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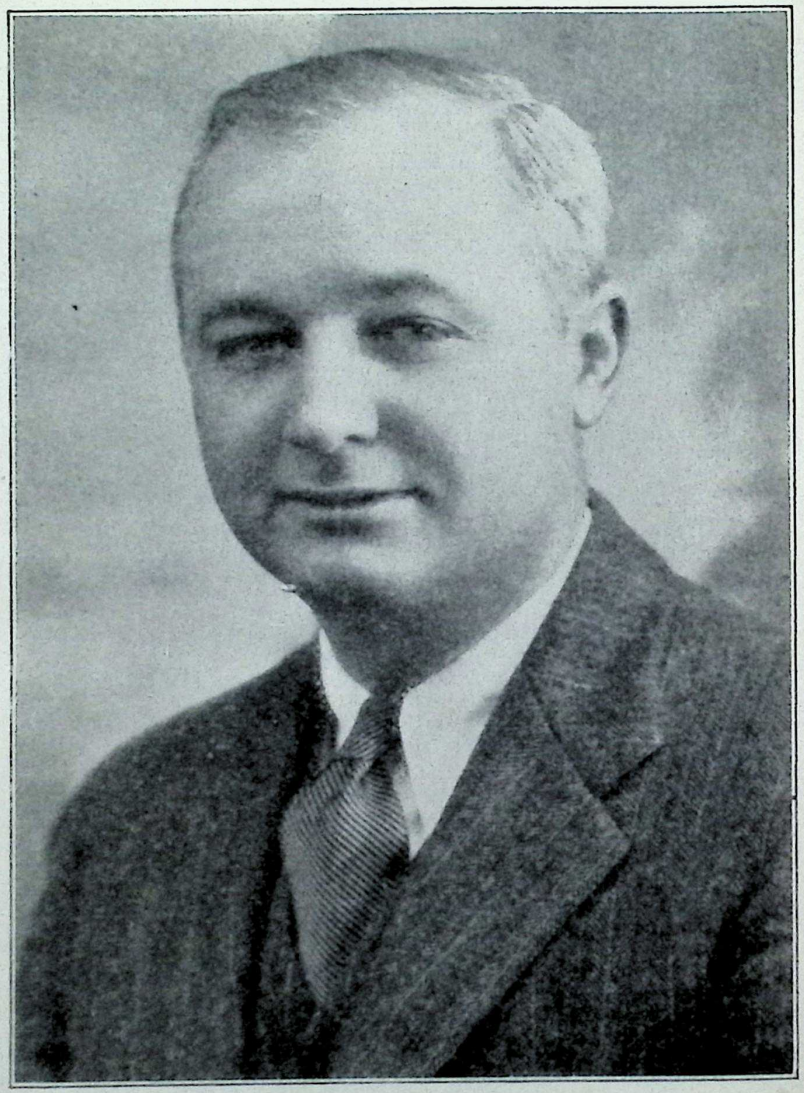
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JAMES M. TODD

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OF THE
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EDITORIAL NOTES AND COMMENT

President Todd. James Mulherrin Todd was born in St. Mary Parish, Louisiana, May 25, 1896, the son of John R. Todd and Fannie Louise Mayer. Having obtained his preparation for college in the public schools of Opelousas and New Orleans, he entered the College of Engineering of Tulane University in September, 1914. Graduating in 1918 in the Mechanical-Electrical Course, he immediately enlisted for service in the World War and was sent abroad to England and France as an officer in the Engineer Corps.

Returning to this country in 1919 his first employment was with Penick and Ford as engineer of their plant. This was followed by service as assistant engineer with William H. Ennis, until in 1923 he joined the staff of A. M. Lockett and Company as an assistant engineer. He retained this connection until

1928 when he began private practice as a consulting mechanical and electrical engineer. He has been recently retained as consulting engineer by Favrot and Livaudais, Architects, and by the Board of State Engineers. Mr. Todd was married in 1922 to Miss Margaret Ker Texada, a graduate of Newcomb College.

He is a member of the American Society of Mechanical Engineers, in which he serves upon the Committee on Local Sections and the Committee on the Economic Status of the Engineer. He is also a member of the American Society of Heating and Ventilating Engineers.

The election of Mr. Todd to the presidency of the Society is a well-deserved honor, for he has been one of its most active members and has always taken an enthusiastic and effective part in advancing its welfare and progress.

Other Officers for 1930. Mr. Frank G. Frost was elected Vice-President, and Professor A. L. Dunlap was elected a member of the Board of Direction. Professor Fox as retiring President automatically becomes a member of the Board, Messrs. F. N. Billingsley and J. H. O'Neill being the other two members. Mr. Muth and Mr. Moses retain their positions respectively as Secretary and Treasurer. A complete list of standing committees is given on the title page of the *Proceedings*.

The Smoker.....

The Time:—January 18, 9 P. M.
The Place:—Florentine Room, Jung Hotel.
And The Girls! ! !

The Incomparables, Ole and Walter, were once again right on the job and gave us another of their interesting and enjoyable entertainments.

The girls were young and attractive, the student members had a good time, and their elders showed the proper amount of restraint and dignity.

Ole was slightly disabled from a recent accident, but it did not appear to cramp his style.

Mr. Todd was master of ceremonies and acquitted himself in his usual pleasing and effective style.

The invited guests included President A. B. Dinwiddie of Tulane University; Commander R. E. Cassidy of the New Orleans Naval Station; Col. Mark Brooks, Division Engineer, U. S. C. E., Major R. S. Fowler, District Engineer, U. S. C. E., and Mr. Robert Glenk, Curator of the State Museum.

Items from Annual Reports. Through a very active and efficient committee and with the co-operation of the State Board of Engineering Examiners, as well as the local sections of the national societies, very effective work has been done toward drafting a law for the registration and licensing of all professional engineers in the State of Louisiana.

Scholarships for students of engineering have been established both in Tulane University and the Louisiana State University.

The privileges of student membership were extended to include Juniors as well as Seniors from approved colleges of engineering.

Certificates of membership will be issued to such members as may desire them. These will be printed on good quality of paper, suitable for framing, and will be furnished at the nominal price of $1.00 each.

The Society sponsored and arranged the details of a testimonial dinner in honor of the recent election of Mr. J. Frank Coleman to the Presidency of the American Society of Civil Engineers.

The invested funds of the Society now amount to over $8,000.00.

The average attendance on the regular monthly meetings was sixty-two (62).

The total membership of the Society is now 500.

During the year just closed the Society lost five of its members by death,—W. L. Fey, E. F. Delery, J. H. Murphy, J. F. Dubus and W. T. Triggs.

Testimonial Dinner to Mr. Coleman. In recognition of the honor which Mr. Coleman's election to the Presidency of the American Society of Civil Engineers had brought to the Louisiana Engineering Society and to the City of New Orleans, he was

tendered a dinner and reception under the auspices of the Society. Mr. Coleman was the real founder of the Louisiana Engineering Society and is now one of its Honorary Members. In order that his many friends outside of the engineering profession might participate in the dinner, invitations were sent to a large number of professional and business men throughout the city.

Accordingly a large group of his friends, both men and women, gathered at the Tip-top Inn of the Roosevelt Hotel on the evening of January 30 to show their appreciation and esteem for him.

Addresses were made by Mr. James M. Todd, President of the Society, Professor W. B. Gregory, Mr. Charles A. Favrot, Mr. R. S. Hecht and Mr. J. Blanc Monroe, the latter in presentation of a handsome silver tea service on the part of the assembled guests. Professor Douglas Anderson, Dean of the College of Engineering of Tulane University, acted as toastmaster.

The Committee of Arrangements on behalf of the Louisiana Engineering Society consisted of Mr. A. M. Lockett, Chairman, Mr. James M. Todd and Col. Marcel Garsaud.

Illumination. Under the title "Requirements of Good Lighting," Mr. M. F. Canning, Illuminating Engineer of the New Orleans Public Service Company, discussed the general problem of illumination. Not so many years ago lighting and illumination was a minor branch of the field of electrical engineering, and our standards of good lighting were adopted very largely from these already set up by the gas lighting industry. In its rapid development, however, illumination has made tremendous strides until now, both on its scientific and on its engineering side, it has become one of the foremost of our technical arts.

Not long since there was held in New Orleans, under the joint auspices of the Southwestern Division of the National Electric Light Association, the New Orleans Public Service and the College of Engineering of Tulane University, a School of Lighting Practice for the purpose of training public service and other technical men in the science and art of illumination.

OBITUARY

Resolutions Upon the Death of Eugene F. Delery

WHEREAS, it has pleased Divine Providence to take from our midst on November 24, 1929, our friend and fellow member, Eugene Frank Delery,

AND WHEREAS, the members of the Louisiana Engineering Society have recognized Mr. Delery's ability, high attainments and integrity, and have always been appreciative of his interest in the Society:

BE IT RESOLVED, That it is the sense of the Louisiana Engineering Society that, in the passing of Mr. Delery the Society has lost a worthy member, the community a useful citizen who was interested in civic affairs and was an honorable type of man.

BE IT FURTHER RESOLVED, That a copy of these resolutions be spread on the minutes of the Louisiana Engineering Society and that a copy be sent to the family of Mr. Delery.

Respectfully,

F. A. MUTH,
JOHN L. PORTER,
LEON LASSEN, *Committee.*

PAPERS AND DISCUSSIONS

REQUIREMENTS OF GOOD LIGHTING

By M. F. Canning.

Read Before the Society, December 9, 1929.

The change from an outdoor life to a predominantly indoor one is perhaps the most outstanding change which has come to the human race. Human beings evolved under natural daylight and during the eons of evolution of the race their eyes became accustomed to the quality, quantity and distribution of daylight. But when civilization moved indoors these factors underwent a vast change, particularly as to quantity. Also the demands upon the eyes became enormously more severe.

For instance during the years man did most of his work outdoors with a superabundance of fresh air and daylight, his conception of close measurement was probably an inch. He did little or nothing by artificial light, when it rained or when night came he quit working. In those days each family was self-contained and self-supporting.

Accordingly, the intensity he became accustomed to was from 300 to 10,000 foot candles of well dffused illumination, to care for his simple visual requirements.

With the advent of specialization, man moved indoors and at once came into strange working surroundings. During the few hundred years of this period his work was still largely hand work, but the demands on his vision increased somewhat so that he worked to limits of 1/16 and 1/32 of an inch. However, in spite of the fact that he worked indoors he still had a window of his own to sit by and consequently enjoyed a natural illumination of 75 to 100 foot candles. As before, he stopped work when night began.

About the time it became impolite to cool your coffee in a saucer, industrial mankind began to feel the urge of production and man moved himself into an atmosphere of smoke, dirt and noise, lighted by a few glaring, sickly lamps on dangling drop cords, his visual requirements increased however, and he was required to produce to an accuracy of thousandths of an inch. The teeter board had tipped to its extremes—from 1 inch accu-

racy and 10,000 foot candles to 1 ten-thousandths of an inch accuracy and 1 foot candle to work by. Is it any wonder the word "sweat shop" was coined?

It is extremely fortunate that the development of better illuminants and the science of proper illumination stepped into the breach to correct some of the new artificiality into which working mankind had been drawn.

About the beginning of the war, illumination literally moved from the janitor class of necessary evils to the class of the productive machine, and the term productive intensity was coined. It was found that man worked better, saw better, and was happier under conditions which duplicated- as far as practicable, the outdoor conditions under which he had worked and lived for thousands of years. The intensities rapidly changed from 1 and 4 foot candles in 1914 to 15 and 20 foot candles in 1926. In some of our more progressive plants today, we find as much as 35 foot candles of general illumination.

In view of these recent, rapid changes the question "Where will we stop?" naturally arises. The answer is, that just as fast as higher intensities can be safely and economically obtained, men will demand them, up to the point where natural daylight quantity, diffusion and color are approached.

When modern light sources appeared, much was known pertaining to the visual organ and sense, but little was known of the science of seeing. Light is essential to vision; and good lighting—proper control of quality, quantity and distribution—can greatly aid vision. Seeing is the result of lighting plus vision. However, we had inherited very little knowledge of this combination, so it was necessary to begin to build the foundation of the science of seeing through research. It is an exceedingly complex subject leading through the sciences in respect to the production and control of light, into the phychophysiology of visual sensations, and finally into the still less tangible realm of feelings, affections, emotions, sentiments, volitions and associations. Much time has been spent in tedious research, but much still remains to be done. The lighting art of the future will be almost as extensive as human activities, and the science of seeing will be an important part of its foundation.

Illumination in Industry

But what is good lighting, and why is some lighting bad? He is a rash man who enters upon the contentious sphere of definition—he must be of the stuff of which martyrs are made. Whilst I have not the temerity to suggest a definition, has not good lighting something akin to the perfect human character—that which permeates all around it with charm and helpfulness, but effaces its own individuality? Good lighting is not synonymous with plenty of bright lights and ostentatious schemes of illumination, nor is bad lighting always insufficient lighting. But insufficient lighting is seldom economical, even when it is arranged as effectively as possible, nevertheless the greater the amount of light the greater the care needed in disposing it so as to get advantage from it.

The lighting of our factories and workships is a profound factor in the environment to which the worker in every country is exposed. It is not merely a question of having sufficient light to secure safety, or of adequately illuminating the work in progress to attain the required speed and accuracy, although this is a matter I shall return to immediately—but even more important is the general atmosphere of stimulation and well-being which prevails in a brilliantly and well-lighted place, with the added joy and gaiety which it brings in its train. Psychologically we are very sensitive to bright light. Just as a dull cloudy day affects our temper and makes heavier demands on our will to keep cheerful and buoyant, so a low level if illumination under artificial light causes the individual to make up from his or her store of nervous energy that stimulation to virile activity which, when there is really plenty of light, comes from outside. If you doubt this, recall the way in which people will gravitate to the most brilliantly lighted areas. Think of your own sensations when, after working in poor light you bestir yourself to flood the room with light. A different atmosphere immediately prevails, a certain tension is relaxed and you have the feeling that you had been, as it were, doing work with the brake on.

Everyone will admit that the unfortunate consequences of grossly insufficient light are obvious, but somehow or other there is an impression that when the illumination is what is

called "sufficient," further advantage is not to be secured. When it is realized that the ordinary daylight to which we are accustomed is about a hundred times more intense than our usual artificial light, such an assumption would seem on the face of it unsound. It cannot be justly argued that the relief felt when light is turned on is a mere passing sensation produced by contrast. Those who are accustomed to plenty of light do not willingly go back to mere mediocre conditions of illumination. The effect is a permanent one and we do well to reckon with it in planning the admission of daylight to our factory and other buildings, and in designing our lighting installation for artificial illumination. For maximum efficiency is related just as much to the atmosphere and tone of our premises as is the perfection of our production systems or the rigidity of our factory discipline. This is the first reason for giving special attention to a higher and more effective standard of lighting in workplaces. It affects the general efficiency of work by conserving the personal resources of workers.

Prof. D. C. Jackson, writing recently for the National Research Council of the U. S. A., has discussed the difficulties of collecting reliable evidence in figures, of the effect of good lighting in industry. The human eye has such an extraordinary capacity of accommodating itself to whatever conditions of illumination it is asked to adjust itself, that workers in many processes are enabled to continue their tasks for hours together without their efficiency apparently being affected by quite large changes in illumination. It is not therefore easy—it is, in fact, very difficult—to assess the actual effects upon the workers of different illuminations. For supposing there is no falling off in efficiency to measure, owing to poorer lighting? The worker may nevertheless be straining all the time to maintain his output with an amount of light which is only just sufficient to avoid an actual falling off in output. But the eye cannot do this month after month and leave the individual unaffected. These things are not capable of rigid proof, but we can all agree from our personal experience, that temper and irritability are the first symptoms to those who know us best, that our day's work has been telling on us, that our faculties have been strained, and this applies to the manual worker, too. None

can say what difference a lifetime of work under good or indifferent lighting conditions would make to the condition of our nervous system at the end, but to most it would stand to reason that we must be better off if we can keep the eye working in an illumination which has a good margin over the minimum with which the eye can just function without definite signs of inefficiency.

Now, first of all, what is the point, as the amount of light is increased or decreased, at which a worker's efficiency is actually affected owing to diminution of seeing power? As I have just indicated, the measure of the efficiency of workers is very difficult. We talk easily about it, and we may often think efficiency is unimpaired when the real fact is that we have no precise standard of gauging it. For practical purposes here our measurements must be precise—for a difference of as little as 1 per cent in effective output is important. In an ordinary factory the bill for lighting could be doubled and still only amount to 0.6 per cent of the cost of wages. If therefore by doubling the amount of light the speed of work could be increased by only 0.3 per cent, or the reduction of output by spoiled work improved by an equivalent amount, it would be worth while to double it. The differences of output it is worth our while to measure are thus very small and in order to study the subject we must choose an industry in which we can be sure that the results are not masked by those physical, physiological and psychological variables which baffle the seeker after truth in this realm.

A government research committee in Great Britain in an effort to study this problem with the aid of those experienced in industrial psychology, chose the industry of type-setting by hand for a critical experimental enquiry. Their experience in this study leads us to think that there are very few industries which permit of such effective examination as this, of that borderland in reasonably good lighting where the effectiveness of the worker is influenced by illumination. For not only can speed of work be accurately measured over long periods on a uniform kind of type-setting, but, more important, mistakes through the choice of wrong type or its misplacement

in the frame are easily detected, perfectly definite and can be readily computed. Without troubling you with details of the work and the precautions taken, the results are briefly as follows: "That if the illumination is less than 2 foot candles, nearly one-quarter of the possible output is lost, while the number of mistakes is more than doubled, and the fatigue experienced by the type-setteers is materially increased. Even when the illumination is as much as 7 foot candles (a value which is probably higher than the present general practice) over 10 per cent of the possible output is lost and there is an unnecessarily high percentage of errors."

There is a total saving in this instance, owing to better light, of between 10 per cent and 20 per cent of the wages bill, and the improvement in the light is paid for many times over by the improvement in output.

The investigation reveals that the borderland is wider than we expected and extends to higher illuminations than we anticipated. Now, it is not unreasonable to think that the tendencies which these facts reveal apply only to this particular industry. Accuracy of seeing, quickness of perception, freedom from fatigue, are the factors which make for efficient work in all industries. The operation of type-setting is chosen merely because it lends itself to the study and measurement of these factors.

But light is not merely to be increased in intensity. It must be correctly disposed or distributed. The greater the intensity we desire to use the more careful it is necessary to be to distribute the light correctly and to shade the lights themselves.

Herein lies the need for the study of each particular problem by itself, for when we consider that experience has taught us that different types of industrial operations require different intensities of light and that these intensities range from 6 to 100 foot candles, depending on the class of work, we realize that we not only have a problem of engineering, but also one of economics.

In connection with the economics of high intensity lighting systems we may find it advantageous to use what is known as

a "general and localized lighting system." This being a system where enough general illumination is supplied to allow freedom of movement and relief from harsh contrasts, and properly installed local lighting to pursue the task before us. However, it is of the utmost importance that localized lighting be installed so as the individual operator cannot tamper with it or alter it in any way. Obviously this would result in a return to our former system of unshielded and glaring lights, which would probably be working not only to the detriment of the operator himself, but also to other operators in his vicinity.

Psychology of Light and Commercial Illumination.

Psychologists claim, and justly so, that a man's mood can be completely changed simply by changing his environment. Here again illumination or the lack of it plays a very important part; for instance, bright surroundings, such as highly illuminated walls, ceiling and furnishings, are stimulating. Brilliant effects, such as those produced by crystals, mirrors, metallic paints, silks, and jewels, which reflect bright images of light sources, are even more stimulating. Here again lighting is more powerful than the media commonly employed by the decorator. On the other hand, low intensities of illumination produce effects which are subduing. Shadows are restful. Darkness may even be mystifying and awesome. Quite without the use of colors we may produce a great range of moods and arouse a range of emotions by means of brightness. Adding to these the powers of colors, we have facilities for much emotional appeal. Colored light is here very powerful, for we may shed it upon everything. Thus, it tinges the entire environment and, thereby, is more powerful in arousing emotions than colored paints, etc.

There is perhaps no place that lends itself to the psychological use of light more readily than our modern commercial structure. Here the designer has the opportunity to use light to its best advantage. He should, however, first bear in mind the principles of light and vision, and also remember that what has been said of illumination in industry is equally important

in commercial lighting and then use light to play on the emotions of his subjects.

Another important point in the design of commercial structures and the lighting of them is the architectural structure of the building. It has been said in this connection that illuminating engineers were prone to sacrifice architectural design for efficiency, and also that the architect on the other hand was prone to sacrifice efficiency for the sake of architectural uniformity. The trend at the present day is to combine in the iluminating engineer the good points of both efficiency and architecture, with a minimum sacrifice of both details. It is therefore becoming necessary for illuminating engineers to study architecture along with illumination. We are beginning to see the results at the present time and are finding that close study of the subject reveals that both the architectural and illumination details can be carried on successfully by the proper use of lighting equipment. This, I believe, marks a great forward step on the part of both architects and illuminating engineers, and looking into the future we can even imagine both these men working in close harmony for the ultimate success of proper lighting.

Conclusion.

It has not been the purpose of this paper to specifically define the "Requirements of Good Lighting"—in fact, I believe to place a strict definition on this subject would be to commit one of the greatest errors possible in engineering. Lighting represents one of the greatest progressive fields, if not the greatest, of science. Standards of illumination constantly change as we learn more about our subject, and to what extent these changes will carry us is more a question of speculation than of definition; and who knows but that within a short period of years our entire system of illuminating may change. However, we must bear in mind that good lighting is fundamentally a problem of vision and that successful design of the future will depend primarily upon this one factor:

MEMBERSHIP LIST

HONORARY MEMBERS

A. L. BLACK, (C. M. and H. M.), with Ford, Bacon and Davis, Inc., 611 Gravier St., New Orleans.

J. F. COLEMAN, (C. M. and H. M.), of J. F. Coleman Engineering Co., 501 Hibernia Bldg., New Orleans.

WALTER H. HOFFMAN, (C. M. and H. M.), Civil Engineer, 1518 State St., New Orleans.

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

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LESTER F. ALEXANDER, (1915), Engineer and Contractor, 834 Audubon Building, New Orleans.

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A. F. BARCLAY, (1908), Chief Engineer Public Belt Railroad, 5670 Rosemary Place, New Orleans.

JOHN S. BARELLI, (1908), Boilers and Power Plant Equipment, 612 Godchaux Bldg., New Orleans.

WADE BARNETT, (1910), Engineer, 8821 Spruce St., New Orleans.

