our carbon black, who buy our lumber, who buy our sulphur and our salt. Mr. Parker has been the leading spirit in fighting the battles for this great measure.

One of your public spirited citizens, Mr. J. K. Newman, became interested in this work, and offered to finance the working up of the plans, for the greater agricultural college. The expense of the architect, we understand is approximately sixty thousand dollars. And it is these plans that were delivered last Friday evening, to become available Saturday for our examination.

It is now our expectation that the whole institution will give up its present site just above Baton Rouge adjacent to the City, and move to the farm, two miles below Baton Rouge.

The Committee of Twelve on Agricultural Education.

Even a brief history of the development of the greater agricultural college idea during the past two years would be incomplete, without reference to the committee of twelve, who, at the request of Governor Parker, traveled at their own expense and visited the States of North Carolina, Tennessee, Illinois, Wisconsin, Iowa, and some other sections, to study the work that had been done and was being done in these progressive states, in behalf of agricultural education.

This committee published its report just before the meeting of the Legislature of 1920, in which they advocated the levying of a property tax of one mill for the building, equipment and support of a great educational institution that should give agriculture chief consideration. This committee was of great influence in securing the final passage of the acts of the Legisla-

ture and of the Constitutional Convention, to which I shall refer presently.

With the view of carrying out the recommendation of this committee, the Tanner Bill was prepared and introduced in the Legislature, providing for a property tax for the greater agricultural college. This measure was before the House, when Governor Parker asked that it be withdrawn, and the severance tax measure took its place.

The Severance License Law.

Governor Parker had worked up a plan of assessing a tax of two per cent of the value of the natural resources of the state, as they were severed from the soil and water. It was his plan to devote this fund to the building of the agricultural college. Agreement was made with some of the leading individuals and corporations, that this measure would not be opposed, during the administration of Governor Parker, provided the funds were used for the building of the agricultural college and for meeting the immediate needs of the institutions of the State for taking care of the insane, the sick, and a few needs of some of the other institutions. It seemed that this measure would have fairly easy sailing, when the question was raised as to increasing the tax beyond the limit allowed by the constitution. This threw consternation into our camps. However, in a few days Mr. Parker came to the front with the new idea of licensing the industries engaged in harvesting the natural resources, instead of taxing their products. The constitutional lawyers agreed that this would be constitutional. The difference in construction, or in the wording of the measure was all important. The measure that finally passed, places a license fee on the sawmill owners, the oil well owners, etc., the amount of the license to be equal to two per cent of the value of the output. This money is to go to a special fund known as the Severance License Fund. From this fund some appropriations were made amounting to about nine hundred thousand dollars for the year 1920-21, and about a million dollars for 1921-22, to the Charity Hospitals, the institutions for the insane, etc., the remainder going to the "La. State University and A. & M. College to be used for the further development and maintenance of the agricultural department of said institution."

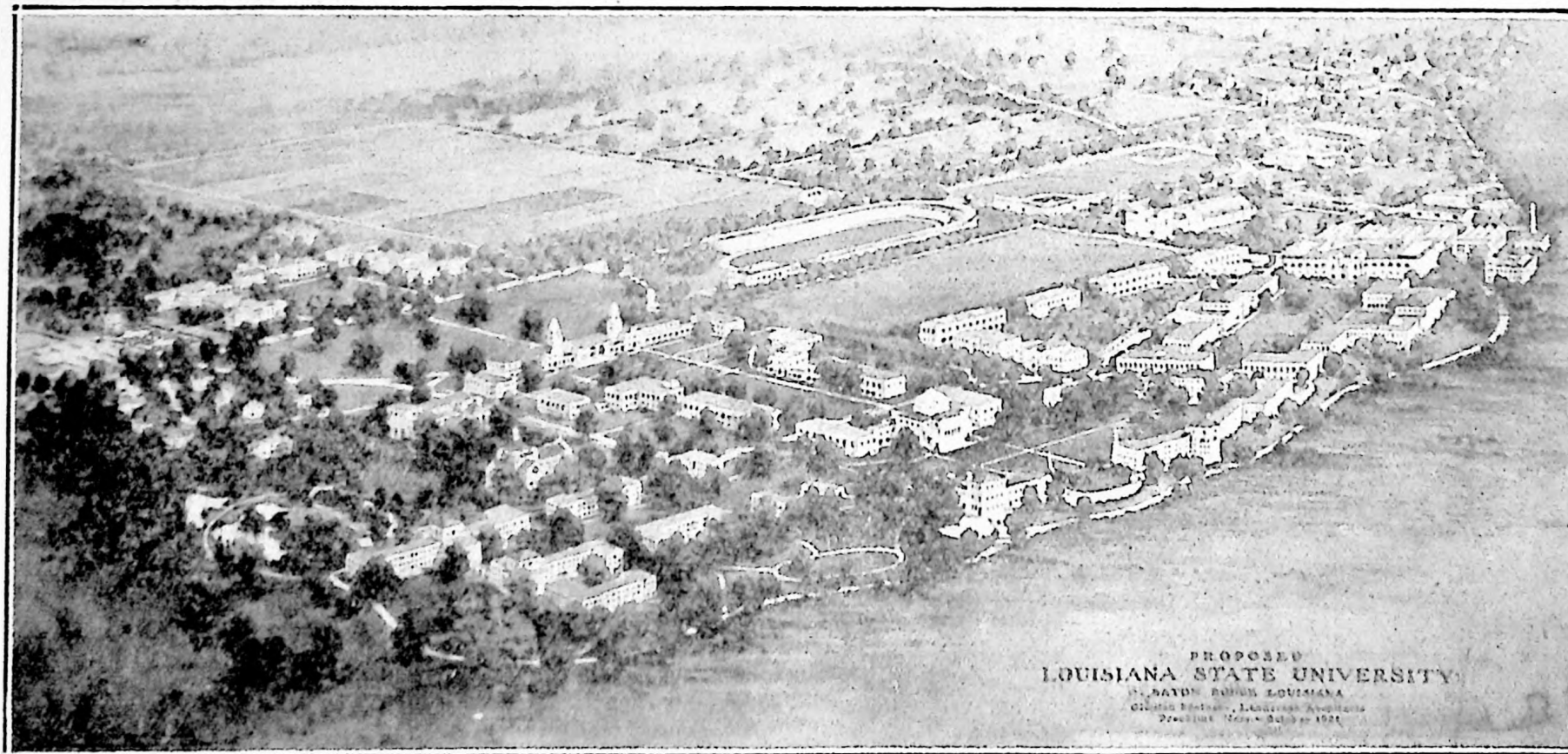
The Constitutional Convention of 1921, made provision that the severance license money shall go to the University and A. & M. College, for building, equipment and support, from July 1st, 1922 to Jan. 1st, 1925, limiting this amount, however, for this period to five million dollars.

After Jan. 1st, 1925, a one-half mill property tax, on all the taxable property of the State will be used for the support of the institution, up to one million dollars a year. At the present assessment a one half mill tax will not amount to one million dollars, but it is estimated that by 1925, if the State continues to develop, the tax will amount to about a million dollars a year. This provision, however, does not prohibit the Legislature from making additional appropriations if urgent needs become apparent.

The financial outlook, therefore at present is about as follows: There is in the treasury now, for the greater agricultural college work, about a million two hundred thousand dollars. We hope this will increase to about two million dollars by the first of July, '22. From July 1st, '22 to Jan. 1st, '25, all the severance money will go this fund, up to five million dollars. We hope it will reach that amount. We feel that a great institution is assured, that will be of inestimable value to the State. The available funds will enable us to construct the best equipped agricultural college in the South, and one of the best in the world. Time, patience and the support of the whole people of the State will be required to bring it into its full measure of strength and usefulness.

Description of Plan

The left-hand margin of the picture represents the northern boundary of the College grounds, about two miles distant from the State capital, to the south. The park area to the right of the main road, going south, represents the foreground of the first group of academic buildings. The long building with two towers in the center is the administration building. Forming the east end of the first quadrangle are the class rooms and offices. At the west end of this quadrangle is located the Hill Memorial library, with an open court to the west, giving an uninterrupted view of the alluvial lands and the river, a half mile



Buildings and Grounds of the New Louisiana State University and A. & M. College.

distant. Between this quadrangle and the northern boundary of the grounds, are located the dormitories, chapel, assembly hall, the men's union, with cafeteria and equipment for the entertainment and comfort of the men students. Some of the residences for members of the faculty will also be located on the eastern portion of this part of the ground.

Just south of the group of buildings described and next to the roads, are the tennis court, football field, large parade ground, then the series of class rooms and laboratories for the sciences, including agriculture, horticulture, forestry, botany, entomology, zoology, chemistry and physics, geology, agricultural engineering, etc., forming the second series from the road westward to where the bluff joins the alluvial lands. Then going back to the road, the third series includes the baseball field, the armory, the shops for all of the engineering branches, the power house, laundry, creamery, refrigerator, abattoir and storage rooms. The southernmost unit of the highlands comprises the livestock buildings such as dairy barns, cattle barns and livestock judging pavilion.

Beginning at the left hand side of the court, we have to the east of the road, the hothouses, then the group of dormitories for women, the women's gymnasium, and the women's building. The next series to the left is devoted to agronomy plots. The remaining portions of the field to the east of the road will be devoted to pasture, farm crops, poultry plant and piggery. In addition to the highland there is about 1500 acres of the alluvial land that will be devoted to crop production and to pasture.

I am not able at this time to enlighten you regarding what course the Board of Supervisors will take in regard to important engineering problems that are involved and in which you will be interested. The problem of heating the various buildings is yet to be considered. The water supply may be provided by boring deep wells or there may be a water main extended from the water plant belonging to the City of Baton Rouge. The power house is provided in the plans and yet it is still an open question as to whether the buildings will be supplied with electric lights from our own power plant or from the City of Baton Rouge. The question of disposing of the sewage is yet an open one. The beautification of the grounds will, in all probability,

be in the hands of Olmstead Brothers, of Brookline, Mass., the celebrated landscape architects.

When the new Board of Supervisors of the University is organized, which will be in the near future, it will then be determined whether this building program will be carried on under the supervision of a salaried construction engineer, or whether the architectural plans for the different buildings will be submitted to a general supervising architect and separate contracts let for each building, to be constructed under the direction of a building committee.

This Institution is to be dedicated wholly to the advancement of the public welfare. We need the hearty support and kindly criticism of all public spirited patriotic men, who are trained in the technical branches of engineering, to help us to avoid costly mistakes. I feel sure that we shall have the most cordial support and assistance from this Association.

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), 8324 Panola St., New Orleans.
LESTER ALEXANDER, (1915), Engineer and Contractor, 834 Audubon Bldg., New Orleans.
DOUGLAS S. ANDERSON, (1909), Professor of Electrical Engineering and Dean of the College of Engineering, Tulane University, New Orleans.
A. F. BARCLAY, (1908), (1916), Engineer Public Belt Railroad, 5670 Rosemary Palco, New Orleans.
JOHN S. BARELLI, (1908), Machinery and Power Plant Equipment, 612 Godchaux Bldg., New Orleans.
WADE BARNETT, (1910), Engineer, 8821 Spruce St., New Orleans.
JAMES D. BECK, (1916), Consulting Engineer, 2331 Constance St., New Orleans.
LEZIN A. BECNEL, (1916), Chemical Engineer, 1510 Arabella 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), Engineer, N. O. Ry. & Lt. Co., 219 S. Dupre St., New Orleans.
F. N. BILLINGSLEY, (1915), Consulting Engineer, 702 Interstate Bank Bldg., New Orleans.
JAMES W. BILLINGSLEY, (1914), Consulting Engineer, Interstate Bank Bldg., New Orleans.
OLIVIER A. BILLION, (1920), Naval Architect, Naval Construction Department, French High Commission, 65 Broadway, New York.
JOSEPH P. BORGES, (1921), U. S. P. H. Service, Alexandria, La.
WALTER P. BRANDON, (1907), Draftsman, Public Belt Railroad, 1726 Elysian Fields Ave., New Orleans.
SHIRLEY C. BRASELMAN, (1919), care American Creosote Works, Station B, New Orleans.
ART. H. BROWN, (1919), Engineer, Dock Board, 1517 Crete Street., New Orleans.
DUNCAN BUIE, (1918), Highway Commissioner, Baton Rouge, La.
EDWARD W. BURGIS, (1919), 528 Bouny Street, New Orleans.
R. T. BURWELL, (1908), Manager, Gulf Department, Hartford Steam Boiler Inspection and Insurance Co., 1128 Hibernia Bank Bldg., New Orleans.
ASHLEY CALONGNE, (1914), Assistant Engineer, with S. A. Calongne's Sons, 630 Gravier St., New Orleans.
E. WHEELER CARR, (1908), President, E. W. Carr, Inc., Engineers and Contractors, Appraisers, Estimates, Mechanical Equipment of Buildings, 415-417 Gravier St., New Orleans.
D. B. H. CHAFFE, JR., (1920), 1448 Jackson Ave., New Orleans.
E. H. COLEMAN, (1911), J. F. Coleman Engineering Co., 822 Perdido St., New Orleans.
J. F. COLEMAN, (C. M.), of J. F. Coleman Engineering Co., 822 Perdido St., New Orleans.
JOSEPH B. CONVERSE, (1921), 3227 Coliseum St., New Orleans.
ROBERT E. CRAIG, II, (1922), Engineer with Doullut & Williams, 1138 Third St., New Orleans.
CHARLES C. CRAWFORD, (1921), 700-B Interstate Bank Bldg., New Orleans.

- W. H. P. CREIGHTON, (1912), Professor of Mechanical and Sugar Engineering, Tulane University, New Orleans.
- HORACE P. CRUMP, (1912), Office Engineer, Board of Port Commissioners, Port of New Orleans, No. 1 Canal Street, New Orleans.
- DAVID L. CULLOM, (1916), Assistant Engineer, Board of Commissioners, Port of New Orleans, 1737 Napoleon Ave., New Orleans.
- W. H. DAVIDSON, (1910), 534 Bienville St., New Orleans.
- B. N. DAVIS, (1913), Engineer and Contractor, 504 Poydras St., New Orleans.
- EUGENE F. DELERY, (1915), Assistant Engineer, Sewerage & Water Board, 1129 Jena St., New Orleans.
- ELLIOTT J. DENT, (1919), Lt. Col., Corps of Engineers, U. S. Army, 309 Custom House, New Orleans.
- DONALD DERICKSON, (1912), Professor of Civil Engineering, Tulane University, New Orleans.
- JACQUES de TARNOWSKY, (1915), Structural Engineer, 403-404 Vincent Bldg., New Orleans.
- J. L. DICKEY, (1915), Civil Engineer and Contractor, 1427 Carrollton Ave., New Orleans.
- M. P. DOULLUT, (1911), Capitalist, 400 Eganla St., New Orleans.
- ALLEN T. DUSENBURY, (1909), Drainage and Reclamation Engineer, 201 Marine Bank Bldg., New Orleans.
- GEORGE E. EARL, (1900), General Superintendent, Sewerage & 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.
- EUGENE N. EHRHART, (1921), 1019 Constantinople St., New Orleans.
- DANIEL STANLEY ELLIOTT, (1921), Professor of Physics, Tulane University, New Orleans.
- MARION J. EPLEY, (1920), President, Toyah Valley Sulphur Co., 809 Canal-Commercial Bank Bldg., New Orleans.
- JAMES P. EWIN, (1915), Sec'y-Treas., Doullut & Williams Co., Inc., New Orleans.
- ROBERT FAGET, (1919), 523 S. Pierce St., New Orleans.
- CHARLES A. FAYROT, (1919), 18 Richmond Place, New Orleans.
- MARSHALL G. FINDLEY, (1919), Spicer, Minn.
- EDWIN J. FISHER, (1913), Proprietor of the Electrical Contracting and Engineering Co., The Electrical Fixture & Material Co., 518-520 Gravier St., New Orleans.
- A. M. FROMHERZ, (1915), Associated with Jos. Fromherz, General Contractor, Title Guarantee Bldg., New Orleans.
- FRANK G. FROST, (1919), New Orleans Railway & Light Co., New Orleans.
- HERBERT N. GALLAGHER, (1921), 7039 Freret St., New Orleans.
- MARCEL GARSAUD, (1905), Engineer and Contractor, 515 Whitney Bldg., New Orleans.
- WILL J. GIBBENS, (1900), Vice-President, Standard Supply and Hardware Co., 822 Tchoupitoulas St., New Orleans.
- MAYER GODCHAUX, (1920), 3815 Carondelet St., New Orleans.
- W. B. GREGORY, (1907), Professor of Experimental Engineering, Tulane University, and Irrigation Engineer, U. S. Department of Agriculture, Tulane University.
- B. H. GREHAN, (1914), 1736 Second St., New Orleans.
- A. H. GUILLOT, (1917), Assistant Engineer, N. O. Railway & Light Co., 201 Baronne St., New Orleans.
- ADAM J. HAASER, (1916), Mechanical Engineer and Marine Superintendent, Vaccaro Bros., Co., 517 Olivier St., Algiers, La.
- ALLEN S. HACKETT, (1921), Contracting Engineer, 515 Whitney Bldg., New Orleans.
- FARRAR PETRIE HAMILTON, (1915), Vice-President, Creosoted Materials Co., Inc., 301 Q. and C. Bldg., New Orleans.
- GEORGE R. HAMMETT, (1920), 2015 Calhoun St., New Orleans.
- CHAS. J. HARDY, (1909), Civil Engineer, 2128 S. Gayoso St., New Orleans.

- M. V. HAULARD, (1906), Superintendent of Track, New Orleans Railway & Light Co., 4154 Iberville St., New Orleans.
- LEWIS G. HEIDER, (1920), 411 Canal Bank Bldg., New Orleans.
- W. S. HENNING, (1919), 2025 Robert St., New Orleans.
- WALTER H. HOFFMAN, (C. M.), Civil Engineer, care Chess, Checkers and Whist Club, New Orleans.
- W. T. HOGG, (1913), Chief Draftsman, Board of Commissioners, Port of New Orleans, 841 Exposition Blvd., New Orleans.
- FRANK L. HOLT, (1915), Electrical Designer, Engineering Dep't., Board of Commissioners, Port of New Orleans.
- NORMAN A. HOTARD, (1913), Assistant City Engineer, 235 Laverne St., New Orleans.
- FERDINAND G. HUMMEL, (1919), 3307 Prytanla St., New Orleans.
- ANDREW W. JACKMAN, (1913), 1704 Calhoun St., New Orleans.
- HARRY JACOBS, (1919), Civil Engineer, 2401 Franklin Ave., 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.
- WARREN JOHNSON, (1903), Vice-President and General Manager, Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc., P. O. Box 840, New Orleans.
- CHARLES E. JOURBERT, (1909), Civil Engineer, 838 Broadway, New Orleans.
- ERROL E. KELLY, (1920), 2463 N. Villere St., New Orleans.
- JAMES P. KEMPER, (1909), Civil Engineer in Private Practice, 310 Audubon St., New Orleans.
- CHARLES MacDONALD KERR, (1914), Engineer, Creosoted Materials Co., Inc., 301 Q. & C. Bldg., New Orleans.
- FRANK M. KERR, (C. M.), Chief State Engineer of Louisiana, 213 N. O. Court Bldg., New Orleans.
- CHARLES KIRSCHNER, (1917), Assistant Field Engineer, Board of Commissioners, Port of New Orleans, 1327 Esplanade Ave., New Orleans.
- JOHN KLOER, (1898), City Engineer, City Hall, New Orleans.
- R. B. KOHNKE, (1911), Engineer for Petroleum Import & Export Corp., 119 S. Anthony St., New Orleans.
- HERMAN KOKOSKY, (1903), Member of Firm of Kokosky & Co., 614 Gravier St., New Orleans.
- ALFRED A. LANAUX, (1921), 411 Tchoupitoulas St., New Orleans.
- HERRICK J. LANE, (1922), Doullut & Williams Co., Inc., 5926 Hurst St., New Orleans.
- EDWARD S. LANPHER, (1918), Superintendent of Lighthouses, Room 224 Custom House Bldg., New Orleans.
- FERD. L. LARUE, (1919), 823 Esplanade Ave., New Orleans.
- G. W. LAWES, (1898), Secretary, Board of State Engineers, 213 N. O. Court Bldg., New Orleans.
- ALBERT J. LEGETT, JR., (1919), Assistant Manager, Johnson Iron Works, Dry Dock and Shipbuilding Co., Inc., 1684 Moss Street, New Orleans.
- J. H. LEWIS, (1908), Morganza, La.
- A. M. LOCKETT, (1900), President, A. M. Lockett & Co., Ltd., 519 Baronne St., New Orleans.
- GERVAIS LOMBARD, (C. M.), Assistant State Engineer, Board of State Engineers, New Orleans.
- JAMES R. LOWE, (1919), Harrisburg Foundry and Machine Works, Harrisburg, Pa.
- CHAS. S. McFARLAND, (1903), care J. B. Camors, New Orleans.
- HENRY J. MALOCHEE, (1898), Vice-President, Buickmaster-Luck-Malochée, Inc., Room "E," Association of Commerce Bldg., New Orleans.
- RUFUS S. MANLEY, (1912), President, Creosoted Materials Co., Inc., 301 Q. & C. Bldg., New Orleans.
- RALPH H. MANN, (1921), 1334 Henry Clay Ave., New Orleans.
- H. G. MARTIN, (1920), Director, Delgado Trades School, 721 Lowerline St., New Orleans.

- A. S. MONTZ, (1919), Constructing Engineer, (Structural), 707 Title Guarantee 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 & Whist Club, New Orleans.
- JOHN HENRY MURPHY, (1914), 1322 Felicity St., New Orleans.
- FRANK A. MUTH, (1915), First Assistant Superintendent, Lighthouse Service, 2323 Short St., New Orleans.
- ALLEN J. NEGROTTTO, (1920), 1831 Carondelet St., New Orleans.
- BERNARD STANLEY NELSON, (1911), Chief Engineer, A. M. Lockett & Co., Ltd., 521 Baronne St., New Orleans.
- WILLIAM T. NEWTON, (1915), Master Mechanic, U. S. Engineers', 5923 Coliseum St., New Orleans.
- WILLIAM F. OAKES, (1918), 707 Title Guarantee Bldg., New Orleans.
- JOHN A. O'BRIEN, (1920), Engineer and Contractor, 1824 S. Dupre St., New Orleans.
- ROBERT M. O'BRIEN, (1916), Superintendent of Equipment, N. O. Ry. & Light Co., 5315 Camp St., New Orleans.
- OLE K. OLSEN, (1905), Contracting Engineer, 822 Perdido St., New Orleans.
- JOHN H. O'NIELL, (1916), Sanitary Engineer, Louisiana State Board of Health, 637 Lowerline St., New Orleans.
- J. DEVEREUX O'RIELLY, (1912), Engineer, Board of Commissioners of the Port of New Orleans, New Orleans National Bank Bldg., New Orleans.
- H. A. PALLFELT, (1914), Civil Engineer, Standard Oil Co., of La., 1205 Whitney Central Bldg., New Orleans.
- HYMAN RABINOVITZ, (1911), with A. M. Lockett & Co., Ltd., 521 Baronne St., New Orleans.
- LESTER H. RAYNER, (1920), 2116 Canal St., New Orleans.
- LYMAN C. REED, (1907), Vice-President-Secretary, Southern Jobbers' Supply Co., 534 Bienville St., 151-159 S. Peters St., New Orleans.
- HAMPTON REYNOLDS, (1910), General Contractor, 1304 Carrollton Ave., New Orleans.
- WILLIAM H. RHODES, (1922), 836 Malson Blanche Annex, 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.
- JAMES M. ROBERT, (1908), Professor of Machine Design, Tulane University, Director Night Classes in Engineering, Tulane University, New Orleans.
- EDWIN J. H. RODRIGUEZ, (1918), Zymothecnic Chemist, 143 Park Row, New Orleans.
- R. P. RORDAM, (1912), Civil Engineer, 6322 S. Liberty St., New Orleans.
- GEORGE C. SCHOENBERGER, (1919), Assistant 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.
- J. H. SEAMAN, (1912), Distributor Huffman Trucks and Cars, 4501 S. Johnson St., New Orleans.
- GEORGE ARTHUR SEAVER, (1920), Chief Engineer, George J. Glover, General Contractor, 1219 Eleanore St., New Orleans.
- SOLIS SEIFERTH, (1911), 1538 Seventh St., New Orleans.
- A. M. SHAW, (1910), Consulting Engineer, 617 Common St., New Orleans.
- LESTER C. SMITH, (1920), Chief Engineer with Doullut & Williams, 816 Howard Ave., New Orleans.
- CHARLES E. SNYPP, (1911), Engineer, with Southern Cotton Oil Co., Gretna, La.
- DAVID WHYTE STEWART, (1920), 2329 General Pershing St., New Orleans.
- ALFRED F. THEARD, (C. M.), Drainage Engineer, Sewerage and Water Board Bldg., New Orleans.
- RALPH R. TINKHAM, (1922), 7801 Brch St., New Orleans.
- FREDERICK G. TUPPER, (1922), 1201 Carondelet Bldg., New Orleans.
- EUGENE UNSWORTH, (1919), Assistant Chief Inspector, New Orleans Department Hart-

- ford Steam Boiler Insp. & Ins. Co., 1128 Hibernia Bank Bldg., New Orleans.
- GILBERT D. VON PHUL, (1916), Contracting Mechanical Engineer, 322 Hibernia Bank Bldg., New Orleans.
- FRANK H. WADDILL, (1898), Consulting Civil Engineer, 407 Canal Bank Annex, New Orleans.
- GEORGE D. WADDILL, (1911), Assistant Engineer, U. S. Eng. Office, 5219 Camp St., New Orleans.
- J. D. WALKER, (1908), Kelly-Walker & Kaufman, Engineering Contractors, 504 Marine Bank Bldg., New Orleans.
- JOHN H. WALSH, (1922), The Bienville, Lee Circle, New Orleans.
- ALLEN E. WASHBURN, (1908), U. S. Engineer Department, 329 Custom House Bldg., New Orleans.
- ALFRED L. WEBRE, (1913), care E. B. Badger & Sons, 75 Pitt St., Boston, Mass.
- LEO S. WEIL, (1920), President, Engineering Sales Co., Inc., 640 S. Peters St., New Orleans.
- LEON C. WEISS, (1918), 613 Maison Blanche Bldg., New Orleans.
- THOMAS M. WHITE, (1912), American Creosote Works, Station "B," New Orleans.
- BEN WILLARD, (1900), Local Manager, General Electric Co., 901 Maison Blanche Bldg., 7111 Freret St., New Orleans.
- W. HORACE WILLIAMS, (1908), President & General Manager, Doullut & Williams, Co., Inc., Civil Engineers and General Contractors, New Orleans.
- C. S. WILLIAMSON, JR., (1916), Head of School of Chemical Engineering, Tulane University, New Orleans.
- VICTOR L. WILLOZ, (1900), Superintendent of Distribution, N. O. Ry & Lt., Co., 201 Baronne St., New Orleans.
- J. NORMAN WILSON, (1911), Assistant Engineer, Sewerage and Water Pumping Stations Department, Sewerage and Water Board of New Orleans, 2425 Audubon St., New Orleans.
- WALTER S. WINSHIP, (1921), Whitney Bldg., New Orleans.
- ALLAN L. WOLFF, (1910), 1522 Aline St., New Orleans.
- PEYTON W. WOOD, (1911), Railway Supplies, 822 Perdido St., New Orleans.
- JOHN K. WOOLF, (1922), 5926 Hurst St., New Orleans.
- DURALDE F. WOODS, (1915), Civil Engineering, Litcher, La.
- SAMUEL YOUNG, (1911), Chief Engineer, Port Commission, No. 1 Canal St., New Orleans.
- HENRY L. ZANDER, (1898), Parish Engineer for Jefferson Parish, Engineer 1st and 2nd Good Roads Districts, Engineer 2nd and 5th Unit Jefferson Drainage District, 821 N. Rampart St., New Orleans.

NON-RESIDENT MEMBERS.

- JAMES R. ADAMS, (1911), Lake Providence, La.
- EDWARD A. ARPIN, (1918), Foreman, Ark.
- CHARLES D. BABBIT, (1911), Consulting Engineer, Box 377, Gueydan, 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.), 58 Sutter St., San Francisco, Cal.
- EDWARD W. BRES, (1915), Mechanical Engineer, 1119 Short St., New Orleans.
- R. W. BRINGHURST, JR., (1912), P. O. Box 192, Alexandria, La.
- JOHN CALLAN, (1918), care W. E. Biggs Engineering Co., Volunteer Building, Chattanooga, Tenn.
- H. E. CAMERON, (1914), 810 Elgin Ave., Houston, Texas.
- C. GLENN CAPPEL, (1915), Manager, Building Department, Doullut & Williams Co., Inc., 816 Howard Ave., New Orleans.

- JOHN J. CHISOLM, (1918), 71 Van Wame Ave., Mariner's Harbor, Staten Island, New York.
- L. C. DATZ, (1906), Chief Engineer, American Cities Co., 2100 First Ave., Birmingham, Ala.
- JOHN J. DAVIDSON, (1918), care Avoca P. O., Morgan City, La.
- GEORGE H. DAVIS, (1909), Engineer and Manager, 115 Broadway, New York City.
- A. D'HEUR, (C. M.), Vice-President, Pacific Oil Co., Room 663, 65 Market St., San-Francisco, Cal.
- W. T. DREW, (1921), Minden, La.
- 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., Engineer, Road District No. 5, Allen Parish, and Engineer, Road District No. 5 Vernon Parish, Elizabeth, La.
- FRANCIS T. FOOTE, (1909), Lumber Business, Kaplan, La.
- LOUIS J. FORTIER, (1914), Captain of Field Artillery, Alabama Polytechnic Institute, Auburn, Ala.
- JAMES McC. FOURMY, (1916), Consulting Highway Engineer, Hammond, La.
- FRED I. GETTY, (1915), Manufacturer of Oil Well and Water Well Supplies, Strainers, Pumps, etc., 603 Cutting Ave., Jennings, La.
- FLOYD HAMILTON, (1919), Lake Charles, La.
- JOHN LOVEJOY HENNING, (1919), 525 Kirby St., Lake Charles, La.
- FREDERICK McH. HILL, (1919), Monroe, La.
- H. H. HOLLOWAY, (1919), Civil Engineer, Amite, La.
- SAMUEL A. HONAKER, (1922), Arcadia, La.
- EUGENE M. HORNOT, (1912), care National Petroleum Corp., Port Tampa City, Fla.
- MARION C. HUCKABY, (1920), Civil Engineer, 203 Roumain Bldg., Baton Rouge, La.
- CHARLES L. JACOB, (1911), care Foundation Company, Athens, Ga.
- E. S. JARRETT, (1909), President, Jarrett-Chambers Co., Inc., Contractors, 30 East 42nd St., New York City.
- JOHN M. JENKS, (1920), Box 64, Bay St. Louis, Miss.
- XAVIER A. KRAMER, (1911), Consulting Engineer, Magnolia, Miss.
- JULES A. LORIO, (1921), Geismar, La.
- L. A. LOUSTALOT, (1913), Civil Engineer, Franklin, La.
- HENRY A. MENTZ, (1915), Consulting Electrical and Mechanical Engineer, Magnolia, Miss.
- JULIAN DUNBAR MONETTE, (1921), Resident Engineer, State Highway Department, Jackson, Miss.
- ROBERT MORRISON, (1919), Cut Off, La.
- HERBERT H. McGEHEE, (1920), Arcadia, La.
- CHARLES W. OKEY, (1911), Assistant Chief Engineer, Elliott & Harman Engineering Co., 245 Ayers Ave., Peoria, Ill.
- WILLIAM C. OLSEN, (1914), Consulting Engineer, Raleigh N. C., Kinston, 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, 213 N. O. Court Bldg., New Orleans.
- OTTO F. RESIZNER, (1910), Reiszner & White, Civil Engineers, LeCompte, La.
- FRANK LOUIS REYNOLDS, (1919), Vice-President, Fox, Reynolds Co., Inc., Building Construction, 81 East 125th St., New York City.
- W. B. ROBERT, (1911), Civil Engineer, Opelousas, La.
- FRANK L. ROE, JR., (1920), Omega, Madison Parish, La.
- ERNEST A. ROSE, (1915), care The Dyer Co., Cleveland, Ohio.
- JOSEPH F. ROSS, (1922), Arcadia, La.

- 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.
HARRY D. SCOTT, (1920), 5536 Prytanla St., New Orleans.
GEORGE SELMAN, (1908), Surveying and Engineering, Box 596, Monroe, La.
HOBARD D. SHAW, (1917), City Engineer and General Practice, Gulfport, Miss.
ELMER E. SHUTTS, (1918), Lake Charles, La.
JOHN A. SILSBEE, (1915), of Gilbert & Silsbee, Civil and Consulting Engineers, Okmulgee, Okla.
FRED E. SMITH, (1916), Chief Engineer, with U. S. Shipping Board, Gulf Division, 1042 Louisa St., New Orleans.
T. BAKER SMITH, (1919), Houma, La.
JOHN Y. SNYDER, (1918), Engineer, 1210-1211 Merchants Bldg., Shreveport, La.
ROGER B. STEVENS, (1920), Engineer, Consulting Board, American Sugar Refining Co., 117 Wall St., New York City.
IRA W. SYLVESTER, (1901), Consulting Engineer, City Hall Bldg., Alexandria, La.
WM. F. TRIGGS, (1914), East Fifth St., Crowley, La.
ROGER I. TANNER, (1921), Abbeville, La.
THOS. H. TUTWILER, (1898), President and General Manager, The Memphis Street Railway Co., Memphis, Tenn.
WIL. von PHUL, (1908), (Ford, Bacon & Davis), President and General Manager, Market St. Railway Co., 58 Sutter St., San Francisco, Cal.
J. LESTER WHITE, (1920), Relszner & White, Civil Engineers, LaCompte, La.
W. S. WHITE, (C. M.), Box 44, Sulphur, La.
A. A. WOODS, (1911), Chief Engineer, Maintenance of Ways and Structures, Southern Ry. System, Lines West, 131 Ingalls Bldg., Cincinnati, Ohio.

ASSOCIATE MEMBERS.

- R. H. BAUMBACH, (1911), Manager, Eugene Dietzgen Co., 316 Camp St., New Orleans.
JOSEPH A. BRENNAN, (1920), 2158 G. St., Granite City, Ill.
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), Manager, Clyde Iron Works Sales Co., 309 Magazine St., New Orleans.
GEORGE B. GIBSON, (1920), 2103 Painter St., New Orleans.
EDMUND J. GLENNY, (1919), 1435 Webster St., New Orleans.
GEORGE J. GLOVER, (1916), General Contractor, 1032-35 Whitney Bldg., New Orleans.
JULES GODCHAUX, (1899), 221 Godchaux Bldg., New Orleans.
A. T. GOMILA, SR., (1920), 2601 General Pershing St., New Orleans.
WALTER F. JAHNCKE, (1920), 814 Howard Ave., New Orleans.
JOHN JURGENSEN, (1922), 6029 Coliseum St., New Orleans.
A. A. KEITHER, (1919), 234 S. Scott St., New Orleans.
STUART O. LANDRY, (1922), 614 Maison Blanche Bldg., New Orleans.
JOHN McINERNEY, (1920), Builder, Hibernia Bank Bldg., New Orleans.
EDWARD T. MALLOY, (1920), 4117 St. Peter St., New Orleans.
HOWARD H. MARSH, (1921), 444 Maison Blanche Bldg., 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., 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), 729 Constantinople St., New Orleans.
STILLMAN W. WHELOCK, (1914), Manager of Sales, Carnegie Steel Co., 1030 Maison Blanche Bldg., New Orleans.

RESIDENT JUNIOR MEMBERS.

JOHN APPLEBY, JR., (1918), Assistant Engineer, A. M. Shaw, 617 Common St., New Orleans; 1518 Melpomene St., New Orleans.
 HENRY HESTER BATE, (1919), Civil Engineer, 4218 Elk St., New Orleans.
 J. J. BULLUING, (1915), Market Street Power House, New Orleans.
 JOHN L. EBAUGH, JR., (1922), Tulane University, New Orleans.
 HORATIO L. GILBERT, (1917), 7708 Sycamore St., New Orleans.
 EUGENE C. GRAVELEY, (1918), Civil Engineer, 1302 Marengo St., New Orleans.
 MAURICE F. HUNT, (1919), 2629 Chestnut St., New Orleans.
 S. DOUGLAS JACKSON, (1916), 331 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 Coliseum St., New Orleans.
 ALEX H. McCOMISKEY, JR., (1919), 2837 Carondelet St., New Orleans.
 SHEPARD F. PERRIN (1915), Mechanical Engineer, Doullut & Williams Co., Inc., 3804 Chestnut St., New Orleans.
 ROBERT A. PIERPONT, (1915), 1036 Napoleon Ave., New Orleans.
 CLIFFORD HOEY STEM, (1914), Sales Engineer, 7933 Poplar St., New Orleans.
 S. A. THEARD, (1920), Oak Grove, La.
 CHARLES J. WYLER, (1919), 530 Jackson Ave., New Orleans.

NON-RESIDENT JUNIOR MEMBERS.

GEORGE O. ALLAIN, (1916), Toll Plant, Cumberland Telephone and Telegraph Co., 6214 St. Charles Ave., New Orleans.
 G. C. BADGER, (1913), Supt. of Engineering and Construction, Grinnel Co., of the Pacific, 453 Mission St., San Francisco, Cal.
 F. R. DUVIC, (1916), Engineer, W. I. Sugar Finance Corp., Cayo Mambi, Oriente, Cuba.
 JACOB F. MULLER, JR., (1912), Plant Supt., Muller Furniture Mfg. Co., Ltd., 3731 Canal St., New Orleans.
 HERBERT P. NATHAN, (1913), Engineer, Union Oil Co., Los Angeles, Cal.; 439 Duquesne Ave., Culver City, Calif.
 CARL SCHNEIDAU, (1916), Superintendent, Mechanical Plant, Bureau of Standards, Washington, D. C.
 LUCIEN J. TROXLER, JR., (1915), Radio Division, Bureau of Engineering, Navy Department; 1741 Que St., N. W., Washington, D. C.

STUDENT MEMBERS.

ROBERT L. ATKINSON, 312 Audubon Blvd., New Orleans.
 WALTER COOKE, 1025 Alvar St., New Orleans.
 JOHN R. DYKERS, Southern Paper Co., Moss Point, Miss.
 EUGENE C. HAWKINS, 7815 Panola St., New Orleans.
 C. L. JONES, 1539 Jackson Ave., New Orleans.
 S. B. SCHWARTZ, 1733 General Pershing St., New Orleans.
 FRANK A. TURNER, 1003 Texas & Pacific Bldg., Dallas, Texas.
 VENNARD WILSON, Capt., 83rd F. A., Camp Benning, Ga.
 LOUIS J. WYLER, 530 Jackson Ave., New Orleans.

SUMMARY.

Honorary Member.....	1
Resident Members.....	164
Non-Resident Members.....	77
Associate Members.....	22
Junior Members.....	16
Non-Resident unior Members.....	7
Student Members.....	9
Total.....	298

PAST OFFICERS.**Presidents.**

Sidney F. Lewis.....	1898	W. B. Gregory.....	1910
Thos. L. Raymond.....	1899	J. C. Haugh.....	1911
Henry J. Malochee.....	1900	D. S. Anderson.....	1912
Frank M. Kerr.....	1901	A. M. Shaw.....	1913
Alf. F. Theard.....	1902	W. H. Williams.....	1914
Alf. Raymond.....	1903	L. C. Datz.....	1915
J. F. Coleman.....	1904	Samuel Young.....	1916
W. B. Wright.....	1905	A. T. Dusenbury.....	1917
W. H. Hoffman.....	1906	John Klorer.....	1918
G. W. Lawes.....	1907	Ole K. Olsen.....	1919
C. W. Wood.....	1908	John Riess.....	1920
J. T. Eastwood.....	1909	R. S. Manley.....	1921

Vice-Presidents.

C. H. Chamberlain.....	1898-1899	A. M. Lockett.....	1911-1912
Alf. F. Theard.....	1900	Wm. H. Williams.....	1913
J. F. Coleman.....	1901	Ole K. Olsen.....	1914
W. B. Wright.....	1902-1903	Samuel Young.....	1915
W. T. Crotts.....	1904	A. T. Dusenbury.....	1916
J. M. Ordway.....	1905	John Klorer.....	1917
G. W. Lawes.....	1906	R. S. Manley.....	1918
C. W. Wood.....	1907	John Riess.....	1919
J. T. Eastwood.....	1908	R. S. Manley.....	1920
John Riess.....	1909-1910	Donald Derickson.....	1921

Secretary and Librarian.

J. F. Coleman.....	1898-1899	L. C. Datz, Jas. M. Robert.....	1911
Gervais Lombard.....	1900	James M. Robert.....	1912
John F. Richardson.....	1901	James M. Robert.....	1913
G. W. Lawes.....	1902-1903-1904-1905	W. T. Hogg.....	1914-1915-1916
Marcel Garsaud.....	1906	J. M. Robert.....	1917
L. C. Datz.....	1908	J. M. Robert.....	1918-1919-1920
L. C. Datz.....	1909	J. M. Robert.....	1921
L. C. Datz.....	1910		

Treasurers.

Alf. F. Theard.....	1898-1899	Ole K. Olsen.....	1912-1913
Walter H. Hoffman.....	1900-1901	E. H. Coleman.....	1914-1915-1916
R. E. DeBuys.....	1902	John Klorer.....	1916
W. H. Hoffman.....	1903-1904-1905	Ole K. Olsen.....	1917-1918
J. C. Haugh.....	1906-1907-1908	Walter B. Moses.....	1919-1920
J. C. Haugh.....	1909-1910	Walter B. Moses.....	1921
J. M. Robert, Ole K. Olsen.....	1911		

Directors.

Thos. L. Raymond.....	1898	C. W. Wood.....	1904-1905-1906
A. C. Bell.....	1898-1899	E. L. Jahneke.....	1905-1906-1907
F. T. Llewellyn.....	1898	John Riess.....	1907-1909-1917
Frank M. Kerr.....	1899-1900	W. B. Gregory.....	1909
Alf Raymond.....	1901-1902	Marcel Garsaud.....	1908-1909-1910

Ernest D. Ivy.....	1900-1901-1902	J. W. Armstrong.....	1909-1910
T. H. Tutwiler.....	1900-1901	Ole K. Olsen.....	1915-1916
A. M. Lockett.....	1910	W. H. Williams.....	1915
A. M. Shaw.....	1911-1912-1914	R. S. Manley.....	1916-1917
L. C. Reed.....	1910-1911-1912	Samuel Young.....	1917
D. S. Anderson.....	1911-1912	J. M. Robert.....	1917
W. B. Gregory.....	1912-1913-1914-1915-1916	H. L. Hutson.....	1918
L. C. Datz.....	1912-1913-1914-1916	John Riess.....	1918
A. T. Dusenbury.....	1913-1914	J. S. Barelli.....	1918
Henry J. Malochee.....	1899	R. T. Burwell.....	1919
John M. Ordway.....	1902-1903-1904	C. S. Williamson.....	1920
A. C. Duval.....	1903-1904-1905	G. W. Lawes.....	1921
W. McCorkindale.....	1903	J. S. Barelli.....	1921

DECEASED.

CHARLES H. DICKINSON, C. M., December, 13, 1898.
 EDGAR L. LAMBERT, R. M., March, 1901.
 H. BOLIVAR THOMPSON, C. M., July 10, 1901.
 THOS. L. RAYMOND, C. M., November 15, 1901.
 GEO. A. LEDERLE, R. M., March 27, 1905.
 JOHN T. NORTON, R. M., July, 1905.
 FRANCIS V. PELLERIN, R. M., March 31, 1908.
 JUDGE JOHN CLEGG, Assoc. M., October 5, 1908.
 JOHN MORSE ORDWAY, Hon. M., July 4, 1909.
 HENRY B. RICHARDSON, C. M., August 22, 1909.
 CHARLES W. WOOD, R. M., April 3, 1911.
 BENJAMIN MORGAN HARROD, C. M., September 7, 1912.
 JOHN D. WHITE, N. R. M.
 JAMES C. HAUGH, R. M., July 6, 1913.
 J. C. HENRY, N. R. M., December, 1914.
 REINNIER SWART, N. R. M., August, 1917.
 FOSTER OLROYD, R. M., October, 1917.
 C. W. BOCAGE, N. R. M., August, 1918.
 A. A. DIETTEL, N. R. M., August 6, 1918.
 ROBERT W. NOLTE, R. M., October 9, 1918.
 DAVID W. WEIDMAN, Jr., M., October, 18, 1918.
 C. H. GILLEAN, N. R. M., November 9, 1918.
 W. J. HARDEE, C. M., November 17, 1918.
 GAIL H. BROWNE, N. R. M., December 7, 1918.
 A. HAROLD DELBERT, Jr., M., January 6, 1919.
 HENRY L. HUTSON, R. M., January 10, 1919.
 C. T. RAYNER, JR., R. M., January 20, 1919.
 CHARLES O. BABIN, R. M., February 13, 1919.
 E. B. MCKINNEY, R. M., March 30, 1919.
 W. B. WRIGHT, R. M., November 16, 1919.
 ALFRED RAYMOND, R. M., January 13, 1920.
 HUBBARD MOYLAN FEILD, R. M., April 10, 1920.
 ARSENE PERRILLIAT, R. M., October 23, 1920.
 W. A. HALLER, N. R. M.
 JOHN DeM. CRAWFORD, N. R. M., May, 1921.
 EDGAR L. STREAM, R. M., October 23, 1921.

MINUTES OF MEETING AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, December 12, 1921.

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

The following applications were ordered to the ballot for the respective grades of membership:

Resident Members—Messrs. John M. Bernhard, Robert E. Craig, 2nd, Herrick J. Lane, Robert K. Mulnix, Wm. H. Rhodes, Ralph R. Tinkham, F. G. Tupper, John H. Walsh, John King Woolf.

Non-Resident Members—Fred N. Hill, Samuel A. Honaker, Joseph F. Ross.

Associate Members—John Jurgensen, Stuart O. Landry.

Junior Member—John L. Ebaugh, Jr.

The financial report of the Secretary was read and bills ordered paid. There being no further business to come before the meeting same was adjourned.

JAMES M. ROBERT, Secretary.

Regular Meeting of the Society, December 12, 1921.

The meeting was called to order with President Manley in the chair and 42 members and guests present. The minutes of the last meeting were read and approved. Professor Gregory and Mr. Moses made informal progress reports on the work of the Membership and Smoker Committees, respectively. Mr. Olsen made a short statement concerning a new luncheon to be held jointly with the local members of the Louisiana Engineering Society, the American Society of Mechanical Engineers, the American Society of Civil Engineers and the American Association of Engineers. It was moved, seconded and carried that the President of the Louisiana Engineering Society appoint a committee of two to confer with members of the other societies and form plans for holding a monthly luncheon. The President Appointed Messrs. Olsen and Muth.

Upon motion duly seconded it was decided that the Louisiana Engineering Society should be represented in Washington on January 5, 1922, at the meeting of the Federated American Engineering Societies, the expenses of our representatives to be borne by the Louisiana Engineering Society.

After some discussion, a motion was made and seconded that it be the sense of the meeting that the new State Highway Engineer be a licensed engineer practicing in Louisiana at the time of the passage of the act creating the State Highway Commission. After considerable more discussion the motion was lost.

The technical exercises of the evening were then proceeded with and Professor W. R. Dodson gave an instructive and interesting address on "The Greater Agricultural College." Professor Dodson was roundly applauded and thanked from the chair for his lecture.

Ballots for the nomination of officers for the ensuing year were then in order and as a result of these ballots the following were nominated to serve for the year 1922:

President, Donald Derickson.

Vice-President, John S. Barelli.

Secretary, James M. Robert.

Treasurer, Walter B. Moses.

Director, to serve 3 years, Marcel Garsaud.

There being no further business to come before the meeting, same was adjourned to the usual collation.

JAMES M. ROBERT, Secretary.

Regular Meeting of the Board of Direction, January 14, 1922.

The regular meeting of the Board of Direction was held on January 14th, with President Manley in the chair and the following members present: Messrs. Derickson, Barelli and Robert.

Ballots for new members were opened, there being 71 formal ballots cast; as a result the following were elected to the respective grades of membership:

Resident Members—John H. Bernhard, Robert E. Craig, II, Herrick J. Lane, Robert K. Mulnix, William H. Rhodes, Ralph R. Tinkham, Frederick G. Tupper, John H. Walsh, John King Woolf.

Non-Resident Members—Frederick McH. Hill, Samuel A. Honaker, Joseph F. Ross.

Associate Members—John Jurgensen, Stuart O. Landry.

Junior Member—John L. Ebaugh, Jr.

Mr Samuel Young was transferred from Non-Resident to Resident membership. The resignation of Mr. Irving H. Morse was accepted as of January 1, 1922.

Upon motion duly seconded it was decided to have the books of the Society audited by a certified public accountant, as this had not been done for sometime.

The Annual report of the Secretary was read and accepted and the report of the Board of Direction was approved for reading before the membership.

Professor Derickson made a short report on Dean Cooley's visit to New Orleans and Messrs. Derickson and Robert were appointed a committee to arrange for his entertainment while here. Professor Derickson also

made a short report on his visit to the Annual Meeting of the Federated American Engineering Societies.

There being no further business to come before the meeting, the same was adjourned.

JAMES M. ROBERT, Secretary.

Regular Meeting of the Society, January 14, 1922.

The regular meeting of the Society was called to order with President Manley in the chair and 31 members and guests present. The minutes of the previous meeting were read and approved. The Annual Reports of the Secretary, Treasurer, and Board of Direction were read to the meeting and accepted.

Professor Derickson made a statement concerning the visit of Dean Cooley to speak to our Society, and upon motion duly seconded and carried, it was decided to postpone our next regular meeting and hold the same while Dean Cooley is here so that all may have an opportunity of hearing him.

Ballots were then opened for officers for the ensuing year and as a result the following were elected:

President, Donald Derickson, 91 votes.

Vice-President, John S. Barelli, 91 votes.

Secretary, James M. Robert, 91 votes.

Treasurer, Walter B. Moses, 91 votes.

Director to serve 3 years, Marcel Garsaud, 90 votes.

Mr. G. W. Lawes was appointed to escort Professor Derickson to the chair and his first official act was to adjoin the meeting to the Annual Smoker at Francois' Restaurant, which was thoroughly enjoyed by all.

JAMES M. ROBERT, Secretary.

ANNUAL REPORT OF THE BOARD OF DIRECTION.

Year 1921.

January 14, 1922.

To the Members of the Louisiana Engineering Society:
Gentlemen:

Your Board of Direction begs to report that during the past year it has held ten regular meetings for the transaction of the Society's Business.

Our Technical Papers Committee has served us well. Attention is called to the high grade of papers presented as well as to the diversity of subject matter.

The Library Committee has compiled an excellent list of valuable books for the engineer. These are now being added to our shelves.

The Membership Committee has recently inaugurated a Membership Campaign which we expect will bring in a large number of new members in the near future. Mr. Ole K. Olsen has very generously doated the sum of \$150.00 to be given as a prize for increasing the membership of the Society. 29 members have been elected this year, bringing the total membership to 296. The growth of the Society is a steady one.

The Publication Committee has given us six excellent issues of the Proceedings this year. Our journal is an undertaking of which we may be justly proud and our editor, Professor Douglas Anderson, deserves the highest praise for its general quality and tone.

More advertisements, however, are needed to keep the Journal on a firm financial basis. The Committee is now trying to work up enthusiasm along this line and we trust that in the near future they will be very successful in their efforts.

Attention is called to the financial condition of the Society. Our investments are well placed and amount to \$1,600.00. The General Reserve Fund shows a balance of \$1,285.26, and the Proceedings Reserve Fund a balance of \$1,659.34. The Treasurer's report shows a cash balance January 1, 1922 of \$1,203.64.

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

Respectfully submitted,

R. S. MANLEY, President.

DONALD DERICKSON, Vice-President.

JAMES M. ROBERT, Secretary.

WALTER B. MOSES, Treasurer.

G. W. LAWES,

J. S. BARELLI,

B. S. NELSON,

Board of Direction.

ANNUAL REPORT OF THE SECRETARY.

Year 1921.

To the Board of Direction, Louisiana Engineering Society:
Gentlemen:

As Secretary of the Society, I herewith submit the following report for the year 1921:

During the past year the Board of Direction held 10 regular meetings; The Society also held 10 regular meetings with an average attendance of 45, maximum 66, minimum 34. A special meeting of the Society was held April 18th at which 10 members were present.

The membership of the society shows a net gain of 11 members. The record of the changes for the year is as follows:

GRADE	On Roll Jan. 1, 1921	Elected	Transferred to	Transferred from	Dropped	Resigned	Died	On Roll Jan. 1, 1922
Honorary	1	0	0	0	0	0	0	1
Resident	150	18	6	2	4	2	2	164
Non-Resident	79	6	2	3	5	1	1	77
Associate	19	3	0	0	0	0	0	22
Junior	19	1	0	2	2	0	0	16
Non-Resident Junior.....	7	0	0	0	0	0	0	7
Student	10	1	0	1	0	1	0	9
Totals.....	285	29	8	8	11	4	3	296

It is with regret that we report the deaths of the following: Mr. Edgar L. Stream, Resident Member and Mr. John DeM. Crawford, Non-Resident Member. Captain Ector B. Latham, who was recommended for membership and elected, died before the ballots were opened.

Submitted separately is the Treasurer's report which shows a balance of \$1,203.64.

Our investment account stands as follows:

Hibernia Bank & Trust Co.....	\$250.00
Metropolitan Bank.....	50.00
New Orleans National Bank.....	250.00
Interstate Bank & Trust Co.....	250.00
Liberty Bonds.....	250.00
N. O. Bldg La. State Fair.....	100.00
Liberty Bonds.....	500.00
Total.....	\$1800.00

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

The following technical exercises were held:

Feb. 14—"Straightening a Large Shaft by the Heat Process," by Mr. Frank G. Frost.

Feb. 14—"Cranes," an illustrated talk by Mr. Griess of the McMyler-Interstate Company.

Mar. 14—"The Financing of Road Construction," by Hon. Harry P. Gamble.

Apl. 11—"Why Louisiana Conserves Her Forests," by Mr. R. D. Forbes.

May 9—"Certain Features Relating to Hydraulic Turbine Designed Settings," by Mr. E. W. Burbank.

June 13—Discussion lead by the Local Section of American Military Engineers.

Sept. 13—"The Economic Value of the Industrial Canal," by Mr. Walter Parker.

Oct. 10—"Trade Schools," by Mr. H. G. Martin.

Nov. 14—"Natural Gas for New Orleans," by Mr. A. M. Lockett.

Dec. 12—"The Greater Agricultural College," by Professor W. R. Dodson.

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

Respectfully submitted,

JAMES M. ROBERT, Secretary.

FINANCIAL CONDITION OF THE SOCIETY, JANUARY 1, 1921.

Assets:

Cash on Hand.....	\$1,203.64
Membership Accounts Receivable.....	673.55
Advertisers Accounts Receivable.....	374.72
Investments	1,600.00
Expenses of Delegate.....	200.00
Total Assets.....	\$4,051.91

Liabilities:

Library Fund	\$ 651.07
Proceedings Reserve Fund.....	1,659.34
1922 Dues.....	41.25
1923 Dues....	1.50
Accounts Payable.....	263.49
Ole K. Olsen Prize Fund.....	150.00
	2,766.65

Balance in General Fund.....\$1,285.26

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
	\$1,285.26

Proceeding Reserve Fund.

Balance from 1915.....	\$ 112.20
Balance from 1916.....	566.13
Balance from 1917.....	568.14
Balance from 1918.....	587.52
Balance from 1919.....	41.08
	\$1,855.07
Deficit from 1920.....	221.98
	\$1,633.09
Balance from 1921.....	26.25
	\$1,659.34

Proceeding Fund—Result for Year 1921.**Revenues:**

Advertisements	\$1,096.67
Subscription, members.....	576.00
Proceedings Sales.....	1.20
Total revenues.....	\$1,673.87

Expenses:

Salary of Editor.....	\$ 300.00
Salary of Secretary.....	60.00
Stenographer at Meetings.....	88.50
Assistant to Editor.....	180.00
Miscellaneous Expense.....	5.25
Printing and Mailing Proceedings.....	1,001.37
Losses through cancelled ads.....	12.50
	\$ 26.25

General Fund—Results for Year 1921.