CECIL N. BEAN, (1922), Supervising Inspector Steam Vessels, 10th District, 8012 Burthe St., New Orleans.

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JAMES W. BILLINGSLEY, (1914), Consulting Engineer, 702 Interstate Bank Bldg., New Orleans.

A. MERRICK BLAMPHIN, (1908), Construction Engineer, Box 897, 606 Maison Blanche Bldg., New Orleans.

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EDWARD S. BRES, (1925), Scott & Bres, Contracting Engineers, 1007 Maritime Bldg., New Orleans.

GEORGE ELMON BROWN, (1929), Representing International Filter Co., Chicago, Ill., and National Aluminate Corporation, Chicago, 2228 S. Gayoso St., New Orleans.

FRANK P. BROUSSARD, (1925), 1839 S. Gayoso St., New Orleans.

LOUIS M. BUJA, (1922), Engineer Globe Construction Co., Inc., 312 La. Bldg., New Orleans.

EDWARD W. BURGIS, (1919), 528 Bouny St., New Orleans.

GEORGE H. BURT, (1928), Chief Engineer, c/o Celotex Co., Marrero, La.

R. T. BURWELL, (1908), Manager New Orleans Department, Hartford Steam Boiler Inspection and Insurance Co., 1128 Hibernia Bank Bldg., New Orleans.

SIDNEY E. CALONGNE, (1927), Civil Engineer, President S. A. Calongne's Sons, Engineers, 907 N. O. Bank Bldg., New Orleans.

C. GLEN CAPPEL, (1915), Vice-President, W. Horace Williams Co., Inc., Engineers and General Contractors, 833 Howard Ave., New Orleans.

CHESTER W. CARR, (1926), Vice-President, E. W. Carr, Inc., 901 Carondelet St., New Orleans.

D. B. H. CHAFFE, JR., (1920), Vice-President, Southern States Equipment Co., Inc., Vice-President, Rogers, Higgins Co., Inc., 801 N. O. Bank Bldg., New Orleans.

ROGER E. CHESTNUT, (1925), with Standard Fruit and S. S. Co., 323 Eliza St., New Orleans.

JAMES HENRY CHERRY, (1929), 1120 Hibernia Bank Bldg., New Orleans.

JOHN HENRY COATES, (1927), Assistant Engineer, Sewerage & Waret Board, 302 S. Murat St., New Orleans.

E. H. COLEMAN, (1922), J. F. Coleman Engineering Co., 501 Hibernia Bldg., New Orleans.

JAMES HOWARD COLLINS, (1929), General Outdoor Advertising Co., 2120 Canal St., 1310 Short Street, New Orleans.

SAMUEL CHAPMAN COLLINS, (1928), 1523 Conery St., New Orleans.

HENRY BELL COOLEY, (1924), Civil Engineer and Attorney at Law, 2427 Soniat St., New Orleans.

J. M. CRACROFT, (1927), Assistant Engineer, Bridge Department, City of New Orleans, 1473 Henry Clay Ave., New Orleans.

CHARLES C. CRAWFORD, (1921), 3227 Coliseum St., New Orleans.

W. H. P. CREIGHTON, (1912), Professor of Mechanical and Sugar Engineering, Tulane University, New Orleans.

HORACE E. CRUMP, (1912), Office Engineer, Board of Commissioners of the Port of New Orleans, No. 2 Canal St., New Orleans.

DAVID L. CULLOM, (1916), Assistant Engineer, Board of Commissioners of the Port of New Orleans, 3620 Baronne St., New Orleans.

HENRY C. DAUBERT, (1928), Engineer, 1615 Bodenger Blvd., Algiers, La.

CHARLES DAVIS, (1925), Engineering Department, Board of Commissioners, 5407 Prytania St., New Orleans.

B. N. DAVIS, (1913), Engineer and Contractor, 1006 Tchoupitoulas St., New Orleans.

DONALD DERICKSON, (1912), Professor of Civil Engineering, Tulane University, New Orleans.

JACQUES de TARNOWSKY, (1915), Structural Engineer, Room 25, City Hall, New Orleans.

J. L. DICKEY, (1915), Civil Engineer and Contractor, 1427 Carrollton Ave., New Orleans.

P. C. DOWELL, (1922), Manufacturers' Agent and Structurla Engineer, 5820 Magnolia St., New Orleans.

WALLACE CAMPBELL DRENNAN, (1927), Field Engineer in Roadway Dept. of New Orleans Public Service Inc., 2235 Carondelet St., New Orleans.

GUSTAVE ROBERT DUBUS, (1927), International Paper Co., Mobile, Ala.

PETER ARMAND DUBUS, (1927), President and Owner, P. A. Dubus & Son, Inc., 634 Louisa St., New Orleans.

ARCHIBALD LEE DUNLAP, (1925), Assistant Professor of Mechanical Engineering, Tulane University, 1320 Lowerline St., New Orleans.

ALLAN T. DUSENBURY, (1909), Drainage and Reclamation Engineer, 1407 American Bank Bldg., New Orleans.

ANDRE C. DUVAL, (1926), with State Board of Engineers, 2206 Jefferson Ave., New Orleans.

GEORGE G. EARL, (1900), General Superintendent, Sewerage and Water Board of New Orleans, Room 402, Sewerage and Water Board Bldg., New Orleans.

RALPH EARL, (1913), Assistant Director of Water Purification Deparmtent, 2142 Eagle St., New Orleans.

JOHN T. EASTWOOD, (1901), Principal Assistant Engineer, Sewerage and Water Board, Sewerage and Water Board Bldg., New Orleans.

EDWIN ESSEX ELAM, (1928), Assistant Engineer, Orleans Levee Board, 4330 Elba St., New Orleans.

DANIEL STANLEY ELLIOTT, (1921), Professor of Physics, Tulane University, New Orleans.

MARION J. EPLEY, (1920), President, Automobile Security Corp., 1706-08 Masonic Temple, New Orleans.

JAMES P. EWIN, (1915), Vice-President and General Manager, Doullut & Ewin, Inc., 901 Queen and Crescent Bldg., New Orleans.

CHARLES A. FAVROT, (1919), 18 Richmond Place, New Orleans.

EDWIN J. FISHER, (1913), Proprietor of the Electrical Contracting and Engineering Co., The Electrical Fixture and Material Co., 518-520 Gravier St., New Orleans.

LIONEL E. FLOTTE, (1930), Distribution Engineering Dept., N. O. Public Service Inc., House J, St. John Court, New Orleans.

FREDERICK H. FOX, (1922), Associate Professor, Civil Engineering, Tulane University, New Orleans.

ROLAND WOODWARD FRENCH, (1924), with N. O. Public Service Inc., 3225 Ursuline Ave., New Orleans.

A. M. FROMHERZ, (1915), President, Jos. Fromherz, Inc., 344 Camp St., New Orleans.

FRANK G. FROST, (1919), General Superintendent, Electrical Dept., New Orleans Public Service Inc., New Orleans.

HAROLD L. GAIDRY, (1930), Gas Dept., New Orleans Public Service Inc., 317 Baronne St., New Orleans.

HERBERT M. GALLAGHER, (1921), Consulting Engineer, 2723 Octavia St., New Orleans.

MARCEL GARSAUD, (1905), Engineer, Tulane-Newcomb Bldg., New Orleans.

JOHN V. GAUDET, (1927), Superintendent of the W. E. Winship Oil Refinery at Frelken, La., 6130 S. Robertson St., New Orleans.

WILL J. GIBBENS, SR., (1900), President, Gibbens & Gordon, 532-534 Canal St., New Orleans.

WILL J. GIBBENS, JR., (1924), Secretary, Gibbens & Gordon, Inc., 532-534 Canal St., 1404 Octavia St., New Orleans.

DAVID W. GODAT, (1924), Assistant Engineer in Charge of Bridges, City Engineer's Office, 7826 Zimple St., New Orleans.

MAYER GODCHAUX, (1920), 4729 Carondelet St., Apt. B., New Orleans.

JOSEPH McCORMICK GONDRAN, (1924), Structural Engineer with Luckens Steel Co., Box 320, New Orleans.

ROBERT E. GOSA, (1929), Vice-President, W. Howard Williams, Inc., New Orleans.

REUBEN CHARLES GOTCH, (1928), with Ole K. Olsen, 8520 Apricot St., New Orleans.

ARTHUR A. GRANT, (1923), Marine Surveyor, Louisiana Bldg., New Orleans.

WALTER K. GRANT, (1922), 1527 Audubon St., New Orleans.

EUGENE C. GRAVELY, (1918), Civil Engineer in Private Practice, 908 Masonic Temple Bldg., New Orleans.

W. B. GREGORY, (1907), Professor of Experimental Engineering, Tulane University, New Orleans.

F. H. GREHAN, (1914), Engineer with Geo. J. Glover Co., Inc., 1670 Soniat St., New Orleans.

LAFAYETTE F. GRIFFITH, (1925), Assistant Superintendent of Electric Distribution, New Orleans Public Service Inc., 317 Baronne St., New Orleans.

A. H. GUILLOT, (1917), Assistant Engineer, New Orleans Public Service Inc., 317 Baronne St., New Orleans.

ALLEN H. HACKETT, (1921), Consulting Engineer, 515 Whitney Bldg., New Orleans.

CALLENDER FAYSSOUX HADDEN, (1928), Supervising Engineer, Standard Supply & Hdwe. Co., P. O. Drawer 620, New Orleans.

DAN HOLLORAN, JR., (1924), Assistant Engineer, Distribution Department, New Orleans Public Service Inc., 1111 Elysian Fields Ave., New Orleans.

GEORGE R. HAMMETT, (1920), Sales Engineer, A. M. Lockett & Co., 954 Picheloup St., New Orleans.

ALLAN J. HARRIS, (1924), President, Walter Castenado, Inc., 1105 Canal-Commercial Bank Bldg., 7615 Jeannette St., New Orleans.

M. V. Haulard, (1906), Superintendent, Municipal Repair Plant, 4154 Iberville St., New Orleans.

WILLIAM WALLACE HAY, (1928), Engineer, 834 Broadway, New Orleans.

ARTHUR C. HAYS, (1929), Sales Engineer, Neville and Cleary, Inc., 1118 Union Indemnity Building, New Orleans.

W. S. HENNING, (1919), Assistant with Board of State Engineers, 213 New Orleans Court Bldg., New Orleans.

ARTHUR WRIGHT HERBERT, (1928), Chief Engineer, The Flint Kote Co., New Orleans.

LOYLESS HAMPTON HIERS, (1929), Gas Distribution Dept., N. O. Public Service Inc., 317 Baronne St., New Orleans.

W. T. HOGG, (1913), Assistant Engineer, Board of Commissioners, Port of New Orleans, 7930 Belfast St., New Orleans.

FRANK L. HOLT, (1915), Electrical Designer, Engineering Department, Board of Commissioners, No. 2 Canal St., New Orleans.

PAUL FROST HOOTS, (1927), Assistant Chief Engineer, New Orleans Public Service Inc., 1635 S. Carrollton Ave., New Orleans.

EDWARD C. HYATT, (1925), Civil Engineer, Orleans Levee Board, 201 N. O. Court Bldg., 3802 Prytania St., New Orleans.

LYALL GIBSON IRELAND, (1929), Assistant to Vice-President, N. O. Public Service Inc., 1634 Robert St., New Orleans.

LEWIS R. JACKSON, (1922), Sales and Engineering, Walsh & Weidner Boiler Co., Chattanooga, Tenn., 1105 Canal Bank Bldg., New Orleans.

ALFRED F. JACOBI, (1922), with Albert Kohn Co., Detroit, Mich., 2240 State St., New Orleans.

HARRY JACOBS, (1919), Civil Engineer, 264 Audubon Blvd., New Orleans.

ERNEST LEE JAHNCKE, (1900), President, Jahncke Dry Docks Corporation; President, Jahncke Service, Incorporated, New Orleans.

PAUL F. JAHNCKE, SR., (1908), President, Jahncke Service, Inc.; Vice-President, Jahncke Dry Docks, Inc.; President, Brookhaven Gravel Co., 814 Howard Ave., New Orleans.

JOHN W. JENKS, (1920), with Dock Board, 500 Camp St., New Orleans.

CHARLES JOHNSON, (1925), Assistant Engineer, Sewerage and Water Board, 521 Lowerline St., New Orleans.

WARREN JOHNSON, (1903), President and General Manager, Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc., P. O. Box 840, New Orleans.

C. LEONARD JONES, (1923), Designer, with Dock Board, 2427 Camp St., New Orleans.

ERROL E. KELLY, (1920), American Bank Bldg., New Orleans.

JAMES P. KEMPER, (1909), Civil Engineer in Private Practice, 2108 Coliseum St., New Orleans.

CHARLES MACDONALD KERR, (1914), Sales Engineer, American Tar Products Co., 5831 S. Robertson St., New Orleans.

CHARLES KIRSCHNER, (1929), Engineer with Mex. Petroleum Co., 37 Neron Place, New Orleans.

LEONARD R. KIRST, (1928), Engineer, Roadway Dept., New Orleans Public Service Inc., 2113 Tulane Ave., New Orleans.

JOHN KLORER, (1898), Commissioner of Public Property, City Hall, New Orleans.

R. B. KOHNKE, (1911), Engineer, 934 Pichelоup Place, New Orleans.

JOSEPH J. KREBS, (1926), Assistant Engineer in Charge of Street Planning, City Engineer's Office, 1215 Foucher St., New Orleans.

HERRICK J. LANE, (1922), Auditor, W. Horace Williams Co., Inc., 1465 State St., New Orleans.

EDWARD S. LANPHIER, (1918), Senior Lighthouse Engineer (Superintendent of Lighthouses), Room 224 Custom House Bldg., New Orleans.

FERD L. LARUE, (1919), 823 Esplanade Ave., New Orleans.

LEON LASSEN, (1926), Assistant Engineer, Water Purification Plant, 4019 Eagle St., New Orleans.

LEROY M. LAW, (1928), with New Orleans Refining Co., 7915 Plum St., New Orleans.

G. W. LAWES, (1898), Civil Engineer, 107 Balter Bldg., 918 Broadway, New Orleans.

RANDALL FRANK LEGEAI, (1923), Engineer, N. O. Public Service Inc., 5800 Fontainebleau Drive, New Orleans.

ALBERT J. LEGETT, JR., (1919), Assistant Superintendent, Johnson Iron Works, Dry Dock and Shipbuilding Co., 5859 Catina St., New Orleans.

PENDLETON E. LEHDE, (1928), President, Electron Engineering Co., Whitney Bldg., New Orleans.

NEVILLE LEVY, (1929), Vice-President, Equitable Equipment Co., 410 Camp St., New Orleans.

J. H. LEWIS, (1908), 502 St. Peter St., New Orleans.

ROWLAND LINFIELD, (1923), Marine Surveyor, 2404 Joseph St., New Orleans.

A. M. LOCKETT, (1900), President, A. M. Lockett & Co., Q. & C. Bldg., New Orleans.

GEORGE LEWIS LORD, (1924), Engineer, 2309 St. Charles Ave., New Orleans.

JULES A. LORIO, (1921), 126 N. Genois St., New Orleans.

EDWARD B. LUDWIG, (1928), President, Canal Steel Works, Inc., P. O. Box 347, New Orleans.

THOMAS MICHAEL McCARROLL, (1926), State Board of Engineers, 1827 S. Dupre St., New Orleans.

CHARLES S. McFARLAND, (1903), 302 Citizens Bank Bldg., New Orleans.

J. A. McNIVEN, (1922), Assistant Engineer, Dock Board, No. 2 Canal St., New Orleans.

ROGER BARTON McWHORTER, (1927), Principal Engineer, (Miss. River Flood Control), U. S. Engineer Office, Second N. O. River District, Foot of Prytania St., New Orleans.

JOSEPH MAGUIRE, (1923), Refrigeration Engineer, N. O. Public Service Inc., 2805 St. Bernard Ave., New Orleans.

IVOR ORIN MALL, (1922), with New Orleans Public Service Inc., 526 Florida Ave., New Orleans.

RALPH G. MALONE, (1924), Chief Engineer, Louisiana Fire Prevention Bureau, 2831 Calhoun St., New Orleans.

EMILE J. MARY, (1929), Refinery Superintendent, Chalmette Petroleum Corp., 6121 Delord St., New Orleans.

ODON O. MELANCON, (1930), Member, State Board of Engineers, 2227 Jefferson Ave., New Orleans.

JOHN W. MONTGOMERY, (1924), Engineer with Lukens Steel Co., 407 Balter Bldg., New Orleans.

A. S. MONTZ, (1919), Architect and Engineer, 740 Poydras St., New Orleans.

HOWARD N. MOODY, (1926), Mechanical Engineering Contractor, 815 Perdido St., New Orleans.

EARLE B. MORDEN, (1928), Chief Engineer, Standard Fruit and Steamship Co., 2011 Palmer Ave., New Orleans.

WALTER B. MOSES, (1912), Mechanical Electrical Engineer; Vice-President, Engineering Sales Co., Inc., 425 S. Peters St., New Orleans.

CARL G. MUENCH, (1927), Vice-President, Charge of Engineering, Constructing and Operation The Celotex Co., 193 Audubon Blvd., New Orleans.

ROBERT K. MULNIX, (1922), General Manager, North Rampart Lumber Supply Co., 525-41 N. Rampart St., New Orleans.

J. D. MURPHY, (1922), Civil Engineer, 2921 Monroe St ,New Orleans. .

FRANK A. MUTH, (1915), Lighthouse Engineer, (Assistant Superintendent) Lighthouse Service, 7705 Willow St., New Orleans.

ROBERT A. NADLER, (1929), Engineering Dept., Celotex Co., 4503 Prytania St., New Orleans.

ARTHUR J. NAQUIN, JR., (1924), Railway Equipment Engineer, N. O. Public Service Inc., 624 Audubon St., New Orleans.

BERNARD STANLEY NELSON, (1911), Chief Engineer, A. M. Lockett & Co., Ltd., 501 Q. & C. Bldg., New Orleans.

LAWRENCE KITCHENER NELSON, (1927), Engineer, 1026 N. Claiborne St., New Orleans.

LEROY J. NEWMAN, (1923), with New Orleans Public Service Inc., 317 Baronne St., New Orleans.

WILLIAM T. NEWTON, (1915), Master Mechanic, U. S. Engineers, 5201 Pitt St., New Orleans.

WILLIAM F. OAKES, (1918), 344 Camp St., New Orleans.

JOHN A. O'BRIEN, (1920), Engineer and Contractor, 313 Louisiana Bldg., New Orleans.

ROBERT M. O'BRIEN, (1916), Superintendent, Rolling Stock and Shops, New Orleans Public Service Inc., 5315 Camp St., New Orleans.

HOWARD NORMAN OLD, (1930), Sanitary Engineer, U. S. Public Health Service, 701 Baronne Bldg., New Orleans.

BENJAMIN J. OLIVEIRA, (1926), Assistant Engineer, Office of City Engineer, 2300 Joseph St., New Orleans.

OLE K. OLSEN, (1905), Contracting Engineer, 325 N. Cortez St., New Orleans.

JOHN H. O'NEILL, (1916), Sanitary Engineering, Louisiana State Board of Health, 637 Lowerline St., New Orleans.

ADLOE ORR, (1926), Civil Engineer and Surveyor, 316 Baronne St., New Orleans.

ALBERT H. PATERSON, (1923), Vice-President, New Orleans Public Service Inc., 2021 Peters Ave., New Orleans.

FRANK T. PAYNE, (1924), Engineer, Payne Engineering Co., Gretna, La.

JOHN L. PORTER, (1924), Director, Water Purification Station, Sewerage and Water Board, 8407 Panola St., New Orleans.

PATRICK HENRY QUINLAN, (1926), Assistant Engineer, Office of City Engineer, 1141 Philip St., New Orleans.

HYMAN RABINOVITZ, (1911), General Contractor, 740 Poydras St., New Orleans.

GROVER CLEVELAND RACKERBY, (1926), Field Engineer, Board of Commissioners, 4125 St. Charles Ave., New Orleans.

CHARLES FREDERICK RANTZ, (1924), Rantz Engineering and Machine Works, 2826 Esplanade Ave., New Orleans.

LESTER H. RAYNER, (1920), Chemical Engineer, 2116 Canal St., New Orleans.

LYMAN C. REED, (1907), Electrical Equipment, 1230 Hibernia Bldg., New Orleans.

LEON MYERS REINACH, (1928), with Ford, Bacon & Davis, 611 Gravier St., 1805 Robert St., New Orleans.

HAMPTON REYNOLDS, (1910), General Contractor, 831 Maison Blanche Bldg., New Orleans.

W. H. RHODES, (1927), Asphalt Department, Shell Petroleum Corp., New Orleans.

JOHN RIESS, (1906), Civil Engineer and Contractor, 807 New Orleans Bank Bldg., New Orleans.

OSCAR RIESS, (1916), Engineer, with John Riess, Civil Engineer and Contractor, 1423 Milan St., New Orleans.

GEORGE P. RICE, (1924), Consulting Engineer, 1301 Hibernia Bldg., New Orleans.

CLAIRE W. RICKER, (1928), Professor of Electrical Engineering, Tulane University, New Orleans.

GEORGE P. ROBBINS, JR., (1928), Member, firm Robbins & Robbins, 4119 Perrier St., New Orleans.

CORWIN A. ROBERT, (1928), Civil Engineer and Surveyor, 4833 Bienville St., New Orleans.

JAMES M. ROBERT, (1908), Professor of Machine Design, Tulane University, Director Night Classes in Engineering, Tulane University, New Orleans.

THOMAS H. ROBERTS, (1923), Mechanical Engineering, 1530 N. Broad St., New Orleans.

EVERETT G. ROESSLE, (1926), with W. H. Williams, Inc., 833 Howard Ave., New Orleans.

RAGUWALD P. RORDAM, (1920), Civil Engineer, 318 Carondelet St., 6322 S. Liberty St., New Orleans.

ELBERT GILBERT SANDOZ, (1927), Private Practice, Surveying Suburban Development and Heavy Building Construction, 625 Canal Bank Bldg., New Orleans.

WALTER HOWARD SCALES, (1930), Southern Manager, National Lumber Mfg. Ass'n., 601 Interstate Bank Bldg., 2023 Broadway, New Orleans.

HUGH SCHLENK, JR., (1929), Research Engineer, Celotex Co., Marrero, La.

CHARLES ERNEST SCHMIDT, (1929), with U. E. Engineers, 1840 Marengo St., New Orleans.

CARL SCHNEIDER, (1926), Aide to the Commissioner of Public Property, 7711 Plum St., New Orleans.

ARTHUR M. SCOTT, (1915), with Ole K. Olsen, Concrete Engineer, 325 Cortez St., New Orleans.

HARRY D. SCOTT, (1920), Assistant to Vice-President, Standard Fruit and S. S. Co., Union Indemnity Bldg., 5424 Pitt St., New Orleans.

GEORGE ARTHUR SEAVER, (1920), Chief Engineer, George J. Glover Co., Inc., 1219 Eleonore St., New Orleans.

SOLIS SEIFERTH, (1927), Architectural Engineer, Secretary-Treasurer, Weiss and Dreyfous, Inc., Maison Blanche Bldg., 5339 St. Charles Ave., New Orleans.

ARTHUR F. SHUEY, (1928), Roseland Box Co., Roseland, La.

B. E. M. SKERRETT, JR., (1928), Personnel Director, Standard Coffee Company, 5594 Rosemary Place, New Orleans.

LESTER C. SMITH, (1920), Secretary-Treasurer, Doullut & Ewin, Inc., 901 Q. & C. Bldg., New Orleans.

CHARLES E. SNYPP, (1922), Engineer, with Southern Cotton Oil Co., Gretna, La.

EDWIN GUY STARBUCK, (1927), Contracting Engineer, Virginia Bridge & Iron Co., P. O. Box 785, New Orleans.

REINHARD A. STEINMAYER, (1925), Assistant Professor of Geology, Tulane University, 1217 Calhoun St., New Orleans.

DAVID WHYTE STEWART, (1920), Chief Engineer, N. O. Public Service Inc., Market and S. Peters Sts., New Orleans.

WAYNE DUDLEY STEWARD, (1925), Field and District Engineer, Portland Cement Association, 1227 Henry Clay Ave., New Orleans.

ERNEST K. STRAHAN, (1929), President, E. K. Strahan, Inc., 2115 Octavia St., New Orleans.

JOSEPH L. SWANSON, (1922), President, Swanson-McGraw Co., Consulting Engineers, 425 Baltar Bldg., New Orleans.

JAMES M. TODD, (1923), Consulting Engineer, 818 Maritime Bldg., 7421 Maple St., New Orleans.

EUGENE UNSWORTH, (1919), Assistant Chief Inspector, New Orleans Department Hartford Steam Boiler Inspection and Insurance Co., 1128 Hibernia Bank Bldg., New Orleans.

BRYSON VALLAS, (1925), City Engineer, Room 21, City Hall, 607 Clare St., New Orleans.

GEORGE E. VINNEDGE, (1927), Superintendent of Construction, City Park, 3139 Prytania St., New Orleans.

GILBERT D. VON PHUL, (1916), Engineer, Contractor, Manufacturer; Office and Works, St. Patrick and St. Louis Sts., New Orleans.

FRANK H. WADDILL, (1898), Consulting Civil Engineer, 407 Tulane-Newcomb Bldg., New Orleans.

GEORGE D. WADDILL, (1911), Assistant Engineer, U. S. Engineering Offices, 911 Cherokee St., New Orleans.

J. D. WALKER, (1908), Engineer for Craven & Lang, Carondelet Bldg., New Orleans.

ALLEN E. WASHBURN, (1908), Civil Engineer, U. S. Engineer Office, Dauphine and Poland Sts., New Orleans.

VICTOR W. WEBB, (1929), Secretary-Treasurer, E. K. Strahan, Inc., 310 Pere Marquette Bldg., New Orleans.

ALFRED L. WEBRE, (1913), Specialist on Heating and Evaporation of Solutions, 348 Merion Road, Merion, Pa.

LEO S. WEIL, (1918), Mechanical and Electrical Engineer; President, Engineering Sales Co., Inc., 425 S. Peters St., New Orleans.

LEON C. WEISS, (1918), 600 Maison Blanche Bldg., New Orleans.

CHARLES WIGGIN, JR., (1927), Secretary-Treasurer, Walter Castenedo, Inc., 1105 Maritime Bldg., New Orleans.

BEN WILLARD, (1900), Local Manager, General Electric Co., 1004 Union Indemnity Bldg., 7111 Freret St., New Orleans.

ELMER WILLIAMS, (1927), Contractor, 118 Fairway Drive, New Orleans.

W. HORACE WILLIAMS, (1908), President and General Manager, W. Horace Williams Co., Inc., Engineer and General Contractors, Southern Bldg., 833 Howard Ave., New Orleans.

C. S. WILLIAMSON, JR., (1916), Head of School of Chemical Engineering, Tulane University, New Orleans.

ARMAND L. WILLOZ, (1922), Engineer, Orleans Levee Board, 4439 S. Miro St., New Orleans.

VICTOR L. WILLOZ, (1900), Distribution Engineer, New Orleans Public Service Inc., 317 Baronne St., New Orleans.

RUSS FAULKNER WILLS, (1926), Assistant Engineer and Terminal Engineer, Southern Pacific R. R., 2633 Napoleon Ave., New Orleans.

J. NORMAN WILSON, (1911), Assistant Engineer, Mechanical Engineering Department, Sewerage and Water Board, 2425 Audubon St., New Orleans.

ROGER O. WINE, (1928), 690 S. Mason St., Hornsbourg, Va.

WALTER E. WINSHIP, (1921), President, Chalmette Petroleum Corporation, Union Indemnity Bldg., New Orleans.

A. R. WINGATE, JR., (1924), Engineering Department, Lukens Steel Co., 1731 Robert St., New Orleans.

ALBERT PARISH WOODY, (1929), Construction Engineer, Gas Department, N. O. Public Service Inc., 3716 Louisiana Ave. Parkway, New Orleans.

ALLAN RAMSEY WURTELE, (1928), Engineering Assistant to the Chairman, Inland Waterways Corporation, Mississippi-Warrior Service, Board of Trade Annex, New Orleans.

ALBERT G. WYLER, (1927), Assistant Engineer in Charge of Field Construction of Bridges, 3123 Toledano St., New Orleans.

CHARLES J. WYLER, (1919), Principal Assistant Engineer, A. M. Lockett & Co., Ltd., 530 Jackson Ave., New Orleans.

LOUIS J. WYLER, (1922), Superintendent, Lukens Steel Co., 2234 Marengo St., New Orleans.

SAMUEL YOUNG, (1911), Chief Engineer, Port Commission, No. 2 Canal St., New Orleans.

HENRY L. ZANDER, (1898), Civil Engineer, 821 N. Rampart St., New Orleans.

NON-RESIDENT MEMBERS.

JAMES R. ADAMS, (1911), Lake Providence, La.

ORLANDO P. ADAMS, (1920), National Tube Co., Nat'l. Works, McKeesport, Penn.

LEWIS SCHERCK ALCUS, (1922), 7445 Maple St., New Orleans.

KENNETH McGRATH BAILEY, (1924), Engineer with Curtin Howe Corp., 415 Lexington Ave., New York City, N. Y.

JAMES ALLEN BARKSDALE, (1926), Assistant City Engineer, Box 691, Gulfport, Miss.

CHARLES DREWRY BATSON, (1928), Manager, Republic Creosoting Company, Mobile, Ala.

JOSEPH P. BERANGER, (1915), Vice-President, Chief Engineer and General Manager, Cuban Dominican Sugar Corp., Room 2136, 25 Broadway, New York City.

MERRILL BERNARD, (1917), Consulting Engineer, Crowley, La.

JOS. M. BING, (1917), Consulting Engineer, 152 West 42nd St., New York City.

ELDRED GRIFFIN BLAKEWOOD, JR., (1926), Resident Engineer, Bridge Construction (Steel Conc. & Timber), Location Surveys for Bridges and Roads, Baton Rouge, La.

PAUL BONHAM, (1926), Civil Engineer and Surveyor, Box 1024, Gulfport, Miss.

R. W. BRINGHURST, JR., (1912), Commissioner Parks and Streets, P. O. Box 706, Alexandria, La.

JACOB THOMPSON BULLEN, (1925), Caddo Parish Engineer, Box 772, Shreveport, La.

THEO. T. CHENET, (1922), Resident Engineer, c/o Payne Engineering Co., Gretna, La.

JEAN EARL CHRISTIAN, (1929), with Graham Engineering Co., 208 Godchaux Bldg., New Orleans, La.

LESTER B. CLARK, (1925), with Andrews, Streetman, Logue, and Mobley, Gulf Bldg., Houston, Tex.

J. B. CONVERSE, (1921), President, J. B. Converse & Co., Engineers, Mobile, Ala.

L. C. DATZ, (1906), Chief Engineer, St. Louis Public Service Co., 3869 Park Ave., St. Louis, Mo.

JOHN J. DAVIDSON, (1918), care Ovoca P. O., Morgan City, La.

ALBERT BAKER DAVIS, JR., (1928), 1101 23rd St., Galveston, Tex.

GEORGE H. DAVIS, (1909), Member Ford, Bacon & Davis, Inc., 39 Broadway, New York City.

PETER J. DROMGOOL, (1923), Marine Department, Pan-American Pet. and Trans. Co., 122 East 42nd St., New York City.

WILLIAM F. EBLEN, (1916), Secretary-Treasurer, Engineering Service Corp., 1806 Post Dispatch Bldg., Houston, Tex.

STEPHEN ARCHER EGGLESTON, (1928), Engineer, Red Cross, Miss.; Home Address, Carrollton, Miss.

L. P. ELBERSON, (1911), Chief Engineer, Louisiana Irrigation & Mill Co., Crowley, La.

S. WALLACE ELBERSON, (1911), General Manager, La. Public Utilities Co., Lafayette, La.

CHARLES H. FENSTERMAKER, (1914), Chief Engineer, Industrial Lumber Co., Engineer, Road District No. 5, Allen Parish, Elizabeth, La.

JAMES McC. FOURMY, (1916), Consulting Engineer, Hammond, La.

A. A. FRASER, (1922), Sales Manager, The General Fire Proofing Building Products Company, 305 Merchants Bank Bldg., Indianapolis, Ind.

EDWARD GEORGE FREILER, (1926), Drainage Engineer, Hammond, La.

G. ACHEE FRICK, (1928), Chief Engineer, Henry A. Mentz & Co., Box 561, Hammond, La.

LLOYD GARNER FROST, (1926), Construction Engineer, Bartaw, Fla.

CHARLES ROBERT GATES, (1929), Roadmaster, Southern Railway, (N. O. & N. E. R. R. and N. O. Terminal Co.), Hattiesburg, Miss.

WILL S. GUEDRY, (1925), Contractor, Associated with Alexandria Contracting Co., Inc., Box 774, Monroe, La.

FLOYD HAMILTON, (1919), Lake Charles, La.

FARRAR PETRIE HAMILTON, (1915), Texas Creosoting Co., Orange, Tex., 408 Walnut St., New Orleans, La.

IRA G. HEDRICK, (1928), Consulting Engineer, Fayetteville, Ark.

HARRY B. HENDERLITE, (1929), Chief Engineer, Louisiana State Highway Commission, 403 Evergreen Drive, Baton Rouge, La.

JOHN LOVEJOY HENNING, (1919), 525 Kirby St., Lake Charles, La.

RUDOLPH HERPICH, (1925), Manager, Southern Banana Corp., Galveston, Tex.

SERGE POWERS HIGGINBOTHAM, (1926), Licensed Surveyor, Box 292, Baton Rouge, La.

SAMUEL A. HONAKER, (1922), Civil Engineer, Box 357 Sacramento, Calif.

C. A. IVES, JR., (1922), Office Engineer, Louisiana Highway Commission, 940 Park Blvd., Baton Rouge, La.

FRANCIS MARION IVICHIEVICH, (1927), Construction Superintendent, Texas Oil Co., Box 363, Middletown, N. Y.

ANDREW W. JACKMAN, (1913), 6025 Freret St., New Orleans, La.

CHARLES L. JACOB, (1911), 1506 Boulevard, N. E., Atlanta, Ga.

E. S. JARRETT, (1909), President, Jarrett-Chambers Co., Inc., Contractors, 342 Madison Ave., New York City.

CHARLES E. JOUBERT, (1909), Civil Engineer, Box 563, Monroe, La.

L. A. LOUSTALOT, (1913), Civil Engineer, Hammond, La.

SAMUEL P. LANDRY, (1929), Field Engineer, Thibodeaux, La.

A. J. McCORKLE, (1930), Contracting Engineer, St. Joseph, La.

R. S. McCORMICK, (1922), Engineer, Napoleonville, La.

HERBERT H. McGEHEE, (1920), 1902 Linden Ave., Apt. 6, Memphis, Tenn.

RUFUS S. MANLEY, (1912), President, Texas Creosoting Co., Orange, Tex.

RALPH H. MANN, (1921), Field Engineer, Am. Wood Preservers Ass'n. 111 West Washington St., Chicago, Ill., Field Hdqrs., 645 Graybar Bldg., New York City.

ERNEST J. MEAD, (1922), Forest Engineer, 2220 North St., Beaumont, Tex.

HENRY A. MENTZ, (1915), Consulting Engineer, Lock Drawer 929, Hammond, La.

WALTER I. NEEL, (1928), City Engineer, Monroe, 1006 N. 2nd St., Monroe, La.

ALLEN J. NEGROTTO, (1920), Engineer, c/o Markham Hotel, Gulfport, Miss.

CHARLES W. OKEY, (1911), Land Department, Lesser-Goldman Cotton Co., Walnut Ridge, Ark.

WILLIAM C. OLSEN, (1914), Consulting Engineer, Raleigh, N. C.

GUY OSBORNE, (1913), Logging Superintendent, Donner, La.

BOYKIN W. PEGUES, (1907), Professor of Civil Engineering, Louisiana State University, Baton Rouge, La.

H. N. PHARR, (1908), Sugar Planter and Manufacturer, Olivier, La.

H. A. PHILIPPI, (1912), Civil Engineer and Superintendent of Construction, 316 Audubon St., New Orleans.

FREDERICK F. PILLET, (1922), Associate Professor, Civil Engineering, Louisiana State University, 613 St. Mary St., Baton Rouge, La.

OTTO F. REISZNER, (1916), Reiszner & White, Civil Engineers, Lecompte, La.

J. B. REYMOND, (1922), 709 Main Street, Baton Rouge, La.

FRANK LOUIS REYNOLDS, (1916), General Superintendent, Irons and Hoover, Inc., 420 Lexington Ave., New York City.

UNION SANDERS ROANE, (1926), with Louisiana Highway Commission, 711 Hypolite St., Baton Rouge, La.

W. B. ROBERT, Civil Engineer, 408 Evergreen St., Baton Rouge, La.

EDWIN J. H. RODRIGUEZ, (1918), Care Johns Manville Corp., 41st and Madison Ave., New York City.

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), Assistant Engineer, 4th District, Mississippi River Commission, 1923 Leontine St., New Orleans.

ARTHUR M. SHAW, (1910), Cnosulting Engineer to the Chinese National Construction Commission, Hangchow-Kiangshan Railroad, Hangchow, China.

HOBART D. SHAW, (1917), City Engineer and Chief Engineer, Harrison County Road Protection Commission, Gulfport, Miss.

FREDERICK B. SIEMS, (1928), Coast and Geodetic Survey, 510 Customhouse, San Francisco, Calif.

JOHN A. SILSBEE, (1915), Vice-Pres., Director and Chief of Department of Petroleum Engineering and Geology, Producers Royalty Corp., 9th Floor, Palace Bldg., Tulsa, Okla., 1702 So. Detroit, Tulsa, Okla.

T. BAKER SMITH, (1919), Houma, La.

JOHN Y. SNYDER, (1918), Engineer, 1211 City Bank Bldg., Shreveport, La.

KIRBY LAND SWINNEY, (1926), with Southern States Building & Construction Co., Mobile, Ala., and Biloxi, Miss., Box 797, Biloxi, Miss.

IRA W. SYLVESTER, (1901), Consulting Engineer, Rapides Bank Bldg., Alexandria, La.

ROGER I. TANNER, (1921), Abbeville, La.

FRANK J. TRELEASE, (1928), with Ford, Bacon and Davis, Colorado Springs, Colo.

STEWART TICKNOR, (1922), 142 Delaronde St., New Orleans, La.

THOS. H. TUTWILER, (1898), President and General Manager, The Memphis Street Railway Co., also President, Memphis Power and Light Co., Memphis, Tenn.

WM. VON PHUL, (1908), Ford, Bacon & Davis, Inc., 39 Broadway, New York, N. Y.

RICHARD CHARLES SANCHEZ WATSON, (1926), Civil Engineer, General Practice, 4901 Walker St., Houston, Tex.

J. LESTER WHITE, (1920), Reiszner & White, Civil Engineers, Lecompte, La.

W. S. WHITE (C. M.), Box 44, Sulphur, La.

A. A. WOODS, (1911), Chief Engineer, Maintenance of Ways and Structures, Southern Railway System, Lines West, 506 Southern Railway Bldg., Cincinnati, Ohio.

D. F. WOODS, (1922), Lutcher, La.

ASSOCIATE MEMBERS.

JOHN A. ABELE, (1922), District Manager, Orton Crane and Shovel Co., 3215 Palmyra St., New Orleans.

FOWLER BOYNTON BANTON, (1927), Assistant Commercial Engineer, New Orleans Public Service Inc., 317 Baronne St., New Orleans.

RAYMOND P. BASSICH, (1923), Manager, New Orleans Blue Print & Supply Co., Inc., 826 Union St., New Orleans.

R. H. BAUMBACH, (1911), Manager, Eugene Dietzgen Co., 316 Camp St., New Orleans.

PERRY HOWES BEALL, (1929), with Frank H. Chisolm, Consulting Engineer, 4632 Banks St., New Orleans.

FRANK C. CODIFER, (1929), Real Estate and Development, 107 Balter Bldg., New Orleans.

MICHAEL A. COOPER, (1927), Representing Utica Heater Co., 622 S. Peters St., New Orleans.

LEWIS McCLELLAN DALGARN, (1921), 1517 Nashville Ave., New Orleans.

H. W. FLETCHER, (1913), Treasurer and General Manager, The Clyde Co., Inc., 309 Magazine St., New Orleans.

ROBERT M. GALLAGHER, (1929), Sales Engineer, Ohio Brass Co., 1938 Audubon St., New Orleans.

JOHN F. GEIS, (1929), Sales Supervisor, Johns-Manville Corporation, 4518 Pitt St., New Orleans.

GEORGE B. GIBSON, (1921), 2103 Painter St., New Orleans.

PAUL JOSEPH GILBERT, (1925), 602 S. and W. Board Bldg., New Orleans.

GEORGE J. GLOVER, (1916), General Contractor, 1032-1035 Whitney Bldg., New Orleans.

JULES GODCHAUX, (1899), 1007 Masonic Temple Bldg., New Orleans.

WALTER F. JAHNCKE, (1920), Secretary-Treasurer, Jahncke Service, Inc., 814 Howard Ave., New Orleans.

RICHARD HARRISON MILLER, (1926), Manager, A. K. Miller Engineering Co., New Orleans.

JOHN McINERNEY, (1920), Manager Construction, 200 Madison Ave., New York City.

OTTO S. JESSEN, (1929), Draftsman, 4956 Music St., New Orleans.

GUS C. KRAUS, (1929), Asst. to Supt. Rolling Stock & Shops Dept., N. O. Public Service Inc., 2723 Paris Ave., New Orleans.

PHILIP T. SAMUEL, (1929), Affiliate Member, American Society of Civil Engineers, 2511 S. Carrollton Ave., New Orleans.

F. W. STEVENS, (1900), Manager, New Orleans District Sales Office, Allis-Chalmers Mfg. Co., 1124 Canal Bank Bldg., New Orleans.

SCOTT THOMPSON, (1928), with Lone Star Cement Co. of La., 1120 Hibernia Bank Bldg., New Orleans.

EDGAR CARUTH WALTHALL, (1929), Sales Engineer, Combustion Engineering Corporation, New Orleans District Manager, 588 Walnut St., New Orleans.

NON-RESIDENT ASSOCIATE MEMBERS.

JOSEPH A. BRENNAN, (1920), General Contractor, The Brennan Co., 1805-97 Market St., Dallas, Tex., 1703 Hayden St., Amarillo, Tex.

JOHN J. STEADHAM, (1912), Supervisor, Bridges and Buildings, N. O. & N. E. R. R. and N. O. T. Co., 308 Newman St., Hattiesburg, Miss.

RESIDENT JUNIOR MEMBERS.

WILMOT A. ACKERMANN, (1928), with Mississippi-Warrior Service, Board of Trade Annex, 223 S. Clark St., New Orleans.

HENRY HESTER RATE, (1921), Civil Engineer, Huasica Pet. Corp., Tampico, Tampas, Mexico.

J. J. BULLUING, (1915), Market Street Power House, New Orleans.

JOHN S. BURKE, (1925), Distribution Engineering Department, New Orleans Public Service Inc., 2215 Dante St., New Orleans.

PHILIP HOPE CAMPBELL, (1925), Engineer, with Mississippi-Warrior Service, 6041 Perrier St., New Orleans.

F. FOWLER CASE, (1922), Draftsman with Sewerage and Water Board, 923 Arabella St., New Orleans.

SALVADOR DI BENEDETTO, (1925), Assistant Engineer, Orleans Levee Board, 1810 Elmire St., New Orleans.

ROBERT JOSEPH DRUEDING, (1925), Assistant Engineer, Orleans Levee Board, 1220 Second St., New Orleans.

DONALD C. DUPLANTIER, (1922), Assistant Engineer, Geo. J. Glover Co., Inc., 2319 Joseph St., New Orleans.

EDWIN RRANK, (1925), 2375 Laurel St., New Orleans.

JAMES L. FULMER, (1923), with Cumberland Telephone and Telegraph Co., 2238 General Pershing St., New Orleans.

HORATIO L. GILBERT, (1917), Surveyor, 602 Queen and Crescent Bldg., New Orleans.

JOSEPH W. HAVLICEK, (1929), Radio Electrician, 8th U. S. Lighthouse District, 6014 Catina St., New Orleans.

STEPHEN C. HORVATH, (1929), Graduate of Delgado Trades School, 816 Jefferson Ave., New Orleans.

FRANK E. HOIGHT, (1926), Draftsman, La. Highway Commission, 452 Convention St., Baton Rouge, La.

WALTER HOLLOWAY, (1923), District Engineer, Mississippi Power Co., Gulfport, Miss., 34 Washington Ave., Ocean Springs, Mss.