Revenues:

Membership dues.....	\$2,674.25
Smoker	257.50
Entrance Fees.....	179.00
Credit for Accounts Payable.....	6.10
Exchange	.20
Paid up arrears.....	21.50
Redeposit	3.00
Total Revenues.....	\$3,141.55

Expenses:

Subscriptions to Proceedings.....	\$ 576.00
Appropriation for Library.....	480.00
Deducted for Military Service.....	25.50
Losses through non-payment of dues.....	151.50
Salary of Secretary.....	300.00
Printing and Postage.....	292.43
Refreshments	111.95
Membership Dues—Federated American Engineer- ing Society.....	272.00
Miscellaneous Expense.....	101.31
Smoker Expense.....	733.77
Exchange	6.15
Total expenses.....	\$3,050.61

\$ 90.94

Annual Statement of Library Fund—January 1, 1922.

Revenues:

Balance on Hand, Jan. 1, 1921.....	\$ 582.13
Revenue from General Fund.....	480.00

Total Revenues.....|.....\$1,062.13

Expenditures:

Miss Carrie Freret, Librarian.....	\$ 180.00
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February 16th—

Macmillan Co.....	4.23
Gaylord Bros.....	3.65
Electrical World.....	5.00
Railway Age.....	8.00
Proceedings 1920, Amer. Soc. Testing Materials	10.40

March 16—

Owen Gernon, Bindings.....	108.50
Tulane University Press.....	12.50

April 12—

Electric Railway Journal.....	4.00
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September 13th—

Gaylord Bros.....	2.60
Power	3.00
Engineering Pub. Co.....	2.00
1921 Standards, Amer. Soc. for Testing Materials	8.00
1921 Standards, American Soc. for Testing Materials	8.00

November 17th—

Military Engineer.....	4.50
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December 15th—

Engineering and Contrating.....	4.00
A. S. M. E.—Engineering Index.....	6.00
Railway Maintenance Engineer.....	2.00
Concrete	3.00
Electrical World.....	5.00
Municipal and Country Engineering.....	2.00
Electric Journal.....	2.00
Tulane University Press.....	17.70

December 31st—

Accounts Payable.....	12.88	411.66
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Balance on hand Jan. 1, 1922.....\$ 651.07

Cash Account.

Receipts:

Check Redeposited.....	\$ 3.00
1921 Dues.....	2,094.00
1920 Balances.....	380.85
1922 Dues.....	37.50
1923 Dues.....	1.50
Entrance Fees.....	165.00
Member reinstated.....	21.50
Exchange	.20
Smoker	207.50
Advertisers in Proceedings.....	1,024.37
Proceedings Sales.....	1.20
Ole K. Olsen Prize Fund.....	150.00
Total Receipts.....	\$4,086.62
Deduct Exchange Charges.....	6.15
Net Receipts.....	4,080.47
Add 1920 Balance.....	1,395.33
	\$5,475.80

Expenditures:

Total Warrants this year.....	\$4,272.16
Balance on Hand Jan. 1, 1922.....	\$1,203.64

Respectfully submitted,

JAMES M. ROBERT, Secretary.

Annual Report of the Treasurer.

To the President, Louisiana Engineering Society, City.

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 8th, 1921 up to and including January 8th, 1922.

Received from Secretary—	Deposited	Deposited	Deposited	Exchange Charged
	Citizens Bank	Liberty Bank	Orleans Bank	
Feb. 2, Memo 1 to 7.....	.....	.....	\$ 972.04	\$2.10
Mar. 9, Memo 8 to 10.....	.....	.....	342.50	.90
Apr. 5, Memo 11 to 14.....	\$ 355.92	.....	.....	.50
May 4, Memo 15 to 18.....	388.80	.....	.....	.55
June 8, Memo 19 to 21.....	.....	\$ 317.68	.....	.70
July 19, Memo 22 to 23.....	.....	225.90	.....	.20
Aug. 17, Memo 24 to 27.....	.....	349.32	.....	.25
Sept. 28, Memo 28 to 30.....	.....	230.00	.....	.25
Oct. 26, Memo 31 to 33.....	.....	207.27	.....	.25
Nov. 30, Memo 34 to 36.....	.....	383.28	.....	.20
Dec. 30, Memo 37 to 38.....	.....	304.76	.....	.25
	\$ 744.72	\$2,018.21	\$1,314.54	\$6.15
Check redeposited (returned NSF).....				\$ 3.00
Total Received from February 2nd, 1921 to December 30th, 1921.....				\$4,086.62
Less exchange.....				6.15
				\$4,080.47
Balance on hand as per Treasurer's report of Jan. 8th, 1921.....				\$1,395.33
				\$5,475.80

Disbursements from January 8th, 1921 to January 8th, 1922.

January 31st—

No.	Name	Amount
1	Walter B. Moses.....	\$ 702.42
2	The Military Engineer.....	4.50
3	Kokosky & Co.....	2.96
4	Miss Carrie Freret.....	15.00
5	Tulane University Press.....	380.10
6	Miss Edna Doll.....	15.00
7	James M. Robert.....	33.75

February 16th—

8	Miss Carrie Freret.....	15.38
9	Miss Edna Doll.....	15.00
10	James M. Robert.....	36.50
11	Fabacher's Restaurant.....	27.70
12	The Macmillan Company.....	4.23
13	Gaylord Bros.....	3.65
14	Garcia Stationery Co.....	1.00
15	Electrical World.....	5.00
16	Railway Age.....	8.00
17	American Society for Testing Materials.....	10.40
18	Tulane University Press.....	40.10
19	American Engineering Council.....	68.00

March 16th—

20	Tulane University Press.....	313.82
21	Owen Gernon Co.....	108.50
22	Fabacher's Restaurant.....	18.35
23	Miss Carrie Freret.....	15.00
24	Miss Edna Doll.....	15.00
25	James M. Robert.....	39.75

March 19th—

26	Whitney Central National Bank.....	4.00
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April 12th—

27	Harry Le Stacy.....	25.00
28	Fabacher's Restaurant.....	11.35
29	Electric Railway Journal.....	4.00
30	Miss Carrie Freret.....	15.00
31	Federated American Engineer Societies.....	68.00
32	Miss Edna Doll.....	15.00
33	Tulane University Press.....	49.00
34	James M. Robert.....	36.80

May 12th—

35	Tulane University Press.....	161.55
36	Miss Carrie Freret.....	15.00
37	Miss Edna Doll.....	15.00

Proceedings of the Louisiana Engineering Society

No.	Name	Amount
38	James M. Robert.....	34.07
39	Frank Norman.....	1.45
June 15th—		
40	Tulane University Press.....	27.20
41	Frank Norman.....	2.08
42	Fabacher's Restaurant.....	21.45
June 15th—		
43	Miss Carrie Freret.....	15.00
44	Miss Edna Doll.....	15.00
45	James M. Robert.....	33.25
46	D. S. Anderson.....	150.00
July 8th—		
47	Miss Carrie Freret.....	15.00
48	Miss Edna Doll.....	15.00
49	James M. Robert.....	33.50
August 2nd—		
50	Tulane University Press.....	154.90
51	Federated American Engineer Societies.....	68.00
52	The Southern G. F. Co.....	40.05
53	Miss Carrie Freret.....	15.00
54	Miss Edna Doll.....	15.00
55	James M. Robert.....	30.00
August 15th—		
56	Whitney Central National Bank.....	3.10
September 13th—		
57	Tulane University Press.....	205.45
58	Fabacher's Restaurant.....	10.10
59	Miss Carrie Freret.....	15.00
60	Gaylord Bros.....	2.60
61	Power	3.00
62	Engineer Publishing Co.....	2.00
63	Miss Edna Doll.....	15.00
64	James M. Robert.....	30.00
September 23rd—		
65	French Cooking Restaurant.....	12.30
66	T. J. Carbrey.....	17.50
October 14th—		
67	Tulane University Press.....	21.50
68	Federated American Engineer Societies.....	68.00
69	American Society for Testing Materials.....	8.00
70	Miss Carrie Freret.....	15.00
71	Miss Edna Doll.....	15.00
72	James M. Robert.....	33.75
73	French Cooking Restaurant.....	12.00

November 17th—

No.	Name	Amount
74	Tulane University Press.....	105.20
75	The Military Engineer.....	4.50
76	Miss Carrie Freret.....	15.00
77	Miss Edna Doll.....	15.00
78	James M. Robert.....	34.50
79	French Cooking Restaurant.....	14.40

December 5th—

80	T. J. Carbery.....	30.00
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December 15th—

81	Engineering and Contracting.....	4.00
82	American Society of Mechanical Engineers.....	6.00
83	Railway Maintenance Engineer.....	2.00
84	Concrete	3.00
85	Electrical World.....	5.00
86	Engineering Publishing Co.....	2.00
87	Electrical Journal.....	2.00
88	Tulane University Press.....	93.00
89	Prof. Douglas Anderson.....	150.00
90	Miss Carrie Freret.....	15.00
91	Miss Edna Doll.....	15.00
92	James M. Robert.....	34.50
93	T. J. Carbery.....	16.00
94	French Cooking Restaurant.....	12.00

December 26th—

95	Donald Derickson.....	200.00
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Total.....\$4,272.16

Total Receipts.....\$5,475.80

Total Disbursements.....4,272.16 1,203.64

Check account in Liberty Bank Jan. 8, 1922..... 860.70

Check account in Citizen's Bank Jan. 8, 1922..... 342.94 1,203.64

Deposit on 3% Certificate Hibernia Bank..... 250.00

Deposit on 3% Certificate N. O. Nat'l Bank..... 250.00

Deposit on 3% Certificate Interstate Bank..... 250.00

Deposit on 3% Certificate Metropolitan Bank..... 250.00

Interest accrued on these..... 105.00

Five 4% Liberty Bonds—Citizens Bank..... 250.00

Five 3½% Liberty Bonds—Whitney Bank..... 250.00

Coupons not deposited..... 63.85

One Share N. O. Bldg. La. State Fair..... 100.00 1,768.85

Respectfully submitted, \$2,972.49

WALTER B. MOSES, Treasurer.

AUDITORS REPORT.

New Orleans, La., February 7th, 1922.

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

Gentlemen:

As per your request I have audited your books and records for three years beginning with the year 1919 and as a result of my examination beg to submit herewith, the following Exhibits and Schedults:

Exhibit "A"—Balance sheet as of December 31st, 1921.

Exhibit "B"—Receipts and Disbursements for 1921.

Exhibit "C"—Fund Balances as of December 31st, 1921.

Schedule One—Accounts Receivable.

Schedule Two—Other Accounts Receivable.

Exhibit "A." shows in detail the Assets, Fund Balances and the net gained over and above all expenditures for the year 1921. The actual amounts gained on respective Funds is set forth in Exhibit "C."

Exhibit "B" shows in detail all receipts from all resources, against which are charged the expenses of the Society operations during the year 1921.

Exhibit "C." shows the Fund Balances at the close of the year 1921. All revenues are shown and expenses deducted therefrom, the balance being the net amount gained by respective Funds during the year.

Schedule One shows balances due by Members for yearly dues, Smoker and Entrance Fees.

Schedule Two shows balances due by Advertisers in the Proceedings.

General.

The Society, at the close of the year 1921, consisted of:

Honorary Members.....	1
Resident Members.....	156
Non-Resident Members.....	73
Associated Members.....	20
Junior Members.....	15
Non-Resident Junior Members.....	7
Student Members.....	9

Total Membership.....281

All books and Records were examined and found neatly kept.

Respectfully,

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

ASSETS.

Current Assets:

Cash in Bank.....	\$1,203.64
Accounts Receivable (Membership) (Schedule One)	673.55
Other Accounts Receivable (Schedule Two).....	574.72
Total Current Assets.....	\$2,451.91
Investments	1,600.00
Total Assets.....	\$4,051.91

LIABILITIES.

Current Liabilities:

Accounts Payable.....	\$ 263.09
Dues paid in advance.....	42.75
Total.....	\$ 306.24

Special Fund Balances January 1st, 1921:

Proceedings Reserve Fund.....	\$1,633.09
General Fund.....	1,194.32
Library Fund.....	582.13
Total.....	\$3,409.54

Ole K. Olsen Prize Fund.....\$ 150.00

Net receipts over and above disbursements as per Exhibit "B".....\$ 186.13

Total Liabilities.....\$4,051.91

RECEIPTS.

Advertisements	\$1,096.67
Proceeding Sales.....	1.20
Membership Dues.....	2,674.25
Smoker	257.50
Entrance Fees.....	179.00
Credit from accounts payable.....	6.10
Paid up arrears.....	21.50
Check redeposited.....	3.00
Total Receipts.....	\$4,239.22

DISBURSEMENTS.

Salary of Editor.....	\$ 300.00
Salary of Assistant of Editor.....	180.00
Salary of Secretary.....	360.00

54 *Proceedings of the Louisiana Engineering Society*

Stenographer	88.50	
Printing and Postage.....	1,293.80	
Losses through cancelled ads.....	12.50	
Deducted for Military Service.....	25.50	
Losses through non-payment of dues.....	151.50	
Miscellaneous Expense.....	106.56	
Membership—American Federation of Engineers.....	272.00	
Refreshments	111.95	
Smoker Expense.....	733.77	
Library Expense.....	411.06	
Exchange	5.95	
Total Disbursements.....	\$4,053.09	
Net receipts over and above expenses.....	186.13	
		\$4,239.22

Proceedings Fund.

Balance January 1st, 1921.....	\$1,633.09
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REVENUES.

Advertisements	\$1,096.67
Subscriptions ,Members).....	576.00
Proceeding Sales.....	1.20
Total Revenues.....	\$1,673.87

EXPENSES.

Printing and Mailing Proceedings.....	\$1,001.37	
Salary of Editor.....	300.00	
Salary of Ass't Editor.....	180.00	
Salary of Secretary.....	60.00	
Stenographer at Meetings.....	88.50	
Losses through Cancelled Ads.....	12.50	
Miscellaneous Expense.....	5.25	
Deduct Total Expense.....	\$1,647.62	26.25
Proceedings Funds Balance December 31st, 1921.....	\$1,659.34	

General Fund.

Balance January 1st, 1921.....\$1,194.32

REVENUES.

Membership Dues.....\$2,674.25
 Smoker 257.50
 Entrance Fees..... 179.00
 Credit From Account Payable..... 6.10
 Exchange20
 Paid up Arrears..... 21.50
 Check Redeposited..... 3.00

Total Revenues.....\$3,141.35

EXPENSES.

Subscriptions to Proceedings.....\$ 576.00
 Appropriations for Library..... 480.00
 Deducted for Military Service..... 25.50
 Losses through Non-Payment of Dues..... 151.50
 Salary of Secretary..... 300.00
 Printing and Postage..... 292.43
 Refreshments 111.95
 Federated American Engineering Society—
 Membership Dues..... 272.00
 Miscellaneous Expense..... 101.31
 Smoker Expense..... 733.77
 Exchange 6.15

Deduct Total Expense.....\$3,050.61 90.94

General Fund Balance December 31st, 1921.....\$1,285.26

Library Fund.

Balance January 1st, 1921.....\$ 882.13

REVENUES.

From General Fund.....\$ 480.00

EXPENSES.

Librarian\$ 180.00
 Subscriptions to Periodicals..... 92.26
 Bindings 108.50
 Printing 30.30

Deduct Total Expenses.....\$ 411.06 68.94

Library Fund Balance December 31st, 1921.....\$ 651.07

Accounts Receivable.

1920 Balances.....	\$ 118.05
1921 Membership Dues.....	499.00
Entrance Fees.....	4.00
Smoker Fees.....	52.50
	\$ 673.55

Other Accounts Receivable.

Advertisers (Proceedings).....	\$ 398.06
Less Credit Balances.....	23.34
	\$ 374.72
Prof. Derickson's Trip to Washington.....	200.00
Total Accounts.....	\$ 574.72

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 1922

President. DONALD DERICKSON, Tulane University.
Vice-President, JOHN S. BARELLI, 612 Godchanx Building.
Secretary, J. M. ROBERT, Tulane University.
Treasurer, WALTER B. MOSES, 640 S. Peters Street.

DIRECTORS

BERNARD STANLEY NELSON, 519 Baronne Street.
MARCEL GARSAUD, 515 Whitney Building.
RUFUS S. MANLY, 301 Q. & C. Building.

STANDING COMMITTEES

On Technical Papers

Marcel Garsaud, Chairman.
Hunter Coleman
Wade Barnett

On Library

Frank A. Muth, Chairman
G. W. Lawes
J. A. O'Brien

On Publications—Division "A"

Douglas Anderson
James M. Robert

On Publications—Division "B"

James P. Ewin, Chairman
B. H. Grehen
Horace E. Crump
F. N. Billingsley
Adam J. Haaser

On Entertainments and Outings

A. M. Shaw, Chairman

On Membership—Division "A"

Samuel Young, Chairman
W. T. Hogg
Shirley P. Braselman
Ralph Earl
Clifford Stem
Ralph H. Maun
Victor L. Willoz
Boykin W. Pegues
T. Baker Smith
Ira W. Sylvester

On Membership—Division "B"

F. P. Hamilton, Chairman
Jacques de Tarnowsky
Edward S. Lamphier

On Employment

H. Kokosky, Chairman

On Civic and Industrial Affairs

J. F. Coleman, Chairman
John Klorer
Ole K. Olsen

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

All business communications should be addressed to J. M. Robert, Secretary,
P. O. Station 20, New Orleans, La.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

VOL. VIII

APRIL, 1922

No. 2

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EDITORIAL NOTES AND COMMENT

Dean Cooley's Visit to New Orleans. One of the pleasantest events of the season's program of the Society was the visit of Dean Mortimer E. Cooley, President of the Federated American Engineering Societies, the latter part of February.

Dean Cooley delivered an inspiring address to the members of the Louisiana Engineering Society, which left us all with a much clearer idea of the aims and objects of the Federated Societies than we had before. The article is printed elsewhere in this issue. He emphasized, first of all, that the organization

is an association of societies and not of individual members. It is essentially an organization for the purpose of utilizing to an extent never before realized the intelligence, experience and training of the engineering profession in the service of the community, the state and the nation.

In the course of his address Dean Cooley pointed out the following lines of activity already undertaken by the Council, some of which have been completed, and still others under way:

Investigation of waste in industry.

Bill for reorganization of the Patent Office.

Plan for a Department of Public Works.

Licensing of Engineers.

Classification of government employees.

A complete geological map of the country.

An Employment Bureau.

Co-operation in the matter of headquarters and office force by engineering organizations in the same community.

Simplification of specifications for paving brick.

Furnishing technical information to Congressmen and department heads.

Publication of a Bulletin.

The Council is contemplating some work along the lines of having the engineering profession participate more actively in the solution of transportation and other public utility problems; of studying the causes of our lack of foreign trade and what may be done in this country to offset the handicap of our high scale of wages as compared with the European countries; and other such problems of so vital an interest to the future welfare and development of the nation.

Dean Cooley concluded his address with some observations upon our modern system of engineering education and emphasized several points in which he thought the system was at fault.

The Mouths of the Mississippi. At the March meeting of the Society, Col. E. J. Dent presented a paper on the above subject, which considers the Mississippi problem from several very interesting points of view. The paper deals principally with the formation of the delta, and Col. Dent expresses the belief that while the advance of the delta into the Gulf along the axis of the river will be slow, the rate at which the shallow bays on each side of the axis may be filled in is a very different matter. A map of the passes made in 1838 shows that the banks in several places were very thin and that at each of these places crevasses subsequently formed, resulting in the formation of new marshes totalling roughly 195 square miles.

It is also a fact that great areas of marsh land have disappeared since 1838, due to the fact that there have been no overflows to deposit the sediment of the river. This subsidence of the marshes not subjected to overflow also has the effect of thinning or narrowing the banks of the passes, with its consequent danger of crevasses.

In order to observe the effect of outlets in protecting the banks, a number of small artificial cuts have been made along South Pass, and it is hoped in the course of five or six years to secure some valuable data from them.

Col. Dent gives considerable space in his paper to Mr. Eads's theory of the jetties, and calls attention to the fact that after passing the ends of the jetties Mr. Eads cut his channel to the left. The water discharged by the pass travels straight ahead and takes the sediment with it. The deposits in the channel to the side have averaged about one foot per year, and this is readily removed by dredging. This same principle is being tried out at Southwest Pass, and there is every reason to believe it will work successfully.

In conclusion, Col. Dent says: "Looking ahead 25 or 50 years, it is believed that we may confidently expect to maintain adequate channels through the outer bars at South and Southwest Passes; that we shall be able to maintain such a distribution of flow at the Head of the Passes that the navigable channels through South and Southwest Passes will be

maintained; that a proper use of side outlets, such as the Jump, Batiste Collets, Cubits Gap, the new outlets from South Pass, etc., will enable us to maintain wide and secure banks."

The Civic Council. There has recently been organized under the above name a body of representative citizens to co-operate with the Association of Commerce in its efforts to assure the success of movements for public projects declared necessary for the development of a Greater New Orleans. Its members consist of a representative from each of the important organizations in the city, such as the Rotary and Kiwanis Clubs, The Young Men's Business Club, Contractors & Dealers' Exchange, Louisiana Engineering Society, etc. President Donald Derickson is the representative of this Society. It is probable that one of the first projects to be taken up by this Council will be that of securing an adequate auditorium to care for the many conventions which come to this city.

Highway News. A force of 275 persons is kept in the field preparing vast amounts of this kind of material for shipment to the states upon requisition under allotments on the same basis as monetary Federal aid for road construction. Up to February 1st of this year the value of materials thus distributed amounted to \$126,000,000. Every effort is being made to distribute this material for spring road work. It is now located at the following centers: Rockford, Illinois; Schenectady, New York; Watertown, Massachusetts; Dover, New Jersey, and in smaller quantities at other government storehouses.

Early bids for construction of Federal aid roads indicate that prices during the coming season will be materially lower than last season. Grading has been bid at 20, 23½ and 30c per cubic yard in Missouri, Arkansas and Minnesota, respectively, as compared with an average of 35c for this section last year. Prices for reinforcing steel range around 6c as compared with 8 or 9c last year. A few bids for the best grades of concrete of about \$17.00 per cubic yard have been received in

sections where the 1921 price was about \$25.00 per cubic yard. Prices bid for the construction of concrete roads per square yard are as follows: Oklahoma, \$1.52; Colorado, \$2.27; Georgia, \$1.38, as compared with an average of \$2.57 during the period 1916-1920.

The Committee on Roads of the House of Representatives on April 6 reported out a highway bill appropriating \$65,000,000 for Federal aid during the next fiscal year, and \$75,000,000 for the fiscal year ending June 30, 1924. The committee decided not to provide for a three-year program in the hope that the financial situation might be such two years hence as to allow a return to an appropriation of \$100,000,000 annually. The bill as reported requires the states to begin work on projects within one year after the money is allotted. An important feature of the bill is that it fixes the maximum Federal aid at \$12,500 per mile instead of \$20,000 per mile, as at present.

Reprinted from the Bulletin of the F. A. E. S.

Why I Should Be a Member of the Local Engineering Society. The ten reasons given below were prepared by Mr. Samuel Young, chairman of Committee on Membership, Division "A." They form such an excellent statement of why every engineer in this community should become a member of our Society that they are printed here as a part of our permanent record:

1. To aid in the promotion of technical knowledge, especially as applied to local problems.
2. To increase my own technical resources by exchange of ideas with fellow-members of my profession.
3. To become identified with a local or state engineering organization which has for its main object the welfare of its membership as well as of the Engineering Profession in general.
4. To aid in the upbuilding of a reasonable standard of ethics and charges for professional services.

5. To increase my acquaintance among the local men of my profession at the short social gatherings following the regular technical business of the meetings.
6. To better fulfill my duty as a citizen by membership in the local Society that promotes and discusses civic projects of a technical nature.
7. To co-operate in the campaign to broaden and increase the demand for engineering service.
8. To obtain for myself the opportunity to acquaint fellow engineers and prominent laymen, who frequently attend the technical meetings of the Society, with the character and extent of my technical knowledge and experience.
9. Because I do not wish to be disfranchised as a "member" of my profession, since all important laws and regulations of interest to engineers are first discussed and voted upon in the circles of local technical societies.
10. Because I both desire and need in my every day work a completely equipped technical library which only a local technical society is capable of furnishing.

What Matter Is Made Of. The following brief statement, prepared by Dr. W. R. Whitney, Director of the Research Laboratory of the General Electric Company, is reprinted from the little "Research Narratives" issued by the Engineering Foundation. Some engineers may find it of considerable interest to take the time to read it. This modern theory of electrons has already resulted in many highly practical applications of its principles to industry.

A new picture of stuff is being painted. Fortunately for simplicity, instead of seventy or eighty, as with the atoms, we have but two new units—the positive and the negative electron. The myriads of complications which correspond to all the differences in matter about us, must reside in the arrangements or combinations of these two simple components.

Such names as electrons and atomic structure do not convey to the mind inherent relationship with radio, radium and X-rays; but a proper view of matter as it is now understood can most readily be pictured

by getting the connection among some such group of present-day subjects. We are now forced to look at all matter as composed of identical, small, electrical charges, which determine the nature of chemical elements and compounds by their numbers and arrangements. An atom—the ultimate particle of a particular substance—becomes more like a solar system than like a solid. The volume of the atomic space is mainly unoccupied, but through it the forces act which are attributable to electric charges within.

Becquerel, who found that a certain uranium ore emitted an invisible ray capable of passing through black paper and still affecting a photographic plate, was partly responsible for our new views. Soon afterward the Curies discovered radium, and this was shown later to be a naturally decomposing atom. Several other decaying elements were also found. During decomposition small electrical quantities were continually discharged.

Similar discharges had already been observed in other fields, but were not understood. For example, when the filament of a lamp is heated in a high vacuum, negative electrical charges are emitted and current thus crosses the empty space. This had early been noticed by Edison. It was not until after the discovery of radium that the true nature of these "electrons" was perceived.

When these little units of negative electricity flow within a wire, they constitute the electric current. When, by high temperature, they are emitted from a metal, they are called thermions. When they pass through a gas with sufficient velocity, their impacts decompose molecules, and the greatly augmented flow of the resulting charged particles produce the common electric arc. When they flow through a vacuous space, under the influence of a high electric force, they are called cathode rays. When their motion is stopped by impact in the surface of a solid, the sudden change of motion starts an electro-magnetic wave, —an X-ray (just as a drum beat sets up a sound wave in air), and when they surge up and down a wireless antennae, they produce the long wireless waves through space.

When constituent electrons are arranged in the groups called atoms, all properties seem determined merely by geography, or orientation. Apparently such

old established things as chemical activity and valence are due to the number of electrons which occupy the outer surfaces of the groups. The shooting electrons of the cathode ray, stopped by the platinum or tungsten target, produce the X-rays, which by reflection in crystallized matter, disclose its atomic arrangement and thus lead to better understanding of many physical properties.

Since decomposing elements emit electrons, since heat drives them from filaments, since gases and air yield them on impact in arcs, since statically charged bodies carry them and lose them (as a car gains or loses passengers)), it is logical that all electric currents are attributed to their motion, all static charges to differences in concentration, and all matters to balanced combinations of them."

New Orleans-Hammond Highway. In connection with this much discussed subject it is of interest to note that at the May meeting of the Louisiana Engineering Society the following resolution concerning this important subject was passed on first reading:

WHEREAS, It appears that there is a tendency to postpone the construction of the New Orleans-Hammond Lake Shore Highway; and

WHEREAS, The interests of the citizens of New Orleans and of the whole of that part of the State in which said highway is designed to be constructed demand its completion at as early a date as possible; and

WHEREAS, There is no evidence of unusual or unfamiliar engineering difficulty in this construction; and,

WHEREAS, There is now available an amount of approximately four hundred thousand dollars sacred to this project;

NOW THEREFORE BE IT RESOLVED BY THE ENGINEERING SOCIETY, That it approves and endorses the project.

BE IT FURTHER RESOLVED, That it urges the State Highway Commission and all other interested authorities to hasten the financing of the remainder of the estimated cost and proceed vigorously with the construction, to the end that at the earliest possible date the benefits to be derived from this highway may be enjoyed.

In the discussion of the above resolution the necessity for prompt action was further emphasized when it was pointed out that the embankment to carry the Lake Shore Highway would require quite considerable time to thoroughly dry out before it would be possible to begin the construction and surfacing of the roadway itself.

Additions to the Library. The Chairman of the Library Committee announces the following new books recently added to our library, and also a set of the publications of the U. S. Coast and Geodetic Survey:

Parr—Stowage and Dangerous Cargo.

Cunningham—Treatise on the Principles and Practice of Harbor Engineering.

Minikin—Practical River and Canal Engineering.

Pease—Modern Shipbuilding Terms.

Sargeant—Centrifugal Pumps.

McElwee—Wharf Management, and Stevedoring Principles.

Warner—Field Mapping for the Oil Geologist.

Ziegler—Popular Oil Geology.

Pogue—Economics of Petroleum.

Davis & Wilson—Irrigation Engineering.

Ross—Waterproofing Engineering.

Hubbard—Dust Preventives and Road Binders.

Hubbard—Laboratory Manual and Bituminous Materials.

Venable—Garbage Crematories in America.

Folwell—Municipal Engineering Practice.

Gerhard—Modern Baths and Bath Houses.

Lewis—The Planning of the Modern City.

Chatburn—Highway Engineering.

Publications of U. S. Coast and Geodetic Survey.

Report on the Blue Clay of the Mississippi River.

Geodesy—Investigations of Gravity and Isostasy.

Hypsometry—Use of Mean Sea Level as the Datum for Elevations.

Geodesy—Instructions to Light Keepers on Primary Triangulation.

Geodesy—A Bibliography of Geodesy.

Geodesy—Triangulation on the Coast of Texas from Sabine Pass to Corpus Christi Bay.

Geodesy—Triangulation in Alabama and Mississippi.

Geodesy—Relative Determinations of Gravity with One-half Second Pendulums, and Other Pendulums in Investigations.

Geodesy—Determination of Gravity and the Magnetic Elements.

Geodesy—Formulae and Tables for the Computation of Geodetic Positions.

Gravity, Magnetism, and Ocean Densities—Physical Observations of Pribilof Island Expedition of 1897.

Safeguard the Gateways of Alaska—Her Waterways.

General Instructions—Field Work of the U. S. Coast and Geodetic Survey.

Grid System for Progressive Maps in the United States.

Astronomy—Determination of Time, Longitude, Latitude and Azimuth.

A Study of Map Projections in General.

Modern Methods for Measuring the Intensity of Gravity.

Hydrography—Construction and Operation of the Wire Drag.

Elements of Map Projection.

U. S. Coast and Geodetic Survey—Its Work, etc.

Centennial Celebration of the U. S. Coast and Geodetic Survey.

Description of U. S. Coast and Geodetic Survey Tide-Predicting Machine No. 2.

OBITUARY.

Charles D. Babbit, a non-resident member of this Society since 1911, died at his home in Gueydan, Louisiana, March 16, 1922.

Mr Babbit was born in Nachez, Mississippi and was fifty-six years of age at the time of his death.

He was one of the pioneer settlers in the Gueydan section, where he practiced the profession of civil engineering. He was a man of stirring character, always ready to exert himself for the good of his community, and he was universally respected and beloved. He leaves a wife and five children, to whom the sincere sympathies of this Society are extended in their bereavement.

PAPERS AND DISCUSSIONS

THE FEDERATED AMERICAN ENGINEERING SOCIETIES.

By Mortimer E. Cooley, President.

An Address delivered before the Society, February 20, 1922.

Mr. President and Members of the Louisiana Engineering Society:

It gives me very great pleasure, indeed, to be here with you. To a number of you it is known that this is my first visit to New Orleans. I miss a considerable number of acquaintances that I have made through others that I had hoped I might meet here, Monsieur Sazerac, for example, and I don't know whether it is Monsieur or Madam Ramos, but any how I miss them.

I had a very wonderful trip, as it seems to me, since I left Ann Arbor on February 3rd, visiting St. Louis, Kansas City, Lawrence, Topeka, Wichita, Oklahoma City, Norman, Tulsa, Ft. Worth, Dallas, College Station and Houston. I have had a splendid reception, and there has been a great amount of interest shown in the Federated American Engineering Societies.

I thought I could do no better here than to make perfectly clear to you the aims and purposes of the Federation; this is very clearly expressed in the preamble of the Constitution of the Federation, and in a couple of paragraphs of the speech made by Mr. Herbert Hoover in Washington on January 6th at the annual meeting of the American Engineering Council. I will read three paragraphs: "This service and others is the expression of the highest motive to which man responds, and as today the distribution and the welfare of the public demands the best efforts man could put forth; now, therefore, the Engineering and allied technical societies of the United States of America, through the formation of the Federated American Engineering Societies, realize a long cherished ideal, a

comprehensive organization, dedicated to the service of the community, State and Nation."

Mr. Hoover, speaking of the Engineer, says: "With the intelligence, experience and training, and the unique knowledge that he possesses, not only of the methods, but of the intangible values among our people, he is now organized so that his voice may be heard outside of his profession. We have probably 75,000 engineers in our country, representing an intellectual possibility in service produced by no other group. It is therefore an augury of real development when the engineers of the United States join together for the purpose of public service. This association has the unique value among the associations that it cannot have any material interest for its purpose. No engineer can receive any material benefits from it. It can advance no economic interest. It cannot, therefore, be charged with any ulterior motive. It is accepted by real engineers, and by people who are acquainted with engineers, as being clearly singleminded."

The Federation was organized in June, 1920, and the Constitution was adopted in October, at which time Mr. Herbert Hoover was elected President. When Mr. Hoover went into the Cabinet he felt it necessary to resign and I have been selected to continue his work. Mr. Hoover had started a real work, and I will have great pleasure in telling you some of the things that have already been accomplished, and some of the things that are contemplated.

First, let me explain the organization of the Federation. It has no individual members; its members are Societies, the national societies, like the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Institute of Mining Engineers. The American Society of Civil Engineers, took a prominent part in organizing the Federation, but owing to the influence of some of the oldest members, it has not yet joined the Federation. There is every indication, however, that it will not be very long before the American Society of Civil Engineers is also a member.

In addition to the National Societies, there are the State Societies, of which you gentlemen are one of the very earliest—I think you are a charter member, are you not? Then there are the local Societies in the cities, and affiliations of engineers and allied technical organizations. For example, there are some twenty or thirty organizations in Boston that have affiliated, and in Detroit there are twenty or thirty, I think, including architects and chemists that have affiliated.

The St. Louis affiliation is a member of the Federation. I think the Boston is also, and if not will soon be. The engineers of Massachusetts have organized in the expectation of becoming a member of the Federation. There are twenty-eight member societies, and the membership of the twenty-eight societies is between forty-five and fifty thousand. There are twenty other societies that are considering joining, and when they become members the membership will probably approach one hundred thousand; and when all of the engineers and allied technical societies of the United States have joined, the membership is estimated from 175,000 to 250,000. Each member Society is entitled to delegates, one to every thousand members, and these delegates constitute the American Engineering Council, so that the Council is like the House of Representatives. The Council now numbers between fifty-five and sixty; it may go as high as two hundred or more when all of the Societies have joined. The Council elects, from its number, what is called an Executive Board. The Council meets once a year; the Executive Board meets five times a year. This Executive Board has six standing Committees, and appoints all of the Special Committees that may be required to carry on the work of the Federation. Each particular job undertaken by the Federation is under the direction of a Committee. Mr. L. W. Wallace, a graduate of the A. & M. College of Texas, is the Executive Secretary. There is a President, an Executive Secretary and four Vice-Presidents.

Before taking up the explanation of the work, let me say something more regarding the possibilities of additional member societies. The Canadian Institute of Electrical Engineers,

which embraces all of the engineers of Canada, met in annual convention in Montreal in January. We sent them congratulatory messages, and the hope was expressed that they might participate in the work of the American Federation. The suggestion was received with very great applause. Now we are directing the Council of the Canadian Institute to take steps at once to join the Federated American Engineering Societies. You will be very much surprised to know that England and France and Italy are considering similar Federations; likewise Australia and New Zealand, and I am told also China, which now has quite a large number of native engineers, educated in this country. It is to be hoped and expected that the Federations of the various countries would form an International Federation, and we would thus have an organization of all of the engineers of the civilized world.

Such an organization would have power that cannot be estimated; it is not too much, I think, to say that if they were properly organized, and if the ideals set up were of the right kind, the engineers could have more influence on the future of the world than any other group of men.

We shall distribute our operations in this country, in such way as to bring to the attention of our engineers the possibilities of doing things that have never before been undertaken. Probably it is proper to return to this phase of the subject a little later on; let me tell you of some of the things that the Federation has, through its Council, already accomplished.

The first, and perhaps, the most outstanding, is the work of the Committee charged with the investigation of the Wastes in Industry. This Committee is quite a large one; it raised its own money, some twenty-five or thirty thousand dollars, and made an intensive study of a half dozen leading industries of this country. It was desired to see what could be accomplished, and the time was very opportune as a study time, for about that time business began to slack off, and in six months they had finished their study, and the results have been published. The first edition is twenty-two hundred copies, a volume of perhaps 30 pages; 200 of the edition was used for complimentary, and 2000 were put on the market and

sold in the first month. This entire report was, within the first six weeks, translated into eighteen languages, and at the last Council meeting the profession was given permission to publish it. The individual reports, in the volume that has been printed and distributed, show the industries concerned, so that this first work has had a great deal of attention. It has received attention from a great many thousand people. Very complimentary words have been spoken of it, but it is only the beginning, and the Council expects to extend its investigations to other industries.

A very hopeful sign is the desire on the part of some of the other organizations to be charged with some responsible work of investigation. For instance, the American Society of Agricultural Engineers met in Chicago between Christmas and New Year. The Board of Directors of that Society had voted to withdraw from the Federation, but at the Convention the membership voted that they would stay in. They then requested the Council for permission to choose, subject to approval, a committee to undertake investigations of Agricultural Wastes, and they said they had \$25,000 in sight, and could get more. So they have been authorized to undertake investigations, though committee has not yet been appointed. My idea, and I think I voice the sentiment of the organization, is to have representatives of the Society throughout the entire country working on problems peculiar to their respective sections. As an illustration, merely suppose there was some problem in the oil field, or in connection with petroleum, that, if solved, would be a very great benefit to the public. The Oklahoma Engineers might be charged with that investigation; not necessarily the Oklahoma Engineers, but those who are in the oil fields proper. Now, suppose again that there are some great questions in connection with automobiles to be solved. Very likely, or very possibly, the Detroit members would be charged with its investigation. And there might be some question easily assignable to the Louisiana members, and you gentlemen would have charge of it. I very much hope that there will come problems which will enable all of the member societies to engage actively in this work.

Now, I shouldn't myself feel like limiting it to member societies, that is to say, if there was a big problem to be solved in some locality in which there was a member Society as well as a local organization, I should feel like inviting both of them to take part in its solution. Of course, you can see that the larger the membership the more influential the organization, and its reports would carry just that much more weight.

Another thing which the Federation has done, and which is on the eve of completion, is the passage of the bill reorganizing the Patent Office. This Committee is under Mr. J. J. Prindell, of New York. The members have given a great amount of time, going to Washington repeatedly. The bill was introduced a year ago or more, I think, but was pigeon-holed and couldn't be gotten out; but, eventually pressure was brought to bear, so that the bill was reported out of Committee, and immediately passed the House with a large majority. It then went to the Senate, and the same day, or the next day, was reported out of Committee, and is now on the calendar of the Senate. It has the promised approval of the President. This reorganizes the Patent Office and puts it on an equal with the other industries, so far as the officers and examiners are concerned. They lost the Examiner during the war, and the work of the office has piled up until it is now some two or three years behind. The Patent Office, of course, is very greatly to the benefit of the people. By some it has been said that the Patent Office is very largely responsible for the tremendous progress made by the arts in this country. Of course you have examples in mind which will go to prove that statement. I can cite one, which is almost self-evident, namely the invention of the cotton gin by Eli Whitney. It is a matter of historical record that this invention contributed almost more than anything else to the success of the cotton production in this Southern country. Of course, that is only one example, and there are innumerable others. Take the Bell telephone, for example; we look upon it now as an indispensable necessity. Professor Bell, however, was unable to realize any marked benefit from it in the first seventeen years, so Congress extended the life another seventeen years, one of the few cases

where that has been done. Take the Edison lamp; what a great benefit that is! You can mention any number of things that will contribute very largely to the benefit of our people at large.

I think perhaps the most notable effort of the Council has been towards the establishment of a Department of Public Works in Washington. This American Engineering Council fell heir to this particular work. It was first started by the old Engineering Council, a creation of so-called founder societies. The plan of the old Council contemplated the establishment of a department with its head a member of the Cabinet. With the organization of the American Council it took a somewhat different form; there was to be a general revision of all of the bureaus in Washington, and the bill providing for a reorganization of all government departments was introduced and passed the House. It is now out of Committee in the Senate, and I think was on the calendar, and had the promised approval of President Harding. But, before going any further with it in the Senate, it was thought wise to refer it to the Cabinet, where it met the fate of being temporarily held up. This reorganization bill did not provide for a separate department of public works with a government member, but it provided for a department of public works in the Department of the Interior, in which all the work of the government that could properly be assigned to it would be taken care of. Of course it would be impossible to do away entirely in all government departments with engineers. Licensing or registration of engineers has had considerable attention by the Council. I think two reports have already been submitted, neither one of which, however, has been adopted. Curiously enough, perhaps, there is considerable opposition to it among the older members, but the young members are in favor of it. Whatever the Council may think of it, licensing laws have been passed by twenty-two States, and it is very desirable that certain fundamental principles should be incorporated into the laws of all States, and it should be possible for an engineer who has taken out a license in one state to practice in any other state without taking out an additional license. His

license in one state should be recognized in another. There was considerable discussion of this at the Council meeting in Washington in January, and the report of the Committee was filed, but no action was taken. A new committee was appointed, which consists of the chief exponents of the two sides, I believe Mr. Moore of St. Louis opposed a license bill, and Mr. Gardner Williams of Ann Arbor was very much in favor of it. I might say I chose the referee, General Dwight. I remember in my boyhood days I used to tie two cats together with a string and hang them over a clothes line. We should be delighted that we are going to get something we can all approve. These gentlemen are reasonable; they will agree only on fundamentals, but that is what we need, leaving the details to be worked out in the different states.

Another work that has been commenced is the classification of government employes, both in title and compensation. The Council is also behind an effort to have all the agents of the government, interested in making maps, get together to the end that we may prepare a complete geological map of the country.

The Council has acted also in the matter of the Employment Bureau, which was turned over to it by the Founders' Societies. It is not accomplishing as much as was hoped for it, and plans are being considered whereby the central office would be maintained in New York, and there would be branch offices in the different important states, so that the questions of employment could be referred to those who would be most capable of handling them. There would, of course, be a branch office here in New Orleans. The organization of all of the allied societies was paving the way for that plan, I thought, in a very satisfactory manner. For example, in Washington there could be one organization for all of the technical societies, the same as in Detroit, Cleveland and St. Louis. There organizations combined, a dozen, fifteen or twenty of them, would employ a Secretary, who would give his whole time to the work of all the societies, and the expense would be divided. There would be a general headquarters for the use of all, and some papers of general interest; but it would still

leave each of the affiliated societies to carry on its own particular line of work without interference.

You may be interested in knowing that at the request of the labor unions, the Council appointed a member on what is known as the Board of Jurisdiction of Awards, and the result to labor has been highly beneficial, I am told, serving to reduce the number of strikes and lock-outs. An example of something done in a hurry came up the other day in Washington. Mr. Hoover brought together all the paving contractors of the country, some sixty or seventy of them. On the first day they got together and aired their views, and the second day they eliminated all but eleven of the great variety of paving specifications. This number has now been reduced to seven, and the opinion was expressed that it could be reduced to half a dozen.

Perhaps one of the most satisfactory services the Council has been able to render is that of furnishing reliable and unbiased technical information to Congressmen, Department Officials and Executives in Washington. Of course, the different industries that are seeking favorable legislation keep paid lobbies there. There are large amounts of money spent to educate Congress. Congress is growing a bit shy of this sort of thing, and when questions of a technical nature arise, the members come around to the office of the Federation, where, through our Committee, they may secure the particular kind of information they desire. Many have expressed themselves as very much gratified at being able to receive information in which there was no axe to grind, and which was single in its purpose. So we have already, in one year's time, achieved a considerable reputation. This is an indication of the influence that the Federation may have in favor of this or that legislation, but we must be on our guard not to take part in any except that which corresponds to the preamble of the resolution which I have read to you, and to what Mr. Hoover stated was the object of the Federation.

Another matter is publicity. I think most of you who have given it thought realize that the engineer's profession has never had very much publicity. The work of the engineering

fraternity is known among engineers, but is not known outside. The papers of the engineers have been technical, and not interesting to men in other professions. Mr. J. P. Braden, Professor at Columbia University, has consented to act as our agent, and during the past year five hundred articles and notices have been put into the general press. These articles were published in nine hundred daily papers and sixty technical journals. The Bulletin which the Federation issues consists of several mimeographed sheets. The capacity of the mimeograph is about three thousand. It has not been feasible to send bulletins to the entire membership of the member societies of the Federation, as that would mean forty-five or fifty thousand imprints a week. The news which we do send out is very well received. For those who may not be familiar with these bulletins, I would say they contain mainly reports of things in Congress that are of interest to engineers, and all of the reports of the Departments as they are assigned, classified, so that you can find just what is being done in Washington. If the publication should be printed, and become larger, it would no doubt take up some other things, but it would never trespass upon the field now occupied by the technical societies.

Now a few remarks as to the work which is in contemplation. Of course, the investigation of waste will be continued. Some of the other things that I am going to speak of have not been undertaken; they may not be undertaken. I am mentioning them merely for the purpose of giving you an idea of the kind of work the Federation proposes engaging in. Take for example the transportation question. Very few realize that one-quarter of the wealth of this country is in public utilities—this includes the railways and the street railways. These public utilities have had a very hard fight in the last few years to secure an advance in rates which would enable them to take care of the advance in wages, and the cost of the things that are necessary in prosecuting the business of the public utility. It is a matter of very great importance then, that the situation be understood, not only by engineers, but by the general public. I am not here to speak in favor of either the public or the public service corporation—it is immaterial for my purpose to discuss that. But these quarrels have gone

before state utility commissions, and into the courts. I believe it is a matter of record that there are several hundred street railways that have gone out of existence. I know of two in my own state, in towns of forty or fifty thousand inhabitants. Not a wheel has turned for months. Now, of course, that is a very great deprivation to the public. The public hasn't been willing to advance the fare, and the railroads went out of business rather than lose more money. There is some psychology in it, naturally. Some public service corporations in the past have, at times, used high handed methods, and this is the opportunity for the public to get its revenge; they actually use the word *revenge*. But the unfortunate part of it is that the public has overrun itself, like Samson, who overran himself with the Philistines, pulling down their temple and he killed himself at the same time. Try to imagine this country getting along without its public utilities. It couldn't be done. What would happen if we moved all of the railroads, the telephone and telegraph lines out of the country? We would go backwards fifty, seventy-five or a hundred years. It would devastate the land. We would not be living in this age at all. My idea in having this question come up for consideration by the Federation is that through our member societies we may urge their members to undertake a campaign of education. You engineers have built all the utilities; you have operated all the utilities; there is no one knows any more about a utility than you do yourselves, and yet there is scarcely one of you in this country who has taken any part whatever in the quarrels that have arisen between the public service corporation and the public. You do not seem to be interested, and yet you are the real authority. Of course, there have been experts, so called, who have testified in these hearings on each side. One side will say one thing, and the other side will say another thing. As a result of these disagreements, the utility commissions and the courts have found great difficulty in reaching their findings; and the public, of course, cannot be eliminated. What is needed by the utility commissions and the courts is not the opinion of individual men, but the opinion of the engineering profession as a whole. A statement of the real facts in the case and the opinion of an engineering society such as this, or of a

group of engineering organizations, would often be of tremendous assistance to utility commissions and courts in their efforts to reach just conclusions.

Another matter over which I am greatly concerned is the lack of foreign trade of this country. We are organized to produce many times more than we can consume in this country, and this capacity was vastly increased during the war, with the result that we have a manufacturing capacity far in excess of our own needs, and we need foreign trade. It is difficult to see how we are going to get it. One of the first difficulties is the great handicap we are under in competition with the low wage scale of foreign countries. Take Germany, for instance, who is now seeking the world's trade. She pays her workmen, I am told, from sixty to eighty marks a day, which, at normal value of the mark, would be fifteen or twenty dollars a day, and we are paying our men eight dollars a day. But when we come into the world's market the mark is worth half a cent, and therefore eighty marks is forty cents, against our eight hundred cents. That gives us for labor twenty times as much as Germany. The Germans work twenty hours, whereas we work eight hours. If we were going into South America to sell a lathe that costs two thousand dollars here, Germany would put it there for one hundred dollars. How are we going to compete? We can't compete, with the ratio of wage scales so much against us. There does not seem to be much hope for any great reduction of the wage scale in this country, so we are forced to tackle the problem from a different point, and that is the elimination of waste. Even though we were on even terms as to wages we are not really prepared to compete for the world's trade. Our spirit is quite different. Our young men will not go into a foreign country to live; they would rather live right here at home. If we do go into a foreign country, we haven't any except our own language to take with us. If we go to South America, for example, if we want to sell a bill of goods, we would have to have an interpreter, or else make them talk in our language. Not only do we not speak their language, but we don't really know the Latin people. We don't know how to do business

with them. Germany, England, France and other nations send their commercial men to live in these countries, and they provide their financial arrangements in keeping with the customs of the industries, and do business as the people there do business.

That leads to another point, which is my ultimate purpose in referring to it. In the engineering profession in this country, as far as education is concerned, almost no attention at all is given to the study of modern foreign languages. We are ignorant. We may be able to translate a little French, possibly, or a little Spanish, but we can't converse in those languages; we couldn't write a letter. I don't suppose there are one hundred men in the engineering profession in this country that could talk, say French, fluently. When I became President of the American Society of Mechanical Engineers, I was asked to go to France on one of the Committees to study engineering education in that country. I could not go myself, so I was asked to find somebody who could go. It was necessary that the man should understand French and be able to converse moderately well in the language. I searched this country over in the educational field, and found that practically every engineer that could talk French was already in France; nor could I find an engineer that could fill that little specification. So the engineering profession, as far as I know, was not represented. I am not proud of that, gentlemen, I am very much ashamed of it, and my only reason for mentioning it is to impress upon you the fact that we are not dealing right with our young men; that our profession should not sit by and let our young men who go to college get along without studying some foreign language.

The Federation should undertake a propaganda, which will make the engineers of this country understand clearly that if the engineering profession is to take its proper place in the world's work, it has to do a few things in addition to what it is now doing. We are individualists. We don't get out and mix. Where will you find an engineer in public life, in your own City Council, in your State Legislature, in Congress? Mr. Hoover is, I think with the exception of George

Washington, the only engineer that ever occupied a prominent public office. George Washington, I am told, was a surveyor in his early days. I think it would be a wonderful thing if we could see the engineers, with their splendid intellects and training, extending their activities into wider fields and playing a more important part in the affairs of the world. I would like to see our engineers emphasize the study of what, for lack of a better name, I shall call the evolutions of civilization.

Going back fifteen thousand years more or less, we find there has been, in every fourteen hundred or two thousand years, a new civilization. Each of these has left some records from which we may learn something of its history. In the development of each of these civilizations we find some record of the activities of the wise men of all the professions except that of engineering. If this civilization in which we live is to endure beyond any that has preceded it, I do not know of any *untried* force other than that of the engineer. The engineer has made this civilization what it is; there is no question about that; he made the material parts of it; he produced the war, that is, he produced the means through which countries were striving to achieve commercial supremacy, which led to the war; he fought the war and won it; that was an engineering scoop; but he is not taking part in the dispute now that the war is over. Everybody stood by and let him occupy the front of the stage at that time, but now somebody else comes to the front to solve the economic problems and the engineer steps back again into the obscurity of the technical details of his profession. However strange it may sound to others, I should like to emphasize the point that if this present civilization is to outlive the others which have gone before, we must turn to the engineer for a solution of the problem.

Now, perhaps, I have paved the way for a story which will seem to illustrate the high regard in which the engineer should hold himself. The story has to do with Henry A. Rowland, of John Hopkins University. When the first Niagara Falls water power development was being considered, engineers from this country and from Europe were called in consulta-

tion, among them Professor Rowland, who was internationally known for his knowledge of physics and electricity. When the experts rendered their bills for their services it was found that Rowland's was five or six times greater than any one of the others. The company declined to pay it and he brought suit, and was required to testify in his own behalf. He pointed out that it was the greatest venture in engineering ever undertaken up to that time, and the company very wisely brought to bear the greatest engineering intellects of the country and of the world. In the course of the trial one of the attorneys asked Prof. Rowland who was the greatest authority on electricity in the world. He promptly replied, "I am." Some of his friends railed him about this and remarked that it was not in keeping with his usual modesty to make a statement like that. "But," he replied, "I was under oath to tell the truth."

THE MOUTHS OF THE MISSISSIPPI RIVER.

By Lieut. Col. E. J. Dent, Corps of Engineers, U. S. Army.

Read before the Society, March 13, 1922.

In this community there is one subject that is constantly before the engineers and the laymen alike. The Mississippi River is the principal source of profit, the principal source of worry, and the principal source of discussion. As a newcomer digs into the subject, he soon gets caught by the microbe and the more he digs the more he becomes fascinated by the magnitude and complexity of the problem.

It seems incredible that any one can visit the top of the levee day after day during the flood season and not become fascinated by the steady flow of water, drift and sediment. In other parts of the country we look down on the rivers from adjacent hills, here we look out on the river from the top of the highest land in sight, and, turning around, we look down on the city streets. It makes a newcomer nervous. It is too much like reversing the laws of nature.

Again, the duration and regularity of the flood are real wonders to one who was not born on the banks of the Mississippi. A rise of half a foot a day sets the river men to gossiping in precisely the same way as a six-foot rise at Cincinnati. Along the banks of the Ohio, a flood is of short duration. The river rises in a few days to its crest and falls quickly. In 1920, the Mississippi at this point stayed, for 40 consecutive days, within one foot of its maximum. During that period the volume of discharge did not vary 10 per cent. The Miami Conservancy District is spending \$35,000,000 to regulate the flow of their river and reduce the maximum to possibly 50 times the minimum; moreover, the regulated flood is to rise to its crest and fall again to low water is less than two weeks.

In 1920, the discharge at New Orleans averaged 1,250,000 cubic feet per second for 40 consecutive days. Men who have been raised on the banks of the Father of Waters may not stop to wonder at this figure, but a few minutes work with a pencil

and paper will make the advocates of reservoirs for flood control at Pittsburgh see that there is considerable truth in the saying that "A river's a river and a creek is a creek."

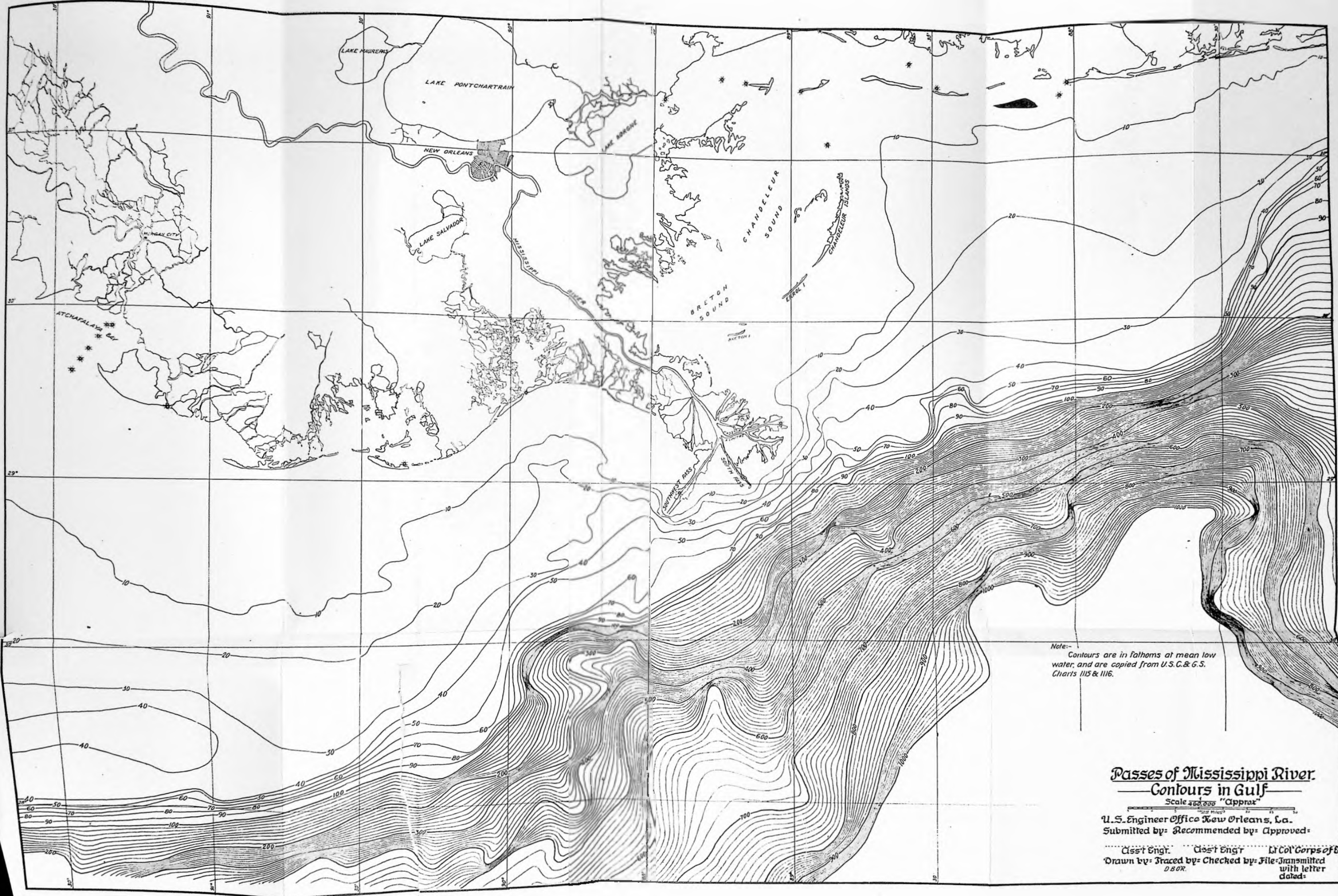
The rate at which the river discharges water is not the only consideration. During the high water stages a staggering quantity of sediment is discharged into the Gulf. This mass has been estimated as sufficient to bury a square mile 315 feet deep each year. During the flood season, it frequently amounts to more than 4,000,000 cubic yards per day.

Plate No. I was prepared with a view to showing the manner in which the Mississippi Delta has been thrust out into the Gulf of Mexico, and the extent to which it may be expected to advance in the future. The shore line is shown but the most important feature is the data in regard to depths of water in the Gulf of Mexico. These data are shown by 10-fathom contours.

Looking at the map, the result of the annual discharge of sediment is at once apparent. The great bay which formerly extended to the mouth of Red River has been filled up, and the coast of Louisiana has been thrust out into the Gulf of Mexico from the Rigolets to Morgan City.

Taking into consideration the fact that the recent deposits around New Orleans are only 35 to 40 feet deep and noting the depths in the Gulf of Mexico on both sides of the delta, it seems probable that the average depth of deposit does not exceed 50 feet. Without attempting to be precise, it is interesting to speculate that the present river could build a delta of this size in 5,000 to 10,000 years; a period less than the elapsed time since the dawn of some of the ancient civilizations of Mesopotamia.

While the present river might have built up the entire delta in 5,000 to 10,000 years, a further examination of the depths in the Gulf will show that the advance during the next period of corresponding length will be relatively negligible. The general direction of the river is Southeast, the average depth of deposit along its course is probably not over 50 feet, but the advance has, so far, been across a nearly level continental shelf, the outer edge of which is in water less than 300 feet deep.



In prolongation of the river, the delta has already passed the edge of the continental shelf. The toe of the deposit is in water about 600 feet deep and about 10 miles beyond the end of the South Pass. Twenty miles beyond the South Pass jetties, the water is 2,000 feet deep. In its present direction, the river has run its course, and in future its advance into the Gulf will be slow.

While the advance of the delta into the Gulf along the axis of the river will be slow, the rate at which the shallow bays on each side of the axis may be filled in is a very different matter. Before discussing this, it will, however, be well to digress for a moment and consider the character of the sediment.

The annual sedimentary load would bury a square mile to a depth of 315 feet, or would bury the City of New Orleans from the Jefferson Parish line to the Industrial Canal and from the river to the lake, to a depth of 10 feet. This sediment is about 50 per cent sand and about 50 per cent clay. In still water the sand settles at rates of a few inches per minute to 5 or 6 feet per minute. Some of the clay settles at an infinitesimal rate.

The diagram, Fig. 2, has been prepared with a view to illustrating the effect of slope upon the deposit of sediment. The line A C D represents, roughly, the slope of the bottom of the Gulf in prolongation of South Pass. The line O P R represents the path that would be followed by a particle of sand settling towards the bottom at a rate of $2\frac{1}{2}$ inches per minute and moving along the axis of the pass at a rate of $\frac{1}{4}$ mile per hour. Such a particle would move parallel to the bottom until the point C was passed after which its path would diverge from the bottom until the limits of the diagram is reached.

If the profile of the bottom were taken along the axis of an outlet discharging into a shallow bay, we should have the bottom slope represented by some line such as A P B, and the particle would be deposited at P.

An analysis by the U. S. Geological Survey of a number of samples of earth collected below the Head of Passes, shows that about 60 per cent. of the material analyzed was coarser than the particle assumed for this discussion. In the case of an outlet

discharging into a shallow bay, a much larger percentage of the total sediment will be deposited near the outlet than will be so deposited when it is discharged from South or Southwest Pass into a portion of the Gulf where the bottom falls off rapidly to deep water.

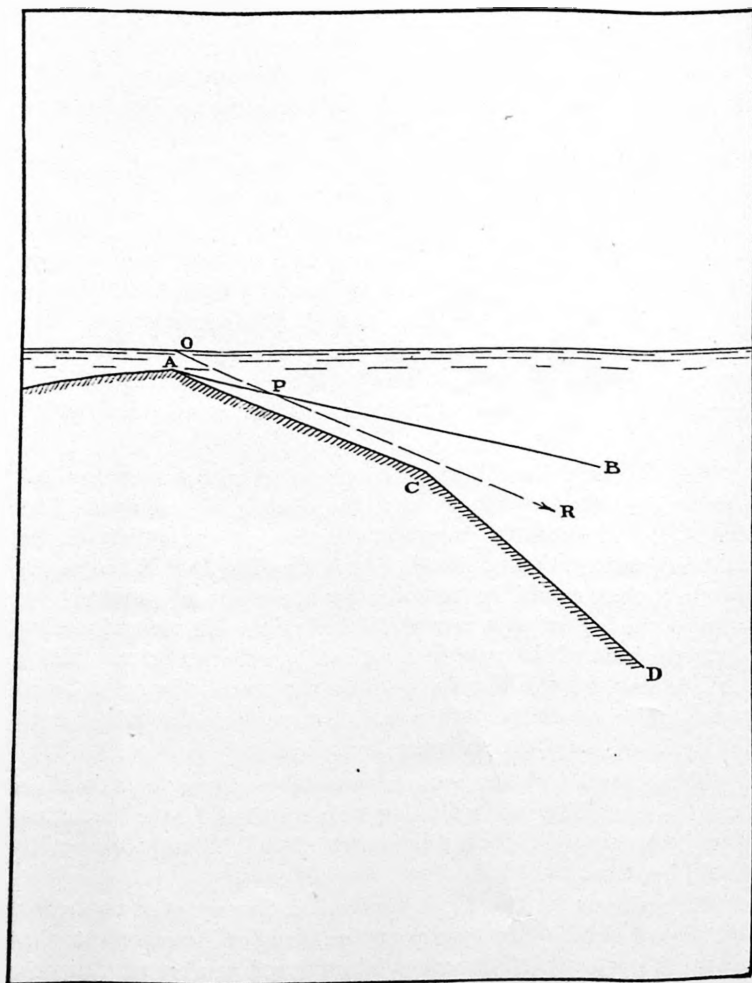


FIG. 2.

The airplane photograph, Fig. 3, shows the end of the minor outlet discharging into shallow water. It will be noted that in advance of the outlet there are numerous small bunches of marsh grass showing that the bay is filled in well in advance of the general shore line.

The airplane photograph, Fig. 4, shows the mouth of South Pass, and it will be seen that a typical sand spit has been formed to the westward of the outlet, but there is no indication that new marsh areas are forming in advance of the beach. This photograph also shows several mud lumps and on the borders of one of the lumps are the cones or miniature volcanoes formed by mud springs. These are very interesting phenomena, but, unfortunately, space does not permit of their discussion here.

An idea of the fineness of the sand deposits may be given by describing an incident that occurred to the writer. A dredge crew described the material in which they were working as coarse sand, an analysis showed that approximately 90 per cent. would pass a 100-mesh cement sieve. The largest particles passing a cement sieve with 200 meshes to the inch will settle through still water at a rate of over 12 inches per minute. Sand that settles at a rate of only $2\frac{1}{2}$ inches per minute is exceedingly fine, but nevertheless coarse enough to be quickly deposited in the shallow bays and sometimes in the channels and bars.

During the low water periods the salt water fills the bottom of the passes and mixing with the fresh water, cause coagulation and the deposit of soft flocculated mud in precisely the same manner as the city water is partially clarified in the settling basins of the New Orleans filtration plant.

The movement of sand by sand waves or by being rolled along the bottom is frequently discussed. It may be briefly stated that at the mouth of the river, sand waves are not of great importance; they rarely reach a height of 3 feet if the sand deposits that do occur can be classed as sand waves. The annual reports of the Chief of Engineers, U. S. Army, contain several discussions of sand waves in portions of the Mississippi where coarse sand is found. The report for 1883 contains a discussion of observations made at Carrollton as a result of which, it was decided that less than 2 per cent. of the total sediment was moving in that manner.



FIG. 3.

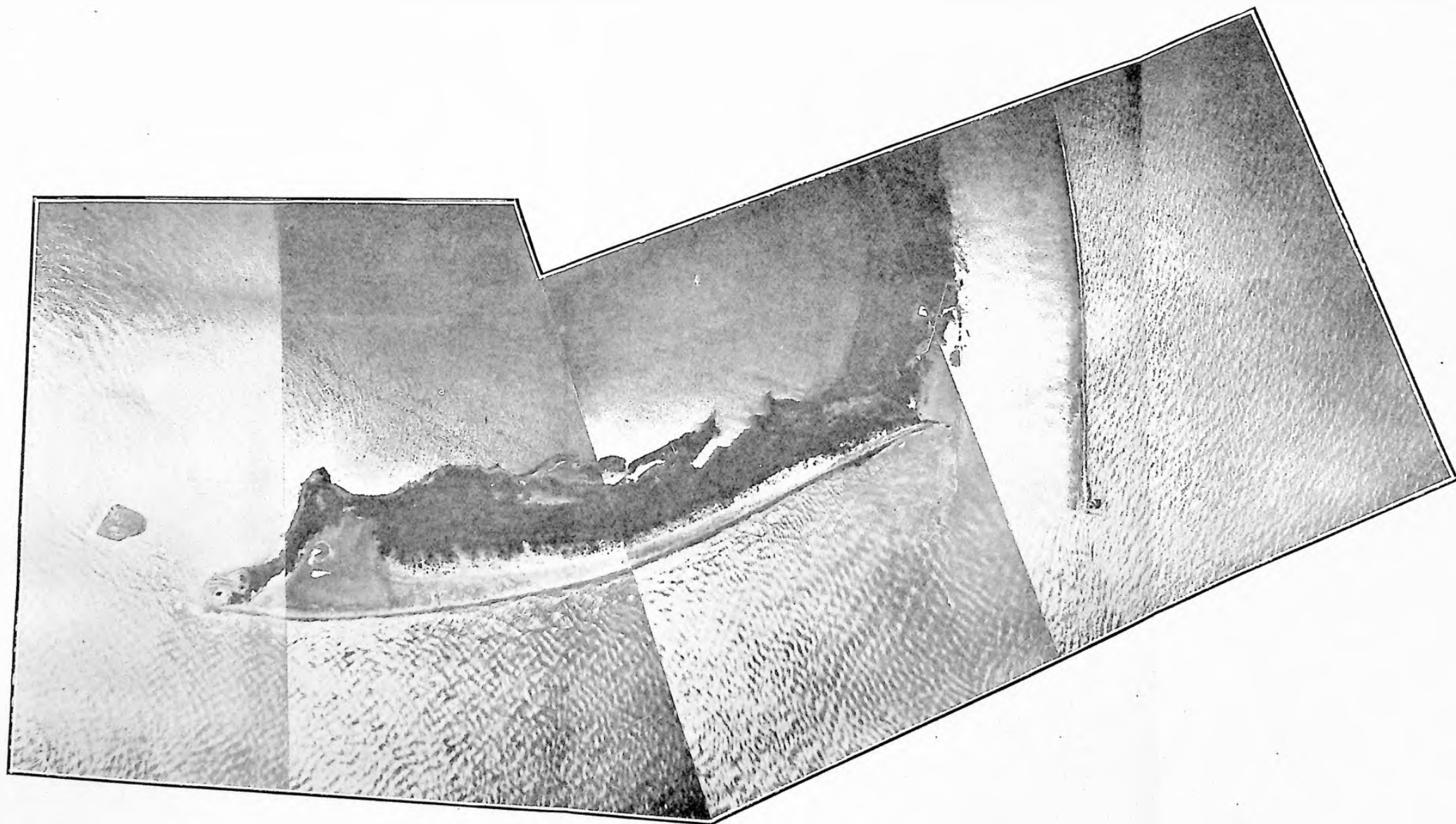


Fig. 4.

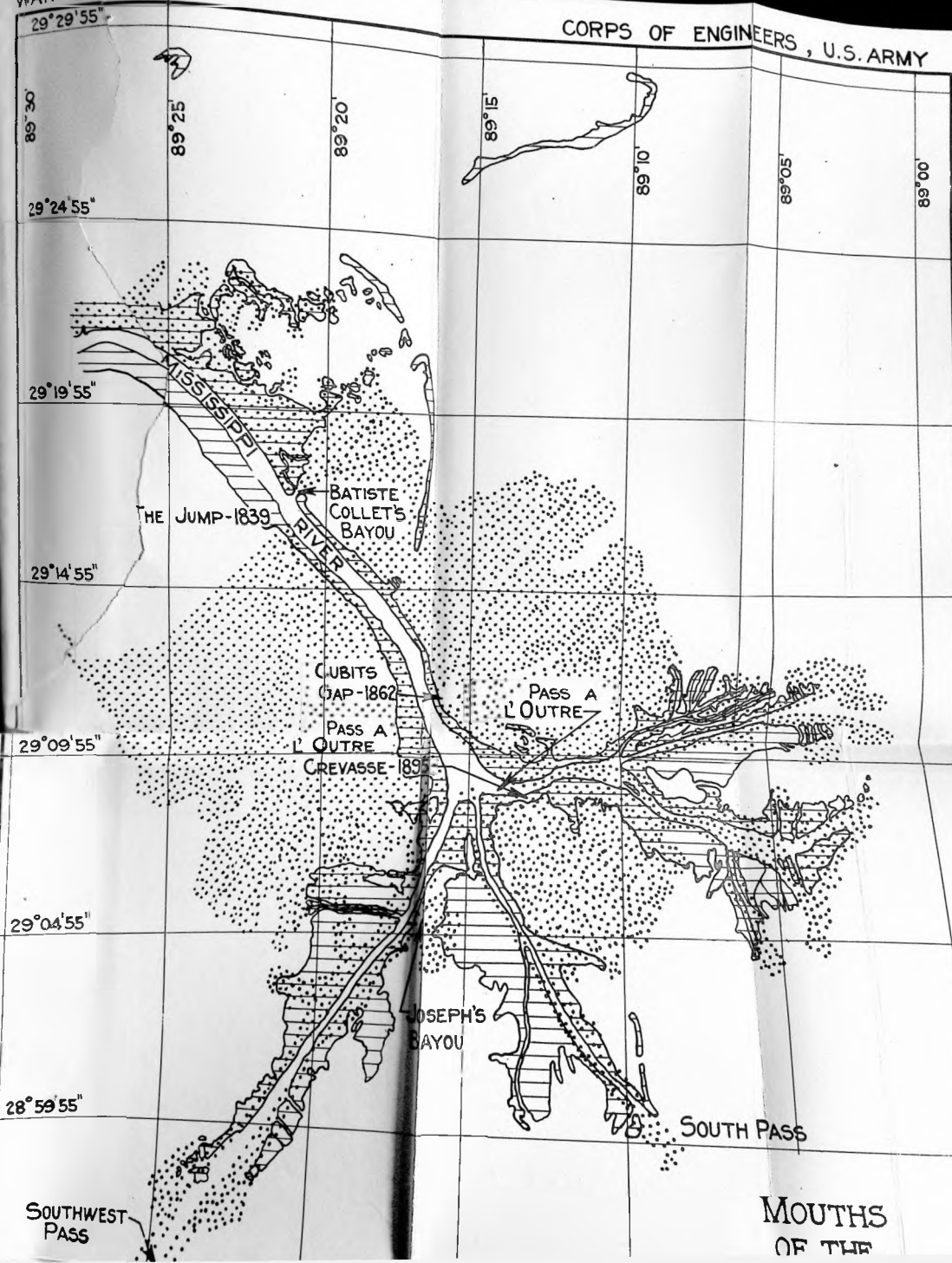
So far as sand being rolled along the bottom is concerned, it is suggested that you compute for yourselves the volume that would result from a continuous procession of sand grains rolling along the bottom, the average sized grain being capable of passing through a cement sieve having 100 meshes per linear inch.

There is another method by which sand is regularly moved along the beds of our rivers. The individual particles move by jumps which carry them a short distance above the bottom and a considerable distance downstream with each leap. With a large number of grains in this manner, there results a thin layer of heavily charged water above the bed of the river. A detailed description of this mode of transportation is given in Prof. Paper No. 86, U. S. Geological Survey "The Transportation of Debris by Running Water," Mr. G. K. Gilbert.

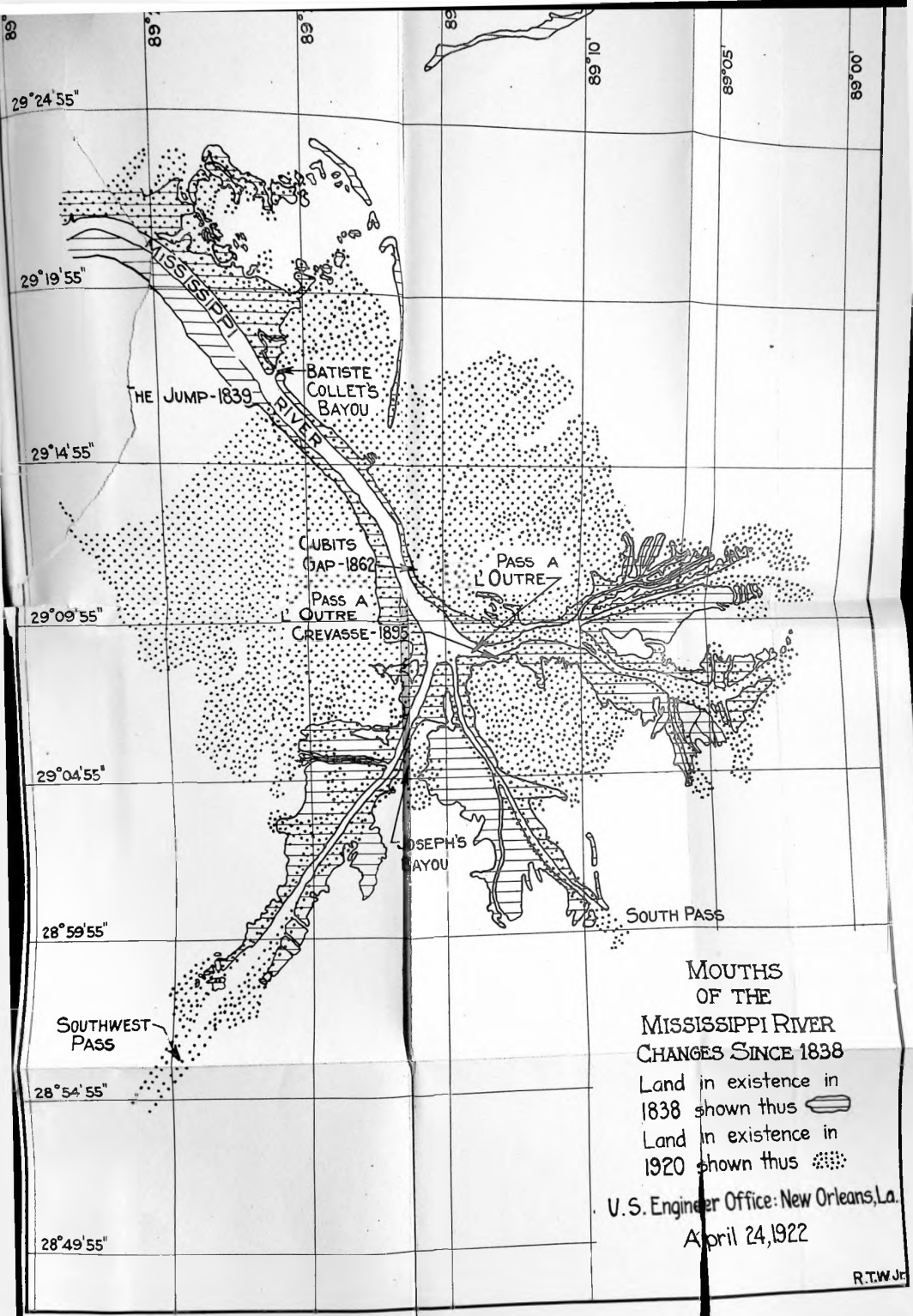
Taking as our measures, the most rapid sand wave movements and the most rapid movement of semi-suspended sand, of which the writer has found a record, and applying the figures to Southeast Pass, the result is about 100,000 tons per day or less than 10 per cent of the quantity of sand in suspension and less than 5 per cent. of the total sediment in suspension. The actual figures are believed to be well below those just stated.

The typical form of sand wave presents a gently sloping upstream face and a downstream face sloping at a sufficient angle to enable the force of gravity to aid materially in rolling the sand down the slope. Actual slopes steeper than 1 vertical to 3 horizontal are the rule. When the outer crest of the bar at the mouth of any pass is reached, conditions would be ideal for the formation of a steep downstream slope if there were a sufficient mass of sand moving along the bottom. The actual slope of the bars to about 40-foot depth is approximately 3 per cent. Beyond the 40-foot depth, the slope is about 1 per cent. These slopes are so gentle that they must be accepted as proof that the greater portion of the bar-forming material is discharged in a state of full suspension.

Before turning back to the growth of the delta, it will be well to summarize the above statements as to sediment. The total annual load is sufficient to bury one square mile to a depth of 315 feet; about 50 per cent. of the whole is sand; during high water, over 4,000,000 cubic yards of sediment may be



MOUTHS
OF THE



The Jump discharged into a shallow bay where a small depth of deposit makes a big showing. The toe of the Southwest Pass bar is in water 200 to 300 feet deep. As a result of the flat bottom in front of The Jump, finely divided sediment and flocculated sediment settling at a very slow speed was deposited in the vicinity of the outlet. In the case of Southwest Pass, any sediment that settles slowly will take a long time to touch bottom and may travel many miles in the interim. For example: a particle of sand settling at a rate of $2\frac{1}{2}$ inches per minute would require 20 hours to reach bottom, if carried to the 250-foot depth during that time. In 8 feet of water in front of The Jump, it would hit bottom in less than 40 minutes.

The comparison of the 1838 and 1921 surveys also shows a number of small sub-deltas. While one of these deltas may be several square miles in extent, it is unfortunately true that the little bayous that created them were apparently so insignificant that almost no record of their history is available. They may be shown on some of the maps, cross-sections of some are available but there are no data as to the volume of water discharged or their changes in size.

The enormous areas of marsh land that have disappeared since 1838, deserve more than passing notice. Familiarity breeds contempt, and the disappearance of these vast expanses of cane has been so gradual as to excite little comment. I know of no other place in the world where such a change is taking place on a scale worthy of comparison or accompanied by similar phenomena.

The marsh areas are subsiding vertically at a rate that is apparent with short time records. Records covering less than 50 years show a marked subsidence of the delta at and below the Head of Passes. Roughly, the rate of subsidence of bench marks on the firm banks of the passes is as follows:

Head of Passes.....	0.2 in. per year
Port Eads.....	0.3 in. per year
Burrwood	0.9 in. per year

At Port Eads and Burrwood, the depth of recent river deposits is believed to be about 250 feet. These deposits are thought to be still undergoing a process of consolidation. The

banks of the passes maintain a constant height or may even increase in height due to an annual deposit of sediment, but a bench mark, a fence post or a pile, gradually settles. A marsh area so situated as not to receive a sufficient annual increment similarly settles and disappears.

The airplane photograph, Fig. 6, shows a portion of the bank of Southwest Pass where a combination of subsidence and wave action has so reduced the width that protective measures must be taken in the near future. The white line near the bay edge of the bank is the line of drift thrown up by the waves. On the channel side, a few rounded tufts of marsh cane may be seen showing that at this point deposits are forming on the inside and are effecting a reduction in the width of the pass.

The photographs Figs. 7 and 8 show a section of the marshes where no overflows have been permitted for so long a time that only small portions of the land remain. The traces of old bayous may be readily recognized. In this case the effect of subsidence has not been masked by the result of wave action.

The fact that narrow banks are subject to the formation of crevasses, as shown by the history of the past 85 years, and the further fact that the banks of South Pass have already become exceedingly thin for a considerable portion of their length, is a subject of no small concern to the business of this port. Drawing a lesson from the manner in which small bayous have built out deltas of their own, a number of artificial cuts were made through the bank of South Pass during the summer of 1921. Each outlet has been strongly paved to prevent its enlargement and the results in the form of deposits during this year's flood will be closely observed. At a distance of 2,000 feet from the openings, the depth of water in the bay averages about 3 feet, and it is hoped that within 5 years valuable results will be obtained.

South Pass was opened to navigation in 1878. Prior to that time, ships had been dragged over the bars of the larger passes, especially Southwest Pass. The natural depth at South Pass was about 8 feet, and at Southwest Pass about 15 feet was maintained by the use of harrowing and stirring devices. Since the opening of South Pass practically all shipping has used that

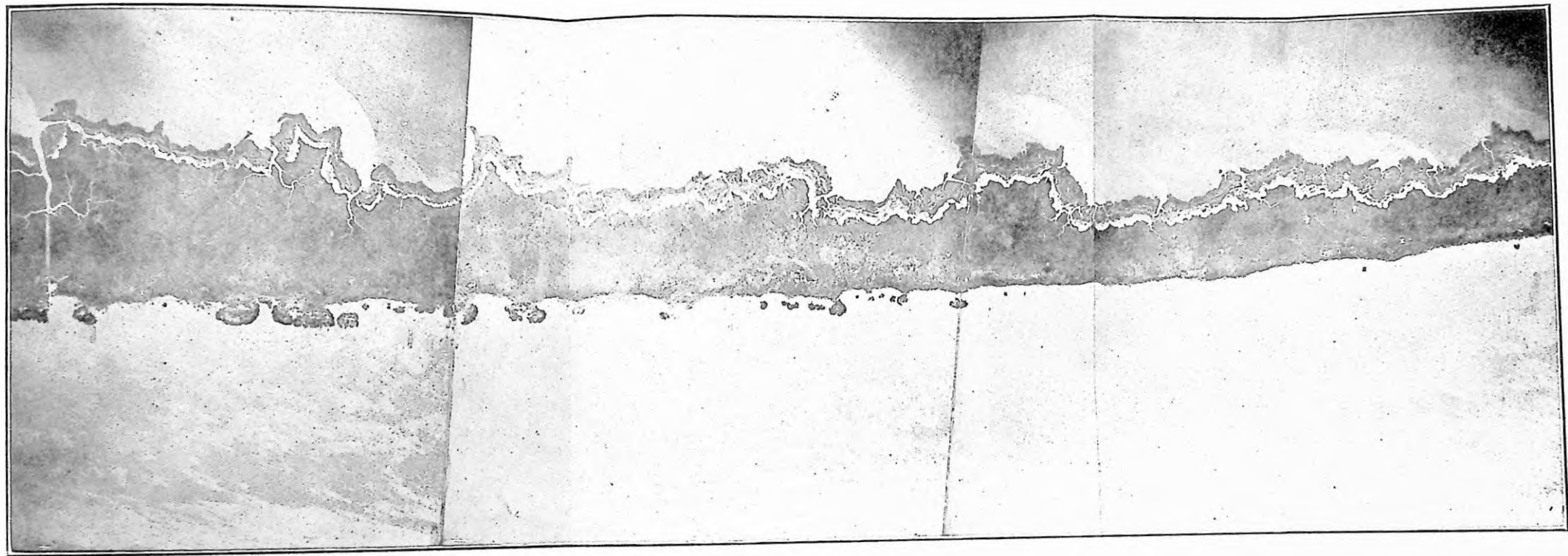


Fig. 6.

entrance, and the depth at the present time is ordinarily 30 to 32 feet.

As early as 1722, the French had proposed the use of jetties for the improvement of Southwest Pass, and this system had been advocated on several occasions between 1722 and 1875. Another school of engineers advocated the construction of a canal with a lock at the river bank, their claim being that no permanent results could be obtained by the use of jetties.

In 1875, in the midst of one of these controversies, the late James B. Eads submitted an offer to improve Southwest Pass on the basis of no cure no pay. His statement of the theory on which he based his plan is so clear that it will be given in his own words.

“The Surveys of Talcott, 40 years ago, and those recently made by the Coast Survey, confirm what the reader would naturally infer, viz; That as the river builds up and finishes its jetties the bar travels seaward; that the bar moves out not as the cause, but as the effect of the jetty building of the river. Seven and one-third miles above the bar the natural jetties are finished and narrowed to their normal width of 1,250 feet, and there the pass is 60 feet deep in consequence. The bar was once unquestionably where this depth of 60 feet now exists. From this point the river gradually widens out to the sea, like a fish's tail, and the current gradually diminishes from four and one-third feet to about three feet per second, at the bar, and to zero some twenty miles beyond in the Gulf.

“Since the white man has known the river, this distance between the bar and the narrow and completed banks of the pass above has been the same, viz:: seven and one-third miles. For eleven miles above, the pass presents the same narrow and deep characteristics. The bar has marshalled the way through ages past to the Gulf, and the natural jetties have been built up at exactly the same rate of speed, and have constantly kept the bar seven and a third miles in advance.

“It is evident, that as the natural jetties advance, the bar is slowly eroded away. The upstream part of the bar is gradually cut out and deposited further out in the Gulf. A little reflection will show that there must be some strange connection or influence existing between the finished part of these jetties and the bar,

that the distance between them should remain so constantly the same. Evidently the volume of current passing out between the finished jetties or banks where they are 1,250 feet wide, are so great that the bar cannot form any nearer than seven and one-third miles distant, and it is just as evident that this volume and current are not sufficient to make the bar form at a greater distance.

"Now suppose that by artificial means these natural jetties could be suddenly extended seven and one-third miles out to the bar. The volume of water would be almost, if not exactly the same, and so would be the current. Instead of passing over the bar as it now does, at three feet per second, it would pass out from between these artificial jetties at the rate of over four feet per second. This artificial and parallel construction would give the stream at the present bar the width, depth, velocity and volume, almost exactly, which it has today, seven and one-third miles above the bar. Could the bar again re-form afterwards nearer than seven and one-third miles from the end of these artificial jetties? Would there be less than 60 feet depth between them, as there is now between the natural ones? Suppose there was no littoral current or Gulf stream to carry away the sediment, the bar would then certainly form again, but when?

"At the rate it has been going out for the past 40 years, it would take the river 65,000 days, or 178 years, to extend its jetties from where they are finished, out to the present crest of the bar. All these years will be required to build up its foundations in the Gulf before it can complete its jetties to the present bar. Is it not evident then that 178 years hence, if the river be left alone, the bar will then be seven and one-third miles in advance of its present location? Is it not equally evident, if man should do in three or four years what it will require the river 178 years to do, that when the bar reappears it will be after the lapse of centuries because it must be located at least seven miles beyond the artificial jetties, and where the water is now several hundred feet deep? Even if there be no currents whatever to distribute the sediment into more profound and distant depths, we will have gotten so far in advance of the bar forming power of the river, that it will require centuries for it to overtake the work of man, and again build up its bar, for this must be done in greatly increased depths."



Fig. 7.

This theory was strongly combated, particularly by the late Gen. A. A. Humphreys, and finally a plan for a less expensive improvement of South Pass was adopted by Congress and Mr. Eads began work. In 1878, the pass was opened to navigation and it has been maintained ever since.

Subsequently the United States attempted to apply the same theory to Southwest Pass. The jetties were extended to the bar twice and both times a new bar promptly formed just beyond their outer ends. There were some important differences between the work at South and Southwest Passes, but they affected the channel above the ends of the jetties and not the channel from the ends of the jetties to deep water in the Gulf. Time does not permit of a discussion of the inner portion of the channel. All engineers are agreed that with a given relation between width and volume of flow, a given depth will be secured.

With respect to the channel beyond the ends of the jetties, it is important to remember that the Mississippi is a fresh water stream discharging into a salt water sea. The specific gravity of salt water is greater than that of fresh water and the latter spreads out fan-shaped over the former as soon as the ends of the jetties have passed. Gen. Humphreys argued with masterful logic that as soon as a layer of quiescent salt water interposed between the fresh water stream and the bottom, the heavy sediment carried by the river would fall to the bottom and form a new bar. This much of his argument has been substantiated at both South and Southwest Passes.

Gen. Humphreys also predicted an enormous increase in the rate of advance of the bar after the jetties were built. This argument was based on the assumption that most of the bar building sediment was rolled or pushed along close to the bottom and that when the jetties confined it to a narrow zone, the bar would advance in the form of a narrow ridge instead of in a broad fan as formerly. This part of the argument has proven erroneous. As stated above, most of the sediment is discharged in a suspended state and it has been scattered over a wide fan since jetties were built in the same manner as before their construction. The rate of advance of the bar has been increased, but only slightly so.

The fallacy in the argument advanced by Mr. Eads lies in the fact that the new bar begins to form immediately beyond the ends of the jetties and advances seaward by annual additions to its outer slope. As the distance from the ends of the jetties increases, the depth over the crest of the bar decreases. It might require 178 years for a new bar to form at Southwest Pass having the dimensions of the old natural bar; the crest of this new bar might be seven and one-third miles from the ends of the jetties. But in the meantime, we should have a bar whose crest was much closer to the end of the jetties and whose depth was more than 12 feet, but not enough to pass ships.

We have here the peculiar circumstance that Gen. Humphreys, who predicted a failure, was largely correct in his theory while Mr. Eads, who backed his erroneous theories with a fortune, made a success of his project.

The fact is that in carrying out his work, Mr. Eads adopted an expedient that neither he nor Gen. Humphreys had considered. For that matter, the late Dr. Elmer E. Corthell, who worked for Mr. Eads on the South Pass jetties, read a paper in 1914, showing that he had not, at that date, noticed the discrepancy between the theories and the facts.

Since the construction of the South Pass jetties, the bar has advanced 3,000 feet. Throughout the 44 years since the jetties were built, a channel has been maintained through that growing bar, but the channel has always inclined sharply to the left as soon as the outer ends of the jetties had been passed. The Eads maintenance contract ended in January, 1901, and during its life approximately 7 times as much dredging was done in the jetties channel where the water was confined as in the bar channel after the restraining jetties had been passed.

At present the sediment discharged by South Pass during high water amounts to as much as 700,000 cubic yards per day, one-half of which is sand. As long as the fresh water is held between banks, separated by a proper interval, the current will take care of this vast load. When the ends of the jetties have been passed and the current can no longer be relied upon to do the work, it is well to give that mass of sand the right of way and put the channel where the sediment does not go. This is exactly what Mr. Eads did when he took a short cut between

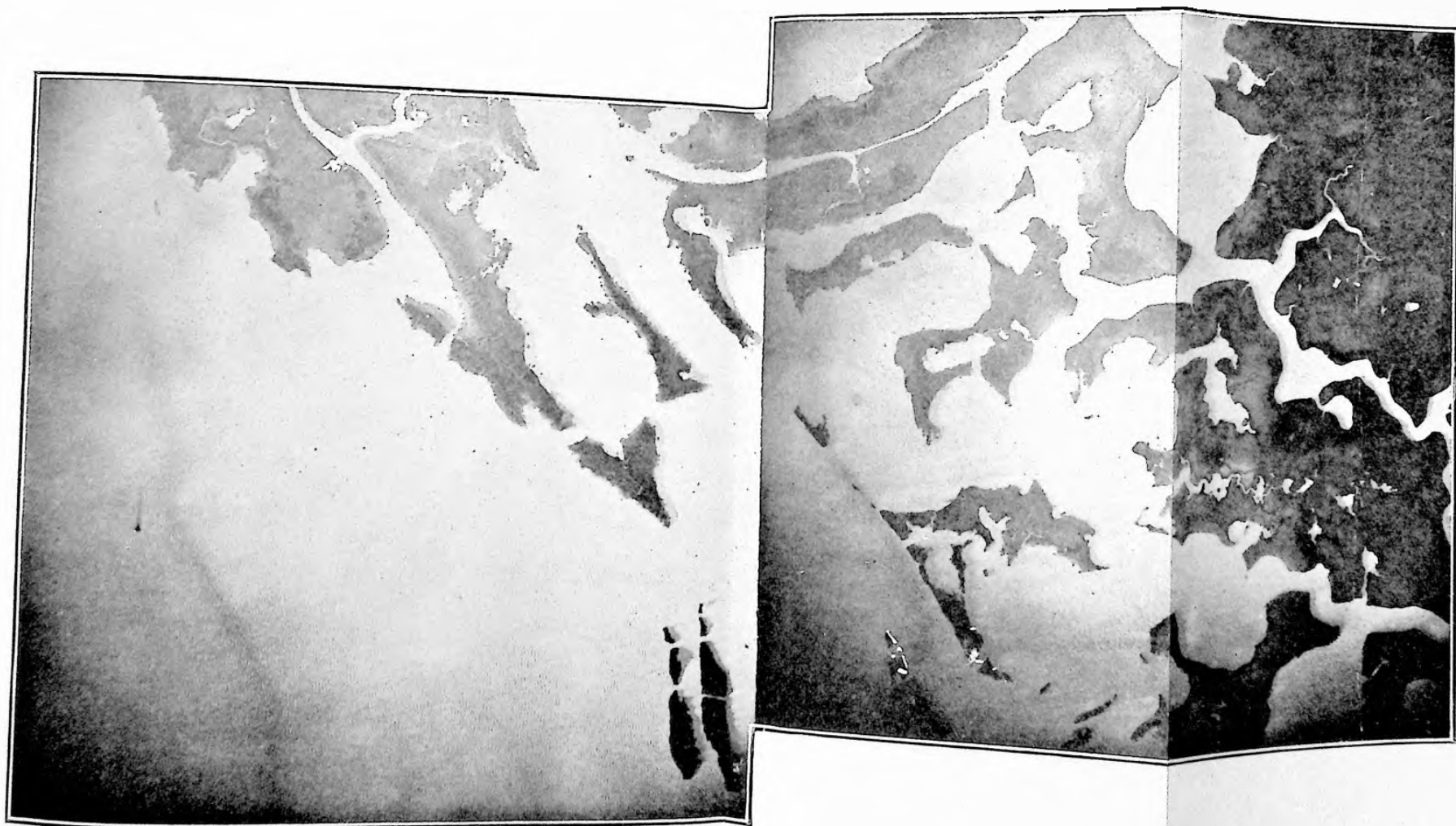


Fig. 8.

two mud lumps and dredged a channel leading to the left. The water discharged by the pass travels straight ahead and takes the sediment with it. Leading off to the left, we have a side canal through the new bar which requires no lock and in which the annual deposits have averaged about 1 foot per year, an amount readily removed by dredging.

The eddy currents resulting from the discharge of fresh water into salt water play an important part in the maintenance of this latter channel. Fig. 9 has been prepared to illustrate the effect of discharging fresh water, confined by jetties up to a fixed point, into salt water. The specific gravity of salt water is greater than that of fresh water and where the two fluids meet unbalanced pressures will exist. The diagram is based on the assumption that the column of fresh water will be enough higher than the adjoining column of salt water to maintain approximately equal pressures at the bottom.

As the surface of the fresh water stream is above the general level of the salt water on each side, the upper layers of river water flow off to the sides and on the surface the fresh water currents are fan-shaped. As the fresh water spreads out the height of this column is reduced and salt water forces its way underneath. This process soon transforms the rectangular fresh water stream into a wide lense of small depth.

If the depth of water on one side of the channel is materially less than on the opposite side theoretical considerations indicate that the fresh water will spread out and displace the salt water from surface to bottom on the shallow side.

Plate No. 10 shows the result of actual observations at South Pass made with a current meter that gives directions as well as velocities. It will be seen that as a particle of sand settles towards the bottom of the channel it is caught by these under-currents of salt water and turned back towards the axis of the fresh water stream.

This principle of a latteral canal through the bar is being tried out at Southwest Pass. When dredging along the new line started, we had a depth of only 12 feet. The depth along this line is now 27 feet and there is every reason to believe that the principle will work at Southwest Pass.

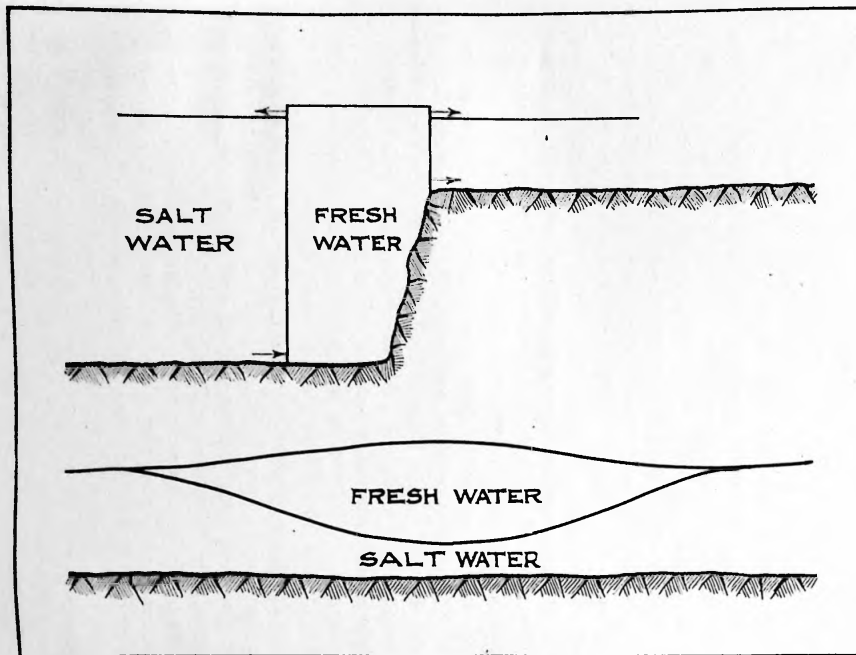


FIG. 9.

Looking ahead 20 or 50 years, it is believed that we may confidently expect to maintain adequate channels through the outer bars at South and Southeast Passes; that we shall be able to maintain such a distribution of flow at the Head of Passes that the navigable channels South and Southwest Passes will be maintained; that a proper use of side outlets such as The Jump, Batiste Collets, Cubits Gap, the new outlets from South Pass, etc., will enable us to maintain wide and secure banks.

The Society may also rest assured that this favorite source of discussion has not been exhausted. They have here at their door a great engineering problem and one that is unique in many respects. Our knowledge of the delta is still very slight, and it is to be hoped that interesting phases may be discussed before you from time to time.

DISCUSSION.

W. G. PRICE: Mr. President and Gentlemen—As this is probably the only opportunity I shall have to talk about the improvement of the Mississippi to Engineers who are interested in that work, I desire to tell you a little of history and make some suggestions, which may seem severe criticism. For this reason I have reduced it to writing.

In the year 1879 I assisted in the survey that located the river shore lines on the map of the world, and also assisted in securing much physical data.

In 1880 I had charge of a party on the upper Mississippi, measuring the discharge and securing other data for the Mississippi River Commission, preliminary to construction work.

I wish to describe some data which I obtained at this time, as I believe it to be of vital importance to any engineer who is doing river improvement works.

We were measuring the discharge with rod floats, as, at that time, no meter had been designed that would do accurate work. The floats were put into the water from a skiff, which was successively anchored at points 80 feet apart on a line across the river.

In order to anchor the skiff at these points a steel galvanized wire was stretched across the river, which was 1800 feet wide. The wire was 9-64 inch in diameter. To hold this wire from being carried down stream by the current, anchor wires of the same material were secured to the cross wire 80 feet apart, and they led up stream to rock anchors.

Each day the bow of the skiff was slid across the river, under the cross wire, to all of the points where the floats were to be dropped into the water. The wire was thus raised once each day from the bed of the river. The galvanizing disappeared from the wire very rapidly.

Where the wire rested across hollows in the river bed so that it did not touch the bottom the impact of the water borne sand against it abraded and reduced the area of its section about one half every six weeks to the extent that it would break and had to be renewed. The current velocity at mid depth was not over 4 feet per second. The anchor wires lasted about 5 months, after which their sections were so reduced by rust that they broke. I will refer again to the destruction of wire in willow mattress by water borne sand.

I think you may wish to know how the Price Meter was produced. I was attempting to measure at Paducah the great flood of 1882 and had been furnished with two meters; one designed by General Ellis, and the other by Clemens Herschell. The Herschell meter was a very finely built instrument, almost the same as was later designed by Mr. Haskell. The grit in the water constantly got into the bearings of these meters, causing friction which changed their ratings and made it impossible to secure any accurate discharge measurements. Vertical eddies in the river caused fine sand to rise to the surface of the water. We took the velocity measurements at mid-depth. I wired Captain Leach at St. Louis to send me an instrument which would work and he wired back "Have nothing to send you; do the best you can." I then decided to make a meter with bearings all open to the water and without packing, as packing would cause friction, but so constructed that the water, under the pressure of a depth of 100 feet, could not get into the bearings.

The electric contact breaker was also protected from the water and the grit that flows with it in almost all streams. This was accomplished by the use of inverted cup bearings. I worked all night making a general drawing and details, and the next day four good mechanics completed the instrument, which cost \$15.00. It is now in the National Museum at Washington.

Many years ago, after my patent ran out, the meter makers W. and L. E. Gurley, changed the upper bearing design, so that water with its grit can get into it. The grit reduces the accuracy of the instrument, and it cuts away the bearing and contact spring, so that repairs are required. I protested against this change, but they had not corrected this serious defect eighteen months ago when I was at their factory.

In the year 1883 I was transferred from St. Louis to New Orleans, and a short time after was told that I was to take charge of the harbor construction work.

A mattress put down that year in the upper end of Carrollton bend on a long easy sloping bank and it was woven without wire fastenings. The next year I designed and built at Gretna what are called spur dikes, or separated fixed points, composed of a woven mattress, covering the bank, extending from low water mark well out on the bed of the river. Large cribs were placed upon the mattress. These cribs were built of brush and timber with pockets to hold the rock. They braced the steep bank and prevented its caving as it otherwise was sure to do when the river fell from high to low. All the permanent fastenings of these fixed points were wood, as I knew that wire and steel bolts and spikes were not durable. Captain Eads, who was president of the Mississippi River Commission, spent some time with me and approved this construction and advocated its use for improving the whole length of the river.

Some years later, when I was building the Atehafalaya dams at Simmesport, I was one day on a tug with Captain Kingman, out on the Mississippi, above the mouth of Red River. The Mississippi was rising rapidly and the whole surface of the river from bank to bank was covered with mattress debris and small pieces of mattress. One large mattress we anchored to

the bank in an eddy and later we let it go and it wrecked some of the New Orleans construction plant. In those years, on a rising river, such floating mattress debris was common, and I believe was no credit to the Mississippi River Commission.

In 1891 I built a dam half mile long across Red River from Turnbolls Island, and when it nearly finished, owing to a change in the membership of the Commission, I was ordered to destroy it, which I did.

In 1892 I built and sunk at Plaquemine, under orders, a lot of revetment mattress on a steep bank, with no cribs to brace up the bank. The willows were held in place entirely with wire. I believed then and still believe that it was a complete waste of money. The same year much of this type of construction was placed in the upper part of Carrollton bend, where the river has since cut in more than a city block in width. I am told that mattress revetment on steep banks, without cribs, is still being used on the river between Vicksburg and Cairo, and that the willows are secured with phosphor bronze wire. In view of my experience with the abrasion of wire on the upper Mississippi is such a construction a wise one? I am told that as much as 100 million dollars have been spent on the Mississippi during the past 40 years in works which have proven failures.

I am told that thick mattresses, with good wooden fastenings, with no cribs on them, are being put down in New Orleans Harbor, and that much of the working time of the Harbor Plant is being used in repairing such revetments. Why not place cribs on them to brace the bank and prevent such destruction?

Captain Eads and Captain Kingman advocated the fixed point idea for improving the river. In view of the past disastrous experience why should it not be tried? The river will cut the bank between the fixed points and form a scalloped shore line. The fixed points must be spaced close enough so that the river can not flank them. In New Orleans Harbor the crib revetment must be continuous along the wharves. It is probable that the fixed points, which were built at Gretna, are not as strong or as near each other as they should be. In them only a woven mattress was used, while a crib mattress, such as I used in the

Atchafalaya dams and which is now being put down in the Harbor is much superior.

COLONEL LEWIS: I am very much interested in the paper Colonel Dent has presented tonight, about the mouths of the Mississippi River. The last speaker discussed the construction of mattresses. That is a matter left entirely to the United States Engineer Department, and while there may be some failures, in individual cases, I would not say that there has been any general failure of the system. I have not been directly connected with the construction of revetments, but I know that the revetment of the river banks of the Mississippi River, wherever it has been undertaken by the United States Engineer Department, is a success. In fact, I was engineer of the Orleans Levee District for eight years, and I know if it had not been for the revetment work done there by the Government, our present Carrollton levee would not be where it is today. Of course, it is possible that in this question of revetment there will be found cheaper methods than are now in use but I do believe the problem of the Mississippi River devolves mainly upon the revetment, from the simple fact that the revetment prevents caving of the river bank, and the enormous amount of silt and sediment in the river, as is now well known, comes from caving banks.

The levee problem will never be solved until the banks are protected. We can build our levees to resist any floods that will come down the river, but we can't maintain them unless the beds are maintained. The cost of the revetment is what stares the engineers in the face; and I hope in the course of time a cheaper material will be devised by which we can hold the Mississippi River in its channel and do away with a great deal of that sediment. If we can solve the sediment problem, we get rid of the problem at the mouths of the Mississippi River to a certain extent.

MR. COLEMAN: I have been interest in the paper by Colonel Dent on the problems of the mouths of the Mississippi River. I suppose the interest of each individual in these problems is determined largely by the effect which the problems have upon matters in which he has the greatest interest. There is no matter

in which I have a greater interest than the Port of New Orleans as a port, and the maintenance, growth and development of the port is wholly dependent for the present time on the proper maintenance of the mouths of the Mississippi River. I had the pleasure a short time ago of visiting the the mouths of the river with Colonel Dent, and I learned many things on that trip which I had not known before, and came to a realization of some of the complex problems with which the gentlemen charged with the responsibility for that work have to deal. I don't feel that I am qualified to discuss the technical details of Colonel Dent's paper. The data which he has gathered have come too recently to my own knowledge to have received the consideration which they should receive before a discussion. But I hope that some of these other gentlemen who have been studying these questions with Colonel Dent, and who are thereby qualified to discuss them, will give us the benefit of their views in the matter.

MR. LAWES: I am interested in the question of the disappearance of the marsh land long the banks of the bayous. It is said that the delta is sinking at a certain rate per annum. Wherever the river mud is prevented from escaping from the banks, the banks do subside, being consolidated and lowered. But, as brought out in Col. Dent's paper, the annual deposit of sediment amounts to 315 feet to the square mile. That deposit over the delta, to my mind, keeps pace with any subsidence, and the delta, as a whole, should not subside under these conditions. Bench marks are far from stable, being influenced by friction and all that sort of thing, and they go down; but that does not necessarily prove to my mind that the delta, as a rule, is subsiding to that extent. The delta was built up by the water spreading over the banks, and it seems to me that the process is being carried on beyond where the water is confined today, and, instead of subsiding, the delta is building up in the same way. I would like to ask Col. Dent about the plan of the United States Engineers in building jetties is almost the opposite to that suggested by Mr. Eads. What is the reason for this difference in plan?

COL. DENT: Jetties have two functions. It is true that most of the jetties built on littorals are converging jetties, but they

are built in the Great Lakes, on ocean bars and other such places where scour is not the main object. In the converging jetty on the Great Lakes there is no question of movement of material involved, because it is cheaper to dig a channel after you have broken up the wave action. In the case of the Mississippi River at Southwest Pass, the jetties were not made parallel originally. That has been recognized as a mistake. The Board which recommended that type had observed results on these ordinary bars elsewhere, and they forgot that the mouth of the Mississippi River is a law unto itself. There is no similar problem anywhere in the world, as far as I can find. On our ordinary bars it has been found that the cheapest way to get a channel was to break up the wave action and the channel remained. At the mouth of the Mississippi you have a million yards of sand going out of Southwest Pass. Dig a channel that big, and it wipes out in a night. The original jetties at Southwest Pass were built along the same lines that had been found effective in the other places where the water was shoal. That has since been recognized as a mistake, and we are building interior jetties along parallel lines. In the case of the Mississippi River you have a given flow of water, and the only way to maintain depth is to proportion the weight and the discharge in such a manner that the entire load will be carried through. I wish to mention another point: It was Col. Lewis that said if you cut out caving banks you cut out sediment in the river. I must differ with him. The Mississippi River from Cairo down is annually depositing material along its entire length. In other words, there is more sediment carried to Cairo than is carried past New Orleans. In any river, after it reaches certain stages of its growth, geologists will tell you that the greatest amount of sediment carried is in the upper portions. As you go down the slope the amount of sediment in the balance of the water diminishes. There is less sediment carried by here today than is brought as far as Cairo. And if you eliminate all caving banks, there will still be the sediment which comes by Cairo. You would still have part of this deposited on the banks, and part of it carried down the river.

A MEMBER: In the question of subsidence may it not be that the tide is rising, instead of the ground subsiding?

COL. DENT: I don't think the tide at the mouth of the river is rising any faster than it is at Biloxi. I might say in regard to that subsidence, it is not limited. The records of part of Myrtle Grove Plantation show that a good many years ago—I can't say just how long ago—they used to send their teams over to get wood from a place that is continuously submerged at the present time. You get back of the solid river bank and the gradual subsidence of those marsh areas is noticeable in that the width of the bank that can be cultivated is steadily decreasing. On that point I am going to ask Mr. Klorer to tell you a story he told me on one occasion about two bench marks, one on the bank of the river and one about a mile back, and his experience when he went to check them up.

COL. LEWIS: I want to differ with Col. Dent from my own experience. In the old steamboat times when I went up, the river banks could be seen dropping off like pieces of fruit cake, and I began to change my ideas, and discard some of the things I had learned from books. There is no question but that a good deal of sediment comes from the Ohio river, but two-thirds comes from the curve in the river bank. What becomes of that sediment? When it crosses the river most of it is deposited. The Mississippi River Commission tried jettying first, just as Mr. Eads did, and it was a failure. Then they built hydraulic dredges to maintain a low water channel of a specified depth from here to St. Louis. That is a temporary expedient. Hydraulic dredges do the work, but the remedy is torevet those banks to prevent the cave in the river bank. If you do that you will maintain the Mississippi River in its proper channel, and it stands to reason you will have a certain amount of sediment flowing down to be carried to the Gulf instead of being deposited on these cross sections.

I am not familiar with the special problems at the mouth of the river, as I have never had any direct engineering connection with them. It seems reasonable that if you prevent the caving of the river bank, it will probably have something to do with the mouths of the Mississippi River.

MR. KLOMER: I think there seems to be an impression that I am going to tell a funny story. This isn't a story. I have

been summoned as a witness, so to speak, to bear out the statement of Co. Dent that there is actual subsidence back of the levee. The matter is this. In 1895 the Mississippi River Commission established a series of bench marks along the river, what are called stone line marks. There were two stone line marks on one side, and two on the other. They were run very carefully, and along in 1911 or 1912 there arose the necessity in connection with the levee work of establishing intermediate bench marks that had been destroyed in the meantime. In establishing this line of intermediate marks there was a very marked appearance of lack of checking. Ordinarily when a levee engineer does check by a precise check mark, a stone line mark, he thinks his levels are right, but if he has a certain amount of conceit about his ability to run accurate levels and doesn't check them on the precise check marks, he questions the correctness of the present bench marks, and that was what happened in this case. In running back to his bench marks further removed from the bank the error seemed to increase in one direction. They always found the bench marks lower than a given elevation, and the further back it ran, the greater was the error. There seemed to be some relation between the amount of subsidence and the natural elevation of the soil on which the bench marks were located. I commenced to question some of the sugar planters to corroborate this observation, and one of them told me the fact that Col. Dent mentioned. On one of the plantations he had been reading the diary of the overseer, and he saw the entry that when the crop was laid by, they were sent for some wood and that one could not hunt ducks on that particular part of the field, a thing which could easily be done today. A little further down around Magnolia, Governor Warmuth told me that back of his drainage machinery you could see the remnants of old banks. At Home Place, some of the younger generation told me they remembered the time when they made crops back of the railroad, which is now not fit for any other cultivation except rice. There was no lack of testimony showing there was a general subsidence of the whole delta. Talking of this subsidence reminds me of the story of Cubit who had his house at Cubit's Gap. The house was originally put on piling six feet above the ground surface. Ground surface at that time was six

feet or less above the mean tide level. Each succeeding high water added a certain increase to the ground surface, and brought the floors of the dwelling a little closer to earth. Finally they found that it was settling on the ground, notwithstanding the fact that the ground was still no higher than about a foot above the Gulf level. So that the accretion kept pace with the subsidence. I think that is one of the conditions at the mouth of the river. Fortunately the engineers are permitted to use stipulations that cannot be used in other jetty work. In Galveston they have to build the structure of rock.