JOSEPH W. JOACHIM, (1919), President and Manager of Home Ice Co., 5117 Prytania St., New Orleans.

WILHELM EMIL KOCH, (1913), Civil Engineer, 2627 Coliseum St., New Orleans.

ROBERT JAMES KUHN, (1925), Electrolysis Engineer, New Orleans Public Service Inc,. 529 Washington Ave., New Orleans.

FRANCIS A. LANDRIEU, (1926), with Board of Port Commissioners, 1729 N. Rampart St., New Orleans.

ALFRED LIPPMAN, JR., (1929), 2329 Joseph St., New Orleans.

CHARLES RENE MADUELL, (1925), with Truscon Steel Co., 5650 Ada Place, Lakeview, New Orleans.

ROBERT VINCENT MARKEY, (1926), Draftsman, Office City Engineer, 2309 Cleveland Ave., New Orleans.

ALBERT E. MARKS, (1925), Draftsman, Phoenix Utility Company, 3320 Palmyra St., New Orleans.

NATHANIEL LEVIN MARKS, (1925), Assistant City Engineer, 2017 Lowerline St., New Orleans.

GORDON J. McLEAN, (1924), Power Plant Equipment, New Orleans Public Service Inc., 1544 Henry Clay Ave., New Orleans.

HU. B. MYERS, JR., (1927), Civil Engineer, 7734 Belfast St., New Orleans.

EDWARD M. NABERSCHNIG, JR., (1923), Assistant to Works Superintendent, Southern Cotton Oil Co., Box 360, New Orleans.

CLAYTON L. NAIRNE, (1929), with N. O. Public Service Inc., 1219 Valence St., New Orleans.

WILLIAM P. OSTER, (1928), 3436 Gentilly Blvd., New Orleans.

CHARLES L. RITTENBERG, (1923), Designer, Dock Board, 4437 S. Rocheblave St., New Orleans.

HARRY STEPHEN SALZER, (1927), Assistant Lighthouse Engineer, U. S. Lighthouse Service, 6028 Catina St., New Orleans.

FRANK GURLEY STEWART, (1928), Survey Department, City Engineer's Office, Assistant Engineer, Bridge Dept., 5016 Camp St., New Orleans.

S. A. THEARD, (1920), Maintenance Engineer, Louisiana State Highway Commission, Baton Rouge, La.

SID E. TROUARD, JR., (1928), 1526 Conery St., New Orleans.

ALVIN A. VOSS, (1928), Engineer, 1701 Valmont St., New Orleans.

CHARLES EDWARD WUERPEL, (1929), with Bonnet Carre Spillway, 1520 Jefferson Ave., New Orleans.

NON-RESIDENT JUNIOR MEMBERS.

G. O. ALLAIN, JR., (1916), Southern Bell Telephone Co., New Orleans.

G. C. BADGER, (1913), Grinnell Co., of the Pacific, 601 Brannan St., San Francisco, Calif.

CHARLES MILTON BROUGH, (1927), 2125 Cherry St., Vicksburg, Miss.

MARTIN CARBONNELL, (1927), 1723 Burdette St., New Orleans.

LIONEL J. CUCULLU, (1928), with The South Coast Co., Houma, La.

JACOB F. MULLER, JR., (1912), Vice-President, Muller Furniture Manufacturing Co., Ltd., 3731 Canal St., New Orleans.

HERBERT P. NATHAN, (1913), Mechanical Engineer, Southwestern Engineering Corporation, 632 Lafayette Ave., Culver City, Calif.

HENRY W. PAGE, (1928), 301 Arkanscas Ave., Monroe, La.

JAMES KILBOURNE PETRIE, (1924), Petrie & McFarland, Inc., Mansfield, La.

BRISTER BLAKE PIERCE, (1929), 841 St. Hypolite St., Baton Rouge, La.

STUDENT MEMBERS.

R. L. ATKINSON, 312 Audubon Blvd., New Orleans.

JEROME C. BAEHR, 908 Webster St., New Orleans.

CHARLES ALBERT BENDER, JR., 1729 Marengo St., New Orleans.

JOHN W. BIERHORST, JR., 3116 St. Claude Ave., New Orleans.

PERCY L. BERNSTEIN, East Beach, Gulfport, Miss.

LAWRENCE CLAUDE BRUNE, 2546 Conti St., New Orleans.

LOUIS CARON, JR., 1715 Napoleon Ave., New Orleans.

CHARLES E. CASSAGNE, JR., 1012 Verret St., New Orleans.

RICHARD HARRISON CHURCH, 7901 Willow St., New Orleans.

RICHARD HUTSON COLCOCK, 828 Burdette St., New Orleans.

ERNEST A. COULOHERAS, 2627 Peniston St., New Orleans.

WILLIAM H. CREIGHTON, 1446 Henry Clay Ave., New Orleans.

CHARLES D. DAVID, Mandeville, La.

ARTHUR A. DEFRAITES, 620 State St., New Orleans.

LUCIEN DEVALL, 2124 Milan St., New Orleans.

CLAUDE E. DOLHONDE, 1000 Broadway, New Orleans.
NEWTON C. EBAUGH, care Georgia School of Technology, Atlanta, Ga.
PETER J. ERICKSON, JR., 4020 Burgundy St., New Orleans.
THEODORE LAWRENCE ESTORGE, 570 63rd St., West Allis, Wis.
GEORGE FINLEY EUSTIS, 1469 Henry Clay Ave., New Orleans.
CHARLES J. FRITCHIE, Slidell, La.
JOHN B. GEIGER, 902 Eighth St., Gretna, La.
MERRILL A. GERSTNER, 1001 Louisiana Ave., New Orleans.
EDWARD H. GESSNER, 119 Audubon Blvd., New Orleans.
JOHN J. GIDIERE, 1015 Eleonore St., New Orleans.
JOSEPH E. GUIDRY, JR., 1101 Henry Clay Ave., New Orleans.
JOHN M. GUILLORY, 5201 Magazine St., New Orleans.
ERIC J. HANNEMAN, 1126 Dumaine St., New Orleans.
VIC F. HARTEL, 2001 Prytania St., New Orleans.
E. C. HAWKINS, 7019 Panola St., New Orleans.
W. T. HESS, 7429 Burthe St., New Orleans.
ALVIN E. HOTARD, 829 Lafayette Ave., Gretna, La.
EDMOND F. HUGHES, 4502 S. Miro St., New Orleans.
HAROLD H. JAQUET, Box 33, El Campo, Tex.
F. LAWES KLEINPETER, 2210 Nashville Ave. ,New Orleans.
CARL V. LAZARONE, Kenner, La.
STANLEY M. LECOURT, 213 N. Solomon St., New Orleans.
CHARLES LOB, 3309 St. Charles Ave., New Orleans.
FRANK W. MACDONALD, 2820 Gen. Pershing St., New Orleans.
ALGERNON A. MABSON, 4020 Prytania St., New Orleans.
E. P. MADDEN, 1228 N. Rendon St., New Orleans.
EVAN W. MAHONEY, 806 Belleville St., New Orleans.
GEORGE ELMER MAY, 1533 Broadway, New Orleans.
LEAL C. McLEAN, 1544 Henry Clay Ave., New Orleans.
JOHN K. MAYER, 1738 Carrollton Ave., New Orleans.
PAUL G. MERRITT, JR., 1931 Gen. Pershing St., New Orleans.
JOHN J. METZGER, JR., 3126 Dauphine St., New Orleans.
ALBERT J. MEYERS, 5517 Prytania St., New Orleans.
EUGENE H. MIAZZA, 3424 Prytania St., New Orleans.
HERMANN D. MYSING, 2115 Palmer Ave., New Orleans.
MYRTIS M. NORTON, 1461 Calhoun St., New Orleans.
J. F. NUNEMACHER, 4915 Baccich St., New Orleans.
PASCAL PERETI, JR., 619 Bourbon St., New Orleans.
PHILIP FRANK PHILLIPS, 4424 S. Claiborne Ave., New Orleans.
CARROLL J. PEIRCE, JR., 8217 Nelson St., New Orleans.
WALTER H. PRICE, 3001 Ursuline Ave., New Orleans.
RAYMOND C. PROUET, 5110 Freret St., New Orleans.
RENE H. REIXACH, 1803 19th St., N. W., Washington, D. C.
JAMES M. ROBERT, JR., 2141 State St., New Orleans.
RODNEY B. ROUGELOT, Gramercy, La.
ASHLEY H. ROBINSON, 1735 Palmer Ave., New Orleans.
HENRY B. SARGANT, care Mississippi Power & Light Co., Jackson, Miss.
JOSEPH H. SAUCIER, 2616 Ursuline Ave., New Orleans.
S. B. SCHWARTZ, Superintendent, Maginnis Cotton Mills, New Orleans.
BEN ZION SEGALL, Tester, N. O. Public Service Inc., 520 Magazine St., New Orleans.
GEORGE JACOB SEGEL, 3022 Baronne St., New Orleans.
LEWIS M. SHELTON, 4915 Baccich St., New Orleans.
WALTER SUMNER SIMPSON, 19 Audubon Place, New Orleans.
CHARLES B. SPENCER, 7325 Hampson St., New Orleans.
DAVID STAYER, 910 Hadden Ave., Camden, N. J.
BRUNO STOLLEY, 630 Napoleon Ave., New Orleans.
HERBERT C. SWAN, 6316 Magazine St., New Orleans.
JOSEPH F. THOMPSON, 139 S. Genois St., New Orleans.

BERNARD J. TORTOMASI, with N. O. Public Service Inc., 2461 Burgundy St., New Orleans.
NELSON W. TREMBLAY, 2025 Jena St., New Orleans.
RICHARD E. WAGNER, 1818 S. Gayoso St., New Orleans.
STEPHEN J. WALLBILLICH, 4027 Delgado Ave., New Orleans.
LUCIEN T. VIVIEN, JR., 1519 N. Broad St., New Orleans.
JOHN MORT WALKER, JR., 6039 Prytania St., New Orleans.
O. P. WALKER, 5918 Chestnut St., New Orleans.
PHILIP ANTOINE WEBER, 3118 Magazine St., New Orleans.
JOHN W. WILSON, 7916 Oak St., New Orleans.
CARROLL LEE WOOD, JR., 819 Cauhoun St., New Orleans.
CHARLES LAFAYETTE WRIGHT, JR., Romeville, La.

SUMMARY.

Honorary Members	6
Resident Members	244
Non-Resident Members	93
Associate Members	24
Non-Resident Associate Members	2
Junior Members	37
Non-Resident Junior Members	10
Student Members	84
Total	500

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Board of Direction, December 9, 1929.

The meeting was called to order by President Fox, and the following members were present: Messrs. O'Neill, Porter, Todd, Frost, Moses and Muth.

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

Communication from the Louisiana State Board of Engineering Examiners relative to the expiration of the appointment of Mr. G. H. Grehan, was brought before the Board, and the President was authorized to submit a list of names to the Governor in accordance with the law.

The following communication from the Louisiana State Board of Engineering Examiners was brought before the Board:

"I am directed to communicate with you as follows:

"It having come to the attention of the Louisiana State Board of Engineering Examiners that legislation requiring the general licensing of engineers in this State is contemplated for the next legislature, it is thought advisable to bring to your attention that it is the opinion of the Board that this is a matter of far reaching consequence and importance to the engineering profession and the public welfare in this State, and it is believed that any such legislation which is to be enacted should have the endorsement of the Louisiana Engineering Society as well as that of the local sections of those branches of the National Engineering Societies concerned.

(Signed) "C. G. SANDOZ,
'Asst. Secretary.''

On motion, duly seconded, it was voted to refer the above matter to the Committee on Registration of Professional Engineers, which committee has the points referred to under consideration in the deliberations at its meetings.

Letter from Mr. James M. Todd, relative to a suitable testimonial for Mr. J. F. Coleman, who had been nominated for the Presidency of the A. S. C. E., was brought before the Board, and on motion, duly seconded, the President was authorized to appoint a committee to co-operate with other suitable organizations in arranging details for a proper testimonial; this committee will submit report to the Board for consideration at the proper time.

On motion, duly seconded, the following applications for membership were ordered to ballot:

Resident Members.

Paul Andry, Jr.
James H. Cherry
Lionel E. Flotte
Harold Langdon Gaidry
Loyless H. Hiers
Lyall G. Ireland
Odon O. Melancon
Howard Norman Old
Walter H. Scales
Albert P. Woody

Non-Resident Members.

Charles R. Gates
A. J. McCorkle
Harry B. Henderlite

Associate Members.

Edgar C. Walthall

Resident Student Members.

Jerome C. Baehr
John W. Bierhorst, Jr.
Lawrence C. Brune
Charles E. Cassagne, Jr.
Richard H. Church
Richard H. Colcock
Ernest A. Couloheras
Charles B. David
Claude E. Dolhonde
Joseph E. Guidry, Jr.
Merrill A. Gerstner
Edward Heim Gessner
Peter J. Erickson, Jr.
Stanley M. Lecourt
Frank W. Macdonald
John Joseph Metzger, Jr.
Albert James Meyers
Myrtis M. Norton
Carroll J. Pierce, Jr.
Walter Hugh Price
Raymond C. Prouet
James M. Robert, Jr.
Charles B. Spencer
Bruno Stolley
Richard E. Wagner
Philip A. Weber
John W. Wilson
Carroll Lee Wood, Jr.

Messrs. K. L. Swinney and Tim McNamara were dropped with regret. There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Society, December 9, 1929.

The meeting was called to order with President Fox in the chair, F. A. Muth, Secretary, and 49 members and guests present.

The minutes of the previous meeting were read and approved.

Reports were received from the Employment Committee, also the Chairman of the Entertainment Committee, indicating progress which is being made, and plans for the annual smoker.

Announcement was made of the death of one of our members, Mr. Eugene F. Delery, and on motion, duly seconded, the President was authorized to appoint a committee of three members to draft suitable resolutions.

The following members were appointed tellers to serve in connection with the nomination of officers for the ensuing year: Messrs. Bres, Brown and Porter.

Nomination of officers resulted as follows:

For President.

J. M. Todd	23
Blank Ballot	1

For Vice-President.

Frank G. Frost	20
D. S. Elliott	2
F. A. Muth	1
Blank Ballot	2

For Secretary.

F. A. Muth	25

For Treasurer.

Walter B. Moses	25

For Member of the Board To Serve Three Years.

A. L. Dunlap	19
D. S. Elliott	1
E. S. Bres	1

On motion, duly seconded, it was voted that the ballots for the Secretary and Treasurer be cast by the President.

The following members were therefore declared official nominees and their names were ordered to ballot:

For President	Mr. James M. Todd
For Vice-President	Mr. Frank G. Frost
For Secretary	Mr. Frank A. Muth
For Treasurer	Mr. Walter B. Moses
For member of Board to serve 3 years	Mr. A. L. Dunlap

The technical exercises of the evening consisted of a very interesting paper on: "Requirements for Good Lighting," by Mr. M. F. Canning. This paper was followed by discussion, and a rising vote of thanks was then tendered the speaker.

The meeting adjourned to the usual collation.

F. A. MUTH, Secretary.

Minutes of the Board of Direction, Annual Meeting, January 18, 1930.

The meeting was called to order by President Fox and the following members were present: Messrs. Todd, Porter, Frost and Muth.

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

Mr. E. J. Rodrigues and F. P. Hamilton were changed to non-resident members.

The resignations of Messrs. A. M. Zibilich, F. B. Siems, F. M. Strout and R. S. McCormick, also B. S. Schwartz, were accepted with regret.

Communication from the Eads Memorial Committee of the Association of Commerce was read and on motion, duly seconded, the following resolution was adopted:

> Be It Resolved, That in view of the importance of the movement to commemorate the services of Captain James B. Eads to the commerce of the Mississippi Valley, the Board authorizes the President to appoint a representative to co-operate with the Eads Memorial Committee of the New Orleans Association of Commerce.

The communication of December 17 from the American Society of Mechanical Engineers was read, and on motion, duly seconded, the President was authorized to designate two members of the Society to represent the Society at the 50th anniversary of the A. S. M. E., in New York City in April, provided they would be in that vicinity about that time, without expense to the Society.

Report of the Special Committee on Scholarships, headed by Mr. Samuel M. Young, chairman, was read, and on motion, duly seconded, it was voted to award a scholarship at Louisiana State University for $40.00 and one at Tulane University for $125.00, to students in engineering, to be selected by the deans of those schools in accordance with the conditions in a report of the Scholarship Committee, such scholarships to run for a period of four years unless vacated sooner. The Board invited attention to the fact that this would mean an annual expenditure of $165.00.

Report of the Special Committee on Registration of professional engineers was read and ordered printed in the Proceedings.

Communications were read from the Treasurer in regard to disposition of the Yerxa Steeves bond, also to the investing of some of the savings account in the purchase of a gold note carrying 6 per cent interest. On motion, duly seconded, it was voted to refer this matter to the Finance Committee, with the request that the savings account in the Canal Bank not be reduced to such an amount that will cause the bank to withdraw the present half-page advertisement in the Proceedings.

The annual reports of the Treasurer and Secretary were read and approved, and were ordered refered to the Society and later to be printed.

On motion, duly seconded, the President was authorized to appoint a standing committee, consisting of five members. The purpose of this committee is to encourage and develop a greater spirit of comradeship and friendliness at meetings, and to assist in every way practicable in having the members get acquainted.

A copy of H. R. 8139, introduced by Congressman O'Connor in the House of Representatives, for a nautical school in the Port of New Orleans, was read, and on motion, duly seconded, the Board voted to favorably recommend the approval of the members present at the annual meteing, to this bill.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Annual Meeting of the Society, January 18, 1930.

The meeting was called to order by President Fox, F. A. Muth, Secretary, and 41 members and guests present.

The minutes of the previous meeting were read an dapproved.

The annual reports of the Treasurer and Secretary were read and ordered printed in the Proceedings.

The annual report of the Board of Direction was read and adopted with thanks. It was ordered printed in the Proceedings.

The annual report of the Committee on Employment and the special report of the Committee on Registration of Professional Engineers was read and ordered printed in the Proceedings.

The contents of Bill H. R. 8139, introduced in the House of Representatives by Congressman O'Connor, was read, together with the recommendation of the Board of Direction at the annual meeting, approving the bill. On motion, duly seconded, the matter was put to ballot and was unanimously carried.

Ballots were canvassed for new members, there being 87 formal ballots and one informal ballot, and the following members were declared elected:

Resident Members.

Paul Andry, Jr.
James H. Cherry
Lionel E. Flotte
Harold Langdon Gaidry
Loyless H. Hiers
Lyall G. Ireland
Odon O. Melancon
Howard Norman Old
Walter H. Scales
Albert P. Woody

Non-Resident Members.

Charles R. Gates
A. J. McCorkle
Harry B. Henderlite

Associate Members.

Edgar C. Walthall

Resident Student Members.

Jerome C. Baehr
John W. Bierhorst, Jr.
Lawrence C. Brune
Charles E. Cassagne, Jr.
Richard H. Church
Richard H. Colcock
Ernest A. Couloheras
Charles B. David
Claude E. Dolhonde
Joseph E. Guidry, Jr.
Merrill A. Gerstner
Edward Heim Gessner
Peter J. Erickson, Jr.
Stanley M. Lecourt
Frank W. Macdonald
John Joseph Metzger, Jr.
Albert James Meyers
Myrtis M. Norton
Carroll J. Pierce, Jr.
Walter Hugh Price
Raymond C. Prouet
James M. Robert, Jr.
Charles B. Spencer
Brune Stolley
Richard E. Wagner
Philip A. Weber
John W. Wilson
Carroll Lee Wood, Jr.

Ballots were also opened for officers, there being 84 formal ballots and 1 informal ballot. The following officers were declared elected for the ensuing year:

President.....Mr. James M. Todd
Vice-President.....Mr. Frank G. Frost
Secretary.....Mr. Frank A. Muth
Treasurer.....Mr. W. B. Moses
Member of Board to serve 3 years.....Mr. A. L. Dunlap

The President took this opportunity of thanking all of the officers, committees and members of the Society for carrying out the work so successfully during the year.

The new President, Mr. James M. Todd, was then conducted to the chair by two escorts; he made a few appreciative remarks, thanking the membership of the Society for the honor conferred on him, and soliciting their help and co-operation.

There being no further business, the meeting adjourned to a most enjoyable smoker held in the Florentine Room of the Jung Hotel.

F. A. MUTH, Secretary.

Minutes of the Special Meeting of the Board of Direction, January 18, 1930

A special meeting of the Board was held subsequent to the annual meeting of the Society, Professor F. H. Fox, President, presiding, and the following members were present: Messrs. Todd, Porter, Frost and Muth.

On motion, duly seconded, Mr. F. N. Billingsley was elected a member of the Board to fill out the unexpired term of Mr. Frank G. Frost, who was elevated to the Vice-Presidency.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

ANNUAL REPORTS

ANNUAL REPORT OF THE BOARD OF DIRECTION

Year 1929

December 31, 1929.

To the Members of the Louisiana Engineering Society:

Gentlemen—Your Board of Direction begs to report that during 1929 there were held 8 regular and 1 special meetings, or a total of 9 meetings of the Board for the transaction of the business of the Society.

The Technical Papers Committee has given us an excellent program of very high-grade papers. These parts are recorded in the Proceedings.

The Library Committee has done good work and some valuable accessions have been made to the Library during the year. Two open book racks were placed in the reading room.

The Committee on Employment has kept up its record for fine work in taking care of the members who desired employment or a change of employment. This committee is a valuable one to the members, also to the employers involved.

The Membership Committee has done good work this year. The increase in membership has been gratifying in that 63 members were admitted. Of course, as usual, there have been a number of resignations and adjustments, with 5 deaths, the net increase resulting in 32 new members.

The Publications Committee has given us six very excellent issues of the Proceedings during 1929. Professor Douglas Anderson, Editor of the Journal, deserves the highest praise for the quality and tone of this magazine, and the Board as well as the members of the Society recognize the fact that the Proceedings is a powerful factor in the interest and usefulness of our Society.

The Committee on Publications, Division "B," has done good work this year in securing new advertisements and in renewing others. While there has been a decrease in the number of advertisements carried, the Board is hopeful that considerable gain will be made during the next year as the work of this committee is necessary in order to maintain the high character of our publication.

Attention is invited to the financial condition of the Society. The financial statement shows that the Proceedings Fund has increased $169.48. Our investments are well placed and amount to $8,151.05. The Reserve Fund shows a balance of $11,261.18, having increased $1,152.22

during the year. The Treasurer's report shows a cash balance on January 1, 1930, of $1,712.75.

Some special committees were appointed during the year to submit reports on certain features of special interest to the Society. The committees which have completed their reports have covered the following important investigations:

The report on "Street Traffic Control," by Miller McClintock and H. Bartholomew, was submitted to the Society for study and recommendation. It was then turned over to the committee, headed by Mr. John L. Porter, a study was made, and the committee submitted its report. This excellent report was then transmitted to the Commissioner of Public Safety by the Board through the Secretary.

In order to add to the comfort of the members at the meetings, a committee was appointed, headed by Mr. James M. Todd as chairman, to investigate the feasibility of installing amplifiers and electric fans in the meeting room. This committee submitted a report advising that the amplifier system was not feasible or advisable; the report also covered the estimated cost of installing electris fans, which report will be borne in mind for future use.

In order to provide for a meeting place more centrally located, also for the possibility of a better location for the Library, a committee was appointed, headed by Mr. James M. Todd as chairman, with the instructions to submit recommendations. A careful investigation was made and the report was submitted to the Board, but owing to the fact that moving of the Library or the change in meeting room did not seem feasible, the Board made provision to have the Library room available for trial from 5:00 P. M. to 9:00 P. M. for two months, commencing November 1 and ending December 31, 1929. These arrangements were carried out and results carefully watched. It was found that only one person took advantage of the availability of the Library at night by withdrawing books after 5:00 P. M. during the period of two months.

During the year the matter of awarding to outstanding Seniors, two Junior memberships in the Society, was maintained; one in the College of Engineering at Louisiana State University, and the other at Tulane University.

Some of the other acomplishments of the year which the Board feels are outstanding cover the following:

Student Members—Provision was made to extend to Juniors in the Colleges of Engineering the opportunity of becoming student members in the same manner as has been open to Senior students. A number of additions to the Society were made through this means, and it is believed that the benefit will be mutual. The student members will have a longer time to enjoy contact with the older members of the Society during their

school life and to attend more of the meetings, which will be of benefit to them.

Scholarships—Provision has been made for the awarding of two scholarships annually, one to the Louisiana State University in the sum of $40.00, and the other to Tulane University in the sum of $125.00, as recommended by the committee appointed for this purpose, consisting of Mr. Samuel M. Young,, chairman; Prof. Douglas Anderson, Prof. Donald Derrickson, Prof. W. B. Gregory and Mr. W. B. Moses. These scholarships will be in addition to the Junior memberships of the Society and it is hoped that they may be maintained for a number of years, resulting in great good for the Society as well as to the recipients.

Certificates of Membership—Provision was made during the year to furnish to all members upon application Certificates of Membership at $1.00 each. These certificates are printed on good quality paper and are suitable for framing. Where practicable, they will be signed by the President and the Secretary of the Society at the time the member was elected, otherwise by the President and the Secretary of the Society at the time application is made.

Registration of Professional Engineers—During the past five or ten years a number of committees have been appointed on various occasions to investigate and submit reports on the registration of professional engineers. During this year the Board desired that definite action be taken toward the preparation of a bill for registration of professional engineers which would extend to the electrical and mechanical engineers, etc., the same opportunities and advantages of registration now enjoyed by the civil engineers and surveyors in this State. The commitee was appointed in accordance with the desires of the Board, with instructions to make a careful study of the matter of registration and to prepare the draft of a bill which could be submitted to the membership of the Society to determine whether or not it desires general registration. This committee has submitted its report and has made a skeleton outline of the important features which it considers necessary in a general registration bill. These accomplishments have already been attained and the committee is now preparing the draft of a bill to be submitted to the Board and to the Society. It has taken into consideration the interests of all classes of professional engineers, also the existing registration law in Louisiana.

In closing the year's work, a special committee was appointed to prepare a report on the feasibility of tendering a suitable testimonial in the form of a dinner, etc., to two of the members of the Louiisana Engineering Society who have been accorded high honor by the American Society of Civil Engineers, i. e., Mr. J. F. Coleman, who has been nominated for the Presidency of that Society, and Mr. A. T. Dusenbury, who has been nominated for the directorship of the 15th District. This committee is composed of Messrs. A. M. Lockett, chairman; Col. Marcel Gar-

saud and James M. Todd. The opportunity will be taken by the committee to make this a citizens' testimonial to the engineers to be honored, and the Board hopes that the function will add to the prestige of the engineering profession, not only in New Orleans, but in the entire South.

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

Respectfully submitted,

FREDERICK H. FOX, President.
J. M. TODD, Vice-President.
FRANK A. MUTH, Secretary.
W. B. MOSES, Treasurer.
J. L. PORTER,
F. G. FROST,
C. S. MUENCH,
Board of Direction.

ANNUAL REPORT OF THE SECRETARY

Year 1929

January 1, 1930.

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

Gentlemen—As Secretary of the Society, I herewith submit the following report for the year 1929:

During the past year, the Board of Direction has held 8 regular and 1 special meetings, a total of 9 meetings; the Society has held 9 regular meetings, with an average attendance of 62, maximum 111, minimum 29.

One of the meetings of the Society was a joint meeting with the local chapter of the American Society of Mechanical Engineers.

The membership shows a steady increase from year to year. This year there has been a net increase of 32 members, although there was a total of 63 members elected and reinstated.

GRADE	On Roll Jan. 1, 1929	Elected	Reinstated	Transferred to	Transferred from	Dropped	Resigned	Died	On Roll Jan. 1, 1930
Honorary Members	6	....	....	....	....	....	....	....	6
Resident Members	238	18	1	3	8	3	2	3	244
Non-resident Members	87	4	....	11	....	3	4	2	93
Associate Members	22	8	....	....	2	3	1	....	24
Non-res. Assoc. Members	....	....	....	2	....	....	....	....	2
Junior Members	33	5	....	1	....	1	1	....	37
Non-res. Jun. Members	10	1	....	....	....	1	....	....	10
Student Members	72	29	....	....	7	3	7	....	84
	468	65	1	17	17	14	15	5	500

It is with regret that the deaths of Messrs. W. L. Fey, E. F. Delery, J. H. Murphy, J. F. Dubus and W. T. Triggs are recorded.

The Treasurer's report is submitted separately, and shows a cash balance of $1712.75.

During the year the Investment Account, as submitted in the Treasurer's report, stands as follows:

Total Receipts	$6,755.08	
Total Disbursements	5,042.33	
		$1,712.75
Checking account in New Orleans Bank & Trust Co		1,712.75
1 Union Title Guarantee (Gold Note)	1,000.00	
22$100.00 First Liberty Loan	200.00	
1 50.00 First Liberty Loan	50.00	
5 50.00 1917 Liberty Loan	250.00	
Greater New Orleans Homestead	1,036.96	
Union Homestead	500.00	
Standard Homestead	500.00	
Italian Homestead	500.00	
Security Homestead	500.00	
Columbia Homestead	500.00	
N. O. Bank & Trust Co., Savings Account	1,554.42	
Canal Bank & Trust Co., Savings Account	559.67	
1 N. O. Securities Collateral Trust Gold Note	1,000.00	
		8,151.05
		$9,863.80

It is noted from the above that during the year $1,000.00 was set aside and a New Orleans Securities Collateral Gold Note was purchased for that sum.

The following technical exercises were held:

March 25—"Cement and Concrete," by Duff A. Abrams.

April 8—"Hydraulic Research in Connection with Power Plant Design," by I. A. Winter.

May 13—"The Layout, Design and Rating of Airports," by Raymond Saal.

June 10—"High-speed Recording Instruments," by Miles B. Hutson.

SCept. 9—"Zoning in New Orleans," by Charles A. Favret.

Oct. 14—"The Sugar Cane Industry in Louisiana," by David W. Pipes, Jr.

Nov. 11—"Sodium Aluminate in Water Purification," by George E. Brown.

Dec. 9—"Requirements for Good Lighting," by M. F. Canning.

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

The Secretary desires to thank you for your co-operation during the year. It has been an honor and a privilege to serve you.

Respectfully submitted,

FRANK A. MUTH, Secretary.

FINANCIAL CONDITION OF THE SOCIETY

January 1, 1930

Assets:

Cash on hand in bank	$1,712.75	
Accounts Receivable (Members)	2,820.00	
Accounts Receivable (Advertisers)	49.53	
Entrance Fees Receivable	244.50	
Smoker Memberships	209.50	
Investments	8,151.05	
		$13,187.33

Liabilities:

Proceedings Reserve Fund	747.61	
Building Fund	151.65	
Library Fund	695.25	
Accounts Payable	295.14	
1930 Dues in Advance	36.50	
		1,926.15
		$11,261.18

General Reserve Funds

Balance from 1914	165.00	
Balance from 1915	189.75	
Balance from 1916	377.45	
Balance from 1917	299.49	
Balance from 1918	27.47	
	1,059.16	
Deficit from 1919	62.93	
	996.23	
Balance from 1920	198.09	
Balance from 1921	90.94	
Balance from 1922	1,186.58	
Balance from 1923	309.84	
Balance from 1924	586.43	
Balance from 1925	975.61	
Balance from 1926	1,128.05	
Balance from 1927	1,363.40	
Transferred from Proceedings Reserve in 1927	700.00	
Transferred from Library Fund Reserve in 1927	300.00	
Balance from 1928	1,374.79	
Transferred from Proceedings Reserve Fund in 1929	700.00	
Transferred from Library Reserve Fund in 1929	200.00	
Balance from 1929	1,151.22	
		$11,261.18

Proceedings Reserve Fund

Balance from 1915	$	112.20
Balance from 1916		566.13
Balance from 1917		568.14
Balance from 1918		567.52
Balance from 1919		41.08
		1,855.07
Deficit in 1920		221.98
		1,633.09
Balance from 1921		26.25
		1,659.34
Deficit in 1922		301.02
		1,358.32
Deficit in 1923		110.65
		1,247.67
Deficit in 1924		120.26
		1,127.41
Balance from 1925		184.56
Balance from 1926		353.57
		1,665.54
Balance from 1927		148.11
		1,813.65
Less amount transferred to General Fund		700.00
		1,113.65
Balance from 1928		164.48
		1,278.13
Less amount transferred to General Fund, 1929		700.00
		578.13
Balance from 1929		169.48
	$	747.61

Proceedings Fund for Year 1929

Revenues:

Advertising Revenues	$1,007.62	
Members' Subscriptions	924.00	
Sales of Proceedings	21.90	
		1,953.52

Expenses:

Salary of Editor and Secretary	360.00	
Printing and Mailing	1,161.04	
Stenographer	45.00	
Miscellaneous Expenses	180.00	
Advertisments cancelled	38.00	
		1,784.04
		$ 169.48

Annual Statement of the Library Fund, January 1, 1930

Revenues:

Balance, January 1, 1929	$ 694.82	
Received from General Fund	480.00	
Total Revenues		$ 1,174.82

Expenditures:

January—	
Silers, Inc.	10.00
Power Co.	3.00
Railway Maintenance	2.00
Electrical World	5.00
February—	
J. M. Dassat	15.00
Johns Hopkins Press	3.92
Miss Carrie Freret	15.00
March—	
American Society for Testing Materials	10.40
Miss Carrie Freret	15.00
April—	
Railway Age	6.00
Miss Carrie Freret	15.00
May—	
Miss Carrie Freret	15.00
Riecke Cabinet Works	16.00
June—	
Miss Carrie Freret	15.00

July—		
Miss Carrie Freret	30.00	
September—		
Miss Carrie Freret	15.00	
October—		
Miss Carrie Freret	15.00	
November—		
Miss Carrie Freret	15.00	
Silers, Inc.	6.25	
McGraw-Hill Publishing Co.	13.00	
December—		
Miss Carrie Freret	15.00	
December 31—		
Accounts payable	24.00	
Transferred to General Reserve Fund	200.00	
		479.57
Balance on hand December 31, 1929		$ 695.25

General Fund, Year 1929

Revenues:		
Membership dues for 1929	$4,057.00	
Smoker Account	305.00	
Entrance Fees	201.00	
Interest on Investments	399.23	
		$ 4,962.23
Expenses:		
Subscription to Proceedings	924.00	
Appropriation to Library Fund	480.00	
Salary of Secretary	540.00	
Printing and Postage	341.13	
Refreshments	105.00	
General Expenses	316.08	
Exchange	4.90	
Dues of Secretary	12.00	
Auditor	50.00	
Smoker Expenses	609.39	
Loss on Membership	428.51	
		3,811.01
Net Profit for year 1929		$ 1,151.22

Cash Account, Year 1929

Receipts:		
1926 Dues Collected	$ 61.00	
1927 Dues Collected	105.00	
1928 Dues Collected	535.25	
1929 Dues Collected	2,604.50	
1930 Dues Collected	32.50	
Smoker Account	287.50	
Entrance Fees	162.00	
Advertisers in Proceedings	1,036.51	
Proceedings Sales	21.90	
Interest	257.96	
Total Receipts		$ 5,104.12
Deduct Exchange		4.90
		5,099.22
Deduct N. S. F. Checks		8.00
		5,091.22
Add Balance of January 1, 1929		1,663.86
		6,755.08
Total Warrants Paid during year		5,042.33
Balance on hand, Checking Account		$ 1,712.75

ANNUAL REPORT OF THE TREASURER

Year 1929

January 1st, 1930.

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

Dear Sir—As per requirements of Article No. 4 of the Constitution, I have the honor to submit the following report covering receipts and disbursements for the period of Jan. 1st, 1929, up to Jan. 1st, 1930:

Received from Secretary—		Deposited in New Orleans Bk. & Tr. Co.	Exchange Charged
Feb. 5	Memo. 1 to 8 inclusive	$1,594.18	$ 1.65
Mar. 12	Memo. 9 to 11 inclusive	502.60	.30
Apr. 9	Memo. 12 to 13 inclusive	167.79	.20
May 14	Memo. 14 to 17 inclusive	597.24	.80
June 12	Memo. 18 to 19 inclusive	329.23	.60
July 16	Memo. 20 to 22 inclusive	413.45	.25
Aug. 26	Memo. 23 to 25 inclusive	445.91	.35
Sept. 21	Memo. 26 to 27 inclusive	144.48	.10
Oct. 15	Memo. 28 to 29 inclusive	195.18	.10
Nov. 14	Memo. 30 to 31 inclusive	161.10	.30
Dec. 12	Memo. 32 to 33 inclusive	177.05	.20
Dec. 27	Memo. 34 to 35 inclusive	214.95	.05
		$4,943.16	$ 4.90
Interest Yerxa Steeves Bond		81.59	
Coupons Deposited (Liberty Bonds)		19.37	
Coupons Deposited (N. O. Securities Gold Collateral Note)		60.00	
			5,104.12
Less Exchange			4.90
			5,099.22
Less Checks Returned—			
Guy Osborne		6.00	
Jos. A. Brenan		2.00	
			8.00
			5,091.22
Balance on hand as per Treasurer's Report, Jan. 1, 1929			1,663.86
			$ 6,755.08

Disbursements from January 1st, 1929, to January 1st, 1930

No.	Name—	Amount
January 19th—		
1	Carrie Freret	15.00
2	Engr. News Record	5.00
3	Concrete Pub. Co.	4.00
4	M. Giglio	15.00
5	F. A. Muth	53.50
6	Edna Doll	15.00
7	Tulane Press	217.25
8	Hotel Jung	213.50
9	Walter B. Moses	264.89
January 21st—		
10	Leo Loubere	50.00
11	Siler's, Inc.	10.00
12	Addressograph Co.	1.66
13	N. O. Bank & Trust Co.	6.00
14	Garcia Stationery Co.	1.80
15	Power	3.00
16	Railway Eng. & Maintenance	2.00
17	Electrical World	5.00
18	R. G. Diamond	35.00
February 25th—		
19	J. M. Dossat	15.00
20	Johns Hopkins Press	3.92
21	Tulane Press	25.00
22	F. A. Muth	59.00
23	Edna Doll	15.00
24	Carrie Freret	15.00
March 26th—		
25	Tulane Press	148.76
26	Amer. Society for Test. Mtls.	10.40
27	Edna Doll	15.00
28	Carrie Freret	15.00
29	F. A. Muth	57.00
30	Boylan's Detective Agency	3.00
31	Cabildo Restaurant	15.00
32	Ferd Marks Ins. Agcy.	17.50
April 9th—		
33	Railway Age	6.00
34	Cabildo Restaurant	15.00
35	Boylan's Detective Agency	3.00
36	Tulane Press	529.75
37	F. A. Muth	54.50
38	Harcol Film Co.	17.50

No.	Name—	Amount
39	Edna Doll	15.00
40	W. C. Rondeau	9.00
41	Carrie Freret	15.00
	May 13th—	
42	Tulane Press	75.80
43	Carrie Freret	15.00
4	F. A. Muth	54.50
45	Edna Doll	15.00
46	Boylan's Detective Agency	3.00
47	Cabildo Restaurant	15.00
48	W. C. Rondeau	6.00
49	Riecke Cabinet Works	16.00
50	N. O. Bank & Trust Co	1,025.51
	June 10th—	
51	Carrie Freret	15.00
52	F. A. Muth	56.00
53	Edna Doll	15.00
54	Douglas Anderson	150.00
55	Tulane Press	121.00
56	W. C. Rondeau	10.00
57	Boylan's Detective Agency	3.00
58	A. Serremon	15.00
59	Addressograph Co.	1.27
	July 15th—	
60	Tulane Press	44.43
61	Brandao Printing Co	5.00
62	W. C. Rondeau	5.00
63	Carrie Freret	30.00
64	Edna Doll	30.00
65	F. A. Muth	110.00
66	Kinnebrew Williams	11.50
67	F. A. Muth	97.10
	September 18th—	
68	Tulane Press	118.35
69	Edna Doll	15.00
70	Carrie Freret	15.00
71	W. C. Rondeau	5.00
72	A. Serremon	15.00
73	F. A. Muth	98.50
	October 14th—	
74	Tulane Press	163.34
75	Carrie Freret	15.00
76	Edna Doll	15.00
77	F. A. Muth	54.50

No.	Name—	Amount
November 11th—		
78	Tulane Press	36.00
79	W. C. Rondeau	5.00
80	Boylan's Detective Agency	3.00
81	Carrie Freret	15.00
82	Edna Doll	15.00
83	F. A. Muth	54.50
84	Silers, Inc.	6.25
85	McGraw Hill Pub. Co	13.00
86	A. Serremon	15.00
December 9th—		
87	Tulane Press	130.35
88	Carrie Freret	15.00
89	Edna Doll	15.00
90	F. A. Muth	54.50
91	Douglas Anderson	150.00
92	W. C. Rondeau	5.00
93	E. M. S. LeBlanc	35.00
94	A. Serremon	15.00
95	Boylan's Detective Agency	3.00
		$5,042.33

RECAPITULATION

Total Receipts	$6,755.08	
Total Disbursements	5,042.33	
		$ 1,712.75
Checking Account in New Orleans Bank & Trust Co		1,712.75
1 Union Title Guarantee Gold Note	1,000.00	
2 $100 First Liberty Loan	200.00	
1 50 First Liberty Loan	50.00	
5 50 1917 Liberty Loan	250.00	
Greater N. O. Homestead	1,036.96	
Union Homestead	500.00	
Standard Homestead	500.00	
Italian Homestead	500.00	
Security Homestead	500.00	
Columbia Homestead	500.00	
N. O. Bank & Trust Co., Savings Account	1,554.42	
Canal Bank & Trust Co., Savings Account	559.67	
1 N. O. Securities Collateral Trust Gold Note	1,000.00	
		8,151.05
		$9,863.80

Respectfully submitted,

WALTER B. MOSES, Treasurer.

REPORT OF EMPLOYMENT COMMITTEE

To the President and Members of the Louisiana Engineering Society:

Gentlemen—As chairman of the Employment Committee of the Louisiana Engineering Society, I take pleasure in handing you herewith my report to cover the year's activities of your committee, which is composed of the writer and Mr. R. Bassich.

Having just received a report from Mr. Bassich, I am combining his records with my own, and I am pleased to report activities during the year as follows:

Number of Applicants	170
Number of Vacancies	136
Number of Vacancies Filled	90

Regarding the vacancies filled, I might mention that in many cases applicants who have secured positions do not notify us to that effect, and it is probable that many more positions have been filled than are shown by this report.

Mr. Bassich and myself feel that this committee is doing good work for the members of the Society, and we hope that they will continue to file their applications with either of us.

I trust this report is entirely satisfactory to you.

Yours very truly,

R. H. BAUMBACH, Chairman.

PROGRESS REPORT OF COMMITTEE ON REGISTRATION

To the President and Board of Direction of the Louisiana Engineering Society,

New Orleans, La.

Gentlemen—This Progress Report is submitted to cover the activities of the committee appointed as desired by the Board to prepare a draft of a bill for registration of professional engineers, in order that mechanical and electrical engineers may enjoy the advantages of registration similar to that now enjoyed by civil engineers in this State.

Careful consideration has been given to the requirements of the existing law in this State, also to the registration requirements of all other States having such laws, and a draft of a bill is now being prepared, to be submitted to the Board and to the Society.

Already a schedule has been selected, indicating the essential points this committee recommends to be in the law.

As soon as the tentative draft of the proposed bill is completed, it will be submitted to the Board in such form that the members of the Society can vote on whether or not they desire registration of professional engineers.

Respectfully submitted,

A. T. DUSENBURY, Chairman.

AUDITOR'S REPORT

January 6, 1930.

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

Gentlemen—Acting in accordance with instructions from Mr. F. A. Muth, Secretary of the Louisiana Engineering Society, I have made a complete audit of the books and records of your Association covering operations for the calendar year 1929, and during the course of my audit verified all cash records as well as the Assets and Liabilities of the Society as at December 31, 1929, and I certify that the attached General Balance Sheet truly reflects the financial condition of the Louisiana Engineering Society at December 31, 1929. I also certify that all books and records were found in order and the receipts and disbursements properly accounted for.

You will take note that the balance of unpaid membership dues from 1926 to 1930 amount to approximately $375.00 more unpaid dues than existed at the same time last year and showing the unpaid dues for 1925 to 1928. The 1927 and 1928 dues are coming in very slowly. The unpaid membership dues at December 31, 1928, amounted to $2466.75, and the unpaid dues at December 31, 1929, amount to $2820.00.

Appended hereto you will find the following exhibits in substantiation of this report:

EXHIBIT "A"—General Balance Sheet, December 31, 1929.

EXHIBIT "B"—Statement showing results of General Fund and changes during 1929 as well as the net revenues for the year. The net profits for 1929 amount to $225.00 less than 1928.