MINUTES OF MEETING AND BUSINESS OF THE SOCIETY.

Regular Meeting of Board of Direction, February 20, 1922.

The meeting of the Board of Directors was held, with President Donald Derickson, Messrs. J. S. Barelli, B. S. Nelson, and Walter B. Moses present.

On account of Mr. Robert's absence, Mr. Moses was made temporary Secretary.

The minutes of the previous meeting were read and approved.

The report of Mr. R. J. Derbes, Jr., C. P. A., covering a complete audit of the books for the past three years, was read, approved and was turned over to the Secretary for his records.

The financial report of the Secretary was read, seconded and upon motion was duly approved.

All bills pending are to be paid.

Two letters were read from the Federated American Engineering Society regarding dues for the coming year, and also in reference to discount which can be taken if deemed advisable, and a motion, duly seconded, was made in which it was decided not to accept the discount, inasmuch as we are not in as severe financial straits as other societies, but to mail check for \$58.43, covering first quarter payment immediately.

Mr. Wade Barnett was nominated as a member of the Board of Directors to fill the vacancy of Mr. J. S. Barell who was elected Vice-President at the last election.

The Treasurer of the Society was given authority by the Board to exchange some of the assets of the society into greater interest bearing funds, and to change the banking place of the society as he might see fit.

There being no further business, the meeting adjourned.

WALTER B. MOSES, Acting Secretary.

Regular Meeting of the Society, February 20, 1922.

The regular meeting of the Louisiana Engineering Society was called to order, with Prof. Donald Derickson in the chair, 62 members and guests being present.

In the absence of Mr. James M. Robert, W. B. Moses was appointed temporary Secretary.

The minutes of the previous meeting were read and approved.

Mr. Samuel Young, Chairman of the Membership Committee, read a report and showed considerable progress being made in the interests of increased membership.

The Society was notified of the election of Mr. Wade Barnett on the Board of Direction to fill the vacancy of Mr. J. S. Barelli who was recently elected Vice-President.

An invitation was read from Mr. J. L. Dickie, graduate of the University of Michigan, inviting the entire membership to a boat ride on the Tug "Boswell," complimentary to Dean Cooley. This invitation was accepted with thanks, by the entire Society.

The President then introduced Dean M. E. Cooley, who had come to New Orleans in the interests of the Federated American Engineering Societies. Dean Cooley delivered a most interesting address on the Objects and Activities of the Federated American Engineering Societies. Dean Cooley was given a rising vote of thanks for his most interesting talk, after which the meeting adjourned to its usual collation.

WALTER B. MOSES, Acting Secretary.

Regular Meeting of the Society, March 13, 1922.

The meeting was called to order with President Derickson in the chair and 70 members and guests present. Minutes of the previous meeting read and approved.

Mr Coleman introduced a resolution concerning the revision of the city Building Code. The resolution is as follows:

Whereas, the building code of the City of New Orleans having been drawn up in _____, and that portion affecting structural design not having been since amended; and

Whereas, the studies and investigations of various members of the profession have resulted in a better understanding of many of the principles governing the design of structures than existed at the time the present building code was drafted.

Therefore Be It Resolved, that the Louisiana Engineering Society requests that the City Engineer give consideration to the desirability of amending the existing code insofar as it effects structural design.

And Be It Further Resolved, that the Louisiana Engineering Society offers to the City Engineer any assistance in its power in the drafting of such amendments to the existing building code.

Upon motion duly seconded, this resolution was carried.

Upon motion duly seconded, the Secretary was requested to communicate a copy of the resolution to the American Institute of Architects, The Fire Prevention Bureau, The Contractors and Dealers Exchange, and the City Architects, stating that if they will also pass similar resolutions that the City Council will probably authorize the City Engineer to call a committee selected from these bodies for the purpose of such revision.

Mr. Ole K. Olsen again called attention to the Engineers' Club.

There being no further business to come before the meeting, the same was turned over to the Louisiana Section of the American Society of Civil Engineers, Mr. Ole K. Olsen, President, Mr. F. A. Muth, Secretary.

The technical exercises consisted of a most interesting and instructive paper entitled "*The Mouths of the Mississippi River*," by Col. E. J. Dent. After the paper, discussion ad libitum was indulged in, after which the meeting adjourned to the usual collation.

JAMES M. ROBERT, Secretary.

Regular Meeting of the Board of Direction, March 13, 1922.

The meeting was called to order with Chairman Derickson in the chair and the following present: Messrs, Barelli, Barnett, Manley, Moses, Robert.

Upon motion duly seconded, the secretary was instructed to write Professor Pegues asking him about the advisability of the State University Seniors joining the Society as Student members.

Upon motion duly seconded, the applications of Messrs. Eugene Hornot and Mr. D. F. Woods for transfer to Non-Resident membership were granted.

A letter requesting the President to serve on the joint Civic Council of the Association of Commerce was read, and upon motion duly seconded, the President was authorized to write the Association of Commerce accepting such membership.

The following applications for membership in the Society, approved by the Membership Committee, were ordered to the ballot: Messrs. John Andrew Abele, Carl Eric Abrahamson, Cecil Noyes Bean, Ragner O. Comer, William Franklin Cooper, Louis Gilbert Flower, Adelbert Cleveland Higgins, Lewis Rhodes Jackson, Alfred F. Jacobi, S. B. Lawrence, Robert Selden McCormick, John Alexander McNiven, Ivor Orin Mall, James Daniel Murphy, Howard N. Moody, Stewart Ticknor, Henry H. Waters, Armand L. Willoz, Louis J. Wyler.

Student Members—Messrs. Lewis S. Alcus, C. Floyd Attaway, Donald C. A. Duplantier, William T. Hess, Haney H. Truxillo, William Hobson Spaar, Oliver Parry Walker.

The report of the Secretary was read and approved and bills ordered paid.

There being no further business, the meeting adjourned.

JAMES M. ROBERT, Secretary.

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PROCEEDINGS

OF THE

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EDITORIAL NOTES AND COMMENT

Reinforced Concrete Diagrams. In the course of some work on the design of reservoir walls for certain proposed additions to the New Orleans Water Purification Plant, Mr. Eugene Delery, Assistant Engineer of the Sewerage and Water Board, has worked out some simple, yet very comprehensive, diagrams and curves by means of which calculations of reinforcement may be rapidly made. The method of constructing the diagram is explained and examples of typical practice are worked out by means of the curves.

In general the notation of the Joint Committee of the American Society of Civil Engineers is used, with slight deviations therefrom which fit in somewhat better with Mr. Delery's sys-

tem and which serve to simplify the calculations. In this matter of notations Mr. Delery offers some rather good suggestions as to a still further standardization of symbols which would be more in keeping with the general run of mathematical and mechanical formulae.

Paper by Mr. DuPlantier. The Society has at times been criticised for the fact that it does not have its younger members take a more prominent part in its activities. To meet this, efforts have been made on different occasions to have the younger men present papers and take part in the discussions; but it is not always easy to secure this co-operation. At the May meeting, however, Mr. DuPlantier, a member of the Senior Class in Civil Engineering of Tulane University read a paper on "The Limitation of Loads on Highways," which was well worked up and which presented the subject in a very interesting way. These Seniors are required to write such papers as a part of their course in Highway Engineering, and Prof. Derickson chose this one as being of sufficient merit to be presented before the Society. There are undoubtedly others of our young men who could prepare papers of interest if they would only take the time and trouble. One of the valuable features about the Louisiana Engineering Society is the opportunity it affords the young engineer to learn to place his ideas, both in writing and in speech, before his fellow members.

The Daily Construction and Industrial News. On Monday, June 5, there appeared Number 1, Volume 1, of this new aspirant in the field of technical journalism. It gives us great pleasure to welcome the newcomer and to wish for it the very largest possible measure of success in its chosen field.

It is a pioneer in the sense that it is the first and only daily newspaper in the South, devoted exclusively to the construction and industrial trades and their allied professions. The first issue contains a great many news items of construction, contemplated or in progress, all through this portion of the South, as well as tabulated statistics as to work here in the city. It

also carries a directory of architects, the various building and trade organizations and other items of interest.

It is published by the News Publishing Co., 427 Camp St. W. L. Kidston is editor and C. M. David is manager.

New Members. Since the publication of the February issue of the Proceedings, the following additions have been made to our membership.

Resident Members.

FELIX L. ALCUS, with L. T. Alcus & Co., New Orleans.

CECIL N. BEAN, Supervising Inspector Steam Vessels, 10th District, New Orleans.

RAGNER O. COMER, Designing Engineer, Dock Board, New Orleans.

WILLIAM F. COOPER, Office Engineer, State Highway Department, New Orleans.

P. C. DOWELL, Branch Manager, Ingalls Iron Works Co., New Orleans.

WILLIAM L. FEY, Electrical Superintendent, Board of Port Commissioners, New Orleans.

FREDERICK H. FOX, Ass't Professor of Civil Engineering, Tulane University, New Orleans.

LEWIS R. JACKSON, Sales and Engineering, Walsh & Weidner, Boiler Co., New Orleans.

ALFRED F. JACOBI, Bridge Engineer, State Highway Dep't., New Orleans.

JOHN D. LOCKWOOD, Field Engineer, Dock Board, New Orleans.

FORRES MCGRAW, Sec'y-Treas., Swanson-McGraw, Inc., Consulting Engineers, New Orleans.

JOHN A. McNIVEN, Sup't. for Janse Bros., Jas. Stewart Co., C. D. Howe Co., New Orleans.

IVOR O. MALL, Ass't. Prof. of Mechanical Engineering, Tulane University, New Orleans.

JAMES D. MURPHY, Resident Engineer, Louisiana State Highway Dep't., New Orleans.

HOWARD N. MOODY, Contracting Engineer, New Orleans.

JOSEPH L. SWANSON, President, Swanson-McGraw, Inc., Consulting Engineers, New Orleans.

ARMAND L. WILLOZ, Draftsman with Dock Board, New Orleans.

ANTHONY M. ZIBILICH, Ass't. Sup't., U. S. Lighthouse Service., 8th District, New Orleans.

Transfer from Student to Resident Member.

LOUIS J. WYLER, Structural Designer, Dock Board, New Orleans.

Non-Resident Members.

CRAWFORD K. DUNBAR, Arcadia, La., Assistant to Resident Engineer, State Highway Dep't., Bienville Parish.

GEORGE P. HOPKINS, Gulfport, Miss., Contractor in Paving and Reinforced Concrete.

S. B. LAWRENCE, Jackson, Miss. Member of firm of Lawrence, Nixon & Phillips.

ROBERT S. McCORMICK, Franklinton, La. Resident Engineer, State Highway Dep't.

FREDERICK F. PILLET, 836 North St., Baton Rouge, La. Ass't. Professor of Civil Engineering, Louisiana State University.

STEWART TICKNOR, Woodville, Miss. Resident Engineer, State Highway Dep't. of Mississippi.

Associate Members.

JOHN A. ABELE, Manager, Engineering Dep't., Woodward, Wight & Co., New Orleans.

ADELBERT C. HIGGINS, Chief Inspector, E. L. A. C., New Orleans.

HENRY H. WATERS, Air-Brake Expert, New Orleans.

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LOUIS G. FLOWER, Crowley, La., Southeastern Representative and District Manager, Layne & Bowler Co., Memphis, Tenn.

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F. FOWLER CASE, Draftsman with Sewerage and Water Board, New Orleans.

Non-Resident Junior Members.

CARL E. ABRAHAMSON, Louisiana State Highway Commission.

Student Members.

LEWIS S. ALCUS, Tulane University.

C. FLOYD ATTAWAY, Tulane University.

DONALD C. A. DUPLANTIER, Tulane University.

WILLIAM T. HESS, Tulane University.

ILANEY H. TRUXILLO, Tulane University.

WILLIAM H. SPAAR, Tulane University.

OLIVER P. WALKER, Tulane University.

Recent Additions to the Library: Stone—Elements of Radio-Telegraphy.

Port of the City of New York.

White—Market Analysis.

Life of George Westinghouse.

Kennedy—Winning the Public.

Hooland Johnson—Handbook of Building Construction.

Adams—Farm Management.

Simons—Compressed Air.

Tead and Metcalf—Personnel Administration.

Diemer—Factory Organization and Administration.

Blanchard—Essentials of Advertising.

Morris—Employee Training.

Johnson—Design and Construction of Work Boats.

Sterling—Marine Engineers' Handbook.

Annin—Ocean Shipping.

Moulton—Waterways vs Railways.

Dudeney—Exporters Handbook and Glossary.

Poor—American Law Charter.

Ferguson—Estimating the Cost of Work.

Sargeant—Centrifugal Pumps and Suction Dredges.

Material Handling Encyclopaedia.

Simon—Dredging Engineering.

Murphy—Drainage Engineering.

Agg—Construction of Roads and Pavements.

Spofford—The Theory of Structures.

Paaswell—Retaining Walls, Their Design and Construction.

Soper—Modern Methods of Street Cleaning.

Harger—The Location, Drainage and Grading of Highways.

Who's Who In America.

Practical River and Canal Engineering.

Building Codes:

City of Detroit, Michigan.

New York City.

Baltimore, Maryland.

Additional building codes will be added at an early date.

PAPERS AND DISCUSSIONS

SIMPLIFIED REINFORCED CONCRETE DIAGRAMS

By EUGENE F. DELERY.

Read before the Society, April 10, 1922.

Object.

The object of these charts, which were developed in the course of the author's work on the design of the reservoir and other walls for the proposed additions to the New Orleans Water Purification Plant, was to secure a simple, yet comprehensive, set of curves by which rapid calculations and comparisons could be made for varying conditions of stress in both steel and concrete, for simple tensile reinforcement and for those beams which use steel in compression as well.

The variation in the safe compressive stress in the concrete, covered by the curves, is between zero and 1200 lbs. per square inch. Three scales for the unit tensile stress in steel, namely 16000, 18000, 20000 lbs. per square inch, are given.

The curves cover values of n for 15, 12, and 10, these being the most common values used in practice.

The plotting and use of the diagrams is very simple, and conforms strictly to standard equations based on the (so called) straight line formulae.

All values used are for safe, not ultimate, stresses.

It is thought desirable to give all the main reference formulae which are shown, as far as possible, next to the corresponding sectional diagrams.

As far as possible, the Standard Notation of the Joint Committee of the American Society of Civil Engineers is used though some deviations have been made.

The notes, on stirrups and diagonal reinforcement, are substantially extracts from the report of the Joint Committee, as are also the remarks on slabs with the exception of Chart 3.

Treatment.

In order to bring out clearly the use of the diagrams, the order of the construction of the charts will now be described with relation to the formulae.

(r): For $\frac{f_s}{f_c}$ write r . Then for any constant value of f_s there will be a definite value of r for each value of f_c .

Using $f_s=16000$ lbs., on the main horizontal base line, as abscissae, plot at equal intervals values of f_c from zero to 1200 lbs. On the verticals through these values plot, as ordinates the corresponding values of r , and draw the r curve, as shown on Chart 1. Next on a supplementary base for $f_s=20000$ from the equation $\frac{f_s}{f_c}=r$ plot the values of f_c on the projected intersection with the vertical dropped through the corresponding values of r .

The base line for $f_s=18000$ may be gotten in like manner, or by similar triangles, graphically. This is easily seen from a study of Chart 1.

All curves, from this point on, will be plotted with reference to the base line for $f_s=16000$.

(k): Using the equation $k=\frac{n}{r+n}$ plot on the verticals through the corresponding values of r the value of k , which gives the k curves; k_{15} , k_{12} , k_{10} , corresponding to values of $n=15$, 12, 10, respectively.

(J): As $J=1-\frac{k}{3}$ it is an easy matter to plot on the verticals through the values of k , the corresponding values of J and get the curves J_{15} , J_{12} , J_{10} .

(1-k): As this is simply the difference between 1 and k , we simply insert the 1-k scale for reading.

(p): This very important ratio is expressed by the equation $p=\frac{k}{2r}$, and as the corresponding values of k and r are

found on the same vertical we calculate and plot the values corresponding for p on the same vertical. This gives curves P_{15} , P_{12} , P_{10} .

($p \times 12$): This curve is plotted for p_{15} only and gives directly the multiplier of d for a beam 12" wide, from which A_s can be gotten directly. This was plotted as a matter of convenience only.

(R): From equation $R = f_s p J = \frac{1}{2} f_c k J$ we plot R knowing the values of p , J , k , n , on the corresponding verticals getting R_{15} , R_{12} , R_{10} to correspond with the values 15, 12, 10, for n .

On all curves the suffix indicates the corresponding value of n . As indicated on the face of Chart 1, for any value of R , or R_{co1} for which f_s is other than 16000 we must multiply

the value of R or R_{co1} found by $\frac{f_s}{16000}$.

The above curves give all the data necessary for the solution of moment problems, where only tensile steel is used.

Note:—Attention is called to the fact that for any value of r or the corresponding value of f_c it is only necessary to trace up the vertical through this value and at the intersection with the curves of k , J , p , R , which have suffixes corresponding to the known value of n read off these values.

Application.

Before going to beams with compression reinforcement we will outline the procedure in two simple cases for tensile reinforcement only.

Given a moment M_E to be resisted, assumed values of f_s , f_c , n , and a beam of unit width.

Get the base line for f_s , find f_c , project vertically up and at the intersection with the corresponding k , J , p , R , curves read these values in the corresponding columns. From the equation $M = R d^2$ substituting the value of R , found, get d . This gives the value of d for the section of maximum moment, and as most concrete beams are rectangular and of constant depth, the value of the depth d at all points of the beam.

Next take a section elsewhere on the beam, get its external moment and from the equation $M = R d^2$, knowing d get R .

Find this value of R on the R curve, with the proper n suffix, and tracing vertically downward get the corresponding values of p , $p \times 12$, J , $l-k$. We have here more than we really need. The value of p here found gives us the amount of steel necessary to keep full tensile stress in the steel, and not overstress the compression of the concrete.

Of course, as we approach the supports the amount of steel required will be governed by the bond requirement, gotten from the shear and by means of Chart 2. More will be said later on this subject.

Compression Steel.

This usually becomes necessary only when it is required, for a special reason, to make a beam resist a greater moment than it could with simple tensile steel only. Usually it is not economical but there are many special cases in which it is advantageous, the most notable one known to the author being the case of a reservoir wall subject to alternate loadings from opposite directions. This refers to interior walls and usually calls for the same amount of steel on both sides of the beam. We will, for the present, deal with the usual case.

(λ): It is well known that the stress in the compression

steel is $f'_s = \frac{k-d'}{l-k} f_s$. For $\frac{d-d'}{l-k}$ we write the Greek letter λ then $f'_s = f_s \lambda$ and $p_a = p_c \lambda$.

(Φ): Placing $d-d' = d(1 - \frac{d'}{d})$ and writing Φ for $1 - \frac{d'}{d}$ then the moment to be resisted by the compression steel becomes $M_{sc} = \lambda \Phi f_s p_c d^2$ and if, for $p_c = .01$, we call $\lambda \Phi f_s .01$ by the term R_{c01} , we have $\frac{M_{sc}}{d^2} = R_{c01} p_c$ with p_c expressed in units, not decimals.

This gives us as an expression for the total moment:

$$M_E = \Sigma M = d^2 (R + R_{c01} p_c).$$

In problems of this kind it is usual to know the maximum compressive stress in the concrete, beyond which it is necessary to use the compressive steel, though not always.

Under these conditions we would already know f_c , f_s , n . Knowing these we get R from the usual tension curves as before described, also p . This leaves R_{co1} to be found, substituted, and p_c to be solved for. It is apparent from the foregoing equations that R_{co1} is dependent on $\frac{d'}{d}$, and k . As we

know k , from the value of R , and as $\frac{d'}{d}$ is known from the assumptions, it is apparent that the value of k will govern.

Using the curve of k_{15} as a reference for all values of k , lay off on the under side of the 16000 base line, a scale of $\frac{d'}{d}$ for $\lambda=0$. Since when $\frac{d'}{d}=k$, $\lambda=0$.

It follows that by projecting down values of k_{15} equal to $\frac{d'}{d}$ and marking these with the value of $\frac{d'}{d}$, we have the scale of $\frac{d'}{d}$ for $\lambda=0$.

As $\Phi=1-\frac{d'}{d}$ we readily mark off the scale of Φ for $R_{co1}=0$. Next plot the scale of B such that a straight line, through equal values of $\frac{d'}{d}$ on the base scale and on B , shall at its intersection with the verticals through the values of k_{15} give corresponding correct values of λ .

It is readily seen that λ becomes maximum when $\frac{d'}{d}=0$.

We next lay off scale A , such that, for equal values of Φ or $1-\Phi=\frac{d'}{d}$ on scales A and the base scale, the intersection of a straight line with the verticals through the different values of k_{15} will give the values of R_{co1} .

It is easy to see that when $\lambda=0$, $R_{co1}=0$.

Application.

From this, knowing the value of k and $\frac{d'}{d}$, find the points on scale A and the base, which correspond to the value of $\frac{d'}{d}$;

lay a straight-edge through these points and where it crosses the vertical through the value of k on the k_{15} curve (This k_{15} curve is used as the reference curve to get R_{co1} and λ to the exclusion of the other k curves at all times) read the value of R_{co1} in the same column as R and r ; substitute this value in the equation and solve for p_c which will be expressed as units per cent.

(λ): To get λ lay the straight-edge through the value of $\frac{d'}{d}$ of scale B and the base line and, as before, at its intersection with the vertical through the value of k on the k_{15} curve read the value in the λ column.

From $p_a = p_c \lambda$ we get p_a and adding this to p we get the total value $p_a + p$ giving the total percentage of steel on the tensile side of the beam.

Note:—The k_{15} curve was used to plot scales B and A, hence must always be used in connection with these scales.

Bond:—Chart 2 is used to find the number of bars of any size and type to furnish bond, the depth d and total shear, on the section V being used.

Knowing the size and type of bar, trace vertically up to the corresponding curve (making allowances in case of deformed bars) and get C_b . Multiply this by $\frac{V}{d}$ and get the number of bars required for the section in question.

Chart 2 also gives cross sectional areas corresponding to square and round bars.

Chart 3:—This gives values of the constant $.09 \left(1 - \frac{2}{3} \frac{C}{1} \right)^2$

Data:—Data for general reference is given as shown in the directions for using, and formulae.

Notation:—This is given in the directions for using.

Notes:—Attention is called to the fact that for each value d' of — two straight-edges, simultaneously laid through the value d of — on scales A and B and the common center, on the base,

give for each value of k at their intersection with the verticals through the value of k simultaneous values of R_{co1} and λ making possible the solution of problems which involve a knowledge of p_c but not of R or of R_{co1} by comparative inspection methods. Example: M, d, d', p_c, f_s known. R, R_{co1}, f_c, k , unknown. This

$$\text{reduces to } \left(\frac{M}{d^2} - R \right) \frac{1}{p_c} = R_{co1}, \text{ or } \frac{\frac{M}{d^2} - R}{R_{co1}} = p_c.$$

Find that point at which the distance intercepted outside the R curve and below a value of $\frac{M}{d^2}$ laid out on the R scale will equal $R_{co1} p_c$, p_c being expressed as units, not decimals.

Simultaneous values of λ will be given by the straight-edge through the B scale.

$$k = \frac{d'}{d}$$

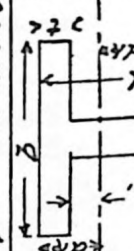
For $\frac{d'}{d} = \lambda = R_{co1} = 0$ the compression steel would be placed at the neutral axis, and R_{co1} is maximum when d' would equal to zero which case could not be possible of achievement, though possible to reason with as a limiting case.

Illustrative Problems.

Case 1:—Given a beam, span 10 feet, width 1 foot, uniform load per running foot 1000 lbs., to be reinforced with tension steel only.

Assumption: $n = 15$; $f_s = 16000$; $f_c = 650$.

Starting at 650, on the 16000 base, trace vertically upward and at the intersections with the respective curves read $R_{15}=109$, and $p=0.0078$.

IMPORTANT FORMULAE.			
<i>Distaken as unity in all cases except T beams and slabs.</i> Using Tension Steel only. $M_s = M_e = R d^2 \quad (6)$ $R = f_s p J = \frac{1}{2} f_s k J (1)$ $E f_s = \frac{1}{2} f_s$ $\frac{1}{2} f_s d R = f_s p d = f_s A_s (6)$ $p = \frac{f_s}{R} \quad (2)$	Using both Tension and Compression Steel. $M_e = \Sigma M = M_s + M_{sc}$ $= d^2 (R + R_{sc} p_c)$ where $R_{sc} d^2 = M_{sc}$ for $p_c = .01$ and p_c is expressed in units, percentum. $\lambda = \frac{R - d}{1 - R} \quad (3) \quad \phi = \frac{d - d'}{d} = 1 - \frac{d'}{d}$ $f_s' = \lambda f_s; \quad p_a = \lambda p_c$ $A_a = \lambda A_{sc}$ $\Sigma M = R + R_{sc} p_c \quad (11)$ p_c expressed in units. When $p_c = p + p_a$ then $p_c = \frac{p}{1 - \lambda}$	Continuous Slabs When p negative <.01 the minimum sum of the positive and negative moment used in figuring shaft $\lambda = .07 >$ W. 09 (1 - $\frac{2}{3} \lambda$)² See Chart 3  $M_e = M_s = R d^2 \quad (6)$ when p, R, J $M_s = M_c = \frac{R d^2 (k d - \frac{1}{2} l)}{k d}$ $k = \frac{2}{1 + \eta}$ $M_s = f_s p d^2$ of the neutral axis ties within $\frac{1}{4}$ and $p = \frac{f_s}{R}$ Neglecting web compression $p = \frac{f_s}{27 R} [R^2 - (k)^2] \quad (9) \quad (2b)$ Including web compression and writing $d' = e$ for F of b $p = F B \left(\frac{R - R'}{27} \right) \quad (9) \quad (2c)$ d' must $> \frac{d}{2}$; d must $< \frac{7}{4}$ or $b + 2(6t)$ The web must carry the total shear	General $p = \frac{f_s}{R} \quad (2) \quad k = \frac{2}{1 + \eta}$ $r = \frac{f_s}{R} \quad (3) \quad \eta = \frac{E_s}{E_c}$ $d - d' k = \frac{2}{\eta} d k \quad (5)$ Diagonal Stirrups for $f_s = 16000$ $s = \frac{2}{3} A_s J d = \frac{2}{3} d$ Stirrups $s = \frac{2}{3} A_s J d$ $s = \frac{2}{3} A_s J d = \frac{2}{3} d$ $\frac{V}{J d} < 240$ if horizontal bars are anchored " < 120 if horizontal bars are not anchored

From the maximum bending moment $M = R d^2$ get $d = 10.7''$ which we will call $11''$ and $A_s = 1.006$ square inches.

On the same vertical we find $k, J, p \times 12, 1 - k$, all of which are given in the tabulation.

Designers Diagram for Reinforced Concrete

Copyrighted 1922
Eugene F. Selig

E. F. DELERY C.E. ME
Assoc. Mem. A.S.C.E.
" A.S.M.E.
" L.E.S.

Chart 2 Bond + Areas

$V = \text{Total Shear}$
 $d = \text{depth to center of reinforcement}$
 $A_s = \text{Area of steel required}$
 $f_s = \text{stress in steel}$
 $f_c = \text{compressive strength of concrete}$

No. of bars
 $A_s = \text{Area of steel}$
 $d = \text{depth to center of reinforcement}$
 $f_s = \text{stress in steel}$
 $f_c = \text{compressive strength of concrete}$

$C_s = \text{area of concrete}$
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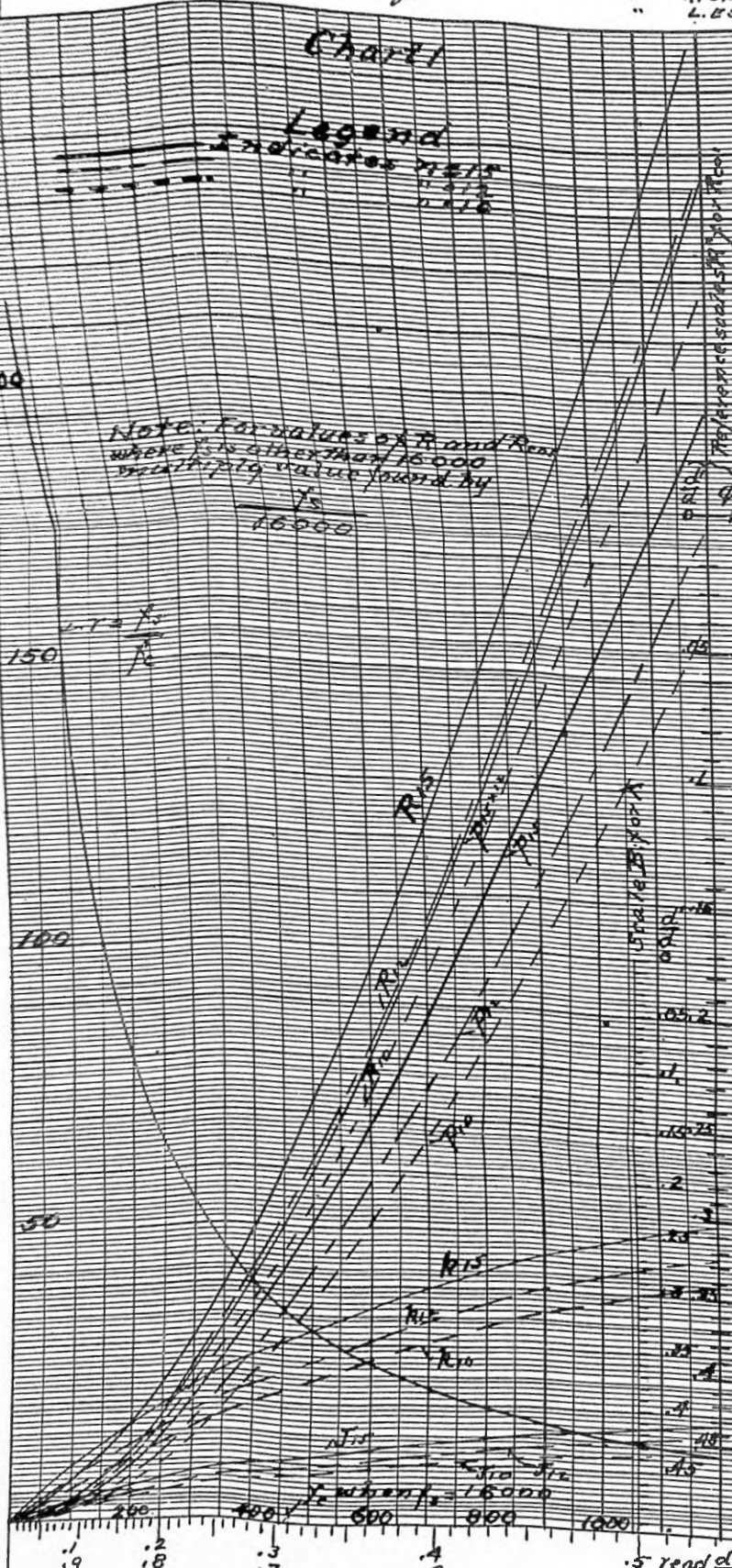
$C_s = \text{area of concrete}$
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Chart 1

Legend
Indicates ratio
of steel to concrete

Note: For values of R and R_{min} where f_s is other than 16,000 multiply value found by $\frac{f_s}{16000}$



f_s when $f_s = 16000$. Multiplier for $R = 1.125$
 f_s when $f_s = 20000$. Multiplier for $R = 1.25$

In getting R or A_s always refer to verticals through R on R curve.



Case 2:—Knowing d , and taking sections at various points along the beam as $\frac{1}{4}$ and $\frac{1}{8}$, the results of which are shown in the table, we proceed as follows:

M
 $\frac{M}{d^2} = R_{15}$ gives R . Trace down the vertical through R and get at the curve intersections p , $p \times 12$, k , J , $l-k$, being sure to use those curves having the suffix 15.

A slide rule and the formulae will suffice for the rest.

Bond:—Get the total shear at any section, divide by d , multiply by C_b , gotten as previously described, from Chart 2, which gives the number of bars at the section necessary for bond.

Case 3:—Both tensile and compressive reinforcement:

Given the beam just worked out, it is desired to load it to 1500 lbs. per foot, the concrete compression to remain 650 and the stress in the tensile steel to remain as before at 16000 lbs. per square inch. The depth of the beam to remain as before 11" with 1 foot width.

It is evident that compressive steel is called for to take the extra moment to be resisted.

Previously the maximum bending moment was 12500 ft. lbs., now it becomes 18750 ft. lbs., as shown by the table.

Where the moment is less than 12500 no compression steel will be needed, as at section $\frac{1}{8}$.

It must be borne in mind that where compressive steel is used $f_c=650$, $R_{15}=109$ and $p=.0078$ as before.

From equation 11; $\frac{M}{d^2} = R + R_{c01}p_c$. The only unknowns are R_{c01} and p_c .

From R we know that $k=.378$. We know $\frac{d'}{d} = \frac{2}{11} = .182$.

Lay a straight-edge through this value on A and the base and at the intersection with the vertical through $k_{13}=.378$ read $R_{c01}=42.5$.

Substitute in equation 11 and get $p_c=1.08$ per cent.

Lay a straight-edge through .182 on B and the base and get $\lambda = .32$ and $p_a = .32 \times .0108 = .0375$, and $p_a + p$ is the total percentage of reinforcement on the tensile side of the beam.

<i>Simple Beams</i> Span C to C of supports $l = 10\text{ft}$ Width of beam $= 12" = 1\text{ft}$ All moments in $\text{ft lbs per ft of width}$ $d' = 2"$			
General Assumptions $f_s = 16000 \text{ lbs } f_c \text{ maximum} = 650 \text{ } n = 15$	Section at		
	$\frac{z}{2}$	Case 2 $\frac{z}{4}$	$\frac{z}{8}$
Case 1 Simple Tensile reinforcement Load 1000 lbs per running foot Moment	12500	9400	5478
R	109	77.75	45.2
p	.0078	.0054	.0032
$p \times 12$	.0916	.064	.038
d	10.7 = 11"	11"	11"
$A_s = p \times 12 \times 11$	1.006	.705	.418
J	.877	.885	.91
R	.378	.335	.273
Case 3: Both Tensile & Compressive Steel			
Load 1500 lbs per running foot Moment	18750	14080	8220
M_e/d^2	155	116.5	68
R	109	109	68
p	.0078	.0078	.0047
$p \times 12$	.0916	.0916	.057
A_s	1.006	1.006	.627
R	.375	.375	.318
J	.875	.875	.895
f_c	650	650	400
d/d	.182	.182	none
λ	.32	.32	
ϕ	.818	.818	
R_{cal}	42.5	42.5	
p_c	1.08%	1.65%	
p_a	.375%	.0527%	
A_{sc}	1.43 in ²	.218 in ²	
A_a	.47 in ²	.068 in ²	
$A_s + A_a$	1.46 in ²	1.074 in ²	
$A_{sc} + A_s + A_a$	2.89 in ²	1.29 in ²	
$155 - 109 = 42.5 p_c; p_c = 1.08\% \text{ of } 1\frac{1}{2}$			
$116 - 109 = 42.5 p_c; p_c = .165\% \text{ of } 1\frac{1}{2}$			
			No Compressive steel required

Tabulated results for this beam are given for moments at points at the center, quarter, and eighth span sections.

A study of the tabulations, in conjunction with the formulae and instructions for using the chart, will bring out the simplicity and ease with which it can be used.

Had it been required to reinforce this beam to resist alternate moments in opposite directions, knowing the requirement for f_c , n , f_s , as before we readily get R , p , and k , and knowing d' — we readily get λ as before and from the equation $p_c = \frac{p}{1-\lambda}$ we readily get p_c . From which it is easy to plot curves such as Chart 4 for easy reference.

Résumé.

The features of these diagrams are the general reference of everything to the values of r ; the simple plotting of all values so that all simultaneous values appear on a single vertical line through the corresponding value of r for simple tensile reinforcement; the development of equation 11; the reference of the values of R_{co1} and λ to the value of k , corresponding thereto, and the known value of $\frac{d'}{d}$ and Φ by means of the base and scales A and B making formula 11 general in its nature.

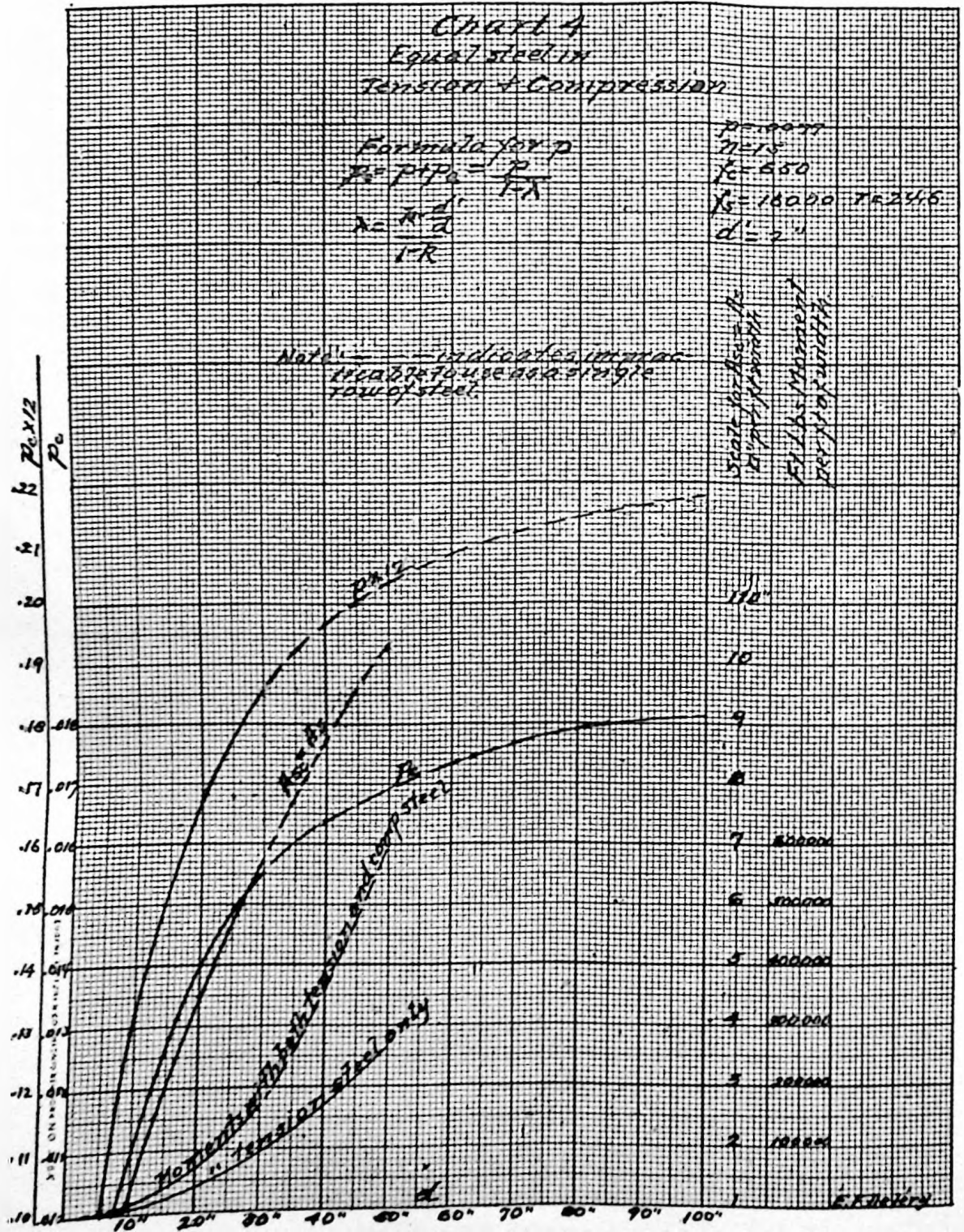
The formula $p_c = \frac{p}{1-\lambda}$ is also thought to be new and is general. Some of the above may not be new but, at least, they were not readily to be found when needed by the author, hence the development of these charts and formulae.

The data on slabs, shear, stirrups, diagonals are mostly from the report of the Joint Committee A. S. C. E., Chart 3 being plotted to facilitate the use of the constant in equation 20.

All of the formulae used will be found to check with the Standard Formulae, for the straight-line theory, though not expressed in the usual form.

Notation.

A few words, at this point, regarding notation may not be amiss. It is fully realized that a great deal of study and effort has been expended on the Standard Notation; it appears, however, to the author of this paper that the number of suffixes necessary is a little confusing and a slip of the pencil may make wonderful changes in the results obtained.



In most mathematical work the letter f designates a function and a summation is usually designated by the summation sign Σ . In the Standard Notation we find f generally, not always, used to designate a unit stress, the suffix designating the nature of the stress. If this was strictly conformed to it would be only half bad, but we find the unit shear designated as v and the unit bond as u . For consistency these should have been f_v and f_u .

Capitals are used to indicate the summation of unit stresses. Prime marks are also much used, and the combination of suffixes and prime marks makes a glossary of the terms almost necessary.

A system which the author has found useful, but which due to general usage has not been adhered to in this paper and the diagrams, is as follows:

Let S indicate steel unit stress of whatever nature. The suffix c indicates compression, the suffix t indicates tension, b indicates bonding stress.

Let C indicate unit concrete stress of any nature, the suffix c indicating compression, t indicating tension, s indicating shear. The summation sign attached to S or C indicates the total forces transmitted by the steel or concrete. If prefixed to M it indicates a summation of moments.

p indicates the steel ratio as in the Standard Notation, except that for tensile steel it has suffixed t , for compressive steel it is expressed p_c , for additional steel on the tensile side we write p_a . Let A indicate area, then A_{st} indicates area of steel in tension, A_{sc} area of steel in compression, A_{sa} area of additional tensile steel. A_c would probably suffice to indicate the area of concrete in compression, though if the tension in the concrete is being considered it would be well to indicate the area of concrete in tension by A_{ct} . A could be used for the total effective concrete area. Indicate all moments by M , the moment of the resisting couple referred to the tensile steel as M_{ss} or M_{nt} . With regard to the concrete compression write M_c ; with regard to the compressive steel M_{sc} , and if we desire to write the moment with regard to the additional steel referred to the neutral axis or to $d-d'$, it might be expressed as M_{sa} or simply M_a .

M_E is used to indicate external moment to be resisted by the section. It is to be understood that the above suggestions are general in their nature and while they appeal to the writer, may not suit others as well, the main claim made for this form of notation being that it is consistent throughout and is easily remembered.

Addenda

Derivation of Principal Formulae used.

(k) :—

Since $E_s = \frac{f_s}{L_s}$ and $E_c = \frac{f_c}{L_c}$ where L_c = unit compression of concrete
 L_s = unit elongation of tensile steel.

$$\frac{E_s}{E_c} = \frac{\frac{f_s}{L_s}}{\frac{f_c}{L_c}} = \frac{f_s}{f_c} \frac{L_c}{L_s} \text{ but } \frac{L_c}{L_s} = \frac{dk}{d-dk} \text{ hence } \frac{E_s}{E_c} = \frac{f_s}{f_c} \frac{dk}{d-dk}$$

For $\frac{L_c}{E_c}$ write n and for $\frac{f_s}{f_c}$ write r then $n = \frac{r dk}{d-dk}$ and

$$dk = \frac{n}{r} (d-dk).$$

Eliminate d and solve and we get $k = \frac{n}{r+n}$

(p) :—Since from equilibrium the sum of the compressive forces must equal the sum of the tensile forces, $\frac{1}{2} f_c dk = f_s p d$.

Eliminating d and substituting the value of r ; $p = \frac{k}{2r}$

The moment formulae for tensile and compressive steel are already expressed in the body of the paper, and have been derived so many times that they will be omitted here.

From equilibrium.

When $p_c = p + p_c$: $\frac{1}{2}f_c dk + f_s \lambda p_c d = f_s p_c d$.

$$\frac{1}{2}f_c k = f_s p_c (1 - \lambda)$$

$$p_c = \frac{f_c k}{2f_s (1 - \lambda)} = \frac{p}{1 - \lambda}$$

This substituted in equation 11 gives the moment curves of Chart 4.

All other equations are as given on chart and derived in the body of this paper. The derivations of the above were given because the form in which they appear is not the usual form.

TO USE CHARTS.

Beams with Tensile Steel Only.

Case 1.

Given n , f_c , f_s , b and an exterior moment which the section must resist.

If the moment is expressed as foot-lbs. divide by b expressed as feet, which gives the moment to be carried if $b=1'$. If the moment is given as inch-lbs. divide by b in inches and get the inch-lbs. resisting moment per inch of beam. The moments are numerically equal in both cases. We call this M_E and from

equation 6; b being unity $\frac{M_E}{d^2} = R$.

Refer to f_c on its proper horizontal scale of f_c (usually 16000). Trace up the vertical through f_c and at its intersection with the curves of J , k , p , $p \times 12$, R , which have as their suffix the known value of n , read on their respective scales the values of J , k , p , $p \times 12$ and R . Substituting R we get d^2 , whence d .

Note:—R curves are given for $f_s=16000$ and for other values of f_s ; $R_x = \frac{f_s}{16000} \times R$.

Case 2.

Given n, d, M_E, f_s .

From $\frac{M_E}{d^2} = R$ get R . From R on the R curve drop down

the vertical, getting $p, k, p \times 12, f_c, J, 1-k$.

Case 3.

Given n, d, M_E, f_s, p . From p on the p curve drop vertically down getting $f_c, k, 1-k, r$, and tracing upward R .

Beams with Both Tension and Compression Steel.

Usually used only when the total moment to be carried exceeds the capacity of the beam reinforced with tension steel

only. Equation 10, $M_E = \Sigma(M_s + M_{sc})$. From 11; $\frac{M_E}{d^2} = R + R_{co1} p_c$

in which R_{co1} is $= f_s \frac{k - \frac{d'}{d}}{1-k} \times .01 = f_s \lambda \Phi .01$ with $p_c = .01$.

For any other value of p_c in equation 11 we write R_{co1} as before and express p_c as a unit (not a decimal).

As d, d', f_c, f_s, n, R are known as also p, k , we get the value of $\frac{d'}{d}$ and of $1 - \frac{d'}{d} = \Phi$.

Lay a straight-edge through the similar known values of $\frac{d'}{d}$ or of Φ on the lower horizontal base and the R_{co1} reference scale Λ and where the line intersects the vertical through the known value of k (use k_{15} curve) read value of R_{co1} in left hand column.

Substitute in equation 11 and solve for p_c .

$$\Lambda_R = \lambda \Lambda_c = \lambda p_c d = p_n d$$

$$\lambda p_c = p_n$$

Lay a straight-edge through the known value of $\frac{d'}{d}$ on the horizontal scale and scale B and at its intersection with the vertical through k (use $k_{1.5}$ curve) read value of λ in the column for that purpose, to the right, when $p_a = \lambda p_c$. The total steel in the beam section is $bd(p + p_a + p_c)$.

Specials.

If a beam is subject to equal alternating moments from opposite directions then $p_c = p + p_a = \frac{p}{1 - \lambda}$

Equation 20 for continuous intermediate slab panels is given along with table of moment coefficients. For minimum thicknesses and special cases see report of Joint Committee A. S. C. E.

Bond.

For bond use equation $N = \frac{V}{d} C_b$, getting value of C_b from Chart 2.

Diagonals and Stirrups.

A few notes on the spacing of bars are shown, for ready reference.

Tee Beams.

From $M_E = Rbd^2$, d may be gotten as in the case of a beam, care being taken to see that $\frac{V}{Jdb}$ does not exceed the allowable value of f_v , usually 40 lbs.

If the neutral axis lies within the flange, then and only then, $p = \frac{k}{2r}$ and p may be gotten from Chart 1 as before.

Otherwise p should be gotten from equations (2_b) or (2_c) according to our assumptions regarding web compression.

Compressive steel in the flange is found from equation 11;
 $\frac{M}{d^2} = R + R_{co} p_c$ after reducing M_E to moment for a unit width
of b.

Note:—Care should be taken not to confuse the tensile steel of negative moment with compressive steel.

Notation.

	Unit Safe Stress.....	Total Stresses.....	Area.....	Modulus of Elasticity.....	Arm of Couple.....	Ult. Unit Stress.....	Moment Couple.....	A_s/A_c	A_{sc}/A_c
Tensile steel.....	f_s	Σf_s	A_s	E_s	Jd		M_s	p	
Compressive steel.....	f_s'	$\Sigma f_s'$	A_{sc}	E_s	$d-d'$		M_{sc}		p_c
Concrete comp.....	f_c	Σf_s	A_c	E_c	Jd	f_c'	M_c		
Concrete shear.....	f_v	V	Jbd						
Bond.....	f_u		ΣO						
External moment.....							M_E		
Summation of moments being considered.....							ΣM		

$$r = \frac{\text{Unit tensile strength of steel}}{\text{Unit comp. strength of concrete}} = \text{a ratio}$$

k =ratio of the distance from the extreme concrete compression fibre to the neutral axis to the distance d . d =distance from maximum concrete compression fibre to the center of the tension steel.

Jd =distance from center of tensile steel to center of application of compressive forces= $d(1 - \frac{k}{3})$

d' =distance from max. comp. fibre to center of comp. steel.

b =breadth of beam.

b' =breadth of web of T beam.

t =thickness of flange of T beam.

k' =distance neutral axis to inner edge of flange of T beam.

Δ_a =Area of additional tensile steel needed to balance the comp. steel= $\lambda\Delta_{sc}$.

$$P_a = \frac{A_a}{A_c}$$

λ =ratio of lever arms of comp. steel and tensile steel about

$$\text{the neutral axis} = \frac{dk - d' \frac{k - \frac{d'}{d}}{1 - k}}{d - dk}$$

R =Section modulus with only tensile steel.

R_{co} =Section modulus of comp. steel with 1% comp. steel.

s =spacing of stirrups or diagonal bars to take up diagonal stresses.

Slabs.

c is the largest right cone which can be included within the column capital itself $1\frac{1}{2}$ " below the bottom of the slab.

l =distance center of center of column.

$\frac{l}{4}$ =width of column strip.

$\frac{l}{2}$ =width of middle strip.

W =total load on panel.

w' =Total unit load per square ft.

R_s =ratio of neg. moment in the two column strips to M_o .

For drop panels and slabs without drop panels the minimum

$$\text{thickness } t_1 = .0382 \left(1 - 1.44 \frac{c}{l}\right) \sqrt{R_s w' \frac{l_1}{b_1}} + 1\frac{1}{2}$$

$$\text{For slabs with dropped panels } t = .02 \sqrt{w' + 1}.$$

$$\text{For floors } t_1 \text{ or } t \text{ must } > \frac{1}{32}$$

$$\text{For roofs } t_1 \text{ or } t \text{ must } > \frac{1}{40}$$

Chart 3 gives values of $.09 \left(1 - \frac{2}{3} \frac{C}{l}\right)^2$ corresponding to values

of $\frac{c}{l}$ in equation 20.

THE LIMITATIONS OF LOADS ON HIGHWAYS

BY DONALD A. DUPONTIER.

Read before the Society, May 8, 1922.

The status of the highway in our national economic life has undergone a remarkable change within the last decade, since the advent of the modern automotive truck. Before this time the only means of transportation which were considered of importance economically were the railroad and the steamboat. The limitations of the horse-drawn vehicle precluded its use for anything but local hauling, where the elements of time and distance were of minor importance.

Under these conditions the rural highways were never called upon to withstand anything more destructive than light carriages and heavy, slow moving wagons. Since the element of time was a small factor it would have been unduly costly to build substantial smooth-surfaced roads. It was only the farmer who travelled the rural roads and he did not use them often for pleasure, but rather as a necessary means of bringing his produce to the nearest railroad station.

These conditions changed, however, with the rapid development of the automobile. The dirt roads that were good enough for the slow farm wagon and the light carriage soon gave way under the effect of the fast moving auto. Money was then spent on improvement, and light construction, such as the gravel and the macadam roads, resulted. But in a few years the large, very heavy motor truck was developed and with its use it was soon seen that roads which were considered excellent types for fast moving light motor vehicles were pounded to pieces through the action of heavy motor truck traffic.

This rapid breaking up of the old types of road under the new conditions has brought the nation face to face with two vital problems, viz: the design of future highways with a knowledge of the effects of these increased loads on road surfaces, and the enactment and enforcement of proper legislation to limit the size of future vehicles and the maximum loads which they may carry.

It is the purpose of this paper to discuss the second of these two problems, but the conditions of the first will be reviewed briefly, insofar as they affect the understanding of the second problem.

In endeavoring to find a practical solution to the first of these problems the Bureau of Public Roads has been conducting a series of experiments at the Arlington Experiment Farm. The experiments are divided into four groups: (1) a study of the amount of impact delivered by motor trucks to roads; (2) a study of the effect of this impact on different types of road surfaces; (3) a study of the effect of traffic on different types of road surfaces and (4) a study of the bearing power of subgrades as affected by moisture.

The most important of these, as affecting legislation in a general way, is the experiment on impact, because of the close relation between the intensity of impact and the weight and speed of the vehicle.

Just what is meant by the term, impact? Webster defines it as a striking together, a collision. This implies an opposite relative motion in the same line of action, for obviously if the motions were opposite but in adjacent parallel planes there would result only a rubbing together. This would cause wear by friction but there would be no impact since there was no collision. This is exceedingly important in its practical application to road design.

If a road were made of glass of sufficient strength to withstand the compressive force of a 12-ton truck, and of absolutely even surface, without a single protuberance, that 24,000-lb. truck could be run on the glass to its absolute physical speed limit without the slightest damage to the glass. The only wear would be that due to friction, which would be small because of the smoothness of glass. This presupposes, of course, that the truck wheels are equally free from irregularities.

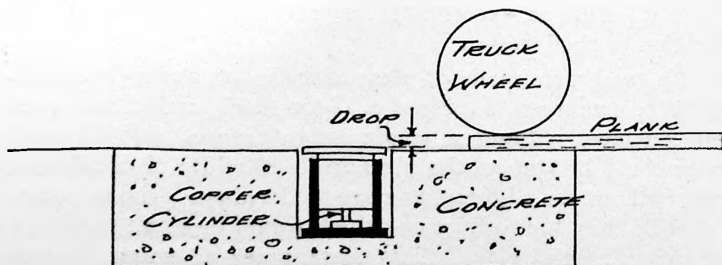
But if in one spot on the road there is a hollow that may be only one inch in depth, the truck will fall at that point with a force of about 8400 lbs. per wheel, plus whatever momentum was in the truck at the time. The destructive energy developed would amount to 700 foot-pounds when there was no

momentum. Experiments have proven that the effect may run as high as five times the total dead load effect; hence with momentum the effect may be as high as 3500 foot-pounds. The same effect would be produced in a lesser degree by the throbbing action of a defective wheel. How long would the glass stand up under the pounding effect of this impact? Glass is without doubt an extreme and impracticable example, but the same results would be present to lesser degrees in actual road materials.

It is now obvious how very important it is to construct a road surface as nearly smooth as is humanly possible. But since nothing constructed by man can be perfect it follows that truck loads must be wisely limited in order that the destructive effect of this inevitable impact will not go beyond practical bounds.

In order to understand more clearly the conclusions of the experiment on impact it will be necessary to have an idea of the procedure used. The following is an abstract of a preliminary report made by E. B. Smith, senior assistant testing engineer and J. T. Pauls, highway engineer, and published in the *Journal of Public Roads*.

"The general character of the apparatus is shown in the accompanying illustration.



Briefly, the device consists of a plunger fitted in a casing and resting upon a small copper cylinder. These cylinders are carefully standardized and the impact is measured by the deformation of the copper when the truck wheel strikes the surface plate. A hole is left in the bottom of the casing so that there

will be no cushioning effect of the air. Various heights of drop are arranged for by the use of different thicknesses of plank.

"Only the rear wheels have been tested thus far, a steel bridge, which is automatically tripped as the front wheel passes, being used to protect the surface plate. The planks are moved back and forth so that the wheel lands directly on the center of the plunger at the different speeds.

"To obtain accuracy, the copper cylinders are accurately machined to $\frac{1}{2}$ inch in diameter and carefully annealed. Five cylinders from each heat are tested in a machine under a pressure of 6,000 lbs., to determine the relation between static load and deformation for the heat. The variation from the mean deformation has been only 1.3 per cent. which is considered less than other experimental errors.

"The deformations of the copper cylinders were reduced to equivalent static loads and plotted to form curves. This may not be a perfect comparison of impact load, as such loads will probably produce a localized shattering effect which does not result from the application of a static load. For this reason the present methods of comparison are considered tentative, and subject to possible revision as the tests proceed."

There were six groups of curves given. I have omitted these since they can be found readily in Volume 83 of the *Engineering News-Record*.

"A three-ton United States Army, class-B truck with solid rubber tires is being used for these experiments. The truck weighs as follows: empty 11,400 lbs.; on front wheels, 4,550 lbs.; on rear wheels 6,850 lbs., and the unsprung rear parts, 3,675 lbs. The tests were made zero load, 3.6 tons and 5 tons. The weight on the rear wheels when loaded is 13,100 lbs., for the former load and 15,500 lbs., for the latter. The rear wheels of the truck are 40 inches in diameter, having two solid-rubber tires which are 6 inches wide at the rim.

"Only the effects of the simple falling of the truck from various heights were considered in the preliminary tests. In conducting the experiments it was discovered that the action of the truck springs had a great influence on the impact results. Spring action is responsible for the relatively high values at zero speed

and for the irregularities when plotted with respect to height of drop. When the wheel leaves the plant, the spring snaps open and produces a greater downward acceleration of the unsprung parts than that due to the action of gravity alone. Within the time of one vibration of the spring, the magnitude of impact at the landing point will depend upon the height of drop, whether it is less, equal to, or greater than the compression of the spring. If the period of vibration is such that the spring has acquired its maximum acceleration in opening and at this instant also lands at the point of application, the impact value will be a maximum. It will be a minimum when conditions are such that the spring is returning to its closed position and is at the point of maximum acceleration in that direction as the impact occurs."

The results obtained indicate in a general way (1), the tendency of increased impact with heavier loads and higher speeds, although the relation between speed and impact is not constant; (2), general increase of impact with the increase in drop; (3), irregularity due to the action of the truck springs as already described and (4), impact is appreciably affected by the condition of power, whether on or off. If the impact occurs when the truck is coasting it is less than when the power is on. This difference amounted in some cases to as much as 30 per cent. It will also be noted that under certain conditions the impact is as much as five times the total dead load.

From this summary it is obvious that the destructive effect of impact, which is directly dependent upon the weight and the speed of the vehicle, is of utmost importance, both in the rational design of roads and pavements and in the equally rational limitation of the loads which are to be carried on them.

The economic limits of various types of pavement used for street and country road surfaces have not yet been fully determined. By traffic limit is meant the amount and type of traffic a road will carry without undue wear. Road work is handicapped in this country by the lack of wide tire statutes and the regulation of traction engines using sharp lugs in the wheels. At present it is necessary in many places to assume a loading that will probably not be exceeded by the un-

regulated traffic. Many engineers favor a law limiting the loads on improved roads to 700 to 800 lbs., to the linear inch of tire width, which is a reasonable limit.

Most of the mechanical trucks in present use have tires wide enough to reduce the pressure below this limit. Near some of the large cities, however, mechanical trucking has increased to proportions that amount to a regular freight line and excessive loads are carried; the loads and speeds of such trucks must be regulated, for no road can stand abuse of this character. In special metropolitan districts where truck freighting is desirable to relieve rail congestion or where it is economical by means of its direct loading and delivery, specially designed toll roads, which are self-supporting financially, could be built to handle much heavier loading, but for free public use roads, maintained by the community, a gross vertical load of 12 tons is a reasonable limit.

It will be interesting at this point to note a proposed national traffic law, as formulated by the National Automobile Chamber of Commerce. The following quotation is taken from a paper delivered before the Joint Highway Congress, December, 1918, by Mr. George M. Graham, Chairman, National Motor Truck Committee of the above association.

"Heights and widths are not the major problems with which we must deal. They can speedily be eliminated. We have fixed on 12½ feet as the utmost distance between the road and the summit of the body, and 8 feet as the greatest width of the body. We do not think these figures should be exceeded, and would cheerfully bow to laws so decreeing. Thus we readily dispose of height and width, but when we come to weight and speed we have much more to contend with.

"It is not to be denied that the heavily weighted truck, running on solid tires and at high speeds, causes damage. But it is not to be forgotten that both this weight and speed serve a highly practical purpose—the cost of carrying the load decreases in proportion to the number of tons carried.

"As a general proposition it may be stated that as the size of the truck increases the cost of operation in relation to the carrying capacity decreases. This is due to the fact that the cost of manufacture, the

overhead in operation, the actual operating cost and the weight of the truck itself, all do not increase in proportion to the carrying capacity.

"From an economic standpoint this is most important. Truck owners have a right to operate their trucks to the highest limit of economy and efficiency. They should be permitted to run the heaviest possible truck made necessary by their haulage problems, and roads should be made equal to the burden as speedily as possible. To take any other position is to legislate directly against an ever increasing army of truck users.

"There are not less than 550,000 trucks in use in the United States (this was in 1918). It has been estimated that farmers alone will apply to the highways 2,000,000 more trucks within the next ten years. The possibilities in all other lines of activity are so many and so varied that the whole subject of truck legislation must be approached with justice and vision.

"Our plan for a uniform truck law calls for permission to operate a vehicle whose gross load is 28,000 lbs. It also provides that the highway commissioner can reduce this limit to 24,000 lbs., where it can be shown that the road will not stand more than this weight. He has also the option of increasing above 28,000 lbs., when highly improved roads make this possible.

....."The load per inch width of tire was, after due consideration, fixed at 800 lbs., throughout, whether solid or pneumatic tires be used.

"An examination of the weight of vehicles made by some 40 manufacturers shows that within the 4,000-lb class, will fall vehicles rated to carry $\frac{1}{2}$ and $\frac{3}{4}$ -ton loads; 8,000-lb. class, 1 and $1\frac{1}{2}$ -ton loads; 12,000-lb class, 2-ton loads; 16,000-lb class, 3 and $3\frac{1}{2}$ -ton loads; 20,000-lb. class, 4 and $4\frac{1}{2}$ -ton loads; 24,000-lb. class, 5-ton loads and within the 28,000-lb. class, 6 and 7-ton loads.

"If it be said that the maximum weight should be put to as low a point as possible in order to deal with probable overloading, attention should be directed to the penalty prescribed in the bill—a penalty made the more easy of infliction since the bill provides for a plate placed on the truck, said plate to show the gross weight of vehicle and load. Any truck carrying more

than this weight becomes liable to the penalty. Therefore, the question becomes one of proper administration."

The discussion thus far has considered the highway solely as a means of traversing land. Since bridges form a very important part of the highway system, attention will now be directed to the concentrated loads used in different states in their bridge design. The following table gives the specifications of several states.

Location, loading and impact were as follows:

Iowa; 15-ton traction engine; no impact.

Illinois; 24-ton motor truck; no impact.

Wisconsin; 15-ton road roller; no impact.

Michigan; 18-ton road roller; no impact.

Nebraska; 20-ton traction engines; no impact.

Minnesota; 20-ton traction engine; no impact.

New York; 15-ton road roller; no impact.

Utah; 18-ton road roller; 25% impact.

Oregon; 15-ton road roller, for medium traffic.

Oregon; 20-ton road roller for heavy traffic.

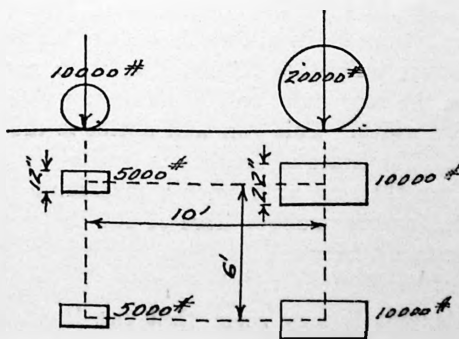
Ohio; 15-ton road roller; 16 $\frac{2}{3}$ % impact.

Montana; 20-ton traction engine; 25% impact.

Mass. Ry. Comm.; 20 ton motor truck with 14 tons on rear wheels; 50% impact.

Mr. J. A. L. Waddell; 18-ton motor truck; 50% impact.

Louisiana specifies a 15-ton truck, 30% impact, with the load distribution as shown in the sketch below.



We see that the proposed load limit of 28,000 lbs., is well within the limits of actual highway bridge design.

When dwelling on the subject of laws to limit the loading of vehicles, the question which naturally arises in one's mind is: "How about the enforcement of the law; is it practical to enforce it rigidly or is it ignored in most states?" I suppose it is safe to say that the state which makes it a point to enforce its other laws will also carry out this one, and vice versa. The last legislature of Louisiana passed a maximum load law in 1921. At the same time it created a new highway commission. This new body has just recently been organized, and it remains to be seen how active the authorities will be in enforcing the motor-vehicle law.

The state of Connecticut is vigilant against infraction of its highway law and as a result its last traffic census, which was made last year is of outstanding interest. Figures from this census showed that only 2.3 per cent. of the trucks exceeded the maximum allowable gross weight limit of 25,000 lbs. Further, the limit of 800 lbs. per inch width of tire was exceeded in 12 per cent. of the cases for front axle and 35 per cent. for rear axles, the range of overloads running from 800 to 1,500 lbs., for the front axle and from 800 to 1,925 lbs., for the rear axle.

As a conclusion I will compare briefly the existing laws on the subject in the State of New York and in our own state. The motor-vehicle law in Louisiana can be found in detail in Act 120 of The Acts of the Legislature, Extra Session of 1921. The maximum loads allowable on the highways of New York are a gross weight of 28,000 lbs., with not more than 16,000 lbs., on the rear axle, and a maximum rate of 800 lbs., per inch of tire width. This you will notice is the same as the model statute. The State of Louisiana limits the gross weight to 15,000 lbs., on the rear axle, with a maximum rate for steel tiers of 350 lbs., and for rubber tires of 600 lbs. per inch width of tire measurement between flanges. However, an excess of 10 per cent. of the factory rated capacity is permitted.

On first thought it may seem that the limit in Louisiana is unduly low, but this is not the case, considering the fact that the best highways in the state are nothing more than gravel roads, and dirt roads are only too common. This limit will

have to remain until the time comes when the people of Louisiana are wealthy enough and wise enough to invest in a modern, durable system of hard-surfaced rural highways.

DISCUSSION

MR. LAWES: I agree with Mr. DuPlantier that we should have roads that will stand up under the traffic. My idea about building roads is to build them so they won't go to pieces before the cost of them has been paid by their users. It will be necessary to change the method of building our heavy truck traffic roads from gravel to some better material than gravel. The gravel road goes to pieces very quickly under heavy traffic, as everybody knows.

Another thing about Louisiana roads is the foundation. We have a soil here that requires a greater depth of foundation than soils in the North where there isn't so much moisture in the soil. For that reason, the foundations for heavy truck traffic must be considerably deeper than would ordinarily be required.

COL. DENT: Mr. Chairman, I have been more or less an enthusiast on roads for many years, although I have not had them under my jurisdiction. Since the automobile has come in, the thing that has impressed me most is that the rural highway, if it is decently pleasant to drive on, immediately attracts what a few years ago would have been classed as city traffic. Mr. Dusenbury mentioned the scenic highway in Oregon. I have seen two lines of traffic on that road, and everybody going about twenty-five miles an hour, and I guess there were forty miles of it, one machine right after another. But that was a good road. They don't have troubles with foundations there. It is not a truck road in any sense of the word. It might have stood truck traffic, but there was none on it. Down here in the Delta Country of Louisiana, you have quaking soil. If you run a heavy truck over a road with a little roughness, you can feel the jar a hundred feet away. It seems to me that will knock out any road you can build. It is the case down in this part of the State that you will have to limit your trucks to a size and speed, and I think the speed is more important than the size.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, April 10, 1922.

The meeting was called to order with Chairman Derickson in the chair and the following present: Messrs. Barrelli, Garsaud, Barnett, Manley, Moses, Robert.

There were 96 formal and 2 informal ballots for membership, as a result of which the following members were elected to the respective grades of membership in the Society:

Resident Members—Cecil N. Bean, Ragner O. Comer, William F. Cooper, Lewis R. Jackson, Alfred F. Jacobi, John A. McNiven, Ivor O. Mall, James D. Murphy, Howard N. Moody, Armand L. Willoz.

Transfer from Student to Resident Member—Louis J. Wyler.

Non-Resident Members—S. B. Lawrence, Robert S. McCormick, Stewart Ticknor.

Associate Members—John A. Abele, Adelbert C. Higgins, Henry H. Waters.

Non-Resident Associate Member—Louis G. Flower.

Non-Resident Junior Member—Carl E. Abrahamson.

Student Members—Lewis S. Aleus, C. Floyd Attaway, Donald C. A. DuPlantier, William T. Hess, Haney H. Truxillo, William Hobson Spaar, Oliver P. Walker.

The following applications for membership were approved for the ballot provided they receive the approval of the Membership Committee: Messrs. Felix L. Aleus, F. Fowler Case, P. C. Dowell, Crawford K. Dunbar, William L. Fëy, Frederick H. Fox, George P. Hopkins, John Donald Lockwood, Forres McGraw, Frederick F. Pillet, Joseph L. Swanson, Anthony M. Zibilich.

Upon motion duly seconded, it was decided to admit Senior students of the Louisiana State University as Student Members under the same conditions the the students of Tulane University are admitted with the exception that L. S. U. students should pay dues of \$3.00 per annum instead of \$5.00

The resignation of Messrs. Tinkham and Everett were read and the Secretary instructed to write them that the regulations of the Society require that the dues of the current year be paid before resignations can be accepted. The resignation of Mr. Stillman W. Wheelock was accepted, effective December 31, 1922.

The report of the Secretary was read and approved and bills ordered paid. There being no further business, the meeting adjourned.

JAMES M. ROBERT, Secretary.

Regular Meeting of the Society, April 10, 1922.

The regular meeting of the Society was called to order with President Derickson in the chair and 37 members and guests present. Minutes of the previous meeting were read and approved. Reports were heard from the chairmen of the Library and Membership Committees.

The technical exercises of the evening were then held, the same consisting of a very interesting paper by Mr. E. F. Delery, entitled, "Simplified Graphic Charts on Reinforced Concrete." After some discussion Mr. Delery was tendered a vote of thanks.

Mr. Muth again called the attention of the Society to the Engineers' Club. There being no further business, the meeting adjourned to the usual collation.

JAMES M. ROBERT, Secretary.

Regular Meeting of the Board of Direction, May 8, 1922.

The meeting was called to order with Vice-President Barrelli in the chair and Messrs. Moses, Barnett, Manley and Robert present.

Ballots for new members were opened, there being 83 formal and 4 informal. As a result the following members were elected to the respective grades of membership:

Resident Members—Felix L. Alcus, P. C. Dowell, William L. Fey, Frederick H. Fox, John D. Lockwood, Forres McGraw, Joseph L. Swanson, Anthony M. Zibilich.

Non-Resident Members—Crawford K. Dunbar, George P. Hopkins, Frederick F. Pillet.

Junior Member—F. Fowler Case.

Mr. Eugene C. Graveley was transferred to non-resident Junior membership as of January 1st, 1922.

Upon motion duly seconded, the Treasurer was authorized to purchase U. S. Government securities approximating \$1,000.00 in value.

Report of the Secretary was received and bills ordered paid. There being no further business the meeting was adjourned.

JAMES M. ROBERT, Secretary.

Regular meeting of the Society, May 8, 1922.

The meeting was called to order with Vice-President Barrelli in the chair and 43 members and guests present. Minutes of the previous meeting were read and approved.

A communication from the Association of Commerce was read asking our Society to voice an opinion on their campaign against tackling signs on trees. On motion by Professor Gregory, which carried, it was decided to inform the Association of Commerce that it was the

sense of the meeting that their movement against tacking signs on trees be supported.

The following resolution carrying the endorsement of the Society was read for the first time: Mr. Coleman introduced the resolution, seconded by Mr. Laws. It was carried with no adverse vote.

Whereas, It appears that there is a tendency to postpone the construction of the New Orleans-Hammond Lake Shore Highway, and

Whereas, The interests of the citizens of New Orleans and of the whole of that part of the State in which said highway is designed to be constructed demand its completion at an early date as possible, and

Whereas, There is no evidence of unusual or unfamiliar engineering difficulty in this construction, and

Whereas, there is now available an amount of approximately Four Hundred Thousand Dollars sacred to this project, now

Therefore Be It Resolved By The Louisiana Engineering Society, That it approves and endorses the project.

Be It Further Resolved, That it urges the State Highway Commission and all other interested authorities to hasten the financing of the remainder of the estimated cost and proceed vigorously with the construction, to the end that at the earliest possible date the benefits to be derived from this highway may be enjoyed.

The technical exercises of the evening were then proceeded with and Mr. Donald DuPlantier read a very interesting and instructive paper entitled, "The Limitation of Loads on Highways." After considerable discussion which was enjoyed by all, a vote of thanks was tendered Mr. DuPlantier.

There being no further business to come before the same, the meeting adjourned to the usual collation.

JAMES M. ROBERT, Secretary.

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PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

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EDITORIAL NOTES AND COMMENT

Radio. No scientific development in recent years has produced such a widespread and enthusiastic interest on the part of the general public as that of Radio Telephony. This was due in large measure to certain very striking developments in methods of transmission and reception, by means of which speech and musical sounds could be transmitted and could be received at any point by means of the well-known telephone, thus putting the operation of a receiving set into the hands of anyone without the necessity of understanding the telegraphic code.

In his paper, published in this issue, Dr. Elliot points out the fundamental discoveries and principles upon which the practice of wireless telegraphy and telephony have been found-

ed, and then proceeds to explain in a non-technical way, as far as it is possible to do so, the operation of wireless telephony, or "radio," as it is more popularly known.

In recounting the historical foundations of the subject, Dr. Elliott calls attention to the names of Henry, an American physicist; Maxwell, a British physicist; Hertz, a German physicist and Marconi, an Italian Engineer. The latter name is the one best known in connection with radio for the reason that it was his work which placed it upon a practical and commercial basis.

The greatest single factor in the successful operation of the modern system of wireless telegraphy, was the development of the now well-known Vacuum Tube. Based originally upon a discovery by Edison, it has been improved and applied in different ways by a host of experimenters until it is now one of the most valuable pieces of electrical apparatus in use today.

In radio receiving the three-electrode vacuum tube may serve as a rectifier, a direct amplifier, a regenerative amplifier or a regenerative oscillator. In fact one tube may function in all four of these ways simultaneously.

For the transmission circuits used in broadcasting, the vacuum tube, with essentially the same construction as the smaller tubes for receiving, but of much larger size, is now in extensive use. It bids fair, with the great amount of experimental research now being applied to the problem, to replace other more expensive and complicated devices for transmission.

Partial Closure of the Hamburg Crevasse. In the many discussions of the problems of the Mississippi and its tributaries in this part of the country, which have taken place in the meetings of this Society, Mr. Kemper has always taken a prominent part; and he has very decided views upon some of its most important phases. We are gratified, therefore, at being able to publish a brief report from him upon some work he did in tying the ends and partially closing the crevasse which occurred at Hamburg on May 16, 1922.

A Donation to the Library. The Chairman of the Library Committee has recently received from Mr. Robert Glenk, Curator of the State Museum, a copy of the book, "Remaking the Mississippi," by John Lathrop Matthews. Acknowledgement on behalf of the Society is hereby made of Mr. Glenk's gift which is another expression of the interest he has always taken in its welfare and progress.

Local Section of the A. S. M. E. William B. Gregory, professor of experimental engineering at Tulane University, has been re-elected chairman of the New Orleans Section of the American Society of Mechanical Engineers, of which Dean Dexter S. Kimball of Cornell, is president. Prof. Gregory heads the new group of New Orleans officers who will serve during 1922-23.

The Society's announcement of the election of the New Orleans executives stated that within the Society more than 9,000 engineers are actively engaged in developing twelve fields of industrial effort. The organization of a professional group to study the Printing industry and the affiliation with this Society of the Society of Safety Engineers was also announced.

The membership of the Society, one of the largest and most influential organizations composing the Federated American Engineering Societies, is rapidly approaching 20,000. Dean Kimball, its president, is now completing a nationwide tour, extending to the Pacific coast, in the interest of organized engineering, which, as a result, it is said, is increasing throughout the far West. One outcome of Dean Kimball's trip, notable in engineering annals, will, it is expected, be greater unity of thought and effort between and eastern and western engineers.

Other engineering organizations, will, it is anticipated, be embraced in the Society's network of affiliations spreading over this and other countries. The membership of the Society, exclusive of affiliates and of student branches in colleges and universities, is given as 16,305 and growing steadily in every section of the country.

The United Typothetae of America is co-operating with the new printing machinery group in arranging a program for the

annual meeting of the Society to be held in New York in December, at which John L. Harrington of Kansas City will take office as president, succeeding Dean Kimball.

Of the twelve professional divisions of the Society, in which 8,694 are enrolled, the management division leads with 1,729 members. The power division is second with 1,619 members. The aeronautics division, whose workers include Orville H. Wright and other leading aviation experts, has 349, and the ordnance division, which is co-operating with the United States Army, has 322 members.

The progress of the management division, it is said, illustrates the interest which American industry is displaying in the problems of management, especially those which affect labor and waste. Enrollment of other professional divisions of the Society, known as the Society of the Industries, follows:

Railroads, 547; textiles, 327; machine shop, 1,083; material handling, 1,086; forest products, 197; fuels, 844; cement, 145; gas power, 446.

The printing machinery group was authorized by the Council of the Society, which has decided to permit the formation of industrial groups which will be developed into regular professional divisions. In this way the Society's study of various phases of industry will be broadened.

The purposes of the printing machinery group, as it is announced, are the development of the idea of standardization in the printing machinery industry, standardization of methods and sizes of paper stock and of paper products, with a view to securing the standardization of printing machinery sizes; collection of data on standardization, and preparation and presentation of technical papers by recognized authorities in the printing industry at national industrial and engineering gatherings.

The Society, it is stated, has branches in sixty-two institutions of higher learning. Growth of organized engineering is shown to have been most marked recently in the South, where local sections, the regional units of the Society, are forming in various cities, including Memphis, Dallas, Chattanooga and Louisville. Engineers of western Massachusetts are organizing

a local section to work with the Society's numerous other sections in New England. In Lincoln and Omaha, Neb., sectional organizations are contemplated.

Prof. Gregory, the New Orleans chairman, who has served this section in that capacity ever since its formation in 1916, with the exception of two years, and was vice-president of the national society for 1921, is a graduate of Cornell, and has had much experience in the erection of sugar machinery and boiler plants, and experimental work at the Washington Navy Yard. In addition to his professorship at Tulane, he is an Irrigation Engineer with the U. S. Department of Agriculture.

Prof. James M. Robert, also of Tulane, has been re-elected secretary-treasurer of the section. Prof. Robert is a graduate of Tulane and has been connected with the university ever since graduation in the department of machine design. In addition to teaching, Prof. Robert has done commercial designing, consulting, testing and experimental work of many kinds.

These officers, with Thomas M. Roberts, general superintendent of the Stern Foundry and Machinery Co., Frank G. Frost, superintendent of power with the New Orleans Railway and Light Co., and Walter B. Moses, vice-president and assistant general manager of the Engineering Sales Co., constitute the Executive Committee of the new Orleans Section. Mr. Roberts, who has been connected with various railroads as superintendent of erection and construction, has been with the Stern Foundry and Machinery Co., since its establishment in 1906.

Frank G. Frost, a graduate of the University of Illinois, has been chief engineer with various concerns in different parts of the country, and was in charge of the design and construction of power stations and underground cable work in Birmingham, Ala., Little Rock, Ark., New Orleans and Houston, Tex. He has been with the New Orleans Railway and Light Co., since 1919.

Mr. Moses, who has been a member of the executive committee of this section ever since its formation, is a graduate of Tulane, and has had much experience in various lines of engineering work. He has been vice-president and assistant general manager of the Engineering Sales Co., since 1918.

Teredos and Tunnels. Among the little marine animals which destroy wooden piles and other underwater parts of waterfront structures, probably the best known are the several varieties of shipworms, so-called, although they are not worms but molluscs. Commonly they are all comprehended in the name *Teredo*, in spite of the efforts of biologists for correct discrimination. *Teredos* bore long tunnels in wood, using their two tiny shells as excavating tools and shields for their heads. As the head advances, the body grows, excreting a calcareous lining for the tunnel. The "tail" maintains connection with the surface of the pile and can close the entrance when danger is sensed. From head to tail there is a passage through the body for the discharge of the borings into the open water. So much for Nature's prototype!

The story of the invention of the tunneling shield by which tunnel work in underwater or water-bearing ground, has been greatly simplified and its scope correspondingly enlarged is an interesting chapter in the history of modern engineering. Marc Isambard Brunel was born in France, April 25, 1769. His father, a farmer, intended him to become a priest. A strong leaning toward mathematics turned the boy in another direction and he served in the French Navy for six years. In 1792, when he returned to his native land, he found the Revolution in full swing. As he was an ardent Royalist, he came to New York and practiced land surveying and canal engineering, and also made plans for the military defences of the Narrows of New York Harbor.

In 1799, he went to England where he spent the remainder of his life. He designed and built in 1803 a complete set of wood-working machinery for the Naval Dockyard at Portsmouth. In 1812, he reorganized the system of wood-working at Woolwich and Chatham Arsenals. He was interested in steam navigation, in shoe-making machinery, in mechanical knitting. In 1818, he took out a patent (No. 4204) entitled "Method of forming tunnels or drifts under ground."* In his specifications and drawings he describes what is in essence the modern tunnel shield, to form a protection for the workers, thrust ahead by the pressure of hydraulic rams upon the

*Quotations are from original patent application.

finished lining. "The body, or shell, of the tunnel may be made of brick or masonry, but I prefer to make it of cast iron,"—thus foreshadowing the many miles of cast iron lining which have been built since his day.

This masterly engineer was not above going to a lowly "worm" for help and advice. His shield embodied a form of mechanical excavator. "The combination of mechanical expedients by means of which I performed the same, I denominate a *Teredo*, or auger, from its analogy to that instrument, and also the *vermes*, known under the name of *Teredo Navalis*. This insect is capable of perforating the toughest timber by the power and organization of its auger-like head worked by the motion of the body enclosed within its tubular cell, which cell may be supposed to represent a tunnel."

When it is considered that the body of the *Teredo* makes a closed dry chamber at the working face and that it deposits a continuous calcareous lining as it extends its tunnel, the analogy is remarkabale.

Like many another genius, Brunel's financial acumen was not great, and in 1821 he was imprisoned for debt. His friends released him by payment of £5,000. The latter part of his life was devoted more to civil engineering projects than to those of mechanical engineering and his great and crowning work was the construction of the Thames tunnel crossing the river between Wapping and Rotherhithe. He used a shield for this work, but one of an entirely different type from that described in his patent of 1818. The work was on a huge scale for that time with the appliances and methods then at hand. This tunnel was rectangular in section, 23 feet high by 37 feet wide, or equal to a circle nearly 33 feet in diameter, which is larger than any subaqueous tunnel since built. The river broke in several times, and the work was not finished until 1843. Helped by his son, Isambard Kingdom Brunel, he conquered each disaster as it came. The anxieties and the days and nights spent in the tunnel proved too much. He suffered a paralytic stroke in 1843, another in 1845 and died in London, December 12, 1849.

(Note: The above article is taken from one of the Research Narratives, published by the Engineering Foundation).

PAPERS AND DISCUSSIONS

RADIO

By D. S. ELLIOTT.

Read before the Society, June 12, 1922.

During the past two and a half months, the most widely discussed topic locally has been, without doubt, the subject "Radio"; and during the past year when other lines of manufacture have been merely hanging on, dealers in radio apparatus have kept factories jammed with orders months behind delivery. Almost over night, the local public became intensely interested in radio, prematurely interested perhaps through the competition of the local newspapers, each striving to be the first in the field for "broadcasting." At that time the power of the local stations was too low to stimulate and sustain the interest of the merely curious, and although the sending has gradually improved during the past two months, the radio audience has narrowed down to those who have a real interest in the subject.

A discussion of radio immediately divides the subject into two parts: damped waves, where the successive waves have decreasing amplitudes or decreasing strength; and continuous waves (C. W.), where all waves have equal amplitudes or strength. Continuous waves represent the more modern branch of radio and form the skeleton of wireless telephony. Damped radio waves are of interest because of their historical significance and because of the fact that they afford the easier vehicles for getting across some of the elementary notions concerning wireless.

The first essential element for damped waves or spark telegraphy was discovered by Henry in 1831, when he showed that the discharge from an electrical condenser could be made oscillatory. In other words, Henry showed that a closed circuit containing a condenser and a coil of wire, called an inductance, could produce, under certain conditions, a high frequency a. c. current. Faraday introduced the idea that the space sur-

rounding a current-carrying conductor is the seat of lines of magnetic and electrostatic strains. In other words, we must consider part of the energy associated with an electric current as located in the dielectric surrounding the conductor. In 1863, Maxwell proved from purely mathematical considerations that these lines of electromagnetic strain would travel through space with the velocity of light. And that is as far as Maxwell went; for being no experimentalist, he had to content himself with this theoretical support for his hypothesis that light was an electromagnetic phenomenon. Twenty-four years later, Heinrich Hertz, succeeded in producing, sending through space, and detecting, these waves predicted by Maxwell. Hertz showed conclusively that wireless waves and light are identical except in the matter of wave-length. Light waves measure from crest to crest something like .001 mm, while wireless waves measure from crest to crest anything from 3 cms. to several miles. It is interesting to note that the type of detector used by Hertz was the fore-runner of the loop aerial which has recently received so much mention in connection with Signal Corps receiving and the radio compass. In his transmitting circuit, Hertz used for the first time, an open oscillating circuit; that is to say, he took the circuit of Henry and opened up the plates of the condenser and by that device secured a larger portion of energy radiated.

In 1895, Marconi, who may be called the first radio engineer, attracted public attention. Marconi set out with the definite idea of utilizing these wireless waves for signalling purposes. Among other things Marconi used an aerial for one plate of his condenser and the earth for the second plate. Modern practice has shown that it is better to use in place of the earth a second conductor—technically known as a “counterpoise.” Collins, an amateur, who crossed the Atlantic with twenty watts power, used a “counterpoise.”

Going back to Marconi, who was the father of spark telegraphy, we will find that his sending set consists essentially of three circuits properly connected together: a power circuit containing a key for the purpose of supplying energy in a predetermined fashion; a closed oscillating circuit, containing an

air-gap, for generating high-frequency alternating current; and the open oscillating circuit for radiating the wireless waves into space. Some idea of the operation of the apparatus may be obtained from the following statements. When the key in the power circuit is held down, energy from a source of low frequency alternating current, 60 cycles for example, passes through a transformer and the condenser in the closed oscillating circuit is charged to a high voltage. When the transformer secondary voltage reaches a maximum, a spark passes across the gap, and the closed oscillating circuit generates high frequency current. Immediately the open oscillating circuit begins sending out wireless waves, each succeeding wave being weaker than the preceding. Finally the gap opens and a single group of waves has been sent out into space. When the 60-cycle current reverses, the process is repeated and another group of waves leaves the system. So that with a primary source of 60-cycle current, 120 groups per second will travel through space. It is this group frequency which determines the pitch of the note you hear at the receiving station; it has nothing to do with the wave-length which depends on the distance in space between successive crests in any wave group. For example when we say a ship is sending on 600 meters, we mean the distance in space between successive waves is 600 meters. The duration of the signal, determined by the time the key is held down, decides whether a dot or a dash is sent.

Now for the receiving end. The receiving apparatus for damped waves is of interest because any modern receiving set which will pick up damped waves, will also record radio-phone signal, provided of course, the signals are strong enough. Of course, the receiving set must be adjusted to the wave-length of the incoming waves. This is known as "tuning." We know from our elementary physics that a good radiator is also a good absorber; so that the first circuit in our receiving set is an open oscillating circuit, which has been tuned to the frequency of the incoming waves. For waves of 360 meters, this frequency is almost a million. The next element is the closed oscillating circuit to trap the incoming energy so that it will not be re-radiated into space. The third circuit is a detecting

circuit for rendering the incoming wave audible. It is a fact that no diaphragm either in the human ear or in a telephone receiver can respond to a frequency of a million, so that special devices must be employed to reduce the incoming oscillations to audibility. At present, two such devices are commonly employed: the crystal detector, and the vacuum tube detector.

The action of the crystal detector is based on the fact that certain crystals like galena and silicon permit a current to pass through them in approximately one direction only. If a circuit consisting of such a crystal in series with a telephone receiver, be used as our detecting circuit, the action of the crystal is to wipe out the lower halves of the incoming alternating waves. The upper halves are fused together by the telephone and the result is a single pulse in the phones for each wave-group. This Wave-group frequency is always well within the range of the human ear, usually about a thousand, and the signals are therefore rendered audible. A vacuum tube operates in essentially the same way and in addition magnifies the incoming signals usually from ten to twenty times audibility.

The three electrode vacuum tube requires special mention. Probably no single piece of apparatus has contributed more to popular radio than the vacuum tube. Not only in connection with radio, but in many other applications, the vacuum tube has brought to the experimentalist a useful tool. A three-electrode vacuum tube consists essentially of a highly evacuated tube containing a *Filament* which can be heated to incandescence. Every incandescent solid emits electrons. An electron can be regarded as the natural unit of negative electricity. In our vacuum tube there is also a second electrode known as the *Plate*. If the *Plate* is kept charged positively by a battery, the negative charges from the *Filament* will be attracted to the *Plate*, the energy being supplied, of course, by the *Plate* battery. If now we place a third electrode, called a *Grid* between *Filament* and *Plate*, we can control the current from *Filament* to *Plate* by altering the potential on the *Grid*. It is immediately evident that if we make the *Grid* sufficiently negative, we can prevent any electrons from reaching the *Plate*. The exact way in which the tube operates can be learned from a study

of its characteristic curve, which is a curve plotted with grid potential against plate current. The significant parts of the curve are the top and bottom which are rather sharply curved and the intermediate portion which is a sloping straight line. Suppose we start with a potential on the *Grid* so that we are located at the lower knee of the curve; as a varying potential due to the incoming waves is superimposed on the *Grid*, the increase in plate current due to the positive oscillations will be greater than the decrease in plate current due to the negative oscillations. The result is a rectified current for each incoming group of waves. In addition the grid circuit acts as a trigger for releasing a much larger amount of energy in the plate circuit, so that we not only get rectification but amplification as well.

If we put a higher potential on the grid so that we are located on the straight part of the curve and the incoming oscillations enable us to stay on the straight part of the curve, then the oscillations in the grid circuit are not rectified in the plate circuit but are faithfully reproduced on a magnified scale. Our tube then acts as a straight amplifier. If we wanted, we could connect the plate circuit of one tube through a special transformer to the grid circuit of a second tube and obtain a second stage of amplification. As many as nine stages of amplification are recorded, but three stages suffice for ordinary practice.

We might do this. We might take part of the oscillating current in the plate circuit and re-introduce it back into the grid circuit. We would then have a *Regenerative* set — Armstrong's famous "hook-up." Although not usual, it is possible for a single tube to act as an amplifier, regenerator and detector at the same time.

But damped waves are gradually going out of use. Already the larger stations are operating with continuous waves—the type which have constant amplitude or strength. It is only a matter of time when spark sets will give way completely to continuous waves. There are a number of reasons for this: First of all, continuous waves give longer transmitting range for a given amount of power; second, they employ lower voltages; third, they have greater selectivity—that is to say, prac-

tically all the energy is located in a definite wave-length; and fourth, they are often easier to read, since the pitch of the signal is adjustable at the receiving station.

Continuous waves can be produced directly in a number of ways. Under certain conditions, the D. C. arc can be used for producing continuous waves; then there is the multi-gap system used in the Marconi stations. High frequency alternators, such as the Alexanderson and Goldschmidt, afford another device for producing C. W. These generators have a maximum output of 200 kilowatts at a maximum frequency of 200,000 cycles. Contrast this with the ordinary 60 cycles. In smaller units, power vacuum tubes are used. Power vacuum tubes form the back-bone of the present broadcasting units. The limitation on the power output tube is its ability to dissipate the heat developed in it. At present, tubes of two kilowatt output are produced in American factories, and from abroad comes the report of a five kilowatt tube. Hook up any one of the above sources to an open oscillating circuit, adjust for resonance, and continuous waves can be sent out into surrounding space.

In regard to receiving continuous waves, the ordinary damped wave receiving set will not operate. There are several ways for making continuous waves audible but the most interesting is by heterodyning. In heterodyning we make use of the phenomenon of "beats." It is a well-known physical principle that two notes of different frequency, sounding simultaneously, produce a third note known as a "beat" note. This note has a frequency equal to the difference between the two original frequencies. The incoming continuous waves are above the audibility limit of the ear, but in heterodyning the receiving station generates locally oscillations slightly different in frequency from the frequency of the incoming waves. This local frequency is introduced into the oscillating system together with the incoming waves. The result is a beat note which renders the signals audible.

We are now in a position to consider the radio telephone. The circuits employed in the radio-phone are somewhat complicated, but the principle of operation is fairly easily understood.

The skeleton of radio-telephony is the continuous wave which is known as the "carrier" wave. When we speak of broadcasting on 360 meters, it is the wave-length of the carrier wave which is meant and which must be tuned for. The problem of radio-telephony consists of generating, and "modulating" or modifying this "carrier" wave to follow the variations in sound waves set up by the human voice or other instrument. As a means for securing this effect, the telephone transmitter immediately suggests itself. But when we consider that the power in the ordinary speaking voice is only about a billionth of a watt, the difficulty of modulating large amounts of energy directly constitutes a difficult problem and the development of radio-telephony has centered around this problem which furnishes an interesting chapter. Without attempting to explain the process for controlling large amounts of power in the largest commercial stations, the Alexanderson scheme involving a magnetic modulator has been evolved; while for controlling smaller amounts of power, several schemes employing vacuum tubes are used at present. And we are talking through the air.

But how can we pick up these radio-phone messages? Any modern damped-wave receiving set, which will detect telegraphic signals, will bring in the radio-phone messages. What happens is this: when the complex radio wave falls on our receiving system, the carrier wave being above audibility, passes through undetected, while the superimposed voice wave reproduces through the telephone receiver, the original sound waves in the same way that they are reproduced in land lines. Any receiving set which will pick up ordinary spark telegraphy will bring in music from the broadcasting stations provided, of course, the signals are loud enough.

Such in broad outline are the salient features of radio up to the present. What about the future? It is always dangerous to prophesy; but it seems fairly evident that the land lines are in no immediate danger of being superseded by the radio-telegraph and telephone. Rather the two systems are complementary. There are some fields of operation where radio has undisputed sway—I refer to the cases where either the sending

or receiving station, or both, are not fixed in position, whether this be in the air, on the water, or under the sea. It is also fairly evident that radio can best be used between points where the traffic is light and the cost of laying and maintaining wire lines too expensive. An example of what I have in mind is illustrated by the radio link established by the American Telephone and Telegraph Company between Santa Catalina Island and Los Angeles. It is not unlikely that similar radio links will be installed at all seaports handling heavy passenger traffic, if the present experiments at New York City show that the investment pays dividends. The most useful application of the radio-phone is in the field of broadcasting. Should the telephone companies set up radio links at seaports, it seems reasonable to expect them to sell broadcasting service, although it is not likely they will furnish broadcasting programs of their own. The wire lines of the telephone companies furnish ready equipment for bringing into their broadcasting station any local entertainment or special program. Perhaps they may do this very thing, if they can induce the local radio jobbers to pay for the service. Much depends on the impending legislation at Washington. Already there are about 315 licensed broadcasting stations and the schedules of 136 are published weekly. While there is no visible end to the amount of government and educational information and news bulletins available, one can not help but wonder how this large number of broadcasting stations will be able to continue the strictly entertainment features of their programs.

While educational institutions have been interested in the possibilities of broadcasting for educational purposes, the engineer is interested in the new set of engineering problems in communication and remote control. An instrumentality which is purported to guide an unmanned boat over the sea and an airship around Eiffel Tower, is something the Electrical Engineer can no longer ignore. Many engineering schools have already taken this view and have given "Radio" a place in the curriculum. It may be of interest to know that Tulane University is offering instruction in radio in connection with the course in electrical engineering. A laboratory is being de-

veloped for studying some of the problems experimentally, and a broadcasting unit of approximately 1 kilowatt power is being assembled. The New Orleans Railway and Light Company has recently erected the supports for the new aerial which will be 120 feet high. The Station is already licensed by the Government with call letters W A A C. When the installation is completed, the members of the Louisiana Engineering Society are invited to visit the station.

REPORT ON PARTIAL CLOSURE OF THE HAMBURG CREVASSE

By J. P. KEMPER.

The Hamburg Crevasse occurred on Tuesday, May 16, 1922, at about 6 o'clock, A. M. I read of it in the afternoon New Orleans paper, and realizing that if allowed to run wild, as crevasses are generally allowed to do, it would put into the Atchafalaya Basin more water than the back levees of the property holders on Bayou Teche and Bayou Lafourche could hold, to say nothing of putting the main lines of the Texas and Pacific and Gulf Coast Railroads out of commission and flooding a large area in Avoyelle, St. Landry, St. Martin and Iberia Parishes, including the town of Melville.

I called up C. D. Kemper at Franklin, and he in turn communicated with Mr. F. B. Williams in New Orleans, and the result was that I left New Orleans on Thursday night May 18th, provided with tarpaulins and other materials to be used in tying the ends of the crevasse to prevent its widening. I had done this same thing to the Torras Crevasse in 1912 and knew what was necessary. We reached the crevasse the next day and on Friday, May 19, placed the tarpaulins in position which immediately stopped the widening. The crevasse was then 1,200 feet wide. Had men and materials been on hand, it could have been held to 600 feet just as easily.

Tying the ends of a crevasse is a very simple process, consisting of spreading a tarpaulin, with a heavy chain sewed into the under side, down the side of the levee until it reaches the bottom of the slope. The tarpaulins I used were of 8oz. duck, 12 feet wide and 100 feet long.

No effort was made to wrap the tarpaulin around the end of the crevasse. It was placed on the side of the levee a few feet from the end of the levee and the levee allowed to wash back to it. At the end of the tarpaulin farthest from the crevasse, I drove some cribbing of two by fours and filled it in with sand bags, thus checking to a great extent the current down the levee near the crevasse. Not more than 20 feet of levee was lost after the tarpaulins were placed in position.

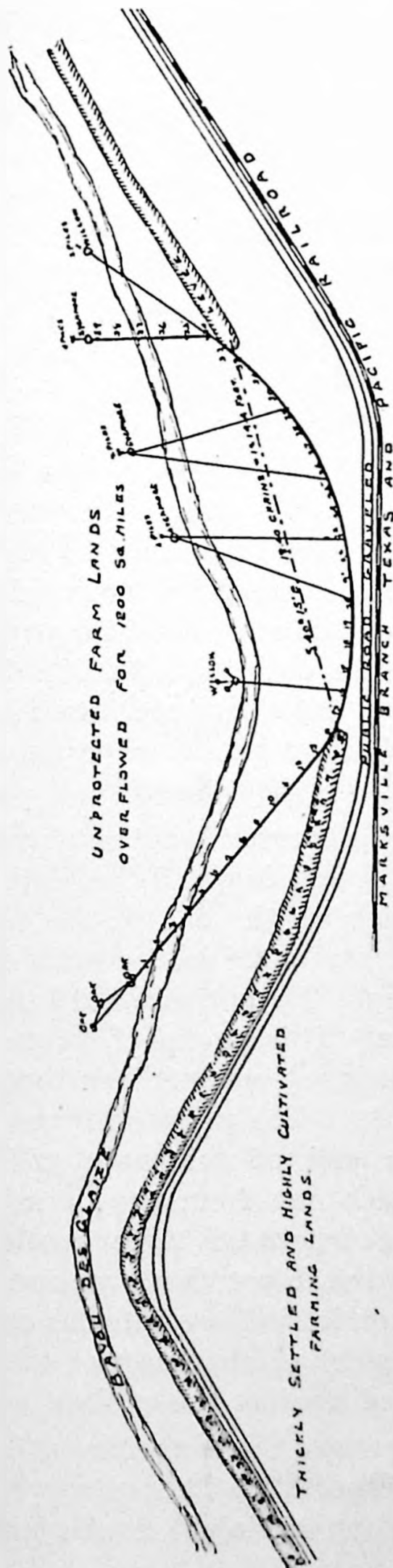
It was agreed between the Texas and Pacific and the Gulf Coast Railroads, the Red River, Bayou DesGlaize and Atchafalaya Levee Board and interests represented by C. D. Kemper, in St. Mary Parish, to each put up \$2,500.00 and have me to close or at least restrict the crevasse by means of wire cables stretched across it and filled in with willow trees and other brush.

On Sunday, May 21, I made a survey of the crevasse as shown on the accompanying plate. The location was most disadvantageous for stretching the cables. I had conceived this plan of closing crevasses long before, but I always figured on having a broad river in front of me. In this instance there was a very small stream not more than 50 feet wide on the lower side of which, between it and the levee, was a batture more or less covered with small trees and brush, while on the upper side was a vast expanse of land, 1200 square miles or more overflowed from 8 to 20 feet deep. I had always contemplated driving piles at each end of the crevasse, laying out my structure on the levee on the upstream side, securing one end of the cables to the piling, shoving the structure into the water and having a powerful boat attached to the other end to swing it around into position, it being provided with short bridles and anchors at intervals of say 100 feet, which would take hold of the ground in the crevasse and relieve the end piling and also the main cables of much of the strain.

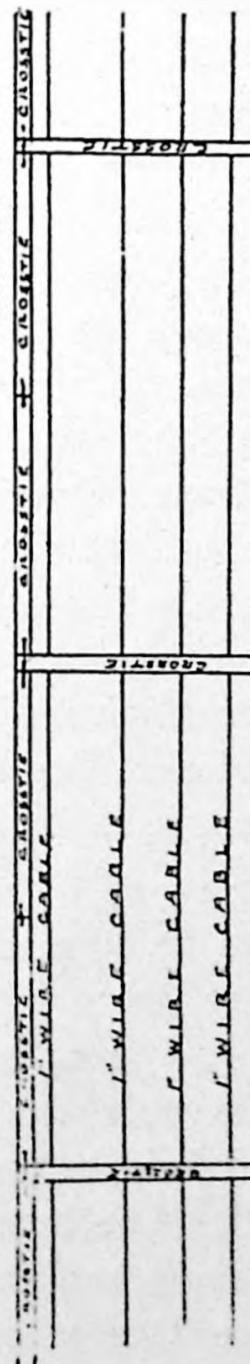
It was necessary to proceed here very differently. There was no pile driver at hand and no definite time set for its arrival. I accordingly selected trees on the opposite side of the bayou from the crevasse to which to fasten my main cables and also bridles. After the arrival of the pile driver, I drove piles behind these trees and guyed the trees to the piles. It happened through mistake that I had a surveyor's tape instead of an engineer's tape, hence the figures on the accompanying plate are in chains and links instead of feet and tenths.

After surveying the crevasse and locating the trees which I proposed to use, I laid off on paper the structure as I wanted it to fit in the crevasse, together with the bridles, all as shown on the plate. The total length from end tree to end tree was

PLAN OF HAMBURG CREVASSE
SHOWING POSITION OF STRUCTURE FOR HOLDING BRUSH.
SCALE 1 INCH = 5 CHAINS



DETAIL OF STRUCTURE PLACED IN CREVASSE
SCALE 1 INCH = 5 FEET



DESIGNED AND INSTALLED BETWEEN MAY 23, AND JUNE 3, 1922
BY *John H. Hays* C.E.
NEW ORLEANS, LA.

almost forty chains, or a half mile; just about half of this was in the crevasse.

I next staked off forty chains up the levee, numbering the stakes from 0 to 40, and built my structure. No lumber was available except crossties. It was necessary that there be enough buoyancy in the cross ties to float the cables with the crossties used for posts standing in a vertical position. The crossties were dry so this was easily accomplished by a structure such as is shown in the accompanying diagram. Four one inch plow steel cables, of breaking strain of 38 tons, and such as are used by pullboats and skidders were stretched on the levee. Four one and a quarter inch holes were bored in each of the crossties used for posts. These crossties were slipped over the cables and spaced a little over 16 feet apart by the lateral crossties whose sole purpose was to float the structure. These lateral ties and the ties used for posts were fastened together by means of several turns of No. 12 gage black iron wire. Before putting the structure into the water the cables at the end marked 0 were permanently secured to the oak tree at 0.

There was, of course, a strong current leading towards the crevasse, so by means of check lines I dropped the bight of the structure down until it was opposite the end of the crevasse. It was my purpose to keep the structure in the main channel of the bayou and not let it get into the crevasse until the other end and bridles were all secure. This, however, proved very difficult. The brush and small trees between the bayou and the crevasse hampered me greatly. The pile driver was at the sycamore tree where the other end of the main cables was to be attached and I put a cable out from the drum of the pile driver and attached it to the structure. After considerable trouble and breaking a few cables, I got the structure across and permanently secured. I then let it loose into the crevasse. There was an immediate and marked checking of the water even before any brush was placed against the cables.

The structure was gotten across Tuesday May 30th, two weeks after the crevasse occurred. On Thursday we began cutting willow trees and brush and letting it float against the

cables. We found that four cables spaced with posts 16 feet apart let a lot of brush and a good many fair sized trees through. Some of the brush we tied in bundles with rope and some we tied to the crossties of the structure. By Saturday afternoon, June 3, we had cut all the brush near at hand and to get any more it would be necessary to barge it. The Texas and Pacific Railroad had successfully withstood the bulk of the flood and the water was falling at their tracks. Likewise was it falling at Melville and the Gulf Coast Lines were safe and the St. Mary interests had found that they could hold all there was to come. The river had fallen five feet at Simmesport since the crevasse occurred and the crevasse water was falling as rapidly as the farmers could prepare their land. These matters considered it was properly decided that further expense was not warranted and operations were suspended.

Viewed as an experiment, I think it entirely proved the feasibility of the plan. Tying the ends of a crevasse with tarpaulins is no experiment; it worked perfectly at Torras in 1912. Had not the washing away of the Hamburg levee been stopped, both the Texas and Pacific and Gulf Coast Railroads would have gone out of commission, many levees along the Teche and Lafourche which held would have broken, many more thousand acres of cultivated land would have gone under water as would also the town of Melville and Morgan City. The damage would have gone into the millions. The cost of securing the ends of the crevasse was about \$500.00.

The cable system of closing crevasses is beautifully adaptable to the Poydras crevasse. There is room there to swing the structure and an abundance of material to put into the crevasse.

Some deviation should be had from the plan I used. Posts 12 feet long should be used instead of crossties and they should be spaced 12 feet apart instead of 16. Six cables should be employed instead of four. Hog wire fencing should be tacked onto the structure before it is put into the water in order to stop the small brush. It is remarkable how brush can wiggle between the cables and get through. But the main thing is that everything should be on hand in readiness on a boat or

barge, with men and quarters for them to live in, tools and everything that is necessary. I had to transport my men nine miles to and from work each day, and send back for their dinner.

Usually closing a crevasse is not desirable because it is saving someone else but a crevasse on the crest or decline of a flood, serves no good purpose and should be closed as soon as possible and what is more important, not be allowed to get too large. The cost of the cable system is far less than any other and the materials can all be salvaged after the water goes down.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Regular Meeting of the Board of Direction, June 12, 1922

The meeting was called to order with Vice-President, J. S. Barrelli, in the chair, and Messrs. Barnett, Garsaud, Manley and Moses present.

In the absence of the Secretary, James M. Robert, W. B. Moses was appointed temporary Secretary.

The financial statement of the Secretary was read, and the Secretary was instructed to pay all bills.

The resignations of Mr. Howard H. Marsh and Roger B. Stevens were accepted, they having paid their dues in full.

The application of Mr. James D. Murphy of Covington, La., for change from resident to non-resident membership was granted, as was also that of Mr. R. R. Tinkhan of Honolulu, Hawaii.

The matter of revision of the building code was discussed at great length, and as a result, the Board recommended that the President and Secretary of the Society continue their negotiations in connection with the revision of the building code to a conclusion, to the end that a committee representative of the different trade industries be appointed in the shortest possible time.

There being no further business to bring before the Board, the meeting adjourned.

WALTER B. MOSES,
Acting Secretary.

Regular Meeting of the Society, June 12, 1922

The meeting was called to order with Vice-President, J. S. Barrelli, in the chair, and 52 members and guests present.

In the absence of the Secretary, James M. Robert, W. B. Moses was appointed temporary Secretary.

The minutes of the previous meeting were read and approved.

Mr. Samuel Young, Chairman of the Membership Committee, reported that their committee had recently met, and that they were preparing a list of potential members for the Society, and that this list would be circularized in the near future.

Mr. F. A. Muth, Chairman of the library committee, reported that several new books had been added to the library, and that a great many building codes from other cities had been received and were being put in the library for the use of the members.

The resolution introduced at the last meeting by Mr. J. F. Coleman, came up for its second reading, and was passed.

The technical exercises of the evening consisted of a very interesting paper by Dr. D. S. Elliott, on "Radio." Prof. D. S. Anderson gave a supplementary talk on this subject, and considerable discussion followed.

Mr. Ole K. Olsen reminded the members that the regular monthly luncheon of the Engineering Club would occur on next Monday, and that these luncheons were regularly held on the third Monday of each month.

Upon motion duly seconded, it was decided to discontinue the meetings of the Society during the months of July and August, in accordance with the regular custom.

There being no further business, the meeting adjourned to the usual collation.

WALTER B. MOSES,
Acting Secretary.

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DOUGLAS ANDERSON, Editor.

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OF THE

LOUISIANA ENGINEERING SOCIETY

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EDITORIAL NOTES AND COMMENT

Spillways On The Lower Mississippi. The "Safe River Committee," composed of 200 of the leading men of New Orleans and of the parishes above and below New Orleans, was formed for the purpose of securing safety from floods for the lower Mississippi Valley. A sub-committee of engineers was appointed by the above general committee, and these engineers were directed to formulate and submit a report on the question of protection by spillways. This committee of engineers was composed of John Klorer, Chairman, W. B. Gregory, Allison Owen, J. P. Kemper, A. M. Shaw and Hampton Reynolds. Their report has been submitted and has been published in pamphlet form. Owing to the great importance of this report, both now and in the

future, it seems advisable to have it preserved in the Proceedings of the Louisiana Engineering Society. Permission accordingly has been secured from Mr. Walter Parker, Secretary of the Committee, and it is reprinted in this issue.

The report is short and to the point and is all in favor of spillways as against the policy of "levees only."

While it is generally assumed that the Mississippi River Commission favors the policy of "levees only" at the present time and that its members are opposed to the spillway idea, it must be remembered that these gentlemen have been studying the problems of the River for many years, and it is natural that they should be somewhat conservative. That the Commission has taken cognizance of the claims of the spillway advocates is evidenced by the fact that a special report on this very phase of the problem—"Spillways at or near New Orleans"—has been made by its direction.

This report was made by Major Clarke S. Smith, Corps of Engineers, U. S. Army, in 1914. Although it has never been published, it was made available to the Engineering Committee for reference, and it is understood that many of its findings were in accord with those of the Committee.

There are undoubtedly many strong arguments in favor of the spillway proposition, and it does not seem unreasonable for the people in this part of the Mississippi Valley to ask that it be given at least as fair a trial as has been given to the levee system.

Reduction In The River Front Fire Risk. Mr. Arthur M. Shaw contributes a paper under this title to this issue of the Proceedings, using as an illustration for his data, arguments and conclusions the recent very disastrous fire at the Army Supply Depot. A description of the design and details of construction of the wharf is first given, with a brief reference to the water supply and fire fighting equipment.

Mr. Shaw then proceeds to discuss the behavior of different materials of construction and of the fire prevention apparatus in the fire. The principal materials used in the wharf were creosoted timber, concrete and structural steel. The wharf was

provided with an automatic sprinkler system which apparently did not function to any great advantage, probably due to a failure of the water supply and an excessive drop in pressure. No use could be made of the chemical appliances on account of the very rapid progress of the fire after its discovery. An attempt was made to use the local fire hydrants and hose lines but in a very short while the pressure fell to such a low point as to render them practically useless. This was probably due to breaks in the pipe lines resulting from the failure of stirrup hangers.