EXHIBIT "C"—Statement showing results of Proceedings Fund, also changes during 1929 as well as balance December 31, 1929. The net profits for 1929 showed very little change as against 1928.

EXHIBIT "D"—Statement of Library Fund for the year 1929.

EXHIBIT "E"—Statement of Cash Receipts and Disbursements for the year 1929.

Unpaid Membership Dues $2820.00—

1926 Dues unpaid	$ 171.00	
1927 Dues unpaid	447.74	
1928 Dues unpaid	783.25	
1929 Dues unpaid	1,418.00	
Total		$ 2,820.00

Increase in Assets—

The total assets at December 31, 1929, amount to	12,855.69
The total assets at December 31, 1928, amount to	11,334.56
Total increase during 1929	$ 1,521.13

My audit discloses the fact that your surplus funds have been invested in the following securities, which are all good and sound:

Bank Savings Accounts:		
N. O. Bank & Trust Company	1,554.42	
Canal Bank & Trust Company	559.67	
		2,114.09
Homestead Stock:		
Greater N. O. Homestead	1,036.96	
Union Homestead Assn	500.00	
Standard Homestead Assn	500.00	
Italian Homestead Assn	500.00	
Security Homestead	500.00	
Columbia Homestead	500.00	
		3,536.96
Liberty Bonds:		
2 $100.00 First Liberty Loan	200.00	
1 50.00 First Liberty Loan	50.00	
5 50.00 1917 Liberty Loan	250.00	
		500.00
Other Bonds:		
Union Title Guarantee Gold Note	1,000.00	
N. O. Securities Collateral Trust Gold Note	1,000.00	
		2,000.00
Total Stocks, Bonds, Savings Accounts, etc., at December 31, 1929		$ 8,151.05

Before closing, I wish to say that the books and records were found up to the minute, accurately kept and in a very neat manner, and the Secretary and Treasurer are due commendation for their good work. I like the way they keep their records, which assists me in finding the necessary figures and information when making my audit. I wish to thank both of them for their assistance. I also take occasion to wish the officers and members of the Society a very Happy and Prosperous New Year, and hope to continue to enjoy your friendship and goodwill.

Respectfully yours,

LEO A. LOUBERE,
Public Accountant—Auditor.

GENERAL BALANCE SHEET

December 31, 1929

Assets

Current Cash:			
Checking Account, N. O. Bank & Trust Co			$ 1,712.75
Accounts Receivable:			
Membership dune unpaid (1926 to 1929)		2,820.00	
Due by advertisers in "Proceedings"		49.53	
Entrance Fees uncollected		244.50	
Smoker Memberships uncollected		209.50	
			3,323.53
Reserve Investments:			
BONDS—			
U. S. Liberty Bonds	500.00		
Other Bonds, Gold Notes, etc	2,000.00		
		2,500.00	
STOCKS—			
Homestead Stocks, plus accrued dividends		3,536.96	
SAVINGS ACCOUNTS—			
N. O. Bank & Tr. Co., Savings Acct	1,554.42		
Canal Bank & Tr. Co	559.67		
		2,114.09	
			8,151.05
TOTAL ASSETS			$13,187.33

Liabilities and Reserves

Accounts Payable (December Salary and Bills Unpaid			295.14
1930 Dues paid in advance			36.50
Reserve Funds:			
Proceedings Reserve Funds (Exh. C)		747.61	
Building Funds		151.65	
Library Fund (Exh. D)		695.25	
			1,594.51
TOTAL LIABILITIES AND RESERVE FUNDS			$ 1,926.15
General Fund Balance at December 31, 1929 (Exhibit B)			11,261.18
TOTAL			$13,187.33

EXHIBIT "A"

GENERAL RESERVE FUND

At December 31, 1929

Balance from Last Report, January 1, 1929	$ 9,209.96
Transfer from Proceedings and Library Funds	900.00
Profit for 1929 as detailed below added to Fund	1,151.22
Balance General Reserve Fund at December 31, 1929	$11,261.18

ANALYSIS OF GENERAL FUND FOR CALENDAR YEAR 1929

Revenues:		
Membership Dues for 1929	4,057.00	
Smoker Account	305.00	
Entrance Fees	201.00	
Interest Earned on Investments	399.23	
		$ 4,962.23
Expenses:		
Allow Dues of Secretary	12.00	
Subscription to Proceedings	924.00	
Appropriation to Library Fund	480.00	
Salary of Secretary	540.00	
Printing and Postage	341.14	
Refreshments	105.00	
General Expense	316.08	
Exchange on Out-of-town Checks	4.90	
Auditor	50.00	
Smoker Expense	609.39	
Loss on Members Dropped for Non-payment of back dues, N. S. F. checks, etc	428.51	
		3,811.01
Net Revenues over Expenses, added to General Reserve Fund		$ 1,151.22

EXHIBIT "B"

PROCEEDINGS RESERVE FUND

At December 31, 1929

Balance at January 1st, 1929, as per last report	$ 1,278.13
Less Transfer to General Reserve Fund	700.00
	578.13
Net gain for 1929 detailed below	169.48
	747.61

ANALYSIS OF PROCEEDINGS FUND FOR CALENDAR YEAR 1929

Revenues:

Advertising Revenues	1,007.62	
Members' subscriptions	924.00	
Sales of "Proceedings"	21.90	
		1,953.52

Expenses:

Salary of Editor and Secretary	360.00	
Printing and Mailing	1,161.04	
Stenographer	45.00	
Miscellaneous Expense	180.00	
Loss from Cancelled Ads	38.00	
		1,784.04
Net Revenues over Expenses (Transferred to credit of Proceedings Reserve Fund)		169.48

EXHIBIT "C"

ANNUAL STATEMENT OF THE LIBRARY FUND COVERING THE TWELVE MONTHS ENDED DECEMBER 31, 1929

Revenues:

Balance January 1st, 1929		694.82	
Appropriation from General Fund		480.00	
			1,174.82

Expenses:

January—			
Siler's, Inc.	10.00		
Subscription to Journals, etc.	10.00		
			20.00
February—			
J. M. Doussat	15.00		
Carrie Freret	15.00		
Subscription to Journals, etc.	3.92		
			33.92
March—			
Subscription to Journals, etc.	10.40		
Carrie Freret	15.00		
			25.40
April—			
Carrie Freret	15.00		
Subscription to Journals, etc.	6.00		
			21.00
May—			
Carrie Freret	15.00		
Riecke Cabinet Works	16.00		
			31.00
June—			
Carrie Freret			15.00
July—			
Carrie Freret			30.00
September—			
Carrie Freret			15.00
October—			
Carrie Freret			15.00
November—			
Carrie Freret	15.00		
McGraw Hill Co.	13.00		
Siler's, Inc.	6.25		
			34.25
December—			
Carrie Freret			15.00

December 31—Unpaid Invoices—			
Carrie Freret	15.00		
Concrete Journal	6.00		
Ry. Eng. & Maint. Jl.	3.00		
		24.00	
			279.57
			895.25
Less—Transfer to General Reserve Fund			200.00
Balance December 31, 1929, after transfer of funds			$ 695.25

EXHIBIT "D"

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS FOR PERIOD JANUARY 1 TO DECEMBER 31, 1929

Balance in Checking Account, New Orleans Bank & Trust Co., January 1, 1929			$ 1,663.86
Receipts			
Dues Collected—			
1926 Dues	61.00		
1927 Dues	105.00		
1928 Dues	535.25		
1929 Dues	2,604.50		
1930 Dues	32.50		
		3,338.25	
Smoker Memberships collected		287.50	
Entrance Fees		162.00	
Proceedings Advertising		1,036.51	
Proceedings Sales		21.90	
Interest on Investments		257.96	
Total Receipts		5,104.12	
Less Exchange		4.90	
N. S. F. Checks		8.00	
			5,091.22
Total Current Cash Accountable			$ 6,755.09

Deduct Disbursements

General Expense, Watchman, etc	159.23	
Smoker Expense	561.39	
1928 Account Paid	324.75	
Refreshments	105.00	
Printing and Mailing	1,046.04	
Stenographer	45.00	
Interest Paid	25.51	
Auditor	50.00	
Proceedings Misc. Expense	165.00	
Library Fund Expense and Salary	255.57	
Entertaining, Convention Expense, etc	145.60	
Salary, Secretary and Editor	355.00	
Salary, Secretary	495.00	
Printing and Postage	309.24	
Bond Purchases	1,000.00	
Total Paid Out		5,042.33
December 31, 1929, Balance N. O. Bank, Checking Account		$ 1,712.75

EXHIBIT "E"

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.

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Douglas Anderson, Editor, Tulane University,
New Orleans, La.

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LOUISIANA ENGINEERING SOCIETY

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Vice-President, FRANK G. FROST, 317 Baronne Street.
Secretary, FRANK A. MUTH, 7705 Willow Street.
Treasurer, WALTER B. MOSES, 425 S. Peters Street.

DIRECTORS

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

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

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XVI. APRIL, 1930 NO. 2

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EDITORIAL NOTES AND COMMENT

Arc Welding of Steel Buildings. At the February meeting of the Society, Dr. Frank P. McKibben, consulting engineer to the General Electric Company, gave a very interesting lecture upon the above named subject. A resumé of the lecture is published in this issue of the *Proceedings*, with some photographs showing the application of electric welding to several different kinds of structural work.

The use of arc welding in connection with buildings, railway and highway bridges, has been increasing with rapid strides. In the city of Los Angeles an interesting application of it has been to the earthquake bracing in a building 150 feet high.

A two years' series of tests on welded joints, recently completed at the Rensselaer Polytechnic Institute, gives results which indicate that such joints can now be made with complete safety.

Arc welding is also very useful in the strengthening of structures by the addition of new members and bracing. There has been a fairly widespread inclusion of electric welding in the building codes of the cities of this country, and a model ordinance, for the use of city building codes, has been framed by the American Welding Society.

The City of New Orleans has under consideration a change in its building code which will permit the use of electric welding in the construction of steel buildings. The Delgado Trades School has expressed its willingness to co-operate in the training of men for this work, and the General Electric Company has offered to provide an expert who will give instruction to the pupils.

Mr. Donald DuPlantier has recently submitted to the Graduate Faculty of Tulane University a thesis upon this subject, as a candidate for the professional degree of Civil Engineer. This thesis is a very comprehensive treatise upon the subject of electric welding and contains a great deal of valuable information, carefully chosen and well arranged.

Dr. McKibben counsels a conservative attitude upon the part of the structural engineer toward the adoption of arc welding. Its advantages and disadvantages should be carefully weighed in connection with any project under consideration, and its adoption should be made only upon this basis.

The New Registration Bill. Louisiana was the first State in the Union to have a law requiring licensing and registration of engineers; this original bill, still in force today, applied, however, only to civil engineers and surveyors. The administration of the law has been ably handled by the State Board of Engineering Examiners, and too much credit cannot be given to the men, who at various times have composed this board, for their self-sacrificing devotion to the cause, and for their constant insistence upon high standards of eligibility for entrance into the practice of civil engineering or surveying.

Enforcement of the law has not been entirely satisfactory, due perhaps to two causes, reluctance on the part of individuals to report other individuals not complying with the law,

and lack of diligence on the part of the proper authorities in the prosecution of cases brought to their attention.

In view of the fact that the present law has been in force twenty-two years, several committees in charge of the drafting of the new law to cover all branches of engineering very wisely decided to make this act a re-enactment and amendment of the original one, rather than an entirely new one.

If this new amendment is passed it will accomplish the desired end of including all professional engineers without in any way undoing the very excellent results that have already been attained in the field of civil engineering and surveying.

The Responsibility of the Society. Published elsewhere in this issue of the *Proceedings* is a letter addressed to the President of the Louisiana Engineering Society from the Louisiana State Board of Engineering Examiners. This letter sets forth a resolution passed by the Board, stating its opinion of the new law as drafted, and calling to the attention of the Louisiana Engineering Society its responsibilities in connection with the proper administration of the law.

This letter should be read carefully and thoughtfully by every member of our Society, and should receive the most earnest consideration of the Board of Direction.

The first point in this resolution is to the effect that the Board of Direction of the Louisiana Engineering Society should consider as one of its most solemn obligations the preparation of the list of names to be presented to the Governor for appointment to the Board of Examiners.

"* * * In the last analysis, no matter how well or how ill such an act may be framed, its success or failure will, in large measure, depend upon the personnel of the Board appointed for its administration."

The second point is that, should the legislation be passed, the Louisiana Engineering Society should refuse to admit to full membership any future applicant who shows that his experience is gained illegally and counter to this law, and/or,

who having stated his intention of practicing engineering in the State, has not already qualified to practice under the law.

We, officers and members of the Louisiana Engineering Society, are the proponents of this legislation and it is our most solemn duty to set the good example of its proper administration and observance.

The Story of the Drafting. Mr. James M. Todd, President of the Society, has for a number of years been the moving spirit in an effort to have the provision of the licensing and registration law extended to cover all other branches of the profession in addition to civil engineering and surveying. It seems fitting that the active movement for the passage of the necessary legislation should come to fruition during Mr. Todd's incumbency as President.

The original committee, appointed to study the subject and to submit a tentative draft of the proposed bill, consisted of Messrs. A. T. Dusenbury, chairman; George R. Hammett, James M. Robert, James M. Todd and George R. Price.

Elsewhere in this issue, as a matter of permanent record, are published the reports of the above as well as of the other committees which have worked in behalf of this legislation, and the act itself as finally drafted is also published in full.

This final draft has received the epproval of:

The Louisiana State Board of Engineering Examiners.
The Louisiana Engineering Society.
The Local Section, A. S. C. E.
The Local Section, A. S. M. E.

The following gentlemen will serve as a Steering Committee for handling the bill before the Legislature:

James M. Todd, Chairman
F. N. Billingsley
E. S. Bres
Donald Derickson
George R. Hammett
Ira W. Sylvester
Frank A. Muth, Secretary

An Advisory Committee has been appointed as follows:

Douglas Anderson
Thos. W. Atkinson
B. H. Grehan
L. G. Hooper
J. T. Bullen
J. F. Coleman
A. T. Dusenbury
Harry Jacobs
John Klorer
J. W. Pegues

Read the New Bill. Every member of this Society and every practicing engineer in this State should read carefully the provisions of this act. For that purpose it is printed in full in this issue. To the mind of the Editor, the outstanding feature of the bill is that it places the qualifications for the professional engineer upon a high educational standard, by which the applicant for registration in the future must be a graduate from a recognized engineering school, or must possess the qualifications for full membership in one of the national engineering societies.

This is in line with what has already been done by the medical profession, and the time is rapidly coming when the legal profession will adopt similar standards and qualifications.

The proper licensing and registration of engineers is a subject now being agitated in all the States, it being recognized that this is the only solution of the problem of protecting the title of "engineer" and the practice of engineering against incompetency and fraud.

And the best laws now being drafted are those in which the standards of qualifications are based upon high educational requirements.

PAPERS AND DISCUSSIONS

ARC WELDING OF STEEL BUILDINGS

By Frank P. McKibben.

Read before the Society, February 10, 1930.

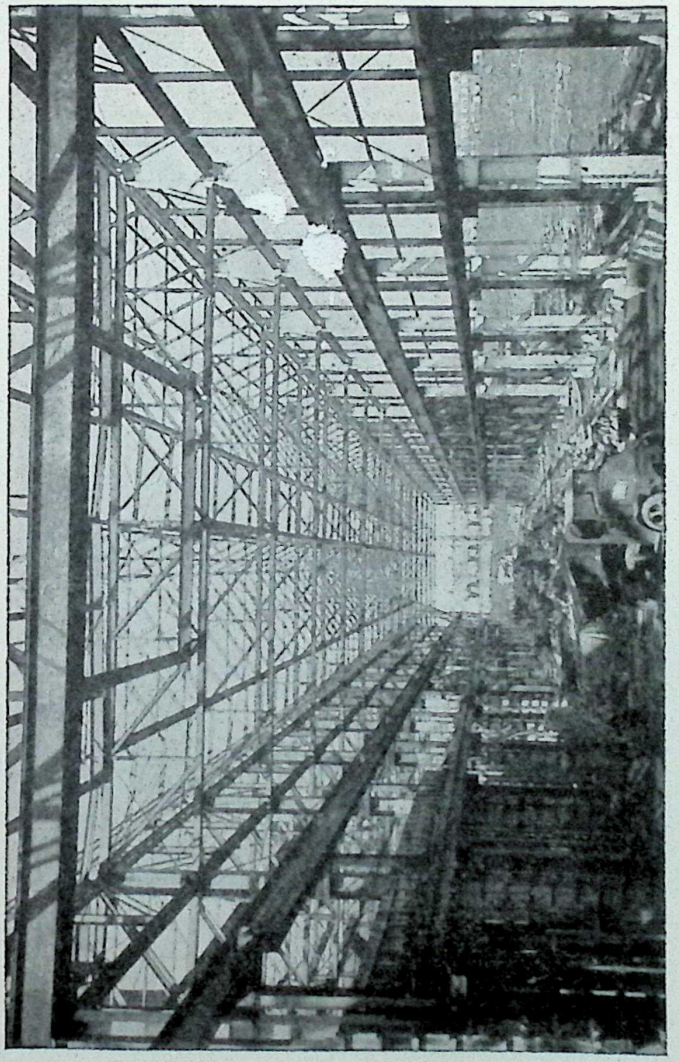
The first public demonstration of the arc welding of steel was before Franklin Institute in Philadelphia in 1877. By 1887 the process was in use in welding street railway rails. And, although as early as 1916 the first arc welding was performed on a steel building of any size, it really was not until during the past decade that the process has come widely into use in building construction.

Kinds of Welding—Steel may be welded by the electric, the chemical or the gas processes; but with only two or three exceptions, of the buildings and bridges which have been welded, the electric arc process has been almost universally used.

When two pieces of thick steel in a building are to be arc-welded, the positive side of the electric current is clamped to either piece and the negative side or terminal is attached to a small wire or electrode clamped in the holding device in the hand of a welder. Te begin welding, the electrode (wire) is touched to the steel to be welded, current flows; then the wire is withdrawn about ⅛ to ¼ inch; an arc forming in the air space produces a great heat in a small space. Heat so great as to melt the two pieces of steel to be welded, and to melt the wire which must be replaced from time to time.

Now this current is of such low voltage that it is not so dangerous so far as shocks are concerned as are the ordinary currents, but of course it will burn badly if one puts his hand into the arc, or against the hot steel, in the same way a hot rivet will burn. One's eyes must be shielded from the arc.

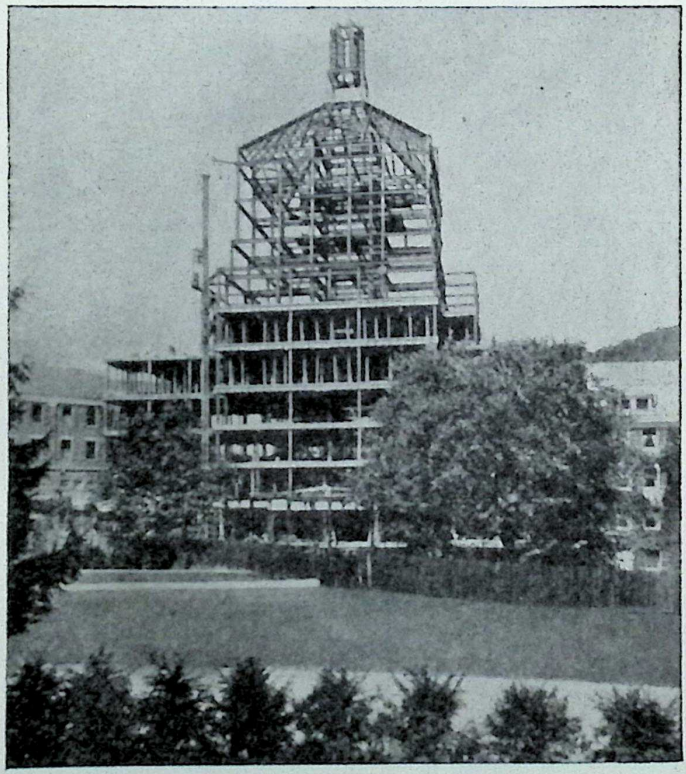
For welding outfits where ⅜ inch fillets are used, I find 175 to 200 amperes with arc voltage of 18 to 20 gives satisfactory results for hand welding with 3/16 inch welding wire.



Arc-welded Factory Building

This wire has practically the same chemical composition as structural steel, with carbon content of from .0013 to .0018.

PRESENT STATUS OF ARC WELDING—There are in the United States nearly 100 buildings in which welding has been totally or partially used. The tallest, Hotel Homestead at Hot Springs, Virginia, welded by the American Bridge Co., is 180 feet high,



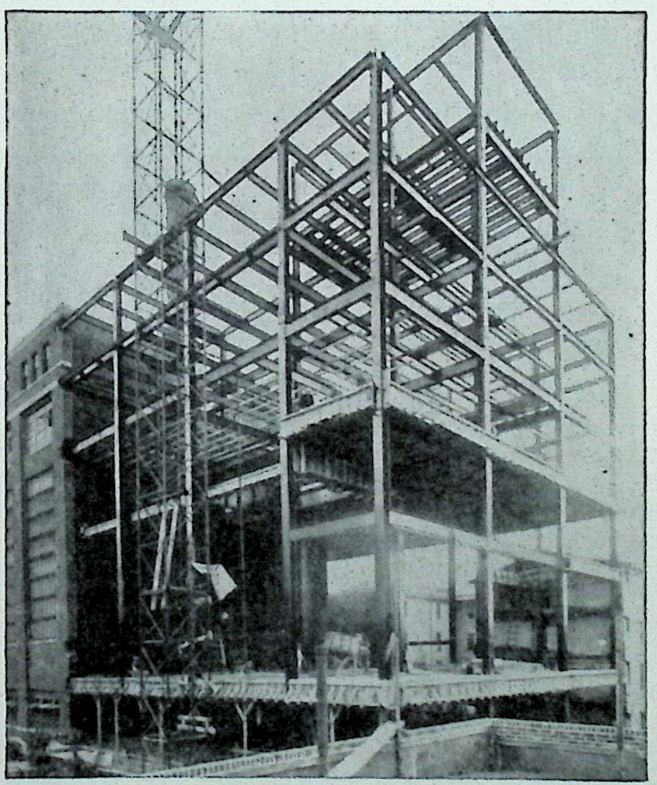
Homestead Hotel, Hot Springs, Va., Arc Welded and Erected by American Bridge Co.

with eleven stories in the main part of the building. In that structure there is not a single rivet.