For reasons which are clearly set forth in the paper Mr. Shaw concludes that the bulk of the river front structures of the future will be designed to rest on wooden supports, protection against decay being secured by creosote treatment until such time as some other method is discovered which will give equal lasting qualities, and at the same time, bring about a decrease in the fire hazard.

The paper closes with suggestions for improved methods of construction using treated timber, and with a number of proposals of a general nature in the way of prevention of fires as well as of methods of fighting the fires should they break out.

Why Should I Join The Louisiana Engineering Society?

Mr. Samuel Young as Chairman of the Membership Committee has started another drive for members. He sends us a list of names of nearly one hundred engineers in New Orleans who should be members of this Society.

In this connection we quote below a short editorial from a recent issue of the Bulletin of the F. A. E. S.

Not "What Do I Get Out Of It?"

But, "What Can I Put Into It?"

It is an altogether too well established policy in connection with inducing people to join associations, to present in glowing terms the individual benefits to be obtained.

This policy, coupled with the rapid multiplication of clubs, societies and organizations has, perhaps ex-

cusably, resulted in the asking of the universal question, "What do I get out of it?"

The greatest thing in life is the satisfaction that comes from service to one's fellowman—service cheerfully rendered without thought of self—and the man who fails to realize the ideal of service is unfortunate, indeed.

The Federated American Engineering Societies realizes in full this high ideal, conceived in the broad spirit of helpfulness, dedicated to the service of the engineering profession, and, through the profession, to the well-being of the public, it is deserving of our heartiest support.

The engineer has been the chief agency in the building up of our civilization. Can he be neglectful of the work of his own hands? Is he not obligated to see it through?

The Federation offers the means. In *this* society there can be no thought of self. Let every engineer ask himself the question, "What can I put into it?"

WILLIAM E. ROLFE."

Activities Of The Civic Council. The Special Committee on Organization of the Civic Council met on Friday, the 14th instant, and discussed plans whereby the work as outlined by Council might be carried out effectively. Following is the plan recommended which is hereby submitted to the Council for approval or revision:

Owing to the comparatively large number of points which the Council is to support, it was decided that these should be put into three main classifications in order that there might be a minimum of confusion and of duplication. These three classifications are as follows:

A—Elimination of flies and mosquitoes. This carries with it the cleaning up of breeding places and of all avoidable attractions such as stagnant pools, unnecessary water containers, etc., and the full protection of containers which must be maintained.

In the matter of fly eradication, it will include the proper enforcement of existing ordinances relating to stables, use of fly-proof garbage cans, proper handling of garbage and of receptacles in which it is placed or transported and the elimination of garbage dumps within the built-up sections of the city.

B—Street Clean-up—This will cover the matter of removal of placards from poles and trees and preventing further offences of this nature and the control of street noises, spitting on sidewalks, throwing trash, hand bills, etc., in streets and any other subject of a like nature.

C—The complete elimination from the entire city of the Argentine Ant.

Subject to the approval of this Council, the plan provides that members of this organization committee be placed in charge as chairman of each of these three major subdivisions as above outlined and that these chairmen shall head committees which will be made up of one representative from each of the member organizations. In this way, every organization will have its part in each section of the work. These departmental committees will select an executive staff and proceed with the active prosecution of its particular campaign along lines to be outlined by its own organization, subject to the approval of this Council and with the co-operation of each member of the various organizations.

It is recommended that Mr. V. A. W. Steger be placed at the head of the Division on Mosquito and Fly Eradication, Mr. P. A. Chopin at the head of the Street Clean-up Division, and Mrs. Jessie P. Wilkinson at the head of the Ant Eradication Campaign. The foregoing members of this committee have been conferred with in the matter, and have been requested to formulate plans for later consideration.

It might be well to add a word as to why this particular method of classification was used.

In taking up so many different lines of work, there is always danger of duplication, if not an actual conflict of interests, especially in the matter of raising funds. For example, while the matter of clearing a municipality of an insect pest such as the Argentine Ant might properly be considered a move to be

backed by the municipal authorities and financed by public funds, the time in which the work must be done and the fact that the work was well handled on a limited scale last year and is now well under way for a final solution by private effort and financing makes it appear wise to adhere to the original plan.

Fly and mosquito eradication will be a matter of enlightenment of the individual citizen, the enforcement of existing ordinances and the provision by the municipality for the disposal of garbage in a more sanitary manner, thus eliminating the most fruitful breeding place for flies.

The Clean-up- Campaign is one which will not require the expenditure of any considerable amount of money, but will require intelligent, aggressive work in securing the enforcement of existing ordinances and possibly the passage of additional ones and above all, the awakening of a public sentiment that will make for a greater civic pride and better municipal house-keeping.

It is recommended that this Council utilize to the utmost the work already done or undertaken in the activities above referred to by the various member organizations, and we suggest that where work is already under way and well organized, that the greatest good can be done by securing the active co-operation of all members of the Council in every such effort.

OBITUARY.

Mr. Adam J. Haaser, a resident member of this Society, died at his home in Algiers on Monday morning, September 9th. He was born in New Orleans, September 4, 1862, the son of John Haaser and Mary Keohler. He received his primary education in the local public and parochial schools. He later attended Jefferson College at Convent, La., and was a student for sometime in the Engineering courses of the International Correspondence School.

Although he started in life in a clerical position he always had a decided liking and taste for machinery and machine shop work, which lead him to take a position in the shops of the Southern Pacific Company with which he was connected for over twenty years. In 1901 he became Machinist in Charge at the Naval Station at New Orleans. A few years later he passed a competitive examination and was appointed Master Mechanic in the Steam Engineering Department at the Naval Station. He remained in this position until the station was closed in 1912. In 1913 he entered the employment of the Vaccaro Bros., and at the time of his death he was Mechanical Engineer for that firm.

He is survived by his widow, formerly Miss Luella Peterson.

He became a member of the Louisiana Engineering Society in 1916 and has always taken an active interest in its affairs. Mr. Haaser was greatly interested in the parochial work of the Church of the Holy Name and was prominent in all of its activities as well as the activities of the affiliated societies.

PAPERS AND DISCUSSIONS

REPORT OF ENGINEERING COMMITTEE

JOHN KLOSER, Chairman

TO THE

Safe River Committee of 100 on Spillways as a Means of Lowering
the Flood Levels in the Lower Mississippi River.

The Engineers forming this sub-committee are all members of this community, and all have the welfare of the City and State at heart. All have the highest regard for the ability of the Mississippi River Commission and the Engineer Corps of the U. S. Army. Some of the members of the committee have, in the past, firmly believed in the methods of control of the Mississippi River as advanced by the Mississippi River Commission, and have subscribed to the policy of "levees only" until the occurrence of the recent high water, while one, at least, for many years has advocated spillways as a method of relief.

Due to the peculiar conditions that obtained during the flood of 1922, more fully described hereafter, doubt has developed in many minds as to the soundness of the policy of "levees only." A study of the data has presented arguments in favor of a spillway for the protection of New Orleans that are apparently unanswerable. The problem is a large one, and only a limited amount of time has been available, due to individual duties and the brief period in which this report must be prepared. It is presented, therefore, as embodying our findings with present knowledge and with the assurance that our minds are open to conviction if errors can be shown in the data submitted or in the deductions made.

PAST HIGH WATER RECORDS OVER-TOPPED PERIODICALLY

The history of high waters in Louisiana has been one of recurring record-breaking floods. Unlike St. Louis, the metropolis of the upper Mississippi, we cannot look into the past as far back as 1844 for our highest water record. It seems that each eight or ten years the highest water record at this end of the

valley is superseded by a new high water elevation. When it became known in 1914 that the Mississippi River Commission had finally concluded as to what was going to be the ultimate high water, the people of Louisiana took heart at the prospect that the upward tendency of levee grades had finally come to an end. Their disappointment can therefore be imagined when the rising tide of the 1922 flood not only obliterated the 1912 highest water records, but over-topped the "ultimate high water" elevation from five-tenths (0.5) to one (1) foot at Natchez, Red River Landing, Baton Rouge and Plaquemine, and certainly would likewise have over-topped it at Donaldsonville and New Orleans, except for the lowering effect of the crevasses below the city. But what was more disconcerting was the fact that the record breaking stages on the lower river were attained this year, notwithstanding a stage of one (1) foot below the previous record at Cairo, and four (4) feet below the record at Memphis, and two (2) feet below the record at Helena and fifteen and twenty (15 and 20) feet respectively below the record at Louisville and Cincinnati on the Ohio. **It must be concluded therefore that insofar as future floods are concerned, the 1922 flood height can by no means be considered as the ultimate high water elevation.**

NO ENLARGEMENT OF THE CHANNEL OF THE
LOWER RIVER, AS A RESULT OF CONFINEMENT
BY LEVEES.

There seems to be no doubt on the point that the expected enlargement of the channel of the Lower Mississippi has failed to materialize. The most ardent advocate of the levee system is hard pressed, after two decades of the application of the levee theory, to prove that the river has not even lost some of its cross-section area. It is true there has been some increase in the river discharge at Carrollton during the period referred to, but this increased discharge is wholly attributable to the increase in gage height and slope, and not to any enlargement of the bed of the river. This statement admits of no argument, for the 1,000,000 cubic feet per second that passed the city with the gage reading 16 feet 25 years ago, **still passes the city at no lower reading on the gage.**

The Committee believes that there is no part of the Mississippi River from Cairo to the Gulf upon which the confinement theory can be said to have been given a fairer trial than that part of the river from Baton Rouge to the Forts. The cross-section, to begin with, was more ideal than that of the upper river, and the channel-enlarging effect expected from levees should have been more pronounced in this section of the river, on account of the practically uniform and comparatively close distance from the edge of the bank at which these structures have been erected. Yet, recent high waters, those of 1920 and 1922 show, if anything, an impairment of the discharge capacity and this year with the highest water of record, we find that the maximum discharge quantities of previous floods have not even been equalled.

The community is therefore confronted with the stubborn fact that the provision for passing greater river discharges must be made by either increasing the high water cross-sectional area of the river through raising the levee heights, or by providing lateral openings in the shape of spillways controlled to operate only at a certain agreed upon elevation of the river.

THE APPROVED MISSISSIPPI RIVER COMMISSION GRADE IS TOO LOW.

Your Committee believes that the present Mississippi River Commission grade is not sufficiently high to protect the city adequately against future floods. This grade is equivalent to 25 feet on the Canal Street gage. Had there been no crevasses and had there been unfavorable winds it is likely that the 1922 high water reading in front of New Orleans would have been nearly 24 feet on this gage instead of 22.7. A margin of 1 foot between the approved grade and a deduced water line of a past flood is not considered sufficient freeboard to afford protection against floods of the future.

CONSTRUCTION DIFFICULTIES INVOLVED IN BUILDING LEVEES TO HIGHER GRADES.

If protection is to be afforded by levees alone, then the consequent raising of the levee grade above the present approved Mississippi River Commission grade, brings us face to face with

a problem in construction already beginning to make itself noticed on the lower river.

There is no lack of evidence that the supporting power of the soil along the river banks from New Orleans down and even for a distance of 30 or 40 miles above the city, is being tested nearly to its load limit by the size and weight of the present levees erected on these banks. There has not been a new levee erected in the past ten years within the above limits that has not shown indications of settling foundation—some to a greater extent, some to a lesser extent, but sufficiently marked to cause the observant constructor, whether he be engineer or contractor, to reckon with this factor.

The records of the Board of State Engineers show that as the natural elevation of the ground decreases, the sustaining power of the soil also decreases and although a levee 20 ft. high may be built without subsidence when the ground surface is, let us say 25 feet above Gulf level, a levee 12 feet high cannot be built where the ground surface is 5 feet above Gulf level without experiencing two or three feet subsidence during construction and continued slower subsidence thereafter. How aggravated this physical condition may become in future levee construction when building to a grade of say 3 feet higher than the present grade, or how critical such a tendency to subsidence may become in times of high water due to an increment of saturation added to the embankment resting on a softened base or foundation "must give us pause."

FOUNDATION DEFECTS ARE DISCLOSED ONLY AT
EXTREME STAGES WHEN IT IS NOT PRACTICABLE
TO CORRECT THEM.:

The higher floods for which provision is to be made with the higher levees of increased section, often disclose foundation defects for which no provision has been made nor can well be made. To illustrate: the Ferriday levee on Lake Concordia, which failed this year through a foundation defect, showed no weakness in the previous high water when the Natchez Gage read 53.5 ft. but "blew out" when the same gage read 55 feet. The foundation under the Hymelia levee that broke in 1912 withstood without suspicion a stage of 20.3 on the Canal Street

gage, the previous highest water, but blew out when that gage read 21.5. Nothing was done to this levee in the interval from 1903 to 1912 except to add to its height and cross section. **What levee foundation might have blown out in 1922 had the river stage reached one foot higher, no one knows.**

In the operation of an industrial plant the boiler at stated intervals is given a test of 200 lbs. per sq. inch pressure and then examined for weak points. If none are found a license is given to operate it at 150 lbs. pressure. It is not practicable to put a levee foundation to a similar test to withstand future floods that may exceed past floods, but there would be a certain degree of assurance felt insofar as foundation defects are concerned to know that the levee had previously withstood floods of greater height and therefore of greater pressure.

DIFFICULTY OF CLOSING CREVASSES IN HIGH LEVEES.

Higher levees to hold out higher waters entail another drawback, and that is the relatively greater destruction caused by their failure, should they fail. The difficulty of closing a crevasse is almost in geometrical ratio with respect to the depth of the water. A crevasse in a levee holding out 5 feet of water can be closed without difficulty at slight expense; if the levee is holding out 10 ft. of water it may be closed at a great expense; if there is 15 feet of water it cannot be closed at any expense because the time necessary to complete a structure adequate for the purpose would exceed the usual time taken for the river to get back within its banks.

With the above facts before us—being developments of a levee system with progressively higher grades—it is necessary and important that a flood relief device for lowering flood heights should invite attention and study.

This Committee is not unmindful of the reasons that have been advanced against the use of spillways for lowering flood heights on the Mississippi River. Indeed, some of its members have in the past, strongly argued against the proposition they are now advocating. This reversal of opinion though, is based on a reversal of, or non-fulfillment of generally accepted results

that were expected to follow the application of the confinement theory.

EXTENT OF FLOOD RELIEF FROM THE POYDRAS CREVASSE.

The Committee believes that the oft-expressed statement that "the relief in flood height afforded by crevasses is negligible and local in extent," was not borne out in the case of the Poydras crevasse, which in width and volume could hardly be classed with such crevasses as Belmont or Nita, or the later Hymelia, but on account of discharging practically into tide level, caused a reduction in flood height, actual and in prospect, of nearly three (3) feet at New Orleans within a period of two (2) weeks. The Committee furthermore believes that the lowering effect of the Poydras crevasse on river gages instead of being local is traceable as far up the river as Donaldsonville and as far down the river as Fort Jackson, a combined length of river of 160 miles, and submits data to sustain these statements made.

THE MOST FORCIBLE ARGUMENT USED AGAINST SPILLWAYS QUESTIONED.

The Committee believes that there is room for doubt in the generally accepted statement that the sedimentary material carried in suspension is at all times to the limit of the river's capacity to so carry material. This is an assumption that the opponents to the spillway theory have used with telling force in discussing this question, the line of reasoning being as follows: The operation of a spillway will cause steeper slopes and greater velocities in that part of the river above the spillway and flatter slopes and slower velocities in that part of the river below the spillway; That the silt-transporting power of a stream varies as the sixth power of the velocity, consequently any reduction in slope, is followed by a reduction in velocity and will cause a reduction in the silt-transporting power of the stream to a surprising degree, with the result that material carried in suspension is deposited in the main channel below the spillway and in a short time will form a bar or will reduce the cross-section of the river below the spillway to such an extent that the cross-section area of the river below the opening plus the area of the

spillway will be no greater than was the area of the river before the spillway was constructed.

It is acknowledged that if such were the case, namely, that if the slightest reduction in the velocity of the main stream would cause a deposition of the sedimentary matter carried in suspension, then it would be futile to pin any hopes of getting permanent relief by means of a spillway.

THE RIVER DOES NOT CARRY ITS GREATEST LOAD OF SILT AT HIGH STAGES.

In the absence of any readily available published data bearing upon this important point, your committee consulted the records of the New Orleans Water Purification Plant where daily observations are made of the turbidity of the raw water, and has platted results which it is believed will be interesting to students of the Mississippi River. (See Turbidity—Stage Chart.) The intake of the pipe to this plant is located at the lower end of the mattress-protected Carrollton Bend at an elevation of about 4 feet below low water elevation, and the pipe is carried on a trestle extending more than a hundred feet beyond the shore line. The samples taken from a pipe located as above described, are believed to be fairly representative of the condition of the Mississippi River water with respect to its content of suspended material.

The chart shows that contrary to prevalent opinion there is no direct ratio between the higher gage heights and the degree of turbidity of the water during floods and the impressive fact is that the maximum turbidity in flood years occurred when the Carrollton gage was less than 14 feet. Therefore if the river is capable of carrying in suspension its maximum load of silt with slopes such as it has at stages six or seven feet below the maximum height, the fear that it may drop its sedimentary load as a result of lowering its height below the spillway may justly be questioned.

The Committee is of the opinion that unless it can be demonstrated as a fact by measurements that a shoaling has occurred below the Poydras crevasse, and which cannot be removed by the ordinary flood stages of 16 feet or less, that the spillway

project recommends itself and presents no difficulties in construction that cannot be overcome within reasonable cost.

LOCATION OF PROPOSED SPILLWAY DISCUSSED.

To obtain the greatest benefit for New Orleans such a structure should be located as near as practicable to the city. Three locations were discussed, (a) one above the city discharging into Lake Pontchartrain, (b) one below the city, on the west bank, discharging in the bayous and bays to the west of the Mississippi, and (c) one below the city discharging into Lake Borgne.

It was recognized that a spillway of proportions ample to afford the desired relief if located above the city and discharging in Lake Pontchartrain would involve the greatest disturbance to existing lines of communication entering the city from above, and would complicate the drainage of all that territory located between the river and the lake raising the level of Lake Pontchartrain several feet. The hazard of overflow in the rear of the city in the event of a storm while the spillway was operating was also an adverse condition to be reckoned with.

The location on the west bank below the city did not offer this last named objection, but lacked the short direct route to tide level that is recognized as so essential to get relief effectively.

A location six (6) miles below the Barracks, on the city side discharging into Lake Borgne which is an open body of water connecting with the Mississippi Sound, was most favored, on account of its short direct route being slightly over five miles, the absence of any complicated disturbance to drainage conditions, a minimum interference with rail or vehicular communication with the territory below, and finally on account of this location involving the least cost. It was also noted that at this location the present cross-section of the river is approximately 10 per cent. in excess of the cross-section of the river at Carrollton and could therefore stand shoaling to some extent should such a condition materialize following the operation of the spillway.

TENTATIVE DIMENSIONS.

As to tentative dimensions and capacity, the committee suggests a width of 6000 ft. with a discharge of 250,000 cu. ft. per

second when the river reaches a stage of 21 feet on the Canal Street gage or 20 feet at Carrollton, and with the crest of the dam fixed at an elevation of 16 feet on the Canal Street gage or 15 feet on the Carrollton gage.

The discharge through the spillway and the relief in flood height obtained at various stages is indicated in the statement below:

Carrollton Gage	Canal St. Gage	Discharge through the spillway Cu. ft. per second	Velocity Ft. per Sec.	Relief in Flood height at N. O.
15 ft.	16 ft.	0	0	0
16 ft.	17 ft.	30,000	5.0	0.5 ft.
17 ft.	18 ft.	65,000	5.4	0.9 ft.
18 ft.	19 ft.	115,000	6.4	1.9 ft.
19 ft.	20 ft.	180,000	7.5	3.0 ft.
20 ft.	21 ft.	250,000	8.3	4.2 ft.

ESTIMATED COST.

It is estimated that such a flood protection measure can be completed at cost of between \$4,000,000 to \$5,000,000 including the purchase of land for right of way, construction of side levees, river bank protection work at the location of the spillway, concrete spillway, protective aprons and creosoted timber bridge for existing railroad and highway communication.

RECOMMENDATION.

The Committee does not advocate the construction of the spillway in lieu of undertaking the raising of the levee line to the Mississippi River Commission grade. Its recommendation is that the spillway should supplement the proposed levee construction as an additional factor of safety not sufficiently provided for by levees built to existing standard grades. It knows of no instance in this country, or in Europe where the super-elevation of the crest of a dam above past high water heights is as little as in the case of Mississippi River Levees. In the absence of any topographical area near this city sufficiently elevated that might serve as a refuge for the thousands of persons who would be driven from their homes in the event of an overflow, the protection of this city against inundation by the flood waters

of the Mississippi River is the paramount necessity facing this community. Conservatism in this regard cannot be excessive.

The following charts accompanying this report:

No. 1. Gage-Discharge Relation at Carrollton showing reduction in discharge capacity as compared with previous floods.

No. 2. Gage relations of the New Orleans and Donaldsonville gages compared with the Baton Rouge gage and showing graphically the reduction in flood height caused by Poydras Crevasse.

No. 3. Hydrographs from Red River Landing to Fort Jackson showing the crevasse effect at various river stations.

No. 4. Turbidity-Stage chart, showing that the greatest sedimentary load carried by the river does not occur at times of highest stages.

Nos. 5 and 6. Typical cross sections of the river at the location suggested for the spillway, showing an excess of about 10 per cent. in area as compared with the cross section of the river at Carrollton.

No. 7. Discharge curves for the proposed spillway by the Merriman formula and by the Francis formula.

No. 8. Stage-Velocity relationship for 1922 as obtained from the Carrollton Discharge observations made by the Mississippi River Commission.

Respectfully submitted,

John Klorer, Chairman,
W. B. Gregory,
J. B. Kemper,
Hampton Reynolds,
Arthur M. Shaw,
Allison Owen.

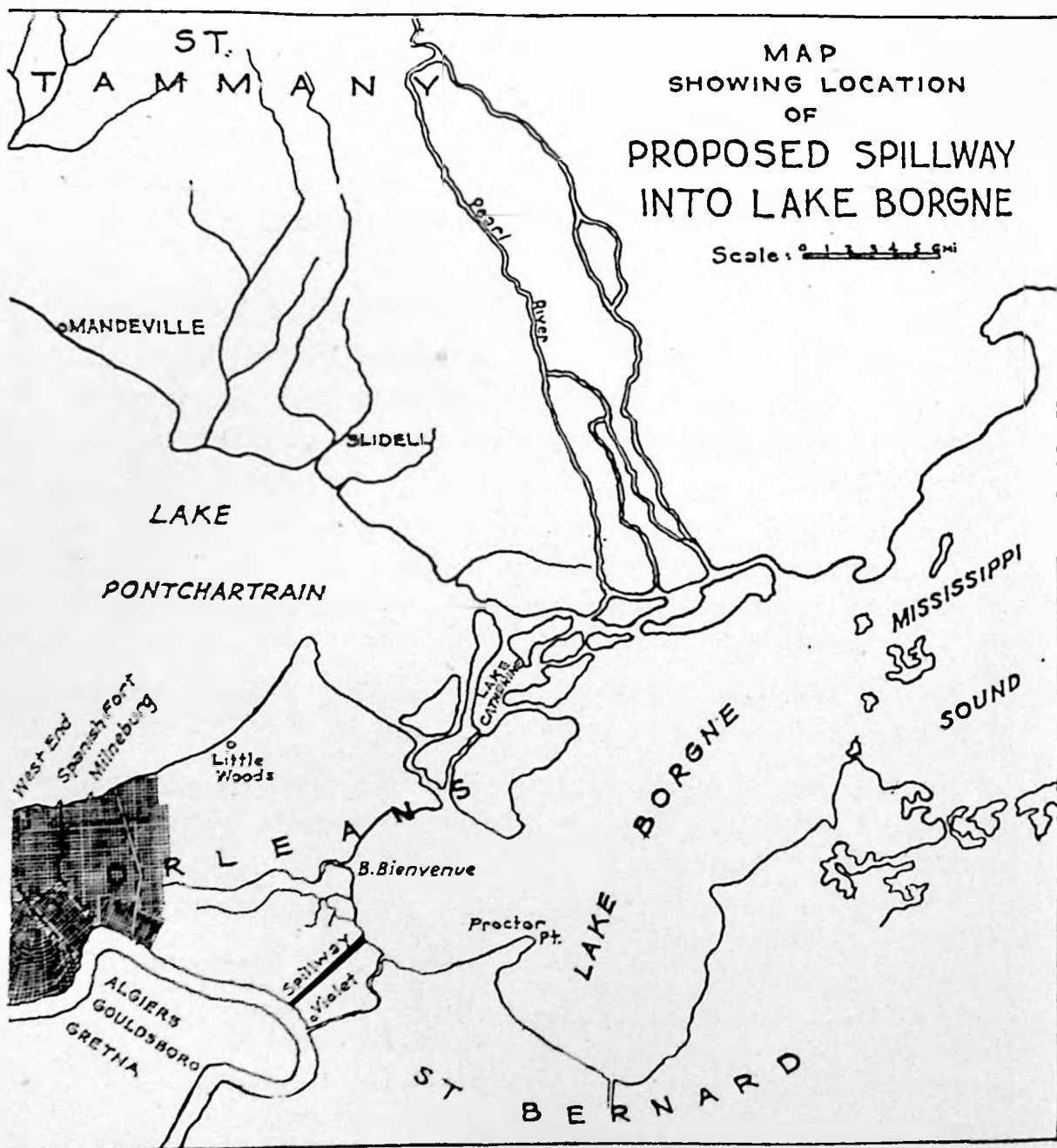




CHART 2

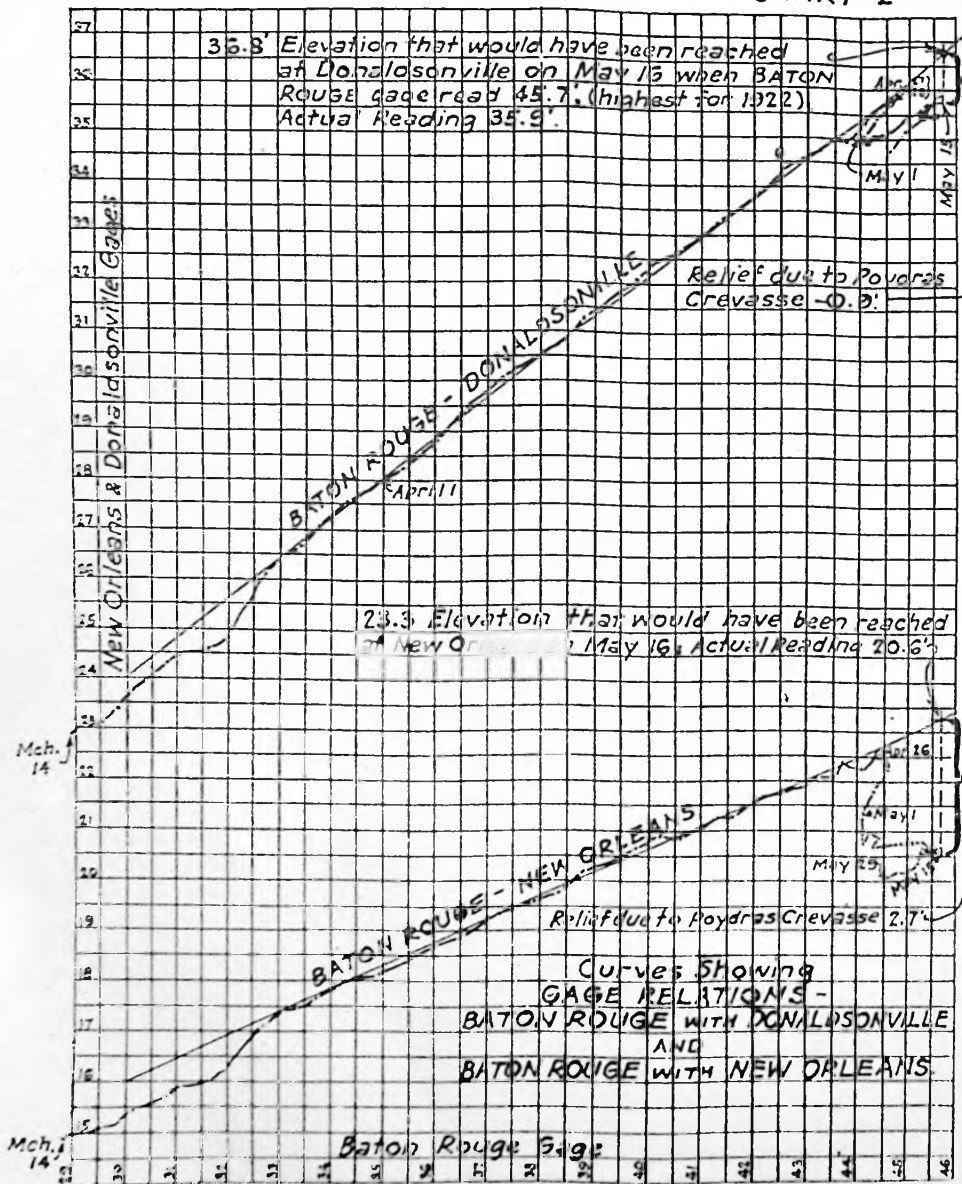
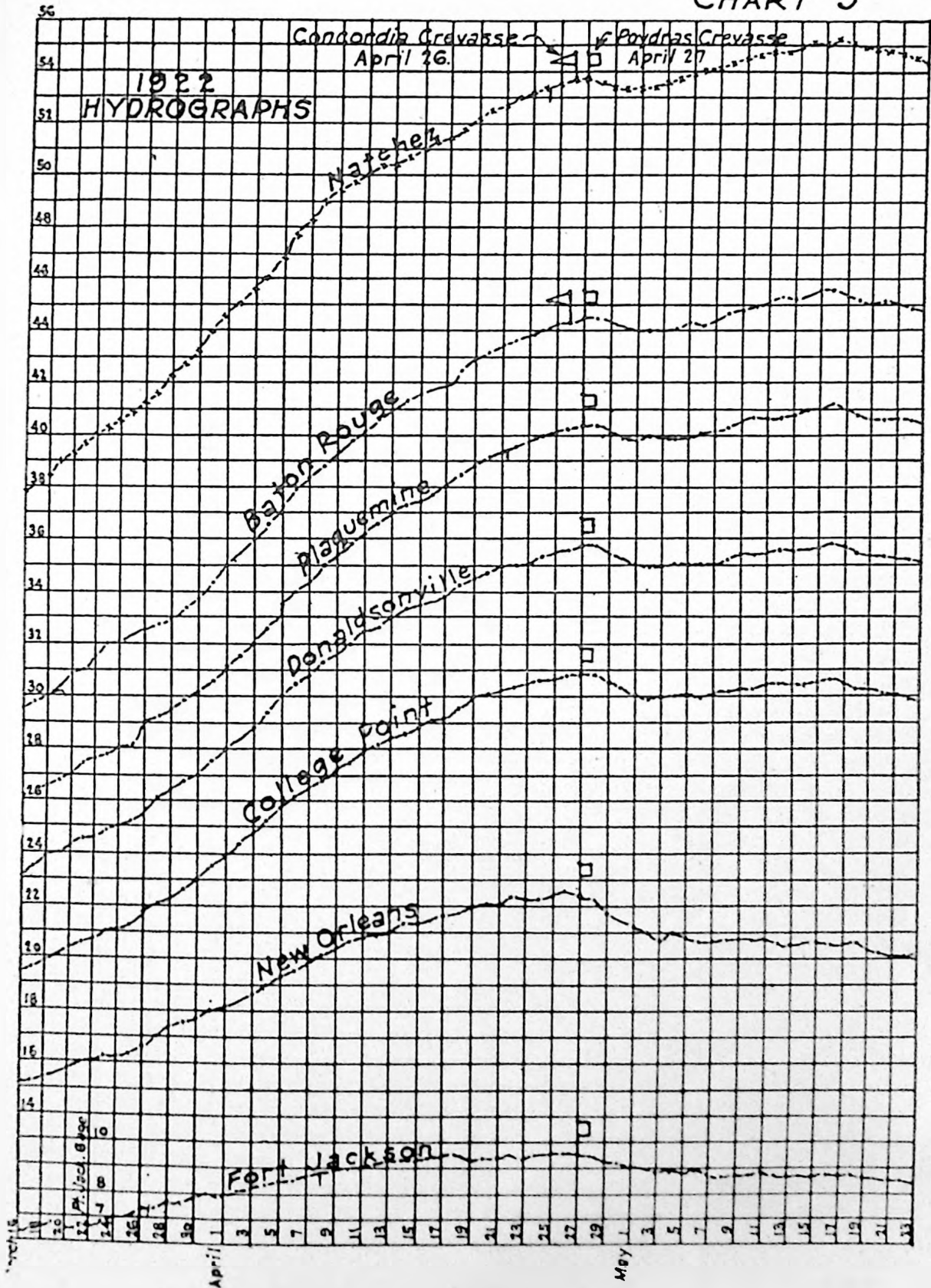


CHART 3



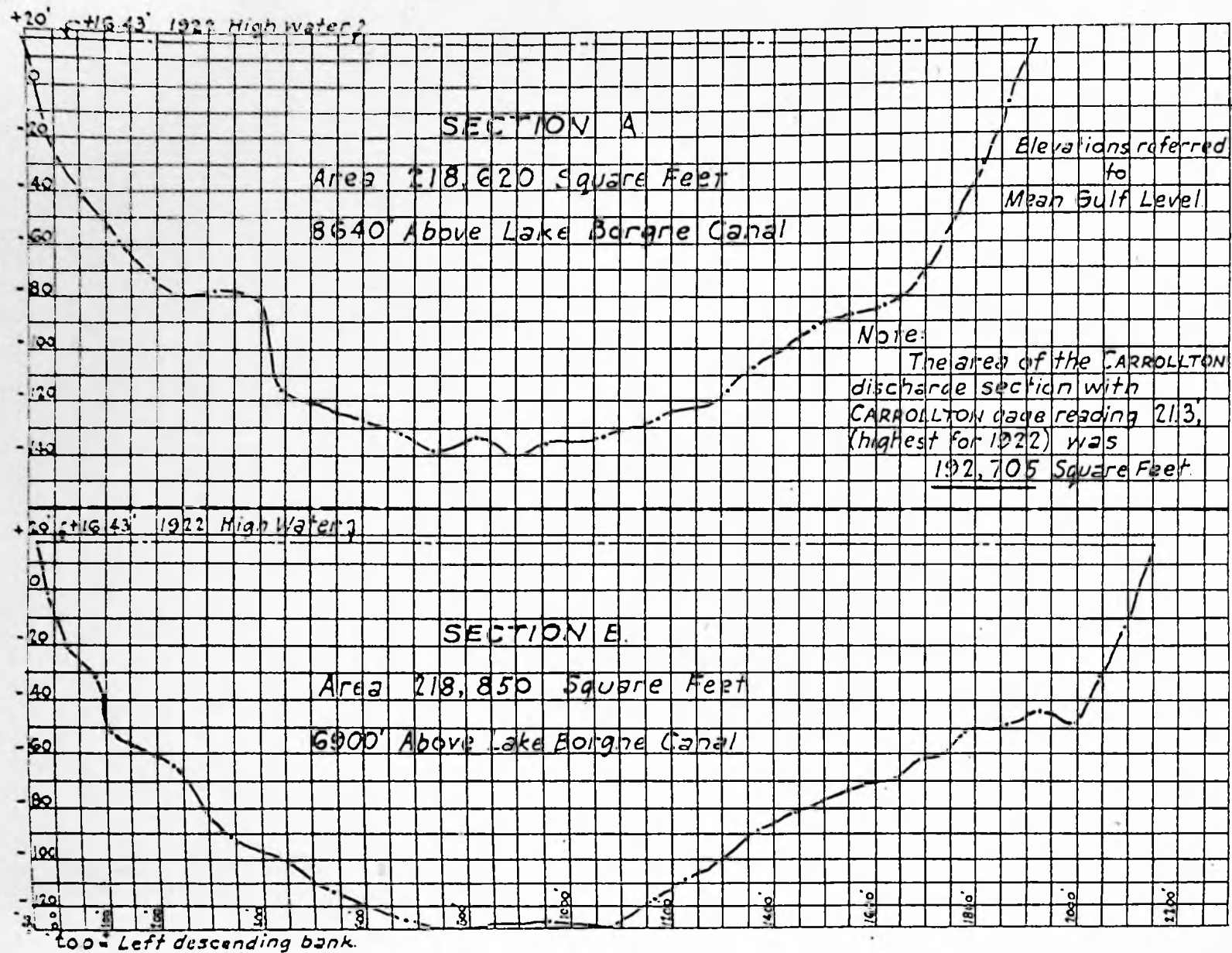


CHART 5

CHART 4.

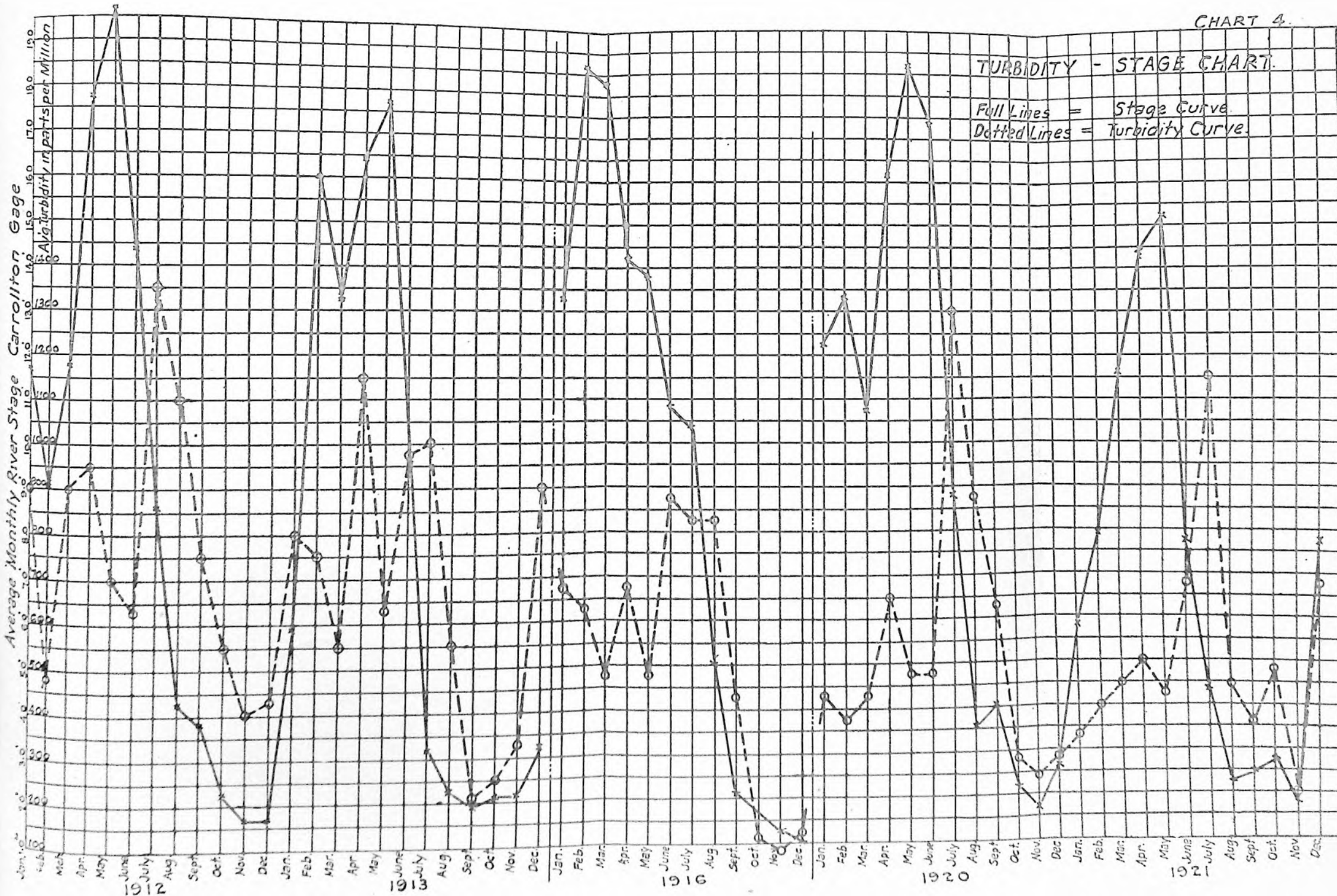


CHART 6

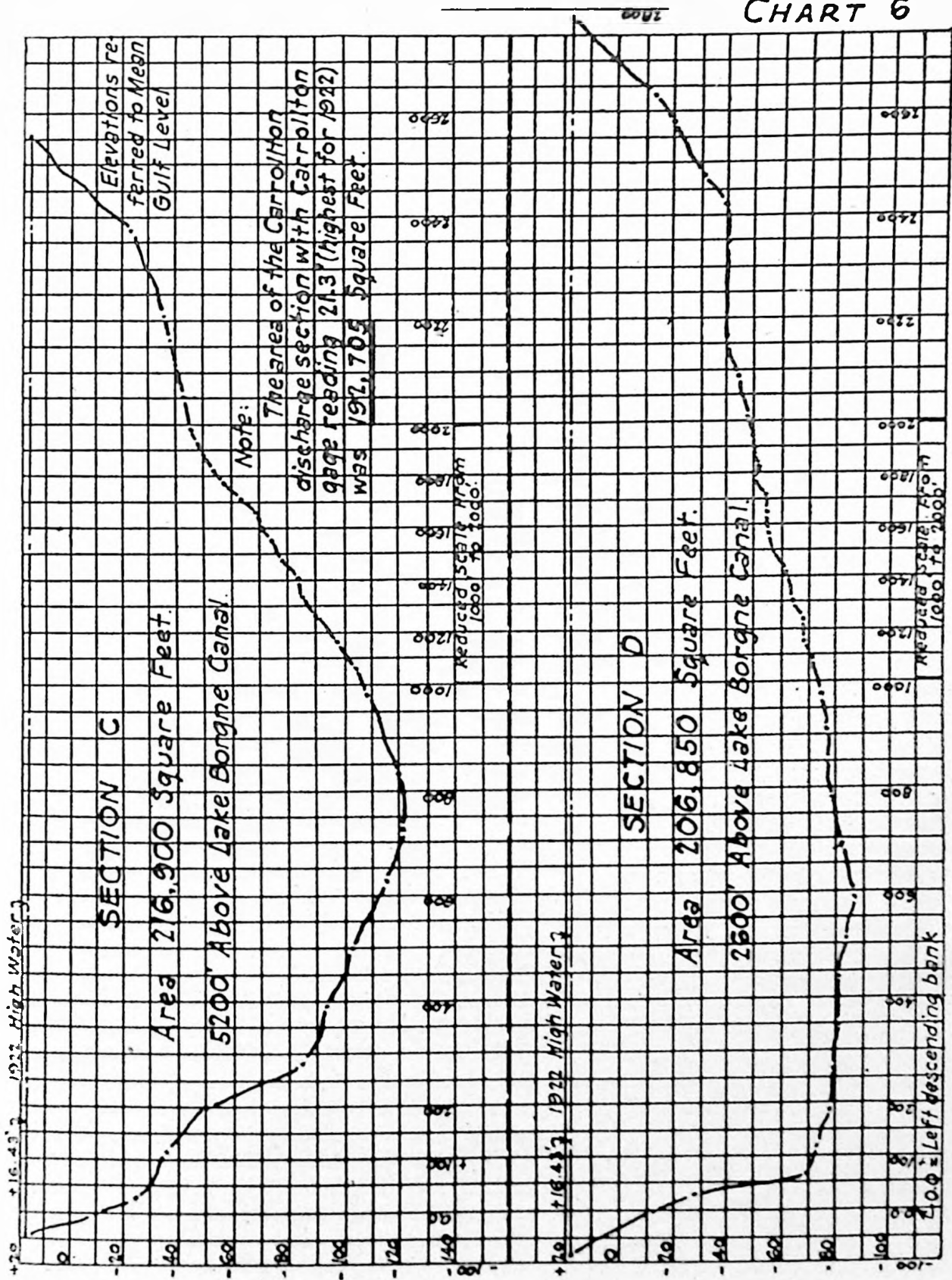


CHART 7

RIVER STAGE - DISCHARGE CURVES FOR 6,000 FOOT (h) SPILLWAY.

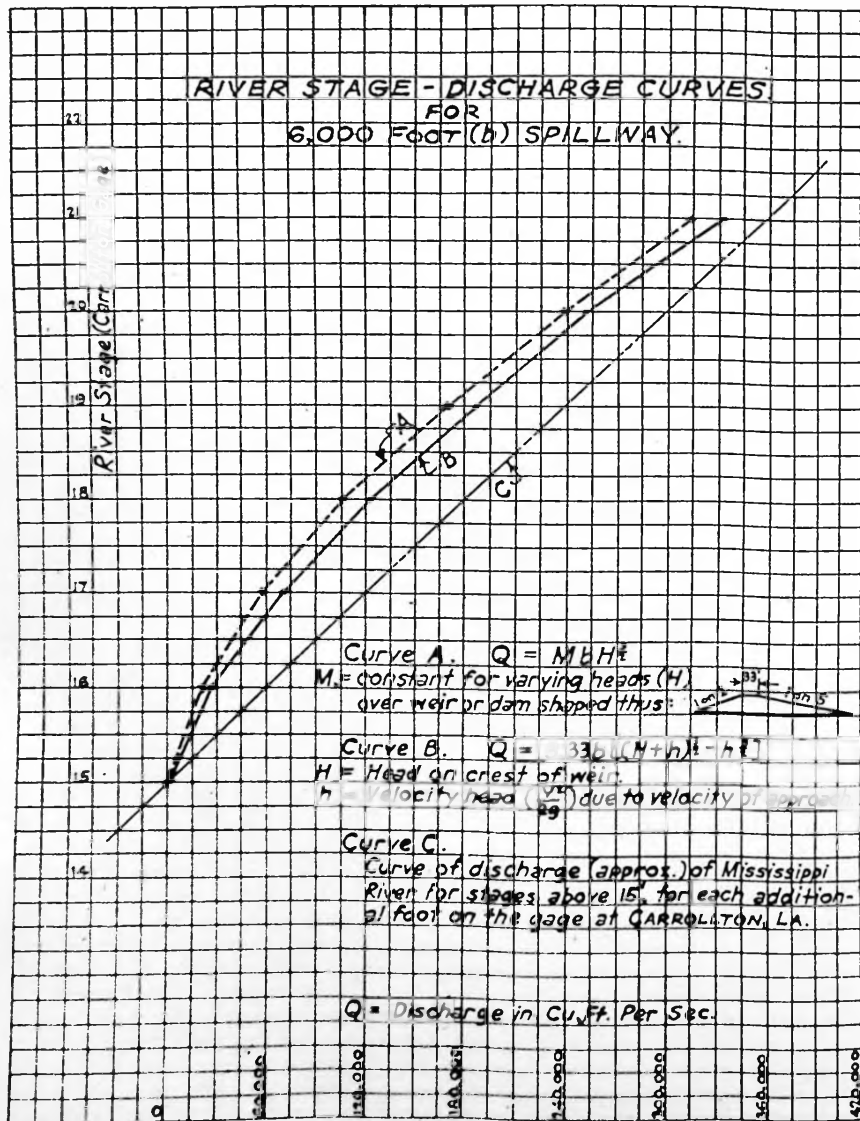
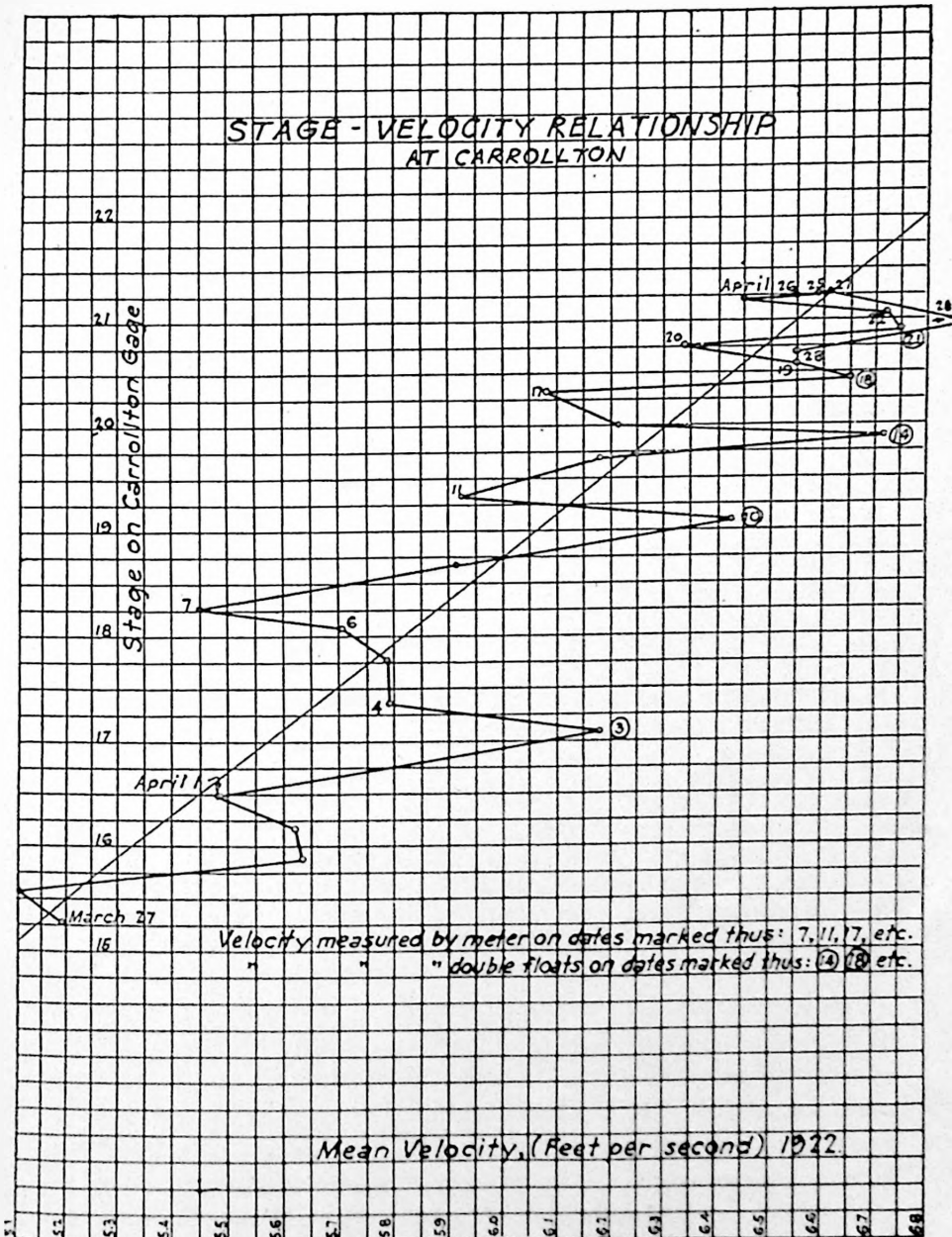


CHART 8.



REDUCTION IN THE RIVER FRONT FIRE RISK

By ARTHUR M. SHAW.

Within the past few months, New Orleans has been visited by three disastrous fires along its river front, each being attended by loss of life and property, the total value of the latter reaching many millions. In addition to this, these fires have interfered seriously with the business of the port and have been a serious menace to other property which, by strenuous effort and good fortune, has been saved from destruction. The seriousness of these losses, and especially the ever present danger of their repetition on even a larger scale, should furnish sufficient incentive for every citizen of New Orleans who is any way connected with the design, construction, maintenance, use or protection of similar facilities to consider all means which may be employed to prevent their recurrence.

Engineer charged with the design and maintenance of wharves, dock sheds and similar structures are especially interested in the following features.

Suitability of various available construction materials.

Design of structural details to prevent or to retard ignition from within the structure or from outside exposures.

Design of details to prevent or retard the spread of fire from one portion of the structure to another.

Design and location of protection appliances, including water mains, sprinkler systems, hydrants, hose houses and reels, chemical extinguishers (and where oil is stored in quantities, the newer foam system for smothering oil fires).

It is possible that engineers might also devise some means of protection against the "harbor oil" menace though this is considered more as a matter to be controlled by municipal and port authorities. It is a real menace, however, which probably never will be entirely eliminated though every effort should be made to prevent the emptying of waste oil in the river as well as to prevent its deposit at points where it may add to the fire hazard. This dumping of oil is done principally at night though oil was being thrown overboard in bucketfuls from one

vessel while I was engaged in taking photographs of the burned Government wharf on September 20th.

For the purpose of this paper, the fire at the Army Supply Depot will be used as an illustration as this is still fresh in the minds of all the members of this Society, many of whom are more or less familiar with the burned structure and its surroundings.

A considerable portion of the following description of the wharf and building, as well as a number of other smaller portions of this paper, are copied from an article which was contributed by the writer and was printed in the *Engineering News Record* in its issue of October 5th. With this explanation and apology, the use of quotation marks to cover occasional repeated matter will be dispensed with.

DESCRIPTION OF WHARF

GENERAL

The burned structure was owned by the U. S. Government (having been built during 1918 and '19 as an adjunct to the Army Supply Base) but was operated, under lease, by the Board of Port Commissioners, for commercial purposes. It extended for a distance of 2,000 feet along the left bank of the river, with its center near the foot of Poland St. The overall width of the wharf was 171 feet, the two-story building being 140 ft. wide, the rear, or land side, platform 11ft. and the water side platform 20 ft. wide. Height of floors and other elevations are given in the following table, the elevations being referred to Cairo Datum:

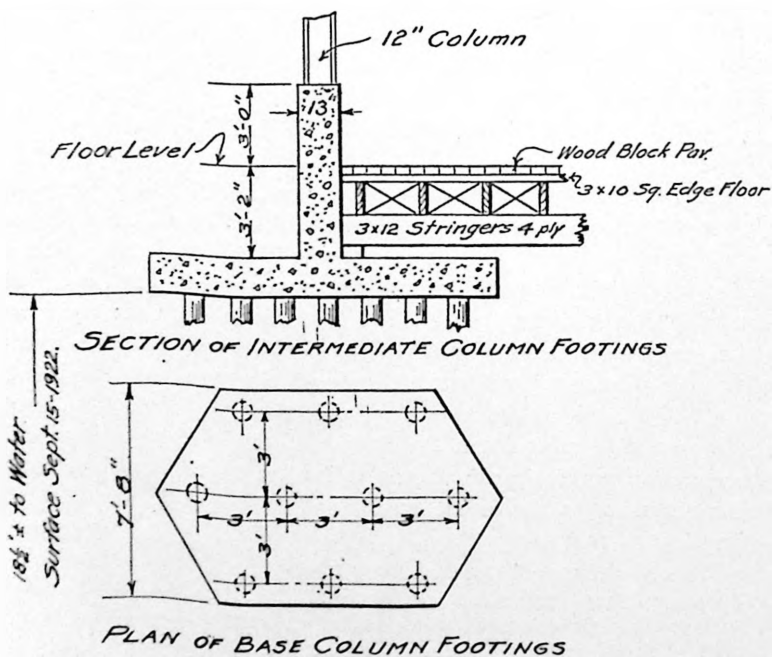
Mean Gulf Level.....	20.43
Water surface at time of fire (about.....)	22.8
Base of fire walls.....	38.7
Base of concrete footings of steel columns.....	41.7
First floor level.....	46.5
Base of steel columns.....	49.5
Second floor level.....	63.5
Wall plate.....	75.5
Belt Line tracks, rear of wharf (about).....	42.5
Extreme low water (Dec. 12, 1872).....	17.30
Ordinary low water.....	21.0
High Water—1921 and 1922.....	40.1

This indicates an exposure of supports under fire wall, on the date of the fire, of nearly 16 feet.

It should be noted that none of the elevations shown in the above tabulation may be taken as absolute, owing to the regrettable fact that there is a lack of uniformity among the various public engineering agencies in the assumed elevation of datum planes.

STRUCTURAL DETAILS

The wharf and building were supported on a substructure of creosoted piles and timbers. Clusters of ten piles supported the concrete column footings which were spaced on 20 foot centers in each direction (See Fig. No. 1 for details). Sash



— FIG. 1 —

and diagonal braces were of three inch plank, bolted to the piles. Four ply stringers were employed, built up of 3x12 planks bolted together. Joists were also of 3x12 and square edge rough 3 inch planks were used as a sub-floor. On this was

placed a sand cushion for the wood block paving of the main floor. The second floor was of plant.

All columns, cross girders to carry the second floor and the roof framing were of structural steel, the heaviest members used being 24 inch I beams.

The roof was of pine sheathing covered by 3 ply "prepared" roofing, without gravel topping. The outside wall covering was of corrugated, galvanized iron.