The next tallest is the steam power plant at Hotel Chalfont, Atlantic City, N. J., 150 feet high, carrying boilers and other equipment common to steam power plants.

The General Electric Company's welded building at West Philadelphia contains the greatest tonnage of welded steel, and

in the 987 tons of steel there is not a single rivet. This building has several 10-ton traveling cranes operating on spans of about 58 feet 6 inches to 78 feet, and has many 2-ton wall cranes. This structure has been in use nearly two years, and a recent thorough examination of all the welds showed them sound and safe.



Arc-welded Power House for Chalfont and Hadden-Hall Hotels, Atlantic City, N. J.

I know of no failure of any welded joint in any building thus far erected—a good record.

There are about 20 railroad and highway bridges which are partially or wholly welded. For example, the old Pennsylvania Railroad bridge over the Susquehanna river at Havre de Grace, Md., had an upper deck welded in to carry the heavy truck and auto northbound traffic, while the old railroad floor was made to

carry the southbound highway traffic, thus making a double decked structure. The upper deck is entirely welded throughout the whole length of the bridge which is about 3000 feet.

A new building in Los Angeles 150 feet high will have its *earthquake* bracing welding.

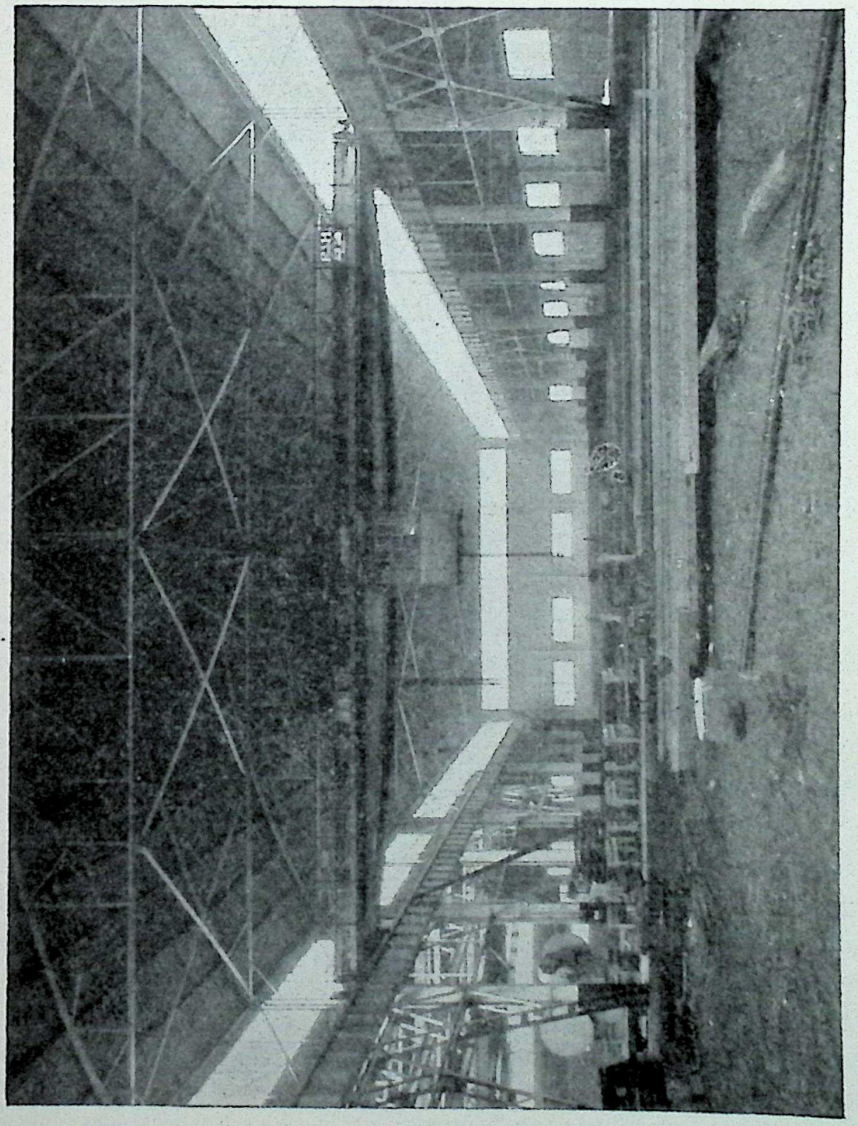
Welding has proved itself very satisfactory and useful in repairing and strengthening old buildings and bridges and in many cases this can be done much more cheaply and with less disturbance than by any other method.

The Pennsylvania Railroad welded some important eyebars on one of its bridges near Pittsburgh in order to strengthen the bridge; the Chicago Great Western Railroad welded several hundred tons of steel on its bridge over the Missouri river at Leavenworth.

Arc welding is very useful in attaching new I-beams to an old beam or column in an old building, because only the brick work in front of the old steel need be removed, whereas, in other methods of connecting, the brick in the rear as well as the front would have to be removed.

Welding and Building Codes—Sixty-three cities and towns have already adopted welding in their building codes, the most populous city being Dallas, Texas, with over 300,000 population. In New England, the only cities which have taken formal action and have adopted ordinances permitting welding are Pittsfield and Lynn, Mass. These two have incorporated the American Welding Society's code for welding steel building frames.

The American Welding Society's code for welding steel buildings is the best thus far written. This can be obtained by writing the author of this paper. It includes the requirements for strength of welds for use in design, for the qualifying or testing of welders, for the grade of welding wire to be used, etc. I recommend that New England cities adopt the American Welding Society's code in order that they may have conservative guidance and in order to allow the taxpayers to reap the benefit of welding. New York, Baltimore and many other cities are now considering the adoption of welding. In one city a permit to weld a hospital building has recently been refused, notwithstanding



Crane Runway, 80-ft. Span and Crane Columns, Arch Trusses, and Purlins, All Arc Welded

the presence of several hospital buildings near the new addition. If ever there was a place where welding should be permitted (under proper workmanship and supervision, of course) it is in the extension of hospital buildings. Although only two New England cities have adopted codes for welding, there are welded buildings in several other New England cities, built, I presume, under special permits or ordinances.

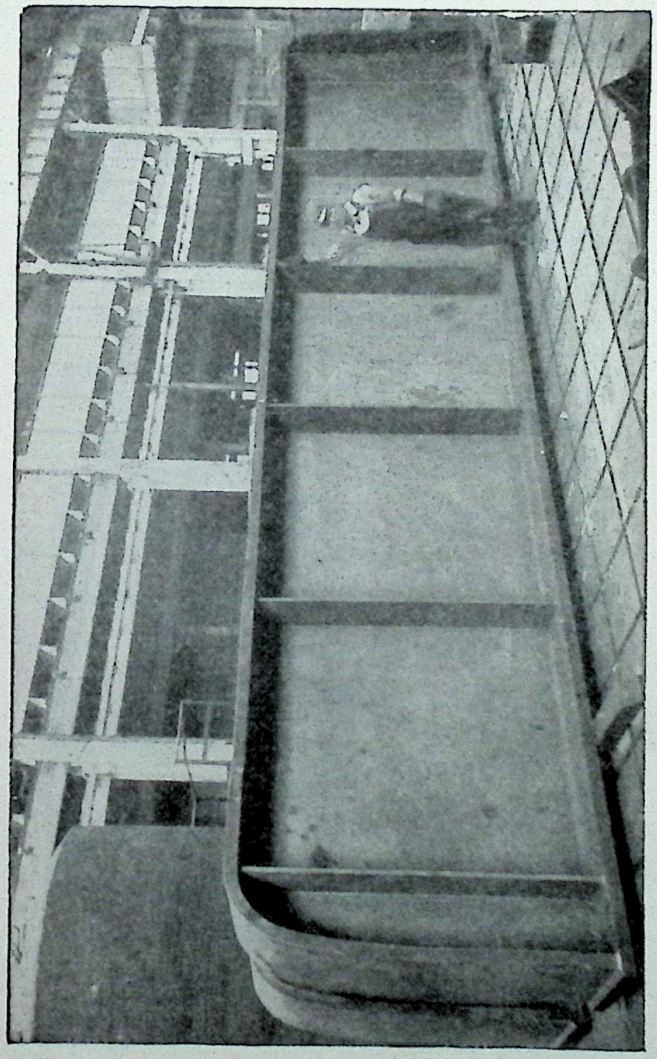
TESTS ON WELDING JOINTS—The Bureau of Standards, the American Bridge Company, General Electric Company, many college laboratories and others have made hundreds of tests on welded joints in order to find out the strengths of welds to be used in design.

As a result of all this, the American Welding Society recommended for buildings that in shear the welded metal (fillet) may be safely stressed to 11,300 pounds per square inch. For a fillet such as is used to connect a beam's web to the face of a column this 11,300 pounds per square inch means 3000 pounds per linear inch for a triangular fillet of ⅜ inch size. In plain English, a ⅜ inch fillet one inch in length can carry 3000 pounds safely, so if we have 30,000 pounds to be transmitted it would take 10 inches of ⅜ inch fillet to do the work.

Look at this another way. If a ¾ inch rivet is good for 4500 pounds in single shear it would require 1½ inches of ⅜ inch welded fillet to equal the rivet's strength; or if in double shear at 9000 pounds, then 3 inches of ⅜ fillet are required.

AUTOMATIC WELDING MACHINES—Although most welding on buildings has been done by hand welding, and for much of this work hand welding is by far the easiest and cheapest at present, there are shops which are fabricating steel with automatic welding machines operating with heavy current and high speeds. One structural shop has such a machine which uses two electric arcs at the same time and can weld two seams at once on a column or on a plate girder flange.

At Holyoke, Mass., the Walsh Boiler Works has an automatic arc welder for welding the longitudinal seams on steel pipes and this uses four arcs simultaneously under great speeds. One of the most noteworthy uses to which this machine has been applied



Girders Fabricated by Arc Welding

is the Springfield, Mass., water line, which is about 7 miles long, shop arc welded in 30-foot lengths, and then riveted together in the field.

Some Examples of Saving of Steel by Welding—In the West Philadelphia welded building of the General Electric Com-



Railroad Bridge in Process of Repair by Arc Welding

pany, the welded roof trusses have spans of 59 feet 6 inches weighed 5000 pounds, whereas riveted trusses carrying the same loads on the same spans weighed 6800 pounds, showing a saving of 1800 pounds per truss for welding. And corresponding figures for 78 feet spans were 9200 pounds and 13,200 pounds, a saving of 4000 pounds for welding.

A comparison between a riveted and a welded plate girder, each of 40-foot span and each carrying 4000 pounds per foot over the entire span, shows the riveted type to weigh 7498 pounds, whereas the welded type weighs 5467 pounds. In this case the welded girder saves 27.1 per cent of steel, or 2031 pounds.

CONSERVATISM—The conservative building commissioner, engineer and architect will not rush headlong into using new and untried methods and materials, but he will not be so conservative as to lean backwards and make no progress at all. I think the proper attitude towards welding should be this: Here is a method of joining steel that is noiseless; in many cases saves much weight of steel; is being more widely used for buildings and bridges every year; and has been permitted already by ordinance in sixty-three municipalities. Let us investigate, and if found to be satisfactory and safe, let's adopt it; if not, let's reject it. At all events, let's investigate.

DISCUSSION

MR. LORIO: In welding cast steel or fabricated steel, is there any difference in application of weld?

PROFESSOR MCKIBBEN: In general, no. With cast steel having practically the same chemical composition as structural steel the same technique for welding can be used for each of these materials. A soft steel electrode with chemical composition equal to that of structural steel is desirable.

MR. ACKERMAN: In welding bung head, you mentioned cutting out old head with acetylene torch. In doing so, doesn't an oxide form, which would do a lot of harm in so far as welding after cutting out old head is concerned?

PROFESSOR MCKIBBEN: In flame cutting, it is desirable to remove any oxide that may be left on the surface to be welded.

MR. DUPLANTIER: Professor McKibben, in your paper entitled "Major Provisions of Arc Welding Specifications," you recommend the use of a bare wire electrode. I read an article published by Professor H. Dustin of the University of Brussels entitled "The Fundamental Principle of Arc Welding," and

noted the following: "Already at the end of 1924, welding rods made of bare wire were considered by the best European specialists as obsolete and inadequate for modern technical requirements. For these experiments, only coated electrodes of unquestionable quality were used." What is your explanation of this difference of opinion?

PROFESSOR MCKIBBEN: My specifications are for arc welding steel buildings and bridges and recommends the use of a bare wire electrode which is practically standard practice in the United States. In Europe, I understand, coated electrodes are extensively used. My experience indicates that a bare wire electrode for welding structural steel gives good results and is cheaper. For certain types of welds, coated electrodes are desirable, but are not necessary for ordinary building work.

MR. URQUHART: I understood you to say that the size of wire for a ⅜ inch weld is 3/16 inch. Does this ratio hold for all sizes of fillets?

PROFESSOR MCKIBBEN: For depositing a ⅜ inch fillet a 3/16 inch electrode with 175-200 amperes gives good results on steel of 5/16 inch thickness or more, but for thin steels, say ¼ inch or less, the above would give too much heat for ordinary speeds of hand welding. I would say that the ratio between the size of weld and the diameter of the electrode does not hold as this is a matter of current density, not of mere diameter.

MR. URQUHART: What is the efficiency of the type of weld in which a weld is made joining two plates with a hole through only the top one (as for riveting), but not through the other one?

PROFESSER MCKIBBEN: This question relates to the so-called "plug welds." Not many tests have been made on the strength of plug welds, but this type of union is useful in many cases where no great stress is to be transmitted. Care must be taken to have the diameter of the hole at least twice the thickness of the plate, in order that the electrode can be directed properly into the root, that is, into the bottom of the hole, to secure penetration into both plates.

THE REGISTRATION ACT

A Bill for An Act

To Amend and Re-enact Act No. 242 of the General Assembly of the State of Louisiana for the year 1920, entitled: "An Act to Amend and Re-enact Act No. 200 of the General Assembly of the State of Louisiana for the year 1914, entitled "An Act to Amend and Re-enact Act No. 308 of the General Assembly of the State of Louisiana for the year 1908, entitled "An Act to Regulate the Practice of Civil Engineering and Surveying; to create a State Board of Engineering Examiners, and regulate the fees and emoluments thereof; to prevent the practice of the said calling or professions by unauthorized persons; and to provide for the trial and punishment of violators of the provisions of this Act by fine or imprisonment; and to repeal all laws or parts of laws in conflict or inconsistent with this Act."

Be it enacted by the General Assembly of the State of Louisiana, That Act 242 of the General Assembly of the State of Louisiana for the year 1920, entitled "An Act to Amend and Re-enact Act No. 200 of the General Assembly of the State of Louisiana for the year 1914, entitled "An Act to Amend and Re-enact Act No. 308 of the General Assembly of the State of Louisiana for the year 1908, entitled "An Act to Regulate the Practice of Civil Engineering and Surveying; to create a State Board of Engineering Examiners, and regulate the fees and emoluments thereof; to prevent the practice of the said calling or professions by unauthorized persons; and to provide for the trial and punishment of violators of the provisions of this Act by fine or imprisonment; and to repeal all laws or parts of laws in conflict or inconsistent with this Act," shall be and the same is hereby amended and re-enacted so as to read as follows:

Section 1. Be It Enacted, by the General Assembly of the State of Louisiana, That, from and after the promulgation of this Act, no person not already registered according to law

shall practice the profession of Professional Engineering or Surveying within the State of Louisiana, unless such person shall be duly registered and licensed in accordance with the provisions of this Act.

Section 2. Be It Further Enacted, etc., That, within ninety days after the promulgation of this Act, any person not already registered according to law, before practicing Professional Engineering shall present evidence satisfactory to the Board of Engineering Examiners, as hereinafter constituted, that he possesses the following qualifications:

a. A diploma from an Engineering College or school, the course of instruction in which is approved by the Board, or,

b. Associate Membership in, or possesses the qualifications required for Associate Membership in one or more of the following National Societies:
American Society of Civil Engineers
American Society of Mechanical Engineers
American Institute or Electrical Engineers
American Institute of Mining and Metallurgical Engineers
American Institute of Chemical Engineers

If said diploma or evidence is satisfactory to the Board, it shall register such person and issue to same a certificate in accordance with the facts, which certificate shall be received as prima facie evidence that said person is duly registered according to law.

Section 3. Be It Further Enacted, etc., That, after this Act shall have been in effect ninety days, any person before practicing Professional Engineering or Surveying within this State, shall pass before the Board a satisfactory examination as to his knowledge of Engineering and/or surveying, and in addition shall present evidence satisfactory to the Board that he possesses the following qualifications:

As a Professional Engineer:

a. A diploma from an Engineering College or School, the course of instruction in which is approved by the Board, or

b. Membership in, or possesses the qualifications required for full Membership Grade in one or

more of the following National Societies:
American Society of Civil Engineers
American Society of Mechanical Engineers
American Institute of Electrical Engineers
American Institute of Mining and Metallurgical Engineers
American Institute of Chemical Engineers

As a Surveyor:

a. A diploma from a College or School, the course in which is approved by the Board, or
b. Five or more years of active practice in surveying work of a character approved by the Board, and indicating that the applicant is competent to be placed in responsible charge of surveying work.

If said examination is satisfactory to the Board, it shall register such person and issue to same a certificate in accordance with the facts, which certificate shall be received as prima facie evidence that said person is duly registered according to law, provided that no person shall be eligible for registration as a Professional Engineer or Surveyor, who is not at least twenty-one years of age, and who is not of good character and repute. Qualifying as a Professional Engineer under this Act shall entitle the person, when registered and licensed, to practice Surveying.

Section 4. Be It Further Enacted, etc., That, the Engineering Examiners shall consist of a Board of five members, three of whom shall constitute a quorum; all members shall be practicing Professional Engineers of good standing, and possess the qualifications required by Section 3 of this Act; not less than three members of the Board shall be practicing Civil Engineers. All members shall be appointed by the Governor of the State from a list presented by the Louisiana Engineering Society, and the Governor shall have the right to remove any or all members thereof, for incompetency, inefficiency, or neglect of duty; provided, however, that any member so removed shall have the right of appeal for reinstatement after trial and acquittal on the charges brought by the Governor before the District Court of the Parish in which the member resides. All vacancies occurring in the Board shall be filled by appointment

by the Governor from list presented by the Louisiana Engineering Society; provided, however, that in the event the said Society fails to present within sixty days, such list when requested in writing by the Governor, the Governor shall make the appointments at his own discretion.

The legal domicile of the Board shall be in the City of New Orleans.

Section 5. Be It Further Enacted, etc., That, the first Board of Engineering Examiners appointed under this Act, shall meet and organize within thirty days from the date of their appointments, and shall name one member to serve two years, one to serve three years, one to serve four years, one to serve five years, and one to serve six years, to be decided by lot or agreement among themselves as to their respective terms. At the expiration of the above terms, each member shall be appointed by the Governor for a term of six years, from names recommended by the Louisiana Engineering Society. Provided, that the present Board of Engineering Examiners shall continue in office until such time as the Board of Engineering Examiners appointed under this act shall have met and organized, at which time the present Board shall turn over to the new Board and the new Board shall accept, all of the records, documents, books, equipment, seals, obligations and funds pertaining to the operation of the Board.

Section 6. Bt It Further Enacted, etc., That, the members of the Board of Engineering Examiners shall receive, in compensation for their duties, Ten Dollars per day during the session of the Board, together with their hotel bills and their traveling expenses by the most direct route to and from their respective residence, the same to be paid out of any moneys in the treasury of the Board upon the certificate of the President and the Secretary. Members shall be entitled to actual and necessary traveling and clerical expenses incurred in the discharge of Board duties when authorized by the Board. The Board is empowered to demand a fee of Five Dollars for registration of Professional Engineer under Section 2 of this Act, also a fee of Twenty-five Dollars for registration of Professional Engineer and a fee of Fifteen Dollars for registration of Surveyor under Section 3, and a fee of Fifteen Dollars for recipro-

cal registration under Section 15; said registration fees to include fee for certificate and license fee for the current year.

Section 7. Be It Further Enacted, etc., That the Board shall have the power to make all by-laws and rules not inconsistent with the Constitution and Laws of this State, which may be necessary for the proper performance of its duties and the regulations of the proceedings before it, also to employ such clerical, legal and other professional assistance as may be necessary, also to provide proper office space and incur such other expenses as are required to carry out the provisions of this Act.

Section 8. Be It Further Enacted, etc., That every registered Engineer or Surveyor in this State. who desires to continue the practice of his profession in this State, shall annually, during the time he shall continue in such practice, pay to the Board, on or before the first day of February, or within thirty days after his return in case of absence from the State, a fee of Three Dollars for Professional Engineer and One Dollar for Surveyor, and the Secretary shall thereupon issue such registtered Professional Engineer or Surveyor, a certificate of renewal of his license for the current year. Any registered Professional Engineeror Surveyor who shall fail to have his license renewed, as above provided, on or before the first day of February of each year, shall have his license revoked. But the failure to renew said license in proper time shall not deprive such Professional Engineer or Surveyor of the right of renewal thereafter, but the fee to be paid to the Board upon the renewal of license after the month of January or the expiration of the thirty days following his return to the State shall be Ten Dollars for Professional Engineer and Five Dollars for Surveyor.

Section 9. Be It Further Enacted, etc., That the Board of Engineering Examiners shall publish annually in pamphlet form, not later than April first, a complete list of licensed Professional Engineers and Surveyors, with their residence, and such published list, when properly attested by the Secretary, shall be received as evidence in court that persons whose names appear therein are duly registered and licensed.

Section 10. Be It Further Enacted, etc., That any person who shall practice or offer to practice as a Professional Engineer or Surveyor either as an individual, employee, or as a member of a company or corporation domiciled in or out of this State without having complied with the provisions of this Act shall be fined not less than One Hundred Dollars, nor more than Five Hundred Dollars, or shall be imprisoned not less than thirty nor more than ninety days, for each offense, by any court of competent jurisdiction.

Section 11. Be It Further Enacted, etc., That the Board is authorized to adopt and use an official seal.

Section 12. Be It Further Enacted, etc., That the Board may revoke the license of any Professional Engineer or Surveyor convicted in any competent court on charges involving professional misconduct or incompetency.

Section 12. Be It Further Enacted, etc., That this Act shall not apply to engineers or surveyors in the employ of the United States Government when acting in such capacity, nor to the Professional Engineers or Surveyors of other States and Territories, when in actual and bona fide consultation with registered Professional Engineers or Surveyors of this State.