Cross fire walls were constructed at intervals of 200 feet there being nine intermediate and two end walls. These each rested on three rows of piles and were constructed as indicated by Fig. No. 2. As indicated in this drawing, these walls were 13 inches thick from the point support of floor joists to base of columns (3 feet above 1st floor level) decreasing to eight inches thick at this point excepting that at 20 foot intervals (where the steel columns were encased within the wall) the thickness of wall was increased, resulting in a double pilaster with a total thickness of 23 inches. It is apparent that the fire walls were built up to a level of the base of columns, the steel frame work then erected, followed by the pouring of the upper portion of the walls. Fire doors, of approved design, protected all openings through the fire walls. Each wall terminated in a T head which formed a fifteen foot section of the outer walls and a fifteen foot section of concrete platform was constructed at the ends of the walls to prevent communication of a fire from one section to another along the outside freight platforms.

FIRE FIGHTING EQUIPMENT

Recesses with concrete sides and tops were let into each of the T heads forming a hose house, opening onto the front and rear platforms. Each hose house was equipped with a double opening hydrant, hose cart, and ample supply of hose, extra nozzles, axes and other emergency equipment. Monitors rising above the roof level were placed at each end of each of the fire walls.

The interior of the building was well supplied by 40 gallon chemical extinguishers, mounted on wheels, and 2½ gallon hand extinguishers. A complete sprinkler system was installed in both the first and second story.

each of 50,000 gallon capacity and they are placed at an elevation of about 100 feet above the wharf. A twelve inch longitudinal main ran under the wharf floor, along the line estimated to be about 100 feet from the land side. This main

was fed through one 10 in. and two 12 in. cross mains leading from the city supply and from the storage tanks. All water mains under the wharf were supported by metal hangers or by wooden cross supports spiked to piles. The hangers were $\frac{3}{4}$ in. round steel supported at each end by a $\frac{5}{8}$ x 3 in. lag screw set in the wooden stringers or joists. One of the hangers, which had failed by the pulling out of a lag screw fastening, is shown by Fig. No. 3.

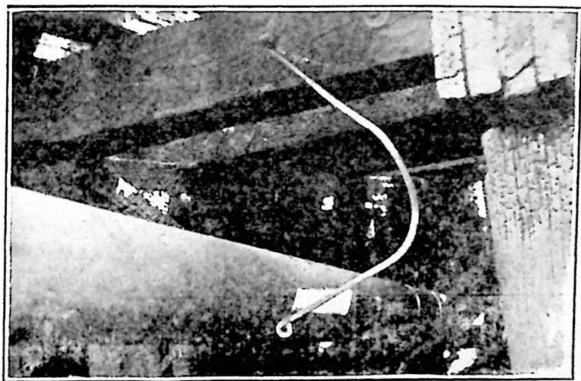


FIG. 3.

A water main support which failed.

Three tracks of the Public Belt Railway ran parallel to the wharf at the rear, all tracks being carried on a creosoted pile trestle. Floors of cars standing on these tracks were practically on a level with the lower floor of the warehouse. Cars standing on the track nearest to the warehouse cleared the platform by about 3 ft.

The only "exposures," as the term is used in fire protection parlance, consisted of the three track trestles and cars at the rear and the Desire St. shed (used by Vaccaro Bros., as a fruit wharf) which was upstream from the burned structure and separated from it by an open basin 180 feet in width along the river front.

WEATHER

The U. S. Weather Bureau station (located about 3 miles southwesterly) shows weather conditions during the night of the fire as follows:

Wind slightly variable in direction but from a generally northerly quarter, practically at right angles to the axis of the burned wharf. Velocity 4 to 9 miles per hour.

Light showers from eight o'clock to 10.35 when rain ceased.

ORIGIN AND PROGRESS OF THE FIRE

While the following description is stated in the form of established fact, it must be admitted that there is still a decided difference of opinion in regard to certain details and it is quite possible that some of the "facts" herein recorded may be found to be erroneous. Every effort was made, however, to secure reliable data and it is believed that so far as they effect the engineering questions involved, the statements may be accepted as correct.

The fire was first discovered at about 8.15 P. M., in a car load of burlap which stood on the track nearest to the wharf. It is probable that the fire had reached quite an advanced stage

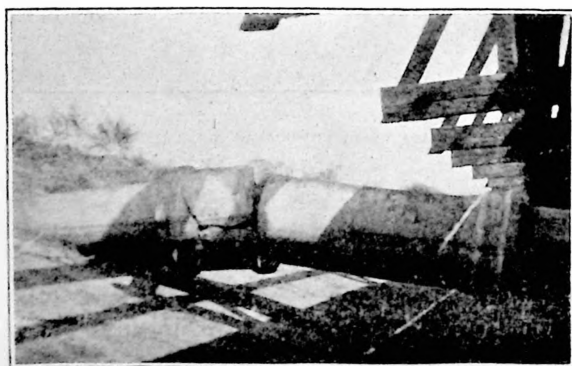


FIG. 4.
Broken cast iron sleeve in 12 in. main—about 14 ft. to landward from hanger shown in Fig. 3.

in the car of burlap before it was discovered. After giving the alarm, Government and Dock employees attempted to put out the fire by the use of the hand hose outfits before described, but in a short time (probably not over 15 or 20 minutes after the fire was discovered) the water pressure dropped so low that

the hose became ineffective though at the outset the force was so great that it required two men to each nozzle.

Under the influence of the northerly wind, soon augmented by the flue like effect of the hot air passing under the floor of the wharf, the fire spread rapidly to all portions of the substructure. From reports of dock workers and men on the vessels on the river side, it is apparent that the draft created under the floor was so great that the fire spread for the whole width almost instantly after it had started under the windward side.

The fire communicated with goods stored on the main floor, first by passing up through the 18 inch grating protected openings provided to serve as drains when scrubbing down the floors, and later by burning through the joists and sub-floor. Several sections of the substructure were burning before the fire reached the interior of the wharf.

BEHAVIOR OF MATERIALS AND APPARATUS

WOODEN MEMBERS

All of the piling, braces, caps, joists, sub floor and block paving were of creosoted Southern pine. This material had been in place for from 3 to 3½ years and with the exception of the subfloor and paving blocks had been fully exposed to weathering for that length of time though very little of it was exposed to the direct rays of the sun.

From the appearance of piling and of timbers of considerable thickness which were exposed to intense heat (but not to direct draft) it appears that such members did not ignite readily nor did they burn to any great depth. A considerable portion of the piles which were in direct line of the draft are still standing though badly charred. These still retain from 10 to 60% of their original section. Several cases were noted in which the bolts used at sway brace connections had burned out a hole large enough for the bolt and its cast iron washer to pull through the pile which was left standing. Practically all of the thinner members which were exposed to the main fire, such as bracing, floor joists, etc., were destroyed.

A search through the debris brought to light hundreds of the wooden paving blocks. Specimens which appeared to be

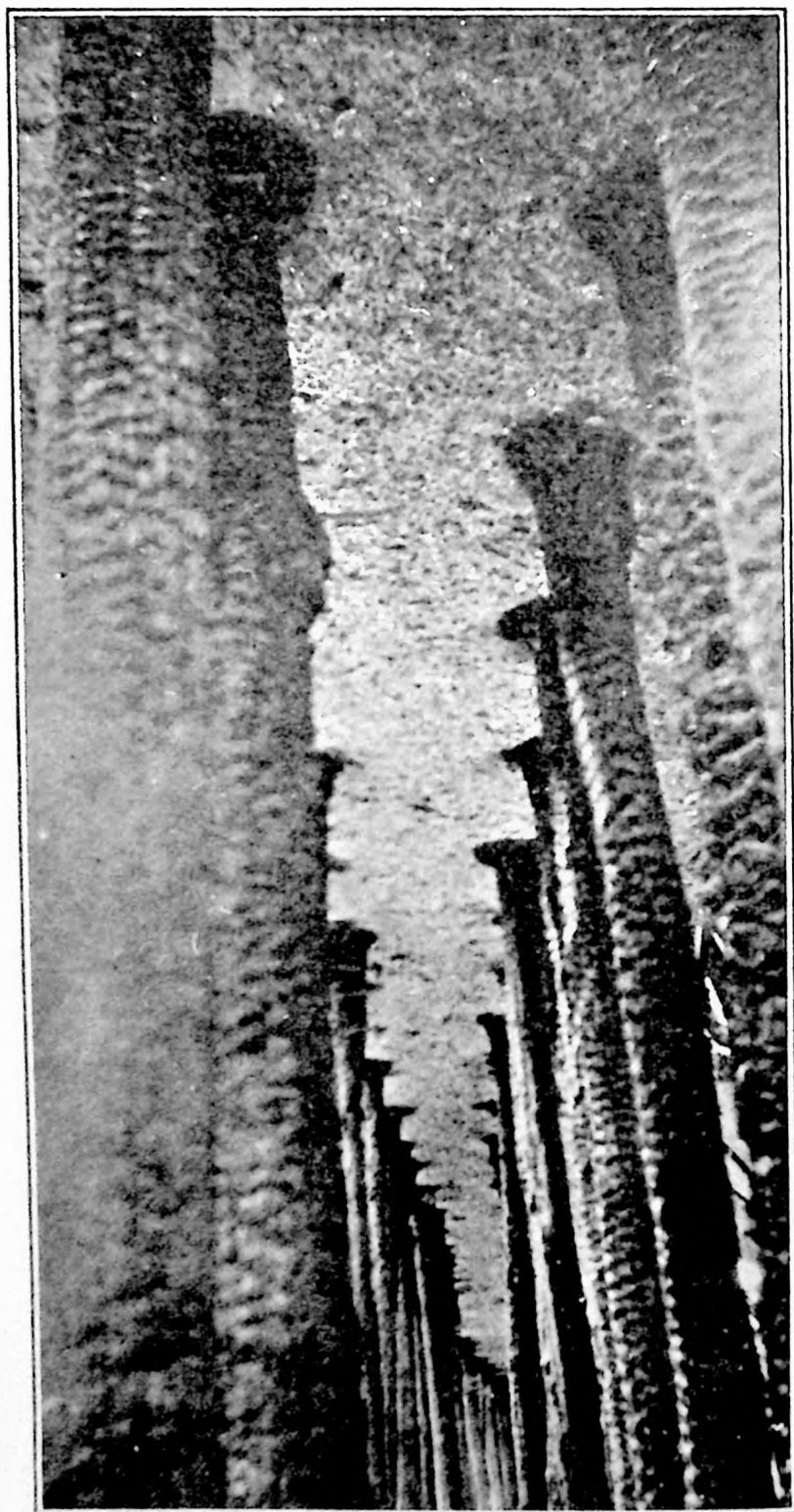


FIG. 5.
Base of fire wall. Viewed from below.

typical of those from the landside platform (Specimen A) and others from the central part of the building (Specimen B) were selected. The condition of these specimens was as follows:

A.—Block intact, a horizontal section through the center showing original outline, slightly charred on under side and burned through for about one-fourth of depth from top. Vertical fracture shows about three-fifths of thickness of unscorched wood with evidence of creosote present. Considerable variation was noted, some blocks being more deeply charred and some in such condition that they would be suitable for relaying if turned over.

B.—This block had lost much of its section, both at ends and sides, and is charred through. Slight trace of original color of the wood. Mechanical strength below that of ordinary charcoal. There can be not doubt that many of these blocks were reduced to an ash though some charred remnants may be found under almost any portion of the building and occasional blocks were discovered which were in much better condition than the sample selected as typical.

Both specimens were taken from locations where the sub-structure (excepting the piles) was completely burned.

As the interior of the building was untenable long before the fire had worked above the floor, no accounts of eye witnesses of the burning of the blocks could be obtained.

The impressions gained from an observation of the ruins and from conversation with competent observers, relative to the inflammability of the creosoted members are as follows:

- 1.—Creosote treatment, if followed by a few months of seasoning, increases the ability of wooden members to resist ignition and retards burning after ignition.

- 2.—Excepting where conditions are favorable for further burning (such as a strong wind and exposure to other burning members) fire in creosoted timbers of heavy section will go out even after it has made considerable headway.

- 3.—Continued intense heat causes creosoted materials to give off a gas which is inflammable and which may aid in the spread of fire after it has reached an advanced stage. The

burning of this gas, and of the oils exuded by heated timbers, causes a more dense smoke than burning untreated timbers.

4.—The amount of oil and gas which will be given off by creosoted timber varies with the intensity and length of time of application, of the heat and inversely as the degree of seasoning.

5.—Creosote treatment does afford substantial resistance to burning in a small fire or in any fire during its early stages but *may* add to the danger of communication to other materials as the fire reaches a more advanced stage.

While the foregoing are given as impressions, it should be noted that the added resistance to fire afforded by a creosote treatment has been noted by other observers and established by laboratory tests.

A typical result is shown of a test described in the Proceedings of the National Fire Protection Ass'n of 1915 (page 133). Five specimens each of untreated air seasoned and of untreated kiln-dried and seven specimens of creosoted, Southern pine were tested on an electric plate, heated to 450° C. (842° F.). In discussing this test, it is stated that: "the conclusions drawn from these preliminary determinations were that creosoted timber, after drying about six months, is much less inflammable than similar timber in an untreated condition." The creosoted test pieces made a more favorable showing both as to initial ignition and loss of section during a given period of application of the heat.

While certain valuable data may be secured from examinations such as have been made of burned structures and from small scale laboratory tests, the subject is of too great importance to justify the engineers and the commercial interests involved in forming conclusions from such data. Nothing but large scale tests, conducted as nearly as possible under conditions parallel to those existing on our river front, should suffice as a guide to future practice. These tests, financed jointly by commercial and public organizations and supervised by a special committee, the personnel of which would insure unbiased action, could be arranged easily and would be of incalculable benefit to this port and to the whole country. It is urgently recommended that such a test, or series of tests be made.

CONCRETE

As will be noted from the general description of the building, the use of concrete was confined to the column footings and to the fire breaks. From the nature of the stores burned and of the substructure, it is certain that comparatively high temperatures were reached in certain sections of the building but there is no evidence of the excessively high degrees of heat which have been reached in such conflagrations as the Baltimore and the San Francisco fires.

Severe spawling of concrete was noted, especially at the corners of the concrete footings where they were exposed to the maximum heat. In a number of instances, exposed corner reinforcing rods were noted but in no case did the failure of concrete appear to be the result of weakening by disintegration. Reinforcing rods were exposed only in such members as had been subjected to severe treatment such as falling (as a result of failure of their supports) or by receiving blows or twists from falling steel members. Corner reinforcing rods of column footings were covered by four inches of concrete. Examination of concrete exposed to maximum temperatures showed signs of disintegration (and frequently spawling) to a depth of nearly two inches on flat surfaces and as much as four or five inches on right angle corners. After knocking off that portion which had become softened by the heat (or heat and water) the inner portion was found to be dense, hard and of a uniform texture. Small gravel was used as the coarse aggregate. No evidence could be found, even in the most exposed samples, of a splitting or disintegration of the individual pebbles forming the coarse aggregate. The concrete had the appearance of a 1:2½:4 mixture. In each case noted of broken concrete footings, the fracture was at the bottom of the anchor bolts. Two bolts were used for each column. These were 7/8" x 18" and they were run through an angle bar (estimated to be about 3x3x12 inches) which served as a washer at the lower end. It was on the plane of this angle bar anchor that the fracture occurred.

Several portions of fire walls, are still standing though with the exception of short portions at the T heads, these are invariably broken off at the elevation of base of columns, 3 feet

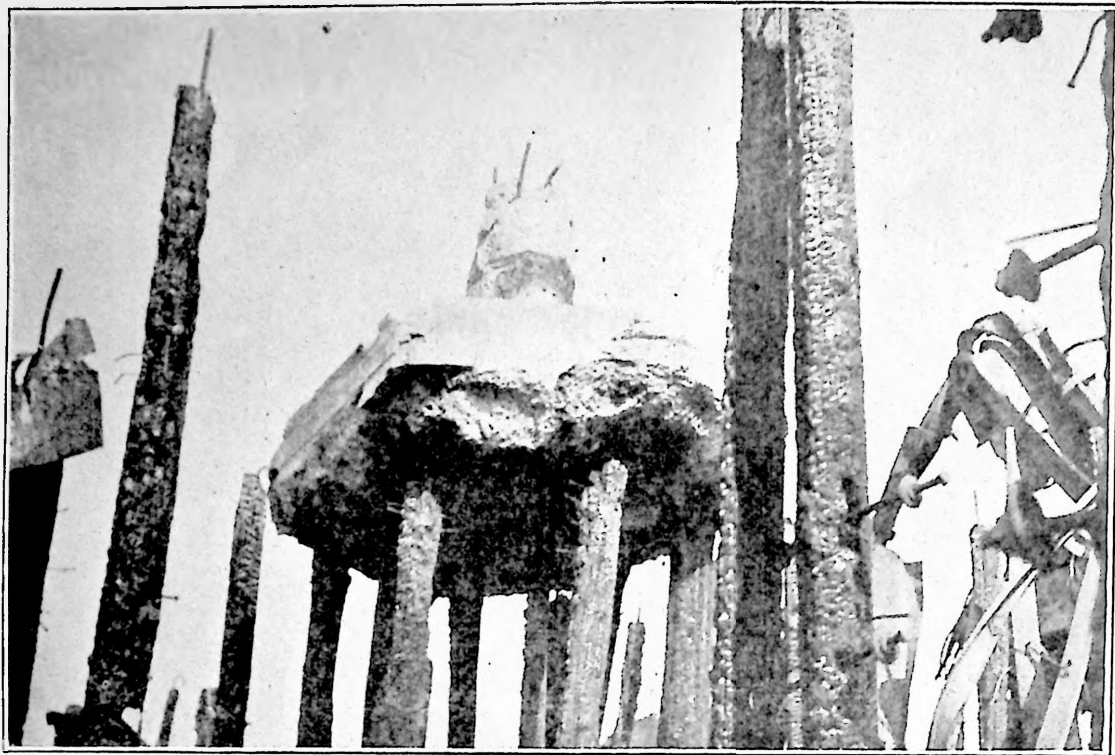


FIG. 6.

Concrete footing for steel columns. Eight of the original ten piles still standing.

above floor level. From an examination of the ruins, it is apparent that those walls which did not fall from burning of pile supports were pulled over by the failure of the structural steel frame work with which they were incorporated. This theory is supported by testimony of observers. It does not appear probable that walls constructed as described could be depended upon to remain standing through the burning of a single intermediate section containing a reasonable amount of inflammable stores, even though the fire were kept from the substructure.

STRUCTURAL STEEL

With the exception of the cross rows of columns which were incased in the eleven fire walls, no steel frame members were covered or in any way protected from the heat of the burning building and contents, the result being that there is hardly a piece of structural steel of any importance which is not badly bent and twisted.

From an examination of the columns, it appears as though they had failed by being pulled over by other members rather than by weakening under heat and crushing down from their loads. A sharp bend, through 150 to 180 degrees, was noted in the most of the columns, at a point only about one foot above the base plate. This is shown plainly in the accompanying photographs. Practically no "crumpling" of compression members was noted and no fusion of heavy sections. Sheet metal, wire and thin sections of pipe were found which had partially melted.

AUTOMATIC SPRINKLERS

At an early stage of the fire, sufficient heat reached the first floor compartments to set off the automatic sprinkler system though owing to the fact that at that time, fire was burning only under the floor, it is not probable that the sprinkler system was an important factor in delaying the progress of the fire. Witnesses have stated that during the later stages of the fire, the sprinkler system was not in operation. It is probable that it ceased to function at the time of the drop in pressure as referred to below.

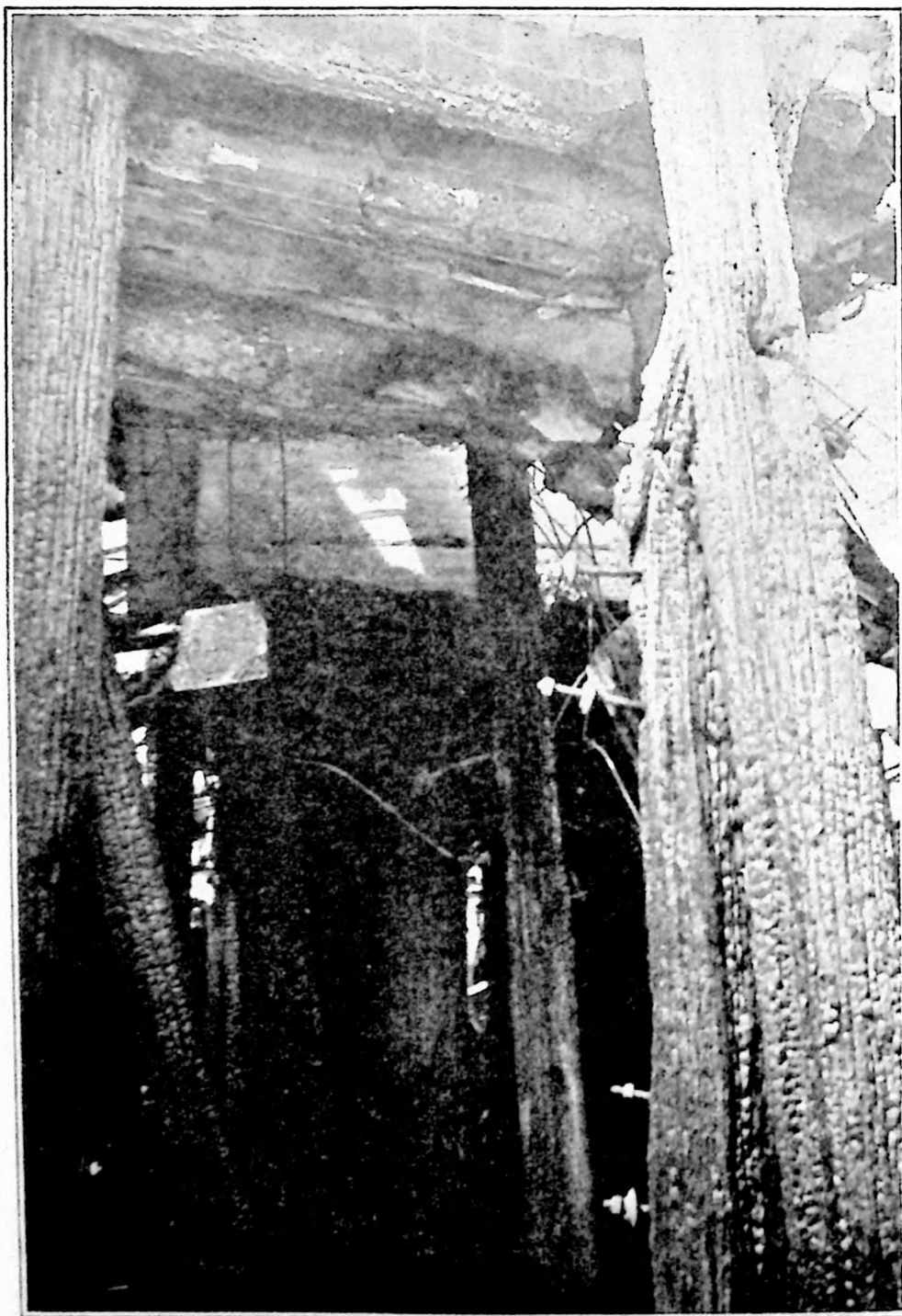


FIG. 7.

View from below of end of fire wall and concrete
section of riverside freight platform.

CHEMICAL APPLIANCES

No use was made of these as the fire made such rapid progress, after its discovery, that they could not be brought into action to advantage.

WATER MAINS AND HOSE CONNECTIONS

When the fire was first discovered, several lines of hose were connected to the nearest hydrants and an effort was made to extinguish the fire in the burning ear of burlap. As already stated, the pressure was good when the hose were first put into action, but in only a short time after the hydrant valves were opened, the pressure dropped so low that the streams were practically worthless. The most reasonable theory regarding this sudden drop in pressure is that some of the stirrup hangers supporting the water mains failed and let the heavy pipe fall and break. A number of these hangers are still in evidence, hanging from one end, the lag screw fastening at the opposite end having come loose, permitting the hanger to hinge on the remaining single support. If the supply lines had remained intact, it is probable that the sprinkler and hydrant systems would have functioned properly, though it is not reasonable to suppose that they would have had any material effect on the final outcome as the fire appears to have reached a stage at which it could not be controlled before it broke through the first floor. With the floor intact, neither the sprinkler system nor the hand hose could have any appreciable effect on a fire in the substructure.

SUGGESTED PREVENTIVE METHODS

In considering the disastrous fires of the past few years along the New Orleans river front, one's mind naturally turns to concrete as a more suitable construction material on account of its resistance to decay and to fire and it is probable that this material could be employed to advantage in certain cases though under present conditions, it can not be considered for the great bulk of our dock and wharf construction for the following reasons:

- 1.—High first cost as compared with other available materials.

2.—Lack of flexibility in adapting facilities to changing business.

3.—Heavier dead loads to be carried on the river bank where foundation conditions are at their worst.

4.—Greater resulting damage to the structure from minor settling which would not be serious in case of timber construction.

5.—Possibility of necessity to retreat from certain sections of the river front due to cutting in of the banks. This may occur even when mattress protection is provided. In case of concrete structures, the original investment practically would be a total loss.

In the light of the foregoing and of the general knowledge of the unsuitability of steel (regardless of first cost) for substructure works subject to the alternate action of river water, silt, and air, it would appear that the bulk of the river front structures of the future will be designed to rest on wooden supports, protection against decay being provided by creosote treatment until such a time as some other method is discovered which will give equal lasting qualities, and at the same time, bring about a decrease in the fire hazard.

Recognizing this necessity of the continued use of timber substructures, the following precautionary measures are suggested by the destruction of the Government wharf though many of these are so obvious as to hardly require mentioning:

Substituting, so far as possible, a slow burning mill type of construction for the light sections now commonly used in bracing.

Fire proof or fire resisting roof covering.

Construction of a longitudinal fire wall from low water to first floor level, to cut off draft.

Construction of cross fire walls at proper intervals, from low water level to above the roof line.

Design of all fire walls so that their integrity may not be affected by the burning or the failure of any or all of the other portions of the structure. (This probably will require practically complete isolation of the walls, so far as any substantial connections are concerned, from the frame work of the structure).

Extension of automatic sprinkler systems to afford protection to substructures.

"Inverted Monitors," controlled from main floor or from some distant point, to reach an interior fire in the substructure.

Placing of all important water lines in such a position and with such supports and protection that they will continue to function under all conditions, so long as the main supply of water continues.

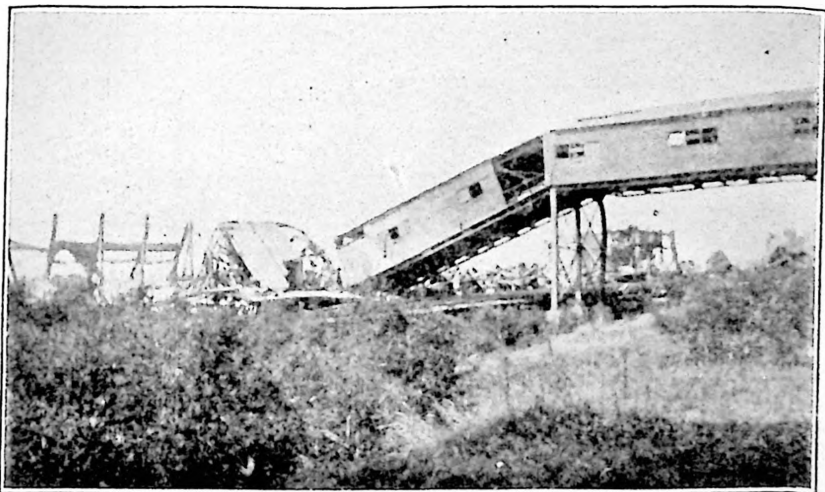


FIG. 8.

Wrecked end of conveyor bridge leading to main depot buildings.

It is also suggested that consideration be given to a design which will provide more open spaces in the substructure for fire streams. The use of fewer brace timbers of heavier section, as above recommended, will be of assistance but it is possible that other improvements may be made to facilitate reaching a substructure fire from a hose held at a reasonable distance.

As corollaries to the foregoing may be mentioned the necessity for more well paved streets which will permit the prompt assembling of fire fighting apparatus at any point on the river front, provision of more floating fire fighting equipment, the rigid control of the "harbor oil" menace, special, high duty fire pumps at important structures, special water mains adjacent to wharves, maintenance of permanent "hose tunnels" under tracks at the rear of wharves so that cars can be moved without

interruption to the fire department, drastic control of unnecessary vehicles and persons in the vicinity of a fire, severe penalties for dumping oil in the river and provision of an ample num-

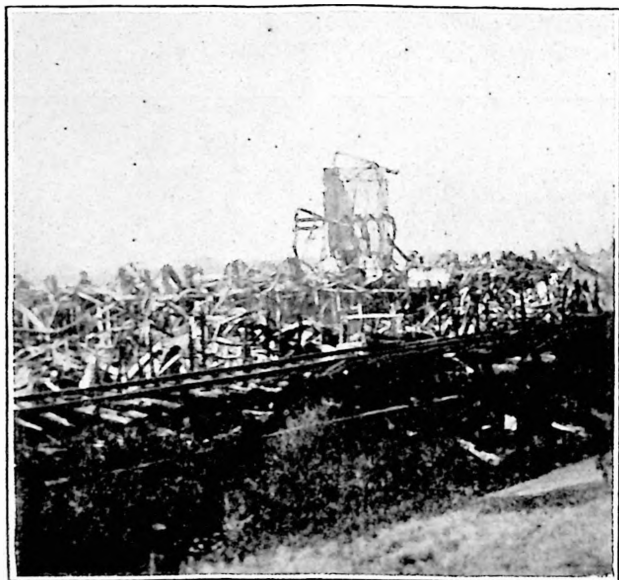


FIG. 9.
General view of wreckage from land side.

ber of well paved cross avenues of approach to all exposures to permit the prompt collection of municipal fire apparatus.

In considering the foregoing suggested means for fire control, it must not be assumed that all can be undertaken without introducing complications other than additional expense. To illustrate, cross fire walls built down to low water level, will act as baffles to the river current, causing excessive deposits of silt at some points and possibly causing dangerous scour in other locations. An annual deposit of mud may not be as serious as an occasional conflagration but it presents a serious engineering problem which must be taken into account in the design of our river structures. High water and silt also may make it impracticable to use the "inverted monitors" suggested, at least in some localities or under certain conditions. As a mat-

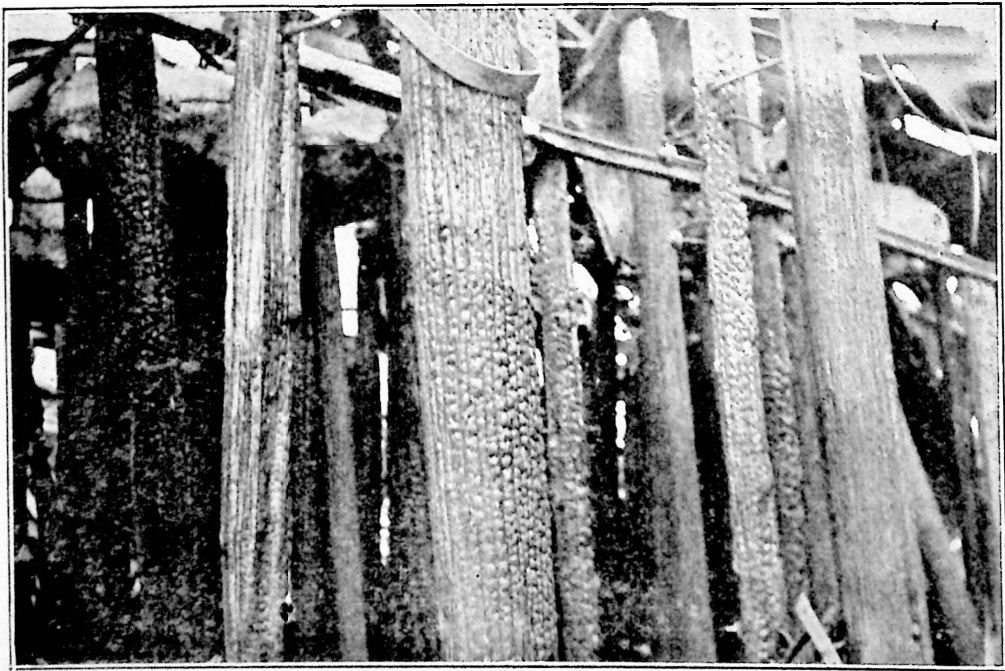


FIG. 10. Piling supports of freight platform, river side.

ter of fact, practically any departure from established practice will bring in new complications and the best methods can be evolved only by a careful balancing of one advantage against

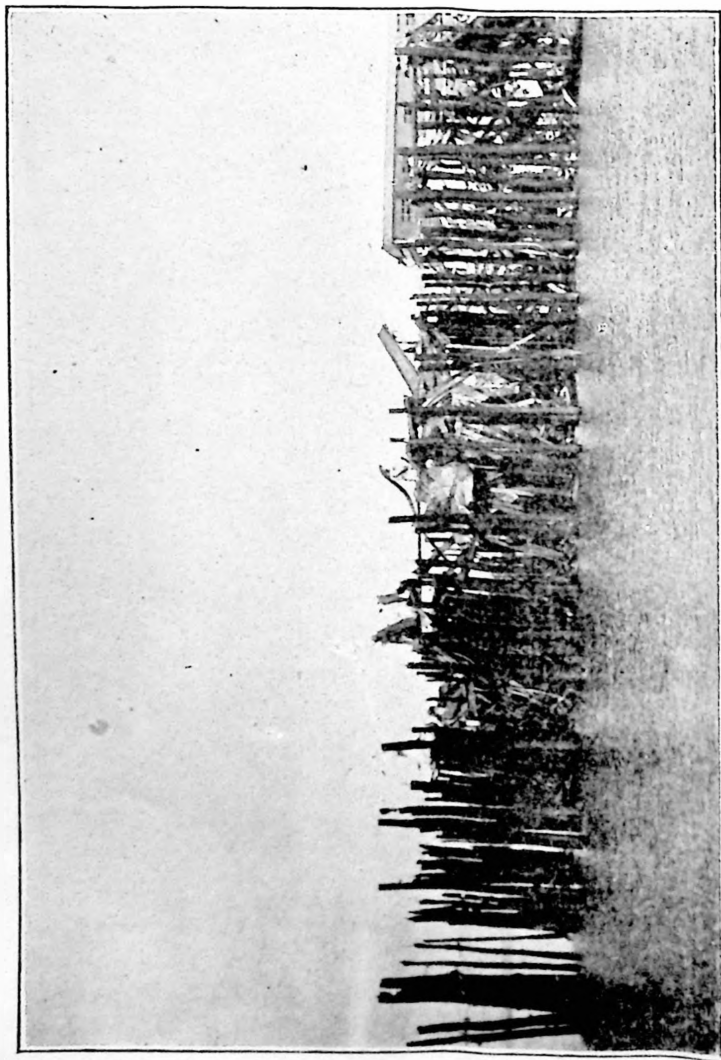


FIG. 11. Looking upstream at lower end of wharf.

another, and this must be done by men who are equipped properly to consider all the points involved.

While the Engineering Department of the "Dock Board" appears to be the logical clearing house for information and suggestions pertaining to the protection of our river front structures from fire, it is assumed that it will be glad to receive, consider and co-relate recommendations from other engineers, shipping and commercial interests, experienced fire fighters, fire insurance organizations and others who may have a knowledge of such matters. It is here recommended that the Board of Commissioners of the Port of New Orleans, through its Engineering Department, undertake the collection of data as above suggested and the preparation of a set of recommendations covering additional protection to be afforded to existing structures (both public and privately owned) and recommended types of details for future construction.

MINUTES OF THE MEETING AND BUSINESS OF THE SOCIETY.

Special Meeting of the Board of Directors—July 5, 1922.

The meeting was called to order with President Derickson in the chair and Messrs. Bennett, Moses, Coleman and Robert present.

This meeting was called to place before the Board several letters received from the Federated American Engineering Societies concerning flood control, river hydraulics and impending action of Congress on the subject. After much discussion, it was duly moved and seconded that the Secretary be directed to draft a letter concerning the views of the members on the subject, together with the municipal situation concerning same.

Adjournment.

JAMES M. ROBERT,
Secretary.

Owing to the absence from the city of the majority of the Board of Direction, there was no regular meeting September 11th, 1922.

JAMES M. ROBERT,
Secretary.

Regular Meeting of the Society, September 11, 1922.

The meeting was called to order about 8:15 P. M., Vice-President Barelli in the chair. On motion the reading of the minutes of the previous meeting was postponed until the next regular meeting.

The Chairman then brought up the question of whether the Louisiana Engineering Society should continue as a member society of the Federated American Engineering Societies. He stated that there was a strong sentiment in the Board of Direction against remaining in the Federation and called for an expression of opinion and some action in this matter.

Mr. Gregory stated that he believed that a great deal had been accomplished toward making an organization of engineers which eventually would do for the profession what the American Bar Association does for the lawyer and the American Medical Association does for the doctor. He did not believe that we have been in the federation long enough to give it a fair trial and suggested that we continue our membership.

On motion of Mr. J. F. Coleman, duly seconded, it was unanimously voted that we would retain our membership in the Federation for the present.

The technical exercises were next on the program and an informal discussion was announced, regarding the Spillway proposed by the

committee of engineers who had interviewed General Beach on his recent visit to this city.

In the absence of Mr. John Klorer, the report of the Engineering Committee was read by Mr. Gregory. This was followed by discussion by Mr. Lawes, Col. Shaw, Mr. J. F. Coleman, Mr. J. P. Kemper, and others, including Mr. James Thomson, Publisher of the Item, who was present as a guest. The discussion was continued until 11 P. M. when the meeting was adjourned to the usual collation.

JAMES M. ROBERT,
Secretary.

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DOUGLAS ANDERSON, Editor.

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PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

VOL. VIII

DECEMBER, 1922

No. 6

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EDITORIAL NOTES AND COMMENT

Management of a Ship Repair Plant. Under this title Mr. Orloff Henry presented a very interesting and instructive paper at the recent joint meeting of the Local Section of the American Society of Mechanical Engineers and of the Louisiana Engineering Society. Mr. Henry's connection with the Jahneke Dry Docks Corporation, which maintains one of the best organized and best equipped ship repair plants in the South, has given him excellent opportunity to study the matters which make up his paper.

He discusses the problems under four divisions:

- Plant facilities.
- Securing the work.
- Performance of the work.
- Accounts and records.

The facilities to be provided in the plant will naturally depend upon the kind of work which it will be the policy of the plant to undertake. If equipped at the outset to do every sort of job which might come in, it may often be the case that some of its most valuable and expensive tools will be idle for long periods of time. While if the plant does not provide this equipment it may often lose very profitable repair jobs. This is one of the difficult questions which the owner of the plant must determine when designing his equipment.

In his discussion of the paper Mr. Bernhard suggests two plans for meeting this point. One is a close affiliation with a large steamship line to the extent of securing all of its repair work; the other is for the repair plant to maintain a building program which would enable it to use its equipment most efficiently.

Securing the work is largely a question of salesmanship, and the character and extent of the division or organization to be maintained for that purpose will depend upon the extent of the plant's business.

The problem of the performance of the work in a ship repair plant is *sui generis*. On account of the very great variety of the work to be done it would not be possible to have the perfection of method and the detail of organization which is so characteristic of our best American manufacturing plants.

The point was made by Captain Bean in his discussion that ship repair men as a rule are specialists from the foreman of the gang down to the humblest helper. They either cannot, or will not, work at anything except their own special line.

The paper concludes with a general discussion of the methods of keeping accounts and records which are adaptable to a ship repair plant.

Reclamation of Lake Pontchartrain Low Lands. The engineer deals with facts and figures, and is not given to being sensational. Without any intention on his part, however, it sometimes happens that the very novelty and originality of a proposal produces such an effect. Such, in a measure, was the effect produced in the mind of the Editor as he listened

to Mr. Theard's proposal to build a dam across the narrow neck of Lake Pontchartrain at the Middle Ground and then pump out enough water to lower the permanent level by two feet. And yet it all seems reasonable enough and there are no insuperable engineering difficulties in the way of its accomplishment.

The principal advantages claimed as a result of carrying out this project would be:

The reclamation of some 400,000 acres of alluvial land to the north, west and east of Lakes Pontchartrain from hurricane damage.

The protection of the shores of Lake Pontchartrain from hurricane damage.

The provision of a permanent crossing of Lake Pontchartrain for highway and other traffic.

There are many questions which will arise and which must be answered concerning the project. To the mind of the writer one of the most interesting of these is,—“How effective will this scheme be in rendering the shore-line of these two lakes inhabitable? At the present time throughout the whole extent of this shore line of nearly 200 miles there is only one settlement of any size close to the water. Even New Orleans has never used the shores of Lake Pontchartrain to any great extent, and is just now planning to do so by means of a sea wall.

Perhaps the most important of the advantages mentioned in connection with this proposal is the protection of the shores of Lake Pontchartrain from damage due to excessive tides caused by the tropical hurricanes which visit this region at times. The idea here is that the dam will hold back these excessive tides which sweep up through the Rigolets and other passes from Lake Borgne.

An Employment Bureau. It would seem desirable that the Louisiana Engineering Society have a well established and well regulated employment bureau for the use of its members. It is true that Mr. Kokosky operated such an agency for a number of years, but its connection with the Society

was never very definitely defined. Since the resignation of Mr. Kokosky, President Derickson has appointed Mr. R. H. Baumbach chairman of the standing Committee on Employment. Even if it should be a matter of some slight expense to the Society, it would be wise to have the employment bureau organized as one of its activities with emphasis upon the fact that it is conducted under the auspices of the Louisiana Engineering Society. Mr. Baumbach is a good choice for Chairman of the Employment Committee. Being a member of the Society as well as local Manager of the Eugene Dietzgen Co. gives him a wide acquaintance among the engineering fraternity.

Spring Meeting of the A. S. C. E. Plans are being made for the Spring meeting of the American Society of Civil Engineers, which is to be held in New Orleans, during the month of April, 1923. While the detailed subject and exact date has not been set, it is stated that the general subject will be on Ports and River Protection. The Louisiana Section of the A. S. C. E. is making tentative arrangements for the reception and entertainment of the visiting engineers and the President of the Local Section, Professor Donald Derickson, has appointed Professor W. B. Gregory as General Chairman. The following are the chairmen of the various committees:

Ole K. Olsen, Chairman, Committee on General Arrangements.

J. F. Coleman, Chairman, Committee on Reception.

W. H. Williams, Chairman, Committee on Hotels and Accommodations.

C. H. Stem, Chairman, Committee on Publicity.

A. T. Dusenberry, Chairman, Committee on Autos and Transportation.

The Local Section is desirous of securing the assistance and co-operation of all the engineering societies in New Orleans as well as individual members of the engineering profession to make the Spring meeting a success and credit to Louisiana. Any suggestions which can be made by the engineers of this locality will be welcomed by the Chairmen of the

Committees referred to above. All engineers are cordially invited to attend the meetings and to participate in the entertainment of the visiting engineers and their families.

Mr. F. A. Muth, 224 Customhouse Building, is Secretary of the local section.

New Members. Since the publication of the preceding issue of the Proceedings the following new members have been elected to the Society:

Resident Members.

Arthur A. Fraser, 2125 Leonidas St., New Orleans. District Manager, J. G. Wilson Corporation.

Walter K. Grant, 1527 Audubon St., New Orleans. Engineer in charge of municipal installations and inspections, Louisiana Fire Prevention Bureau.

Joseph V. LeBlanc, Jr., U. S. Engineers' Office, 140 Decatur St., New Orleans. Sup't. of Construction of Levee Building.

Mason J. Young, 2222 Wirth Place, New Orleans. Assistant to District Engineer, New Orleans.

Non-Resident Member.

Louis M. Buja, St. Patrick, La. Resident Engineer for Louisiana Highway Commission.

Non-Resident Associate Members.

Cecil A. Eby, 3010 West College Street, Shreveport, La. Building supplies and engineering specialties.

Jesse D. George, Logansport, La. General Contracting and Highway Construction.

Non-Resident Juniors

Clarence A. Ives, Jr., 256 St. Philip St., Baton Rouge, La. Graduate Louisiana State University, 1922.

James B. Reymond, 709 Main St., Baton Rouge, La. Graduate Louisiana State University, 1922.

Chester A. Rowland, Box 37, University Station, Baton Rouge, La., Graduate Louisiana State University, 1922.

Non-Resident Student Member

Reginald A. McFarland, Baton Rouge, La. Class 1923,
Civil Engineering, Louisiana State University.

Measuring Molecules. (A research in pure science often has many and unexpected practical applications.)

How large are molecules and what are their shapes? The laymen frequently expresses incredulity as to practical usefulness of the refined and abstruse work of scientific research. Such incredulity is found even among technical men and other persons whose occupations or fortunes are built upon the sciences. Attempts to solve problems whose industrial importance needs no explanation often are unsuccessful until Science has gone far toward the "root of the matter," fundamental facts so gained are frequently of wide application.

A modern method for separating copper and certain other metals from some kinds of ores is known as the flotation process. Finely pulverized ore is mixed with water containing a small quantity of oil which forms a persistent froth upon agitation. The solid particles of ore are wet with the oil and these oiled particles adhere to the bubbles of froth. Thus the ore particles float to the top of the tank containing the mixture while the non-metallic particles of the ore, not being wet by the oil, do not adhere to the froth and fall to the bottom of the tank. The remarkable selective action of some oils on certain ores and the effects produced by small quantities of acids and other substances are imperfectly understood.

Some experiments undertaken by Dr. Irving Langmuir in the General Electric Laboratory at Schenectady, have led to the determination of the sizes of molecules of a number of substances and to the proofs of the fact that molecules could not be merely smooth, rigid spheres. It appeared that the dimensions of some molecules differed, the length, for example, in some cases, being several times the square root of the area of the cross-section. It was also evident that the active atoms, or groups of atoms, in certain molecules of a liquid when spread upon the surface of a solid or another liquid, turned in the direction of the surface of contact so as to en-

gage the atoms or molecules in the supporting surface. This knowledge helps to explain why certain liquids will wet each other, and certain solids, but not others—in other words, will spread in a uniform film over the whole surface of contact.

These experiments were undertaken solely because of their scientific interest. Only later was it realized that they had an important bearing on the process of flotation.

These phases of the subject, it will readily be seen, are of importance also in the very practical problem of lubrication, of interest to everybody who runs a machine of any kind. For in order that he may have sold to him the right kind of lubricant, or in order that expensive machinery may not be injured, those who manufacture the lubricants should have the benefit of the chemist's and physicist's knowledge of the fundamental principles developed by such research as that of Dr. Langmuir.

Probably of even wider interest than lubrication, is the subject of painting and varnishing of surfaces of wood, metals and ceramics. Persons who are experimenting upon the nature of paints and other protective coatings for wood, are finding that Dr. Langmuir's studies in connection with the phenomena of flotation are helpful to them also.

But how big is a molecule? To use as an example a commonly known substance, a molecule of castor oil has a cross-section in square centimeters expressed by the fraction having 209 for its numerator, and one with sixteen ciphers after it for the denominator; its length in centimeters is 5.5 divided by 1 with eight ciphers;—almost too small to be conceived.

(Taken from Research Narratives of the Engineering Foundation.)

(Based upon information from Dr. Irving Langmuir, General Electric Company Research Laboratory, Schenectady, N. Y.)

Reciprocal Registration of Engineers. At the recent convention in Chicago of Representatives of the State Boards of Engineering Examiners the most important question coming up for discussion was that concerning a plan for reciprocity between the various state boards in the matter of registering engineers. The importance of this is brought home to every engi-

neer who has to practice in different states where registration is required. The Articles of Agreement here presented were drawn up by a special committee of which Col. Gausaud was a prominent member, and they were adopted by the National Council, subject to ratification by the boards of the separate states. They have already been ratified by Louisiana and Florida, and probably by other states of which we are not informed at this writing.

ARTICLES OF AGREEMENT ON RECIPROCAL REGISTRATION OF ENGINEERS

COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS

Article 1. Reciprocal registration shall be granted only to an applicant who is already licensed in a state which is a member of this council. A detailed professional record, properly attested, and accompanied by references as to character and qualifications from three registered, practising engineers shall be filed with the board of registration of the state in which the applicant is originally licensed. Qualifications for reciprocal registration shall be determined upon the basis of such professional record, thorough consideration of which shall constitute examination.

Article 2. Engineering experience gained by the applicant prior to his reaching the age of eighteen years shall not be counted as a part of his professional experience.

Article 3. Professional experience shall be considered as beginning when the applicant shall have entered upon a position in professional engineering work which requires original thought and responsibility. For example:

(a) In the field, experience shall begin to count when the applicant reaches a position of responsibility equivalent to that of actual transitman.

(b) In the shop, or laboratory, experience shall begin to count only after apprenticeship, foremanship, inspectorship, or other subordinate position; unless the work done specifically shows that the applicant possesses originality of design, and has had responsibility in his subordinate position.

(c) In the office, or drafting room, experience shall begin to count when the applicant ceases to do purely mechanical work, such as tracing, or lettering, requiring only manual dexterity for its performance, and enters a position of responsibility where he begins actual design.

(d) Experience in the teaching of engineering shall begin to count when the applicant is a full-time instructor in engineering in an engineering school of recognized standing; and each year of teaching shall be considered equivalent to one year of practice.

Article 4. As evidence of qualification for reciprocal registration, the applicant shall have had ten years of experience in professional engineering; and in addition shall show that he is qualified to design, as well as to direct, engineering operations; and his experience record shall show progressive advancement in the character of the work performed.

Each case shall be considered on its own merits; and the experience record must be given in such complete detail that the board of examiners will be able to determine the character of the work performed by the applicant.

Article 5. Graduation from an engineering school of recognized standing shall be accepted as equivalent to four years of practise.

An engineering school of recognized standing shall be one which requires the equivalent of a high school, or preparatory school, diploma as an entrance requirement; and demands the equivalent of a four-year course in engineering for graduation.

Article 6. Reciprocal registration between states shall be made operative by means of certification of the applicant's qualification from one state to another. This certification shall be by means of a card, or form, bearing the date, serial number, signature of the officers and seal of the board of the state issuing same. These cards shall be printed and distributed by the Council of State Boards of Engineering Examiners.

Article 7. An applicant shall be granted this certificate of reciprocal registration by his own board if his qualifications fully comply with the standard herein provided.

Article 8. The aforesaid reciprocal registration certificate shall be prima facie evidence of qualification for license in any state which is a member of this Council. Upon presentation thereof, together with the legal fee required, and such information (other than evidence of qualification) as may be requested for the records of the board to whom application is made, such board shall issue license or registration to the applicant.

Article 9. Any reciprocal certificate may be revoked by the state issuing same upon presentation to its board of examiners of good and sufficient evidence of incompetency, or proof that the applicant's character warrants such revocation.

Article 10. Should any questions or disagreements arise, or should any points in the above agreement appear to require interpretation, such questions shall be referred to the Council for action at its next regular meeting; or in case more expeditious action shall be necessary, they may be acted upon by the Council by letter ballot.

If action is taken by letter ballot, such action shall be conducted through the office of the Secretary of the Council in the customary manner; and the votes shall be counted not later than sixty days after forwarding from his office, by registered mail, of questions at issue. The Secretary of the Council shall thereupon immediately certify to the various member boards the roll call and results of the vote, and the determination of the questions at issue; and consequent actions shall be in accordance with the majority of the votes recorded.

AGREEMENT OF MEMBERS OF COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS.

For the purpose of making operative the reciprocal registration of professional engineers in the various states, upon conditions and qualifications as set forth in the adopted report of the Council of State Boards of Engineering Examiners, the several State Boards of Engineering Examiners, members of the Council, hereby agree to adopt and put in practice reciprocal registration as provided in the aforesaid report, copy of which is hereto attached and made a part hereof, with full force and effect.

Witness the following resolution of record in our minutes of November 23rd and 24th, 1922.

RESOLVED THAT the State Board of Engineering Examiners of the State of Louisiana, hereby approve the foregoing agreement and in testimony thereof authorizes its President and Secretary to affix their signatures and the official seal of the said Board thereto.

(Signed) FRANK H. WADDILL, President.

(Signed) DONALD DERICKSON, Secretary.

(Seal)

PAPERS AND DISCUSSIONS

MANAGEMENT OF A SHIP REPAIR PLANT

BY ORLOFF HENRY

Read before a joint meeting of the Local Section of the American Society of Mechanical Engineers and the Louisiana Engineering Society, October 9th, 1922.

Perhaps few enterprises present so many difficulties of organization and efficient management as a ship repair plant. The builder of a machine intended to do a particular work may be confronted with a difficult problem; but the builder of a machine designed to do a variety of work is confronted with quite another and infinitely more difficult problem. So it is with the building of an organization and the laying out of a system for the operation of a ship repair plant. The management of the average production enterprise accomplishes the building of an organization and a system which may reasonably be expected to continue to function from day to day over more or less extended periods in a satisfactory and harmonious manner; but always to produce the same result and working always towards the same end. When so functioning the only changes usually necessary in such an organization or system will be those intended to produce the same results in a more expeditious or efficient manner.

In the case of a ship repair plant the results to be secured are so numerous and varied as to practically preclude the possibility of building a system whose orderly functioning would not continually demand the judgment and control of the management on basic problems whose satisfactory solution would continually tend to disrupt the entire system. It might, therefore, be supposed that the systems in use in a ship repair plant would necessarily not reach the high stage of development possible in production enterprises and that the controlling elements or key men in the organization would necessarily be required to exercise a greater measure of controlling judgment and would necessarily be of higher average ability than would be the case in production enterprises.

It is not the intention of this paper to discuss those executive problems having to deal with finances or with external corporation policies not affecting directly the working organization. The corporation officials under whose jurisdiction such problems would come will, therefore, not be considered and it will be merely assumed that a satisfactory executive or executive organization exists to handle these matters and that the function of developing an organization to perform the actual work of a repair plant and a satisfactory system under which that organization may function will rest in the hands of a general manager and his assistants. It is of course logical to suppose that the general manager will also be concerned in matters of financial and executive policy, but with these phases of his activity we will not attempt to deal.

The scope of the problems to be discussed appears to fall naturally into four classifications, viz:

- 1st. Plant facilities.
- 2nd. Securing the work.
- 3rd. Performance of the work.
- 4th. Accounts and records.

They will be discussed in the order named.

Plant Facilities

The extent of the plant and equipment to be provided in the case of a new enterprise constitutes the first great problem with which the management is called upon to deal. The controlling factors in the settlement of this question will be the financial resources of the enterprise, the probable amount of business to be secured, the scope of the work which it will be necessary to perform in order to secure such business, and the character and extent of the plant and facilities available in competition.

Complete and careful analyses should be made of the tonnage of the shipping using the port in which the plant is to be located; the tonnage and size of the average ship be determined and decision taken as to the largest ship for which the docking facilities, if any, are to be provided. Probable increase in the tonnage entering the port should be taken into

consideration and it should be known whether any considerable part of such tonnage is operated or is likely to be operated by lines or agents whose business is known to be or likely to be controlled by other plants.

With these factors known the management should be in a fair position to estimate on the amount of work which they may reasonably expect to secure and to determine the extent of the facilities which must be provided in order to assure a chance of securing such work. Should the necessary facilities on the above basis be beyond the financial resources of the enterprise it will, of course, be necessary to limit the scope of the work to be undertaken or to provide for additional finances. With the latter condition we are, of course, not concerned.

In establishing the policy of limiting the scope of the work to be performed it must be remembered that the laying up of a ship for repairs is a very costly proposition to the owners in view of the loss of the ship's earnings as well as the cost of the repairs. It will, therefore, frequently appear to the best interests of the owners to give their work to a plant capable of handling everything to be done on the ship and this consideration will work against having a limited capacity and will frequently operate to prevent securing work which the shop otherwise would be in a position to handle.

It should be borne in mind, however, that there are certain classes of work which it is not considered necessary to enumerate herein, which have proven profitable, and which well deserve the consideration of the management in determining the scope of the work. This factor is also of importance in estimating the effect of competition as it will frequently happen that a large and well equipped ship repair plant will cater to a class of work which could not under any conditions be secured by a smaller plant; while the work handled by the smaller plant may be of such a nature as not to be secured by, or attractive to, a larger plant. It is, therefore, perfectly possible for two or more repair plants to operate in the same port without, to any extent, competing with each other.

Having determined the scope of the work which the plant is intended to perform it becomes a comparatively simple technical problem to settle upon the equipment necessary. It should always be preferred to expand to meet the needs of a growing business than to provide facilities in excess of those necessary for the work which may be secured. In any case, however, it is, of course, very desirable that the plant be so laid out as to permit of the necessary extensions along logical and predetermined lines; and the possibility of future extensions should be very carefully considered in the lay out of such a plant.

Unfortunately, in beginning the operation of a new plant or in continuing the operation of an existing plant the value of any tool cannot be determined in the case of a ship repair plant with the same certainty and exactness as in the case of production enterprises where each particular tool has a definite and more or less continuous function to perform and where the value of such a tool to the cost of production may be definitely determined. In the case of a ship repair plant it may be essential to provide a tool to take care of certain work within the scope to which the plant is committed which tool may, however, be idle for months at a time when the character of the work being handled is not such as to require its use.

It, therefore, follows that the schedules of tool charges in use in such repair plants are more or less arbitrary schedules in which the charges fixed for the tools in constant use are generally so graded as to take care of the more highly specialized tools, unless the nature of the work performed by the tool of intermittent use is such as to permit of a high rate.

After the plant has been in successful operation it becomes a comparatively easy matter to determine from experience and satisfactory records whether a certain tool is or is not justified.

In repair plants of large scale it will generally be necessary to furnish to ships undergoing repairs fresh water, steam, and electricity and these facilities must, therefore, be considered in determining the extent of the plant and equipment, and if within the scope of the service to which the plant is

committed must be either available to the plant from outside or must be provided for in the plant itself. It would, therefore, appear from the foregoing that in actual operation it would be very difficult, if not impossible, to have a particular tool or facility in a ship repair plant rest entirely on its own merits, but that contrary to the desirable practice in the case of production enterprises it is advisable to carry, at least, a considerable part of the tools and facilities under overhead which, with a reasonably constant volume of business, can be reduced to a percentage of the volume of business and so taken care of.

Securing the Work

It is not the intention to enter into an exhaustive discussion of the methods of securing ship repair work. In general, the application of the principles of salesmanship to this particular problem is not likely to differ materially from the selling of any other specialized service with the exceptions which will be noted. If the scope of the plant is limited, if its methods are inefficient, and if its work is not of a high order the selling of its service will undoubtedly require an individual or organization of a high order of ability, unless a plant for some reason possesses something approaching a monopoly of this particular class of work.

In the case of a large and efficient plant it may reasonably be supposed that the owners or operators of the ships on whose work such a plant would depend will know of the facilities provided by such a plant and will be willing and even anxious to secure from the said plant estimates on any work they may have. In addition, if the organization of such a plant has established a reputation for doing efficient work and charging reasonably; or if the character of the work to be performed is such that estimates will be difficult and possibly unfavorable to the owners; it is likely that such a plant may secure work on a time and material basis. In such a case it would appear that an expensive and highly organized Sales or Contract Department would not be necessary and it would be only necessary for some of the operating or executive officials of the plant to keep in touch with the owners and oper-

ators of ships and to have some means for learning promptly of any damage which might be sustained by ships within the range of their operations.

Performance of the Work

Having secured the work the utilization of the plant and facilities which have been provided must rest with the organization's ability to handle in an efficient manner any work within the scope of activity to which the plant is committed.

In the case of a large repair plant the work to be performed may vary from the furnishing of a new hatch cover to the rebuilding of the main engine or from a simple case of docking and scraping and painting the hull to the rebuilding of the hull itself. Almost every class of work is included; wood work, joiner work, interior decorating, machine work, plate work, electrical work, boiler work, forgings, and any one of the myriad of mechanical operations necessary to replace or repair anything that may be broken about a ship.

It must be apparent at a glance that, with such a variety of possible work, no such perfection of method would be possible in an activity of this kind as in the case of a manufacturing enterprise. In the manufacturing enterprise every workman and every tool has a specific duty and each performs a certain operation or makes a certain part necessary to the finished product. The material necessary for such production can be gauged with reasonable accuracy and can be supplied as needed within very accurate limits. The finished products of each operation can be made to flow smoothly and uninterruptedly to the assembling or shipping departments and the finished product can be loaded or packed and shipped with reasonable dispatch and continuity. Each operation and each element in the organization can be made a part of a system which can work with the smoothness and precision of a well oiled machine; but no such perfection of the work in a ship repair plant can be attained. It is unlikely that any workman or any machine will be called on to duplicate exactly any operation. The gang that today changes a wheel may be called upon tomorrow to lift a turbine casing. Each job brings its own particular problems, and it could

hardly be expected that any fixed system could be devised that would fit any and every case.

At first thought it might seem to be logical and best to systematize along the lines of the usual classes of work. Thus, it would seem that the machine work could be handled by a machine shop and an outside organization each in charge of a general foreman, and both in charge of a machine shop superintendent. The same might seem to apply to the plate shop, the joiner shop, and so on. Actually, such a system is found to have many drawbacks; the greatest being the difficulty of co-ordinating the work of the various departments and sub-departments, and so arranging that the work of each department would be performed for the best interests of the job rather than for the convenience of the particular department.

From what has already been said we are prepared for the conclusion that the satisfactory organization for a ship repair plant must provide some unusual features by which, or through which, the controlling judgment of the management may be applied almost to the smallest tasks. A further conclusion must also be that such judgment must be easily and continually available and the results of such judgment be expressed in prompt and efficient direction.

In actual operation the desired results have been secured by the establishment of a Department of Control. Such a department would be directly under, and responsible to, the Plant Superintendent or Works Manager, who, in turn, would report to the General Manager.

The Department of Control would combine the functions of an Engineering Department and an Estimating and Contracting Department; and would furnish the machinery through which the management would function in the actual direction of the work. There would also be the usual shop departments, each shop being under the direction of a foreman or leaderman who would be responsible for the work of his shop or for the gangs under his charge, but the work of whose shop or department would be co-ordinated with that of other shops or departments through the direction of the Control Department. There would necessarily also be a Material and

Tool Department, a Purchasing Department, and an Auditing Department, and possibly a Record Department, although the latter might be combined with the Auditing Department or the Control Department, or the work it would perform be divided between them.

The personnel of the Control Department must necessarily possess a very high order of ability. They should preferably possess technical training, should be thoroughly familiar with the design and construction of every part of a ship; they should be thoroughly familiar with all of the mechanical processes included within the scope of operations of the plant; they should possess initiative and executive ability and be able to inspire enthusiasm and to handle men. Upon their ability and fitness depends the success or failure of this system.

In actual operation the Control Department would receive the specifications issued by the owners or agents upon which bids are requested for repairs to ships; or to them would be referred the information that any particular ship is or may be in need of repairs. This Department would be charged with the task of inspecting the ship in question. The examination should be as complete and exhaustive as possible in order that the representative or representatives of the Control Department may be acquainted with the exact nature of all of the work to be performed. This inspection would act as a check on the specification issued by the owners or in the event of no such specification being issued would result in the making of one. Each particular bit of work to be performed or likely to be performed would be separately listed.

The Control Department or its designated representative having listed up the work thus in complete detail would proceed to place along-side of each item their estimate separated as to material and labor. In the performance of this work they would be assisted by the foremen or superintendents of the different shop departments. In case of any doubts as to the methods to be used or the extent of the work to be performed the foremen concerned would be required to make an inspection of their own and the methods finally determined upon would be the result of an agreement between the Control Representative and the actual operating organization. It is

thus assured that the various foremen under whom the actual work will be performed if the work should be secured are committed before hand to the cost, methods and time of execution of the work and therefore have an intense personal interest in seeing that the work is performed in accordance with such methods or others which may appear more efficient and that the costs and time set down in the estimate be not exceeded.

After the costs of labor and material and the estimated time have been assigned to each item, careful consideration is given to the determination of the total time involved for the job. It is, of course, to be realized that many of the items may be

Now when this data has been secured and placed in the carried on simultaneously, while others may have to wait for the completion of certain work before their inception.

proper form the heads of the Control Department will assign to each item the proper allowance which their judgment may dictate for contingencies and also the proportion of plant overhead and the desired profit. The total will represent the bid to be submitted for the particular ship and the entire bid will be submitted by the Control Department to the superintendent and, if necessary, to the general manager for their approval or adjustment. It will be seen that if for any reason the superintendent or the general manager should consider it necessary as a matter of external policy to change the allowance for contingencies, overhead, and profit they are in possession of all the data as to the actual cost as nearly as it is possible to estimate them.

When the bid is submitted to the owners, if the work is secured, the specification and bid are referred back to the Control Department; the contract is by them assigned a job number, each particular item is numbered and copies of the specifications carrying the job number and item numbers are by them issued to each foreman, sub-foreman or leaderman who will be concerned with the work to be performed. Copies are also issued to the Material and Tool Department, the Auditing Department and the Purchasing Department. The Tool and Material and Tool Department, the Auditing Department and the Purchasing Department. The Tool and Material Department are thus authorized to issue tools and material against this

particular job; the Purchasing Department is authorized to purchase such material as there may be requisitions for and which the Tool and Material Department certifies is not in stock; and the Auditing Department proceeds to open the necessary accounts.

It is the duty of the Control Department to designate one of its members to handle this particular contract if it is of sufficient magnitude, otherwise, it is made one of several small jobs being looked after by one man, whom, for convenience, we will herein designate as an inspector.

The first duty of the inspector upon being assigned a contract is to determine when the work can be undertaken and to make the necessary arrangements by notifying the different Shop Departments to be prepared to handle their portion of the work at that time. He must also at the earliest possible moment with the assistance of the various foremen, if necessary, make a complete check of the material involved in order that as much time as possible may be allowed the Material Department and the Purchasing Department to secure any material that may not be on hand, or to reserve the necessary material which may be on hand for the job in order that no unnecessary delays may occur.

If the work to be performed requires that the ship be docked, the docking schedule must of course be taken into consideration and all arrangements made accordingly.

Both the inspector and all of the foremen concerned are jointly charged with the responsibility of seeing that the necessary material is available in order that this important feature may not be overlooked. When the work is actually undertaken the inspector is to be constantly on the job or must, at least, give to the job as much attention as it may require. It is his duty to see that the work of the different gangs or individuals is performed without interference and in the necessary order; that none of the gangs are held up for lack of material or because others have not completed their portion of the work and, in general, to run the job so that the work will be most efficiently and economically carried on and the greatest dispatch secured.

The various foremen, sub-foremen or leadermen are not relieved of any of the responsibility for the efficient operation of their particular gangs and as all of the work follows along methods previously determined or along other methods later decided in conference between the inspector and the working organization to be more efficient, there is no chance for the working organization to shift the responsibility for an increase in cost or any unexplained delay.

The General Manager and his assistants in a ship repair plant, as in all other enterprises, are, of course, constantly on the alert for any opportunity to improve the system and to increase the efficiency of the organization; and considerable perfection of method may be reached in a high class plant. There are, however, few, if any, operations within a repair plant which can be standardized. Even the changing of two identical wheels may require a vastly different amount of effort and time. One wheel may start easily and present little or no difficulty of removal, while another almost identical wheel may be stuck and may for some time resist all efforts to wedge or jack it loose and may have to be heated. Even the scraping and painting of ships of almost identical size will represent different problems according to the great difference in the condition of the bottoms.

It will, therefore, appear almost impossible to effect a standardization of method even in the case of what might appear to be the simplest and most frequently repeated jobs, nor can the management judge with any degree of certainty of the time which will actually be required and they are, therefore, compelled to make allowances for contingencies, or, should their judgment so dictate, to take a chance. A high degree of efficiency can only be obtained by a very careful selection of the workmen so as to secure a working force of a high order of ability; by inspiring in the men a spirit of loyalty to the organization, a desire to co-operate with the workmen of other departments and an interest in their work. Some system of record is also very desirable by which the results produced by each particular shop or department may be gauged as accurately as possible and the source of any losses or leaks determined and the defects remedied.

Material and Tool Department

A well equipped and efficient Material and Tool Department is indispensable in the operation of any ship repair plant. Such a department does not call for lengthy comment, except that as its importance to the ship repair industry is perhaps greater than to almost any other, some of its features may be worthy of note.

In a large ship repair plant there are hundreds of thousands of dollars worth of portable tools and equipment, most of which may be in the warehouse or tool rooms during slack periods and nearly all of which may be drawn out during busy periods. Owing to the variable character of the work the labor turnover in a ship repair plant is necessarily very high and it is, therefore, essential that small tools especially be carefully accounted for. In the case of a ship repair plant some form of the usual tool check system is found in operation. Generally men who are entitled to draw tools are furnished with tool checks. Each set of tool checks bears the same number and the number of the checks issued is recorded with the workman's number. In many cases a deposit is required for these tool checks which deposit is returned when the workman leaves the company's employ, if all the checks are returned. When it is desired to draw a tool the workman hands in, or sends in, a check for each tool and this check is recorded by the Tool Department and hung in the place of the tool. The workman's number is recorded in each case and before a man can be paid in full he must secure a clearance card from the Tool Department showing that he is not charged with any lost or broken tools. Daily reports are made by the Tool Department to the superintendent and to the Auditing Department showing the outstanding checks against any workman and should the value of the tools outstanding charged against any workman be in excess of the amounts due him by the company payment is withheld until the tools are returned or satisfactorily accounted for. The workman is always given a chance to explain the loss or breakage of tools and if his explanation is satisfactory the superintendent's office authorizes the Auditing Department to cancel such charges against him.

Requisitions for material in connection with the various jobs must be signed by an inspector, a foreman or a sub-foreman authorized to requisition for material, must carry a job number on file with the Material Department and must be for a job with which the requisitioner is known to be connected. If the material is not on hand the requisition of the Material Department on the Purchasing Department is authority for the purchase of the necessary material. Limiting amounts are, however, usually placed upon the requisitions and should the value of material requisitioned for exceed these amounts the approval of one or more of the higher officials is required in order that the company may be protected against unnecessary purchases.

Purchasing Department

The Purchasing Department of a ship repair plant probably operates under more unfavorable conditions than in almost any other industry. Owing to the great variety of the material and supplies which may be needed for a repair job it is necessarily impossible to keep any considerable portion of the supplies in stock and as the repair of ships is very frequently an emergency proposition it is usually almost, if not quite, impossible to anticipate the requirements. It thus happens that a very large part of the buying of such a plant is in the nature of emergency purchases of material and supplies for immediate or quick delivery for which frequently the Purchasing Department has to pay a premium. This, however, is the necessary price that must be paid for such purchases and in general the premium so paid is less than the interest on the investment which would be required in an attempt to stock material or supplies having a slow and infrequent turnover. There are, of course, large quantities of material and supplies for which such a plant has a constant demand and such materials and supplies are carried in stock, and are, therefore, subject to economic purchase. In view of the large number of emergency purchases it frequently becomes necessary for the plant to operate one or more trucks which are generally under the jurisdiction of the Material Department and subject to the call of the Purchasing Department.

Accounts and Records.

The Auditing Department will naturally keep the usual and necessary financial accounts and records by which the condition of the business may be determined. In addition to these accounts it is desirable and, in fact, necessary that accounts be kept by which the work of each department may be checked and the status of each job or contract continually and accurately determined. With this idea in view the Auditing Department would receive from the various foremen an accurate distribution of the time of all men working under them; the time of each man being distributed to the job number and item number on which the time was spent. The Auditing Department would also receive from the Material and Tool Department a distribution of all material and supplies and tools lost or broken distributed against the job and item to which such material and tools applied. This data would be turned in to the Auditing Department daily and in as short a time as possible, preferably, within twenty-four hours, the Auditing Department should make up a complete statement of costs showing the cost of labor, material, incidentals, and any other item of expense charged against each item of each job then appearing on the books. The total of expense against each item of each job would then appear daily against the estimated costs and contract price for each item and the management of the plant would, therefore, be constantly informed as to the relation of actual cost to contract price and would know which items were running high and would be able to concentrate their attention upon these items. All maintenance and upkeep accounts as also accounts for plant extensions and betterments would be kept constantly up to date and distributed as might be most advantageous in order that the influence of these accounts on costs and overhead would be continually known, and together with a knowledge of the variation of the volume of business, would be used to effect an adjustment of the percentage to be applied for overhead.

The Auditing Department would have charge of the time keeping and time checking departments of the plant and would make out all pay rolls and pay off the men. The time check-

ing of the plant would probably be limited to a system of having the men punch in and out of the plant on a system of time clocks. Time checkers would make the rounds of the plant at varying times, making probably four checks a day, and each man punching in would have to be accounted for to these checkers. In addition to this, each foreman's distribution of time for each of his men would have to agree with the clock time, or any discrepancies be satisfactorily explained.

Records, preferably in the shape of cards, would be kept by the Tool and Material Department which would serve the purpose of a perpetual inventory of materials, tools and supplies in stock. From the data so kept the Tool and Material Department would make up periodical reports for the benefit of the management showing the turnover of each class of material and tools, and from a study of these reports and a knowledge of the importance of any item to the work to be performed, and the possibility of its quick delivery in the event of its not being stocked, the management would determine the extent of the stock to be carried.

In addition to these reports the Auditing Department would tabulate daily the labor costs for each department against the contract price for each item of each complete job and this tabulation with the proper proportion of overhead and incidental expense distributed to each department would show daily the percentage of profit being earned on completed jobs by each department of the plant. These reports would enable the management to determine which department, if any, was falling back and to concentrate their attention to improve the efficiency of such department.

Such itemized records of cost as the management might determine should also be kept to be used by the Control Department for their guidance in estimating on work. Such cost data, however, would have to be used with the greatest caution in view of the fact previously brought out as to the difficulty of exactly duplicating any job.

Interesting and valuable data can be secured if a record is kept of the actual operating time of each piece of equipment and tool in the plant. A proper portion of the interest on

the investment in grounds and buildings and such general items of expense as taxes, insurance, and the like can usually be apportioned to each tool in proportion to the floor space occupied or some other satisfactory basis. With the increased utilization of electric power and individual motor drives it is usually comparatively easy to determine the approximate power consumption of each tool or group of tools and this item of expense can, therefore, generally be distributed to each particular tool. The cost of repairs to each tool or class of tools is almost invariably kept separately and this item of direct expense is therefore easily available. In addition to the foregoing the management can usually without much difficulty arrive at a satisfactory basis for distributing administrative costs and the desired profits to each tool. The total of all of the foregoing items distributed to each particular tool divided by the total number of operating hours with which that particular tool is credited will give the hourly rate which each tool should earn in order to pay its way; and this data while, as before explained, not necessarily final and conclusive, is of great value to the management in adjusting schedules of tool charges and in arriving at decisions as to whether any particular tool is worth while or should be replaced.

Tool schedules will frequently play an important part in time and material jobs and the possession of data with the aid of which satisfactory tool schedules may be formulated or adjusted is greatly to be desired.

In conclusion it is, of course, to be realized that the repair of ships has attained the dignity of a great industry and it is not to be supposed that time or space would permit of a complete and exhaustive discussion of all the problems of management involved. An effort has been made to discuss these problems which appear most important and which by their contrast with the usual practice should be of the greatest interest. Good judgment dictates that the patience of our hearers be not too greatly strained and it is to be hoped that the conclusion of this discussion will be signaled by a desire to hear more rather than by a sigh of satisfaction.

Discussion

THE CHAIRMAN: I notice in the audience tonight some gentlemen who, I am sure, would like to join in the discussion.

Mr. Ewin, you have had something to do with the management of ship yards; we would like to hear from you.

MR. EWIN: There are several things I have noticed in Mr. Henry's discussion of the proposition of management. I have had about three years' experience, but it was under very rapidly changing conditions. It is my understanding that the paper has reference to conditions in a large ship-yard, one in which there is going to be a big volume of business. If that was not the case, I think that the various departments, the number of men necessary to get together the records, and the information called for under the management plans that Mr. Henry outlines would be so great that, unless there was to be a very tremendous volume of business, they would create expenses that would be almost prohibitive in the handling of the business.

In the auditing and the record-keeping of ship-yard cost, it has been my experience that, in order to get information which is authentic, which is sufficiently accurate to use in making estimates of cost and seeing what your actual performance has been, it takes a very large number of men. The clerical work involved is such that, to get it right, so that it will be of actual use to you, requires a very large pay roll, which is a large percentage of the cost of the work to be done. Unless your yard has a volume of business on which you can count for a steady income so as to organize your force to such an extent as to give you that information, it is likely to eat up a big portion of the profits of the work you get. That was a thing that occurred to me in the point brought out by Mr. Henry relative to information that a man in his line should have in the operation of the business.

MR. HENRY: Mr. Chairman and gentlemen: Answering the points Mr. Ewin brought out, in the order in which he raised them.

First of all the size of the organization required to secure the data mentioned. Possibly I did not make myself clear as

to the extent of such data. It has not been considered, so far as my experience has gone, wise to attempt to secure data for a ship repair plant in the detail that it is usually attempted to secure it for a ship yard. The actual building of ships is very much closer to a production proposition than are repairs. In the building of a ship an item is made of how much it costs to drive a rivet, or to replace any particular piece of machinery. Owing to the great degree of variation no attempt would be made to keep data of that kind in a repair plant. It might cost you ten times as much to drive a rivet where you have to remove one plate and build a scaffold as it would cost to drive a rivet or two on the deck where you could get to it. On the other hand if you had to change a whole plate, you could drive the rivets cheaper than if you had to build the scaffold simply to drive a few of them. The data kept in that case would cover perhaps the cost of removing a plate, say eight feet by thirty feet, or of whatever size it might be, simply designating whether the plate was high up or a keel plate. This would be done more for the purpose of giving the control department some idea of whether a scaffold would have to be rigged, or blocks would have to be shifted. The cost data can be kept from the actual daily distribution of time which the auditing department makes up, and the log book of the foreman, showing what work was done.

These things run in a general sort of way, and over a period of six months or a year an average will be struck showing that it costs about so much to change a plate, and so on. As I mentioned, such data can only be used as a sort of a guide.

THE CHAIRMAN: I notice Mr. Bernhard is with us, a ship builder and port engineer, and we would be glad to hear from him.

MR. BERNHARD: My idea of a successful repair plant is one that recognizes the fact that it should be occupied all the time, its tools working continuously. Therefore, you will see that a really successful ship repair plant should have close affiliation with a large steamship line, with the result that they could say to the steamship line, "we will be free next week or

next month, and you can send out number two or number ten and we will give it an overhauling. That is available to any size repair plant. In other words, the ship yard's first duty would be to locate the particular steamship line which, in its size and number of ships, is best suitable to fill the balance in its load crews. I would very much like to hear from Mr. Henry as to whether he stressed this point in his paper.

MR. HENRY: I skimmed over that point, Mr. Bernhard, by saying that the facilities which had been provided, and the material in use, would perhaps be known to the owners and operators of ships.

Your point is undoubtedly an important one, and any ship repair plant that cannot at least count on the business of one fairly large line has a hard road to travel. Most of the large repair plants, I think do control the business of one or more lines, without which it would be almost impossible for them to keep any sort of organization. It is possible they might have large jobs on hand this week, and next week no work at all.

One point I don't believe I brought out, which Mr. Bernhard suggests, is the possibility of a repair plant to take care of just such boats as sometimes are needed by the shipping industry. Frequently it is desirable to have a manufacturing program in the shops. For instance, in the machine shops they can build engines and pumps for which at times there might be a demand. In their plate shops they can make barges or tanks. They can then maintain their working organization.

MR. BERNHARD: Do you believe a repair plant should also be a building plant?

MR. HENRY: Not necessarily. I think it is very desirable, but the conditions that such a plant would have to meet, due to location or any other cause, would make that almost impossible. For instance in the Jahneke plant it would be very difficult for them to build ships. A plant located far from the centers of supply of materials, with a high freight rate, would find it very difficult to compete.

MR. EWING: This has always seemed to me to be advisable for this reason. If the repair plant has a ship under construction, an opportunity comes to put in a bid on a piece of repair

work which requires the services of different crafts, it would give one an excellent opportunity to take these men off the work upon which they are steadily engaged, and, under the leadership of one man, put them on the repair work. This should be done in such a way and at such time as to minimize the total number of them on special jobs. With the various regulations of the crafts that one encounters in doing such work seem that if such a production scheme could be worked up, and if they could maintain such an organization, it would give a tremendous advantage to the yard bidding on the repair work. If, in time, the ship business should justify it, and a plant is financially strong enough to do it, it would seem to be a good thing to build one ship at a time as an investment proposition on the part of the plant. This would permit of utilizing their forces for the building operation, and at the same time have them available when they are needed for repair job.

MR. BERNHARD: Mr. Henry, further explanation of my point, I have in mind two ship yards; one does small repair work, handles barges, and has gradually built up a fleet of about one hundred barges, running over one hundred tons each. The barges are owned by the ship repair plant, and they can take almost any outside repair work with the promise of very quick time and low prices. When there is not much repair work, as is usually the case in summer, they go ahead and build boats for their own account, to be either sold or to extend their own service.

The other is a repair plant for vessels of a larger class. It has two ways, and whenever they have spare time they can go ahead and build their own ships, with the result that they can keep their crews working on one particular job. In other words they become a sort of protection plant with the idea that certain men do continuously the same kind of work. They can then handle repair work for outside parties or construction work of their own. That is a very important point which repair yards should keep in mind.

THE CHAIRMAN: We also have with us Captain Bean, United States Supervisor of Steam Vessels, New Orleans District. May we hear from Captain Bean?

CAPTAIN BEAN: Mr. President and Gentlemen: I have listened with great deal of interest to Mr. Henry's paper, and to the discussion of Mr. Ewin and Mr. Bernhard. I think Mr. Henry has covered the ground very carefully, but, as Mr. Ewin has said, he has done so from the standpoint of the large repair plant, where items of cost may be determined with considerable accuracy.

I think we have all overlooked in the ship repair plant the human element. We have spoken of the cost of production, etc., but I think the labor is a most important factor. In the ship repair plant there are a class of men who follow special lines. For example, there is a gang of men that change wheels; they are very proficient at that work, but they wouldn't be worth a continental anywhere else. There will be men lying around the dry docks waiting for that kind of work. There is a gang that bores cylinders and such like work, and it is very hard to get these men to do any other kind of work. I think if you could run a manufacturing plant in connection with your yard, it would be very nice. Concerning the question of a repair plant building ships in its spare time, I know of but one ship in the history of this country that was built that way. John Roach in years gone by bought the ship *Rio Grande*, the Mallory Line operated her for many years, and she has just been sold again. Referring more particularly to the coastwise business, I don't see how the plan could be worked in this country, for the reason that each individual line builds a distinctive type of ship. We now have in this country hundreds of ships laid up, designed and built as freight carriers, and still the coastwise lines are building ships for their own use, because they require, in a way, a special type of ship.

THE CHAIRMAN: The paper is now open for general discussion. We would like to hear from Mr. Roberts.

MR. T. H. ROBERTS: Mr. Chairman and Gentlemen: I came up here to learn something; I am always trying to get information. I have been in this repair business for probably forty years, working on ships and around machinery, and I can say that I have listened to Mr. Henry's paper with a great deal of interest. In fact I concur in a good many things that he has

outlined, and I am inclined to agree with the other speakers that his plans of organization apply more particularly to a large plant with a regular flow of work. However, as Mr. Henry has said, this is simply the basis to work on, and it may be adapted to different size plants. I may say, that I have estimated upon, contracted for, overhauled, carried through to completion and sent to sea hundreds of ships. Some of these contracts ran up into the hundreds of thousands of dollars. Each job presented a different set of conditions. Different organizations had to be placed in control; a ship may require repairs to her plates, or to her wheel or in her engine room. A different gang handles each part of the job, one gang for the plate and rivetting work, another for the wheel, and another for the engines.

I have had good opportunities to become familiar with repair plants all over this country. On the Lakes they try to combine ship repair plants and ship building plants, and, as Capt. Bean has just said, it very seldom amounts to much. We have thought many times about introducing into these various plants with which I have been connected manufacturing of some kind. The manufacturing costs ran up so high, that we had to abandon the plan. On the Great Lakes they separate these shops. For instance, the American Ship Building Company constructs its hulls at Loraine, and the engines are built at Pittsburg in the other shops. On the Atlantic Seaboard, they tried manufacturing in several of these shops. About twenty-five years ago, if I remember correctly, they were trying to introduce manufacturing methods into the repair shops, but it seems that in all cases the cost ran up so high they abandoned it. Here is our own city we have one of the most progressive concerns I have ever known, the Johnson Iron Works. I have never been connected with them, but I have been in competition with them for twenty-five years. The Johnson people maintain a ship repair plant across the river that requires dry docks, and they have, in my estimation a very creditable plant. They handle the building of barges out on Bayou St. John, and I don't think that they use the same labor in both places, transferring them from one to the other. When they have a barge to build the crowd that builds the barge goes through

the furious storms of the North Sea, it appeared to Mr. A. B. Wood, a distinguished confrere of mine, and to me that the solution of our problems is not only possible but cheap and practical.

How this can be done when applied to our local conditions is the subject of my paper this evening.

The project comprises the building of a substantial dam at the east side of Lake Pontchartrain so as to prevent the tides of the Gulf from entering the Lake and to allow the lowering of the water in the Lake some two feet below mean gulf tide, and the maintaining of this level at all times and under all climatic conditions. This would result in a number of important advantages, one of which and not the least important, would be to render possible the reclamation of the low lands in this large water shed.

Let us see what would be the main advantages and the most important points to consider to obtain these great improvements.

The reclamation of the greater portion of 400,000 acres of alluvial land, the protection from hurricane damage of the shores of Lake Pontchartrain, the construction of roads from the city to Slidell or Hammond, and of a great continuous highway to the Mississippi summer resorts; these are a few of the advantages that would result from the construction of a levee and locks across the shallow narrow neck of Lake Pontchartrain at the "Middle Grounds" and the installation of pumps to maintain a lower level of the Lake.

We hold as an established and proven fact that all design of any large engineering project should be based on engineering judgment, and not entirely on ancient formulae.

In other words such design should be made by a rational method, similar in principle to the rational method used in drainage canals design, rather than by the blind application of run-off formulae developed in other localities.

The design of any important engineering work, especially one of this magnitude, is an individual problem, and the designer will find it essential to give careful consideration to all the various local affecting factors. Among these must

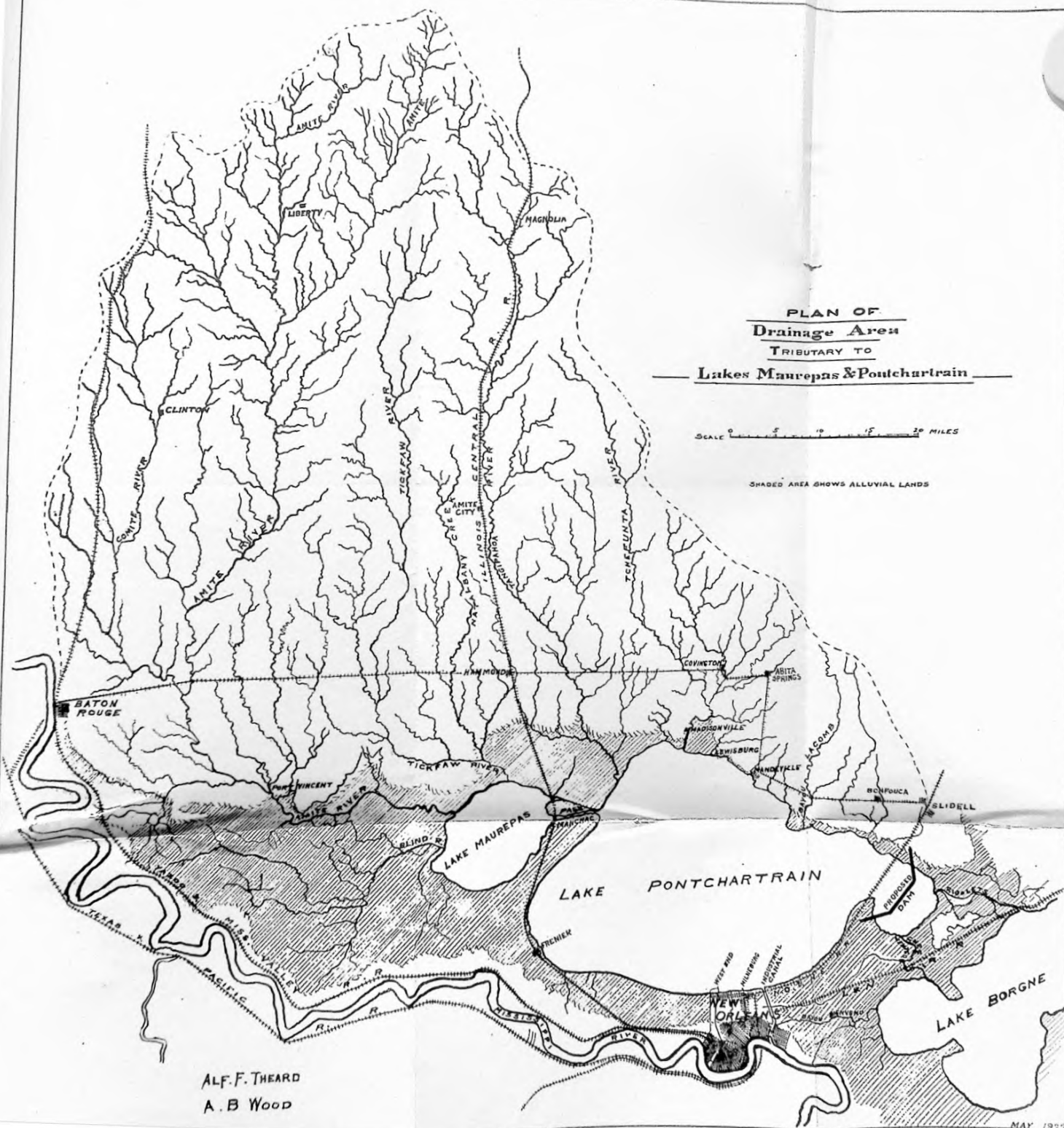
PLAN OF
Drainage Area

TRIBUTARY TO

Lakes Maurepas & Pontchartrain

SCALE 0 5 10 15 20 MILES

SHADED AREA SHOWS ALLUVIAL LANDS



ALF. F. THEARD
A. B. WOOD

MAY 1922

be included the topographical, geological and hydrographical conditions of the territory to be affected by the proposed work; the frequency and magnitude of storms, floods and tides; the cost of the structure, the benefits to be accomplished and the probable damage resulting from failure.

There is a drainage area or water shed tributary to Lake Pontchartrain and Lake Maurepas of approximately 5500 square miles or 3,520,000 acres extending north as far as the source of the Amite River or north of Magnolia, Mississippi, and lying east and west between Pearl River and Baton Rouge.

The rainfall run-off of this area would have to be handled by the proposed pumps but the water surface of Lake Pontchartrain and Lake Maurepas will provide an equalizing basin for excessive rains so that only the average monthly run-off of the rivers would have to be handled by pumping.

This is not an impractical amount of water to handle, figuring on an average yearly rainfall throughout this area, of 55 inches per year, and a yearly run-off equal to less than half this amount.

Pumps equal in capacity to these now in service in the drainage system of the City of New Orleans would be sufficient for the service if operated continuously. The Lake level could be reduced to a level equal to that now prevailing at the low tide, and a fluctuation of a foot or more could probably be allowed to care of a week or more of excessive rainfall.

As to the question of run-off, experience shows that cloudbursts, which occur here and there during the summer or rainy season, have resulted in rather erratic information.

In this very city, where accurate information has been carefully kept of all storms for over 50 years by the United States Weather Bureau, and during the last 29 years by our local authorities, the records show that the area and intensity of storms within the city vary very greatly, although the territory under observation covers only 25,000 acres.

The lowering of the Lake level will require a minor quantity of dredging and improvement at the mouths of all navigable tributaries to the lakes, but the depth of the water

throughout the lower reaches of these tributaries would generally be ample to accommodate all existing lake craft. This has been demonstrated during protracted periods of extreme low tide.

It will be necessary to have locks and bridges constructed on the main dike and probably a lock at the lake end of the Industrial Canal. Very large gates along the main dike may also be found advisable.

The main dike would provide a magnificent highway across the lake much shorter and more beautiful than the Chef Menteur Road, and eliminating all ferries. Nature itself seems to have provided for the location of the main dike. The depth of the water across the Middle Grounds is not in excess of six feet except at the narrow dredged channel where the locks would be placed, and it is believed that its construction would involve no unusual engineering difficulties. The bottom, as far as information at hand indicates, is of good solid sand and would probably be a good foundation for the main dike, without the necessity of piling, although provision must be made for proper anchoring of the new work. It might be found on further study that anchoring by piling or other methods will be found necessary under the main dam.

I have not personally made any soundings or borings but am relying on information gathered from the maps published by the hydrographic office. They show a shallow depth and a sand bottom where the dam is contemplated to take advantage of both the small depth and the sand formation. Besides we must have two locks and probably an additional system of gates. These would necessitate a special foundation. The lowering of the level of the Lakes Pontchartrain and Maurepas would naturally be gradual and consume some time.

There will have to be, of course, some additional dry weather drainage of the present swamp area, as the land is developed and cultivated, but the low tide level would at once free the lands from surface water and, with the digging of short canals, their development for agricultural purposes would be possible at very moderate cost.

As to the question of settlement of the low lands thus affected, it can only be estimated that their subsidence would

be proportional to the lowering of the moisture line and that is a question which would require special study for each individual developed area.

If in a project of reclamation it were possible to predict mathematically the exact duration of the period that would elapse between the time the water is removed from the surface of the drained area and the time when this area begins to pay cash returns from crops, it would be an easy problem to solve, and a very much easier matter to obtain financial assistance for any such project. But that depends on so many factors that each individual area must be studied by itself before conclusions are finally reached.

The failure of the average project to accomplish results burdens the land owner with the first material loss. He feels it most. One thing is certain and that is, that, even if a success is eventually accomplished, during the period of development the reclaimed area must bear an additional or increased charge in taxes, improvements, etc., without any immediate return. The amount of capital thus invested on properly developed lands will yield very large returns when crops are sold and, under favorable weather conditions and good management, a double risk that all farmers take, will continue to do so. This is the fortune of any land reclamation enterprise.

Now it may be urged, as an objection, that we have had sad experience, in the results obtained from the reclamation of large tracts of land adjoining or very near the city. That is true, but it is my impression, that these unfortunate conditions may have been the result of other conditions and not of a protracted period of development without financial return. In some cases, over capitalization has ruined the project and precluded the possibility of additional capital being obtained for development. Some times bad management of the resources obtainable and again sometimes, erroneous treatment of the engineering work may have resulted in complete failure and financial loss. Failures will not encourage investors to advance or invest capital in such enterprises but, with proper safeguards and competent management, we all know that reclamation of waste lands is a very enticing and generally

a financially successful proposition. Lake Pontchartrain would become a constant level, fresh water lake, more like Lake Michigan and the other great lakes and the beautifying of its beaches and the construction of bathing resorts could be realized. As to the conversion of the Lakes from salt water to fresh water and the resulting biological or physiological action on the water surface, I am not prepared to say positively whether this action would cause unsanitary conditions. One thing is certain; Lake Maurepas has gradually become a body of fresh water and I have never heard or read of a complaint about its sanitary condition. It is about one-fourth the size of Lake Pontchartrain and it is reasonable to expect even better results, under the same conditions, in a larger body of water.

This project would not affect in any way the building of a sea wall in front of the city as the conditions thus created would not materially differ from those that will exist during periods of low water. On the contrary with a permanent level varying slightly, it appears to me that the building of the sea wall would be facilitated.

During the construction of the Industrial Canal, force of circumstances compelled the temporary discharge of the dry weather drainage of the city into Lake Pontchartrain, resulting in the fouling of its waters, along the South Shore line between Spanish Fort and Little Woods. The present project of lowering the lake would not interfere with the discharge of the dry weather drainage of New Orleans and the surrounding industrial area, which, as already provided for in design of our city drainage, would be discharged into Lake Borgne. This could easily be extended to care for the industrial development now taking place immediately above the city. The proposed Hammond-New Orleans Road could be built within a few hundred feet of the lake front without risk of hurricane damage, and this shore, as well as the shore around Mandeville and Lacombe changed from a pest ridden swamp into one of the most beautiful lake fronts in the world. The Illinois Central Railroad, along the Lake Shore would thus be protected from hurricane damage as would also the Southern Railway tracks around Sea Brook.

It is not unlikely that the maintenance of the present trestle carrying its tracks between Point aux Herbes and North Shore is somewhat of an expensive proposition for the Southern Railway and as the structure ages, will get more expensive. By a very slight change of location, moving east, the tracks of this road could be placed on the proposed dam, the section of which could be altered to accommodate them, and the cost of maintenance would be minimized or become almost negligible. The stopping of the tidal flows through the Rigollets and the Chef Menteur would simplify the construction and maintenance of the Louisville and Nashville Railroad bridges at these points.

This project pre-supposes an absolutely safe levee system along the east bank of the Mississippi River between Baton Rouge and New Orleans and the raising to proper grade of the Protection Levee around the City of New Orleans. It cannot be put into execution until the question of spillways or outlets for the river on the east bank above New Orleans is definitely settled. It will not interfere with any spillways below the city directly connected with Lake Borgne and has no bearing on any on the West Bank of the River. You will please note that I have referred to a spillway not to a crevasse. If there ever occurred such calamity as a crevasse above the city, the water would naturally be impounded in the vast area between the high lands across the lakes, the protection levees around the city and the Lake dam. Opening of both locks and of all gates or valves, would certainly offer some relief, and prevent the waters from rising above the protection levees. A very important question to be considered in connection with this project is the height of tides in the gulf and in the Lake during heavy storms, a not unusual condition for New Orleans and the territory under study.

A most elaborate and interesting review of all records of high storm tides is given in a paper prepared by our learned and eminent district Forecaster for the Weather Bureau at New Orleans and was read before this Society some two years ago. Dr. I. M. Cline gives a full statistical review of all storm tides and none are more interesting and more germane to the question under consideration than the records

of the tides which preceded and prevailed during the extraordinary storm of September 29th, 1915.

In an editorial comment on Dr. Cline's paper, *Proceedings of October, 1920*, says: "This subject should be of the greatest interest to the engineering fraternity of this section on account of the effect of these tropical hurricanes and their resulting high tides upon many of the most important engineering projects such as marsh land reclamation and drainage, the protection of proposed coastal areas and the control of channel approaches to the rivers and harbors of the Gulf Coast." This is absolutely correct and we must now consider the records given and see how far they affect this project. In reading carefully the record published, it appears that no storm that ever visited this section has exceeded or even approached in intensity that of September 29th, 1915, and as its center passed slightly west of New Orleans its high tides were in excess of any ever recorded here. As evidence of its terrible havoc, the damage resulting from this hurricane was estimated at \$13,000,000.00 and 275 persons were drowned. Let us therefore assume this storm as an extreme case. Tides began to rise slightly on September 22nd, and continued until the water had reached the following heights after the storm center had passed. On the coast, at the entrance to the Rigolets and to the Chef Menteur, 9.6 feet; along the coast, between Lake Borgne and Bay St. Louis 10.0 feet, and on the west shore of Lake Pontchartrain a record of 13.0 feet. Assuming mean Gulf level at 20.43 Cairo Datum the above readings would mean. Elevation 30.03 at the Rigolets and Elevation 33.43 at West Lake Shore. These records are official and show positively that the water was never higher at the Rigolets or at the Chef Menteur than 30.03 C. D. or 2 feet below the suggested elevation of the proposed dam.

Referring to the 13.0 tide in the Lake, Dr. Cline says:

"In Lake Pontchartrain to the right or east of, but nearly in the center of the hurricane the water was 13.0 (Elevation 33.43 C. D .) at Frenier, due to the wind forcing the water up against a dense growth of timber in that locality. A few miles further along the line of advance of the center of the storm, near

the connection between Lake Pontchartrain and Lake Maurepas, where there was open space, the height of the water was 6 feet (Elevation 26.43 C. D.) At Frenier we find that the force of the wind, with about 25 miles open water way, banked the water 13 feet (Elevation 33.43 C. D.) against an obstruction of only a few miles extent, 7 feet higher than on either side."

How this extreme tide of 13.0 feet was recorded and only at one special spot, when a few miles away the water stood 7 feet lower is a question of importance that should be investigated, before it is accepted as authoritative. Obviously none of the protection levees around the sides and rear of the city would have stood any such height.

I can not abstain from inserting here a recent clipping from the Literary Digest which may apply to a condition similar to that at Frenier.—Here it is:

Rose to the Occasion, Anyway

A riverside village boasted a post on which was marked a line showing the height to which the river had risen during the time of a serious flood.

"Do you mean to say that the river reached this height five years ago?" asked the astonished visitor.

"Not exactly sir," replied the villager, "but the children were so fond of rubbin' out the first mark that the Council had to put it a bit higher so as to be out of their reach.'"—*Epworth Herald*.

Now resuming seriously, I know from the Sewerage and Water Board's records taken continuously at several points during this storm, that the reading of 26.2 C. D. at the rear and side levees of New Orleans was the extreme elevation recorded by our gauges during the storm, and incidentally this agrees very nearly with Dr. Cline's report.

Let us assume that after the dam is constructed there is a recurrence of a storm of such intensity as that of September 29th, 1915, with the same high tides and its center passing west of the city in the same disadvantageous location, forcing the worst conditions on the city as it did then. The dam and the embankment of the Southern Railway should hold a 9.6 to 10.0 foot tide or say Elevation 30.03 to 30.43 C. D. The dam is figured to hold against a higher tide and all records

show that the Southern Railway embankment along Peoples Avenue has held this tide in 1915 and will hold it now.

As it is assumed that the level of the Lake would be not over 18.50 C. D. even if there was a repetition of these hurricane conditions the height reached would be correspondingly less. The Lake would be some 8' 0" lower than during the 1915 storm tide and even if a storm swell was caused at some point, like it is claimed occurred at Frenier, this extraordinary storm swell must of necessity be less than 7' 0", if figured on a reduced condition of depth of the water in the lake, as I believe that the depth of the water is a very important factor in fixing the height of all storm waves and swells. In other words, if under present conditions there was a tide of 6 feet in the Lake, and an extraordinary swell of 13 feet or 7 feet additional, at one point as during the 1915 storm, all of which is measured above mean gulf level, when the dam keeps out the gulf tide, any local swell inside of the Lake during a similar extremely intense storm should be calculated on an assumption that the Lake water would be 18.50 C. D. instead of 26.20 C. D. and that the depth of the water in the Lake would be less after the dam is in service. But even if under extreme conditions a small area was flooded temporarily, this cannot be avoided any more than any section can avoid a cloudburst or a water spot and, with the dam constructed and keeping the gulf tides out of the lake, the water would recede from the small flooded area very promptly. As long as the dam would prevent the gulf swell from entering the lake, the dam would prove its usefulness and accomplish its purpose. Inside the lake, a large body of water offering an open sweep some forty-two miles long for the wind to bank the water, the local storm swell would affect a small limited area in the vicinity of the center of the storm or immediately east of this center and no project can avoid such a condition caused by an act of God. The best drained area in the world can not avoid at times being temporarily flooded by a cloudburst. Cities and drainage districts might as well abandon all drainage projects because it might happen that part of the drained area will be temporarily flooded occasionally as the result of a very heavy and extraordinary rainfall.

I could cite other cases which are negligible in the consideration of the development of all large projects, but I am convinced that I have given a sufficient explanation of this storm tide question to conclude that the highest tides during extraordinary tropical storms are not to be considered as a serious objection to this project, especially when it is recognized that a storm of such intensity as that of September, 1915, is not likely to visit this territory again within the next two hundred years.

In a recent article (June 29, 1922) entitled "Rain Fall versus Judgment," the Engineering News Record editorially says:

"Observed fact, scientific deduction, and practical judgment come together in quite remarkable manner in the problems of bridges and floods. Many years of observation, since the deluge against which Noah provided, have not removed the subject of heavy rainfalls from the realm of the unknown and unexplored and the engineer will always be in the position of taking chances when he undertakes to proportion a bridge waterway.

"It is hardly possible to make every bridge opening large enough to carry the most intense flood flows that have occurred anywhere. Scientific deductions warrant the transfer of experience in a degree, but practical judgment usually says that it does not pay to go to an extreme in safety provisions."

It is always better to favor the side of safety but the above remarks fit so well the probable conditions as we see them, even if unusual tides and rainfalls occur, that they should not be a serious reason to urge against the realization of a project that appears so full of tangible benefits to the City of New Orleans and to the entire territory adjoining the two lakes.

The cost of the project is well within the means of the State of Louisiana; the increased assessment of the lands alone would refund and pay the interest charges on a bond issue. The Levee Boards, Highway Department, and the railroads would benefit and might render financial aid. The cost of maintenance and operation can not be ascertained positively until further study of the project, but it is estimated that the operation of the Pumping Station would cost between

\$100,000 and \$200,000 annually and the maintenance would be comparatively very small. To the cost of operation must be added any expense to be incurred in interest and sinking fund for the amortization of the cost of this project if it is financed by a special bond issue. The question of whether it must be financed by the owners of the lands to be reclaimed or by the State is a very important feature to be considered.

The cost of the entire work is estimated at \$10,000,000.00 divided as follows:

Dam	\$ 3,000,000.00
Locks	2,000,000.00
Bridges	1,500,000.00
P. Sta. and Equipment	1,000,000.00
Gates	1,500,000.00
Miscellaneous	1,000,000.00
	\$10,000,000.00

The project is alive with engineering questions of great importance; it is immense in its scope and requires deep engineering study; and it is this feature of it, linked with its wonderful benefits, that has made its study so attractive to us who have discussed and considered it carefully. It is worthy of a comprehensive investigation and it is now submitted for your consideration, with the conviction on the part not only of Mr. Wood and myself but also of others who have considered it with us, that it is a project not only of great moment for the City of New Orleans and its future development, but also a most interesting engineering problem, absolutely practical and adaptable to our local conditions. It is an idea, alive with wonderful possibilities, and requires more than a superficial or hurried consideration.

I believe that, as it applies to a large area over parts of which both the Federal, State, Parochial and Municipal Governments have jurisdiction, a joint commission should be entrusted with powers to make a thorough investigation, making a full survey of the area involved, and all necessary topographical and hydrographical observations, soundings, gaugings, etc. This commission should present its conclusions within a reasonable time with recommendations to the Governor or to the authority which created and appointed it, when final arrangements can be made to put the plan into execution or

to modify it in accordance with the terms of its recommendations.

While we may over-estimate the value of this idea, pardon me for quoting a recent article by Dr. Edwin E. Slosson in *Science News Bulletin*:

"The rarest and most valuable thing in the world is that scintillating but impalpable excretion of the cerebral cortex known as an idea.

"Yet a large part, and probably the most valuable part of what is produced by the activity of this thin gray film which covers certain brains, is lost for a time and in some cases for ever, through the carelessness of contemporaries.

"There is no form of conservation that is so important as the conservation of ideas. The greatest waste is our failure to utilize, not our carelessness in methods of utilization."

Nature seems to suggest what can be accomplished here. Let us make use of this idea, the result of this suggestion. Why should we waste any time, besides that strictly necessary to study this idea. Let us get to work and we will reap the benefits ourselves. We, are satisfied, that as the study of its different features will proceed, its great benefits will become more and more evident and its importance to the future development and advancement of our city will compel the financing of means for its construction.

In referring to a report on waste in Industry, which has been regarded as an outstanding contribution of American Engineering to the business community, an official of the Department of Commerce says:

"Of course it is an engineer's report and some of you may want to discount the technical man's findings, but surely you will admit, these engineers are at least half right," etc. This is a layman's opinion of an engineer. Let me hope that you engineers will find us better than half right. Submitted herewith are two plans illustrating the general idea and location of the dam. These plans are merely an outline of the general design and no attempt has been made to go into details of construction. The idea is submitted; details can be worked out without any great engineering difficulties.

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Regular Meeting of the Board of Direction, October 9, 1922.

The meeting was called to order with President Derickson in the chair and Messrs. Barelli, Manley, Moses and Robert present.

On motion duly seconded the following applications were ordered to the ballot for the respective grades of membership:

Resident Members—A. A. Fraser, W. K. Grant, J. V. LeBlanc, Jr., M. J. Young.

Non-Resident Member—Louis M. Buja.

Non-Resident Associate Members—Cecil A. Eby, Jesse D. George.

Non-Resident Junior Members—Clarence A. Ives, Jr., James B. Raymond, Chester A. Rowland.

Non-Resident Student Member—Reginald A. McFarland.

Upon motion duly seconded, it was decided to pay Mr. Carbrey \$10.00 for his trouble in returning to the city for the July meeting in his ignorance that there was no meeting in July.

With reference to members delinquent in dues, it was decided to keep after them in an effort to collect rather than drop them from the Society.

A letter of resignation from Mr. John Dykers was read, his resignation being accepted. Upon motion duly seconded Mr. A. M. Blamphin was reinstated to membership, having paid up his arrears.

Upon motion duly seconded it was decided to pay the dues of the Society to the Federated American Engineering Societies, retaining, however, the discount for employment service.

Upon motion duly seconded the financial report for September was accepted and bill ordered paid. There being no further business the meeting was adjourned.

JAMES M. ROBERT,
Secretary.

Regular Meeting of the Society, October 9, 1922.

The meeting was called to order with President Derickson in the chair and 40 members and guests present. The minutes of the previous meeting were read and approved.

The president reported to the meeting the death of Mr. Adam J. Haaser, and Mr. Walter Moses was appointed a committee of one to draw up suitable resolutions.

The meeting being held under the auspices of the New Orleans Section of the A. S. M. E., the meeting was turned over to Professor W. B. Gregory as chairman of the Local Section, who presided.

The technical exercises of the evening was an interesting paper by Mr. Orloff Henry, entitled "Management of a Ship Repair Plant." After considerable amount of enlightening discussion Mr. Henry was tendered a vote of thanks, after which the meeting was adjourned to the usual collation.

JAMES M. ROBERT,
Secretary.

Special Meeting of the Society, October 25, 1922.

The meeting was called to order with President Derickson in the chair and 13 members present. The meeting was called for the purpose of hearing Mr. J. F. Coleman read the following resolution:

RESOLVED, That it be the sense of this meeting that it approve of the project for the construction of an Auditorium.

BE IT FURTHER RESOLVED, That the president be authorized to appoint a committee to co-operate with the committees of similar organizations to effect that end.

Upon motion duly seconded, that resolution was passed. In conformance with the above, the chairman appointed the following committees to serve: Messrs. Bernhard, Chairman; Fox and Mann.

The meeting was honored by a visit from Mr. John R. Freeman, Past President of the American Society of Mechanical Engineers and of the American Society of Civil Engineers. Mr. Freeman made a few remarks concerning the coming meeting of the American Society of Civil Engineers in New Orleans.

These remarks were thoroughly enjoyed by those present after which adjournment was taken.

JAMES M. ROBERT,
Secretary.

Regular Meeting of the Board of Direction, November 13, 1922.

The meeting was called to order with President Derickson in the chair and Messrs. Gausaud, Barelli, Robert, present.

Ballots for new members were opened, there being 83 cast. As a result the following were elected to the respective grades of membership:

Resident Members—A. A. Fraser, W. K. Grant, J. V. LeBlanc, Jr., Mason J. Young.

Non-Resident Member—Louis M. Buja.

Non-Resident Associate Members—Cecil A. Eby, Jesse D. George.

Non-Resident Junior Members—Clarence A. Ives, Jr., James B. Raymond, Chester A. Rowland.

Non-Resident Student Member—Reginald A. McFarland.

The resignation of Mr. Lezin A. Beemel was accepted with regret. Upon motion duly seconded, it was decided to recommend to the Society the appointment of Mr. J. S. Barelli, as a member of the American Engineering Council for 1923 and 1924.

Upon motion duly seconded, the Secretary was requested to notify the Association of Commerce that the new President to be elected January 13, 1923, would represent the Louisiana Engineering Society on the Civic Council.

The report of the Secretary was read and approved and bills ordered paid. There being no further business the meeting was adjourned.

JAMES M. ROBERT,
Secretary.

Regular Meeting of the Society, November 13, 1922.

The meeting was called to order with President Derickson in the chair and 21 members and guests present. The minutes of the previous meeting were read and approved.

A letter from the Local Section of the American Society of Civil Engineers calling attention to the Spring Meeting to be held in New Orleans in April, 1923, was read and a motion was made, seconded and carried that we should co-operate with the Local Section A. S. M. E., in holding this meeting.

A letter from Mr. J. F. Coleman suggesting that the Society contribute toward placing a bust of Mr. James B. Eads in the Hall of Fame, was read and upon motion duly seconded, it was decided to appropriate \$50.00 to this fund.

The recommendation of the Board of Direction that Mr. Barelli be appointed on the Engineering Council for the next two years, was read and approved and upon motion duly seconded Mr. Barelli was appointed as stated.

There being no further business to come before the meeting, Mr. Alfred F. Theard read a paper entitled "Reclamation of Lake Pontchartrain Low Lands." After considerable interesting discussion which was enjoyed by all present, the meeting adjourned to the usual collation.

JAMES M. ROBERT,
Secretary.