Section 14. Be It Further Enacted, etc., That the Board of Engineering Examiners shall make annual report to the Governor of its transactions, with such recommendations for the advancement of the service as it may consider best.

Section 15. Be It Further Enacted, etc., That the Board is authorized to accept, in lieu of its own requirements under Section 1 of this Act, certificates of registration of similar Boards of Engineering licensing authorities of other States, having similar registration laws, whose requirements for registration and enforcement thereof are satisfactory to the Board, provided said authorities of said other States likewise accept the certificates of registration issued by this Board in lieu of their own requirements for registration, and provided further that applicants for registration under this Section shall be in good standing with the authorities in their own States and shall otherwise fulfill the requirements of this Board.

Section 16. Be It Further Enacted, etc., That the Attorney General of the State is hereby authorized and directed to prosecute any violation of this Act when proper evidence is submitted to him by the Board.

Section 17. Be It Further Enacted, etc., That all laws or parts of laws in conflict with this Act be and the same are hereby repealed.

THE DRAFTING OF THE REGISTRATION BILL

The following letters and reports constitute a record of the activities of committees and organizations in connection with this important undertaking:

New Orleans, La.,
February 7, 1930.

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

Your Committee on Registration of Professional Engineers has completed its deliberations and submits this report with a draft of the proposed legislation to be presnted to the Legislature at the 1930 session, to be enacted into a law.

The committee has borne in mind at all times that the existing law for Registration of Civil Engineers and Surveyors has been on the books for about twenty-two years. While there are no records of any convictions, there is no doubt that the law has had a good moral effect. It is the pioneer law of its kind in this country, but it has lacked the teeth required of such a law.

The weakest element of the existing law is the enforcement clause. It is understood that some amendments and changes in the law have been contemplated from time to time as being desirable, but the committee believes that now is the time for this State to prepare a new law and the enclosed draft will, it is believed, meet these requirements.

The aim of the proposed law as shown on the attached copy of the draft of the proposed bill is to strengthen the effect of the present law, make the needed improvements and meet the changing conditions of the profession of engineering, also to extend to the other branches of engineering the same advantages of registration now enjoyed by the civil engineers and surveyors in Louisiana.

Your committee has given careful consideration to the preparation of this bill, which was drafted after the committee had decided which are the important features to be included as shown in the attached skeleton outline, and after a tabulation

and study has been made of every engineering registration law in the United States. Every suggestion from all local sources has been carefully considered and adopted where possible.

The actual draft of the tentative bill is based on the principles and outline for a uniform registration law for engineers and surveyors approved by the Board of Direction of the American Society of Civil Engineers as recommended by its committee working in collaboration with representatives of the National Council of State Boards of Engineering Examiners and the American Association of Engineers. Such modifications have been made in the uniform law as will suit the conditions in this State.

Attached hereto is a complete draft of a bill which has the full recommendation of the committee. We believe it will meet with your approval. Because it is a very short time before the Legislature meets, it is recommended that the attached skeleton of the bill, which has the endorsement of your committee, be submitted to the Society membership for approval as rapidly as possible in order that after the approval has been obtained, the proper legislative Steering Committee may be appointed and begin its preparation for handling the bill.

Respectfully submitted,

A. T. DUSENBURY,
Chairman;
GEORGE R. HAMMETT,
GEORGE P. RICE,
JAMES M. TODD,
JAMES M. ROBERT.

Note: The tentative skeleton outline is not published with above report as it was not completely adopted in the final drafting of the bill.

New Orleans ,La.,
March 6, 1930.

To Mr. James M. Todd, President,
Louisiana Engineering Society,
New Orleans.

The Special Committee appointed by you to consider the matter of shaping up such legislation as required in connection with the proposed plan for the registration of all profes-

sional engineers and surveyors in the State of Louisiana, begs to submit herewith to you and the Board of Directors for your consideration a draft of a bill prepared for presentation to the Legislature of Louisiana.

In its present shape the bill represents the results of a careful study by the members of this committee, and those of a previously appointed committee, of the existing legislation in this State and of that in all the other States which have registration laws. The preliminary draft of the bill had the constructive criticism of the individual members of the Louisiana State Board of Engineering Examiners and of other interested engineers.

We believe that the enactment of this bill, substantially as drawn, will be a real benefit to the people of the State and to the engineering profession in general.

For presentation to the Society at this time we are attaching an abstract of the provisions of the bill as submitted to you.

Respectfully submitted,

REGISTRATION COMMITTEE.

F. N. BILLINGSLEY,
Chairman;

JOHN H. O'NEILL,
B. H. GREHAN,
G. R. HAMMETT.

New Orleans, La.,
March 25, 1930.

Mr. James M. Todd, President,
Louisiana Engineering Society,
818 Maritime Building,
New Orleans, Louisiana.

Dear Sir:—

I am directed to inform you that at a special meeting of the Louisiana State Board of Engineering Examiners held on this day in accordance with the request of the Louisiana Engineering Society, to consider and report upon the proposed change in Act No. 242, the Board has passed the following resolution:

"BE IT RESOLVED, That this Board has studied the proposed Act to amend and re-enact Act 242, "AN ACT TO REGULATE THE PRAC-

TICE OF CIVIL ENGINEERING AND SURVEYING IN THIS STATE,'' and reports to the Louisiana Engineering Society that this proposed legislation has its approval. However, it feels constrained to call to the attention of the Louisiana Engineering Society as well as the Engineering Profession, that in its opinion, based upon an extended experience in the administration of the present act as well as its interested observation of the results of its administration, that in the last analysis, no matter how well or how ill such an act may be framed, its success or failure will, in large measure, depend upon the personnel of the Board appointed for its administration. It feels that this is of such consequence that it recommends to the Louisiana Engineering Society that it incorporate in its by-laws a resolution to the effect that when its Board of Direction is called upon to submit a list to the Governor that before preparing such list the President of the Society shall read this resolution to the Board of Direction to the end that it may be impressed with the gravity of its duty.''

I am further directed to state that the Board would urge that should this legislation be passed, the Louisiana Engineering Society sustain the spirit of this law by refusing to admit to full membership any future applicant who shows that his experience is gained illegally and counter to this law, and or, who having stated his intention of practicing engineering in the State, has not already qualified to practice under this law

With these two safeguards as stated herein, both involving interest upon the part of the Louisiana Engineering Society, the Board believes that much good will be accomplished in creating an unified spirit upon the part of the profession, from which will result an unity of thought and purpose, which heretofore has not existed.

I am further directed to request that this letter be published in the Proceedings of the Louisiana Engineering Society and a copy is being mailed to the Editor to-day.

Very truly yours,

C. C. SANDOZ, *Asst. Secretary.*

New Orleans, La.

April 14, 1930.

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

Your committee has made a careful study of legislation on the subject of registration and licensing of professional engineers and of a report of a previous committee, and submits with this report a draft of a bill to provide for the licensing of professional engineers and surveyors by amending the Act which requires the registration of civil engineers and surveyors.

Your committee has been assisted in its work by suggestions, comments and criticisms of tentative drafts by a number of members, and particularly by the present State Board of Engineering Examiners.

In accordance with the wishes of the Society, the proposed bill has been referred to the local sections of the A. S. C. E. and A. S. M. E., and we are pleased to report that it has been approved by these organizations and has also been approved by the State Board of Engineering Examiners.

Respectfully submitted,

Committee on Registration of
Engineers and Surveyors.
F. N. BILLINGSLEY, *Chairman,*
J.H. O'NEILL, *Vice Chairman,*
MARCEL GARSAUD,
B. H. GREHAN,
G. R. HAMMETT.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Board of Direction, February 10, 1930.

The meeting was called to order by President Todd, and the following members were present: Messrs. Fox, O'Neill, Frost, Billingsley, Dunlap, Moses and Muth.

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

The report of the auditor was read, and the Secretary was instructed to request the Editor not to print the three paragraphs of the auditor's report on page 2 relative to homesteads.

A letter from the Association of Commerce relative to the Arbitration Law of Louisiana was read and the Secretary was instructed to make reply.

On motion duly seconded, it was voted to recommend to the Society the amending of the constitution in accordance with the usual method, as follows:

> Section 5. Omit sentence: "There shall be not more than 500 members at any one time."
>
> Add: "Members who have paid dues for thirty years shall automatically become Life Members and shall be exempt from dues."

In regard to the celebration of the 50th anniversary of the A. S. M. E. in New York in April, the Secretary was instructed to furnish the list of names from members of the Louisiana Engineering Society who reside in New York.

The report of the Committee on Registration of Professional Engineers was read, and on motion duly seconded, it was voted that the registration of professional engineers be recommended by the Board to the Society in such a way as to secure the indorsement of the Society.

In connection with this motion, the Secretary was instructed to take the necessary steps to notify the members of the Board of a special meeting to be held to consider the tentative draft of the registration bill before it is brought to the attention of the Society in connecion with the Society's indorsement. Other necessary instructions were given in regard to the method of handling the matter.

Letter from Mr. Frank R. Shaw, Sanitary Engineer, Public Health Service, to Professor Donald Derrickson, was read in connection with H. R. 8807 and S. 3167. On motion, duly seconded, it was voted that it was the sense of all members of the Board that these two bills, providing for certain improvements in the Public Health Service, be unanimously approved.

The Secretary was instructed to communicate with Professor Derickson in regard to this matter.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Society, February 10, 1930.

The meeting was called to order about 8:10 P. M., President Todd in the chair, F. A. Muth, Secretary, and 88 members and guests present.

Owing to the length of the program, it was voted to dispense with the reading of the minutes of the previous meeting.

Announcements were made in regard to the convention of the American Concrete Institute on February 11-13, and of the School of Lighting Practice, to be held February 18-21.

The technical exercises of the evening consisted of a most interesting and instructive address on "Arc Welding," by Dr. Frank P. McKibben. The address was illustrated with lanter slides and was followed by helpful discussions. A rising vote of thanks was tendered the speaker.

The meeting adjourned to the usual collation.

F. A. MUTH, Secretary.

Minutes of Special Meeting of the Board of Direction, February 21, 1930.

A special meeting of the Board of Direction was held about 8:10 P. M., February 21, at Tulane University, and the following members were present: Messrs. Todd, O'Neill, Billingsley, Fox, Dunlap and Muth.

By invitation, the Louisiana State Board of Engineering Examiners was represented by Messrs. Derickson, Grehan and Muth.

The purpose of the meeting was to consider the tentative draft of the bill for registration of professional engineers and surveyors as prepared by the committee of which Mr. A. T. Dusenbury was chairman, in the light of suggestions which had been received from various members of the Board of Direction.

The original committee was thanked for its splendid work in so expeditiously carrying out the desires of the Board as outlined in the meeting held in June, 1929, and this commitete was discharged with thanks. The committee in question consisted of Mr. A. T. Dusenbury, chairman; James M. Todd, G. R. Hammett, James M. Robert and George P. Rice.

Messrs. Derickson and Grehan presented some most valuable suggestions in the form of constructive criticisms, which were taken into consideration by the Board after these two members of the Society had re-

tired. The other suggestions made by Board members were then referred to a new committee, appointed at this meeting.

On motion duly seconded, it was voted that the President be authorized to appoint a committee with authority to draft a bill for the action of the Society. The committee consists of the following: Messrs. F. N. Billingsley, chairman; G. R. Hammett, B. H. Grehan and John H. O'Neill.

The Secretary of the Society was instructed to act as Secretary of this committee, and this special committee was instructed to consider the suggestions made by Messrs. Grehan and Derickson and other members of the Society and to incorporate these suggestions in a revised draft of the bill.

The committee was instructed to hold its meeting at the earliest practicable date to prepare the draft for submission to the Society.

Very truly yours,

F. A. MUTH, Secretary.

Minutes of the Board of Direction, March 10, 1930.

The meeting was called to order by Vice-President Frost, and the following members were present: Messrs. Dunlap, Fox, Moses, O'Neill and Muth.

Professor James M. Robert was present on invitation. President James M. Todd was excused, due to his absence from the city.

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

Report from the Finance Committee was read, and on motion duly seconded, was received.

On motion duly seconded, it was voted that the Treasurer be authorized to invest $1,000 in securities for the Society.

The resignations of the following members were accepted with regret: Messrs. L. B. Clark, P. Lehde, L. J. Cuculu and V. F. Hartel.

Mr. A. F. Shuey was changed to non-resident member.

The following names were dropped with regret: W. D. Stewart, F. B. Barton, L. F. Griffith and E. J. Mead.

Mr. H. J. Malochee was reinstated.

The matter of representation of the Louisiana Engineering Society at the 50th anniversary of the A. S. M. E. in New York was brought up and in view of the fact that Professory W. B. Gregory expects to attend as a representative of Tulane University, on motion duly seconded, it

was voted that Professor Gregory also represent the Louisiana Engineering Society to the A. S. M. E.

A report of the Committee on Registration of Professional Engineers was read by Vice-Chairman O'Neill, and on motion duly seconded, it was voted to have the report read at the Society for its action.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Society, March 10, 1930.

The meeting was called to order about 8:10 P. M., Vice-President Frost in the chair, F. A. Muth, Secretary, and 67 members and guests present.

The minutes of the previous meeting were read and approved.

Announcements were made of the meeting at Tulane University, to be held on March 21, the occasion being an address by Dr. H. B. Smith, President, American Institute of Electrical Engineers, also of the meeting of the American Association of Petroleum Geologists, to be held at the Roosevelt Hotel, March 20 to 22, inclusive.

On motion duly seconded, the following amendments to the constitution were carried on first reading, in accordance with the constitution: Amend Section 5 of Constitution: Omit sentence, "There shall be not more than 500 members at any one time." Add, "Members who have paid dues for thirty years shall automatically become Life Members and exempt from dues."

After committee reports had been made, the progress report of the Committee on Registration was read by Vice-Chairman O'Neill, in the absence from the city of the chairman, Mr. F. N. Billingsley. Attached to Mr. Billingsley's report was an outline of the tentative draft of the bill for registration of professional engineers and surveyors.

On motion duly seconded, it was voted to receive the report with thanks and to request that the committee proceed to prepare the bill in final form for its presentation to the Society, also that copies of the bill be sent to the members of the local sections of the A. S. C. E. and A. S. M. E., also to the members of the Louisiana State Board of Engineering Examiners, in order to secure the comments and suggestions from these bodies.

The chairman announced that copies of the draft of the bill for presentation to the Society would be available upon application to the Secretary after March 20, and he requested all those who desired copies to leave their names on paper provided for this purpose at the speaker's table on this night.

The technical exercises of the evening consisted of a most interesting address on "Acousti-Celotex, and Acoustical Correction," by Mr. Wallace Waterfall. The address was illustrated with numerous blackboard sketches and was followed by helpful discussions.

A rising vote of thanks was then tendered the speaker.

The meeting then adjourned to the usual collation.

F. A. MUTH, Secretary.

Minutes of the Board of Direction, April 14, 1930.

The meeting was called to order by President Todd, and the following members were present: Messrs. Dunlap, Moses, Billingsley, Frost, O'Neill and Muth. Professor Donald Derickson was present upon invitation.

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

The resignations of the following members were accepted with regret: Messrs. C. E. Schmidt and R. B. McWhorter.

The Secretary was instructed to write to Colonel A. M. Shaw with reference to a communication brought before the Board.

The matter of transferring student members to higher grades in the case of those who have been carried on the rolls for several years as student members, remitting the initiation fee owing to the conditions now existing, was brought up for consideration, and on motion duly seconded, it was voted to authorize the President to appoint a committee to draft an amendment to the constitution and by-laws providing for automatic transfer of student members, etc., to full membership under certain conditions.

A communication from the State Board of Engineering Examiners was read, giving the approval of the proposed draft of the registration law for professional engineers and making a prerequisite for full membership being based on compliance with the registration laws for engineers in the State.

Professor Donald Derickson attended the meeting upon invitation and spoke in regard to the importance of the suggestions or recommendations of the State Board of Engineering Examiners, and on motion duly seconded, the President was authorized to include the drafting of the amendment to the constitution in regard to full membership along the lines suggested by the State Board of Engineering Examiners, this work to be carried on by the committee heretofore authorized on this date to prepare an amendment to the constitution regarding student membership.

The report of the Registration Committee was received, and on motion duly seconded, it was voted to refer it to the Society for its action tonight for first reading.

A letter from Mr. William T. Hall, Commissioner of Public Utilities, offering a framed picture, was brought before the Board, and it was recommended that this letter be read before the Society this night.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Society, April 14, 1930.

The meeting was called to order about 8:10 P. M., President Todd in the chair, F. A. Muth, Secretary, and 65 members and guests present.

Minutes of the previous meeting were read and approved.

The Secretary read a letter of April 11 from Mr. Wm. T. Hall, Commissioner of Public Utilities, offering to present to the Society a framed painting of a section of the Vieux Carre at the location of the Cabildo. Mr. Hall was present upon invitation, and he made the presentation of this beautiful painting, which was prepared by Mr. Joseph Woodley Gosling. The picture was accepted for the Society by Mr. Ben Willard, one of the members, and it will be displayed in the library room.

Reports of committees were received, also a splendid report of the celebration of the 50th anniversary of the A. E. M. E., in New York, by Professor W. B. Gregory, who represented the Society on that occasion.

The following was presented to the Society for its approval: For second reading: Amend Section 5 of the Constitution: Omit sentence, "There shall be not more than 500 members at any one time." Add: "Members who have paid dues for thirty years shall automatically become life members and shall be exempt from dues."

The foregoing amendments to the constitution were unanimously adopted, and as a result the following members have been automatically changed to life members: Messrs. John Klorer, Thomas H. Tutwiler, George W. Lawes, Henry J. Malochee, Frank H. Waddill, H. L. Zander.

Committee on Registration submitted its report through its chairman, Mr. F. N. Billingsley, and in accordance with the constitution the following was submitted to the Society looking toward the indorsement of the membership: For first reading: A bill to change present law for registration of Civil Engineers and Surveyors to include Professional Engineers and Surveyors in accordance with motion adopted at meeting of the Society, March 10.

Copies of the draft of the proposed bill have been furnished to members of the Society upon application, and notices that additional copies could be secured were printed upon the post card notices of this meeting.

On motion of Professor Donald Derickson, duly seconded, it was voted to accept the report of the Registration Committee and to indorse the bill for registration of professional engineers, also the President was authorized to call a special meeting of the Society for the second reading of the bill, and if favorably acted upon at that meeting, to appoint a committee to look after the success of the bill in the State Legislature.

After the unanimous vote was taken on the foregoing motion, the President announced that the bill would be prepared for a second reading at a special meeting called for 8:00 P. M., Monday, April 21, in the Engineering Building of Tulane University. The President also took occasion to state that the bill in its present form was the result of the deliberations of three committees who have been working on the preparation of the bill for about a year, also the constructive criticisms and suggestions of the members of the Louisiana State Board of Engineering Examiners.

The technical exercises of the evening consisted of a most interesting address on "A Discussion of Street Traffic Control Lights," by Mr. A. J. Naquin, Jr., Transportation Engineer, New Orleans Public Service, Inc. This address was illustrated with interesting charts and was followed by considerable discussion. A rising vote of thanks was then tendered the speaker.

The meeting adjourned to the usual collation.

F. A. MUTH, Secretary.

Minutes of the Special Meeting of the Society, April 21, 1930.

The meeting was held at 8:00 P. M. in the Stanley Thomas Hall, Tulane University, in accordance with post card notices and announcements at the regular meeting of April 14.

The meeting was called to order with President Todd in the chair, F. A. Muth, Secretary, and 20 members present.

In accordances with notices of April 18, this meeting was called for the purpose of considering for second reading: A bill to change the present law for registration of Civil Engineers and Surveyors to include Professional Engineers and Surveyors, in accordance with motion adopted at meeting of Society, March 10.

Announcement was made that the bill had been unanimously approved at the previous meeting of the Society, also that it had been

approved by the Louisiana State Board of Engineering Examiners, and the local Sections of the A. S. C. E. and the A. S. M. E.

After presentation of the bill for second reading, on motion duly seconded, it was put to vote looking to indorsement of the Society, and was unanimously carried.

On motion duly seconded, it was voted that the Registration Commitete be discharged and that it and the Louisiana State Board of Engineering Examiners be thanked for their splendid support and assistance in the preparation of this bill, which has received the united support of the engineering profession in this State.

The President announced that the Steering Committee authorized at the previous meeting would be appointed after consultation with members of the Board of Direction, so that the bill can be properly introduced and sponsored in the State Legislature.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

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

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

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EDITORIAL NOTES AND COMMENT

Acoustic Engineering. Published in this issue of the *Proceedings* under the title, "Acousti-Celotex and Acoustical Correction," is a paper, which, when delivered at the March meeting of the Society, was a revelation to the audience as to the remarkable advances which have been made in the application of the laws of sound to the very practical problem of architectural acoustics.

This paper is by Mr. Wallace Watrefall, Acoustical Engineer in the Research and Development Department of the Celotex Company, and is an effective illustration of what is perhaps the most prominent characteristic of this age of remarkable scientific and engineering achievement, viz, the close relation between research in pure science and its application to practical problems. In fact, *pure* science is almost an anomalous term in these days, when we see the extremely practical applications which are being made of some of the most abstruse scientific theories and principles.

Who could have foreseen the marvelous developments of radio and its allied industries in the very abstruse and highly mathematical theory of the propagation of electro-magnetic theory as enunciated by Clerk Maxwell about the middle of the nineteenth century?

And while the laws and principles of sound are not so abstruse as those of electro-magnetics, still the work of the acoustical engineer has been the scientific application of these principles to the practical problems.

According to Mr. Wallace's paper there are three general types of problems which present themselves. These are acoustical corrections, the reduction of noise and sound insulation.

The paper takes up the first two of these quite fully and touches rather briefly on the subject of sound insulation.

Traffic Lights. Mr. A. J. Naquin, Transportation Engineer of the New Orleans Public Service, contributed a paper on this subject to the April meeting of the Society. The paper is published in this issue of the *Proceedings.*

After outlining the fundamental physical and mechanical principles which are used in the calculation of such quantities as "clearance time," "braking time," "stopping time," "length of cycle," etc., Mr. Naquin proceeds to discuss the three systems of control of street traffic lights which seem best adapted to conditions in this city.

These are:—

The Synchronized System.
The Reverse Synchronized System.
The Progressive System.

Their relative values are indicated in a very interesting manner by means of distance—time charts, with the period of operation of red and green lights, respectively, indicated in color thereon.

A comparison of these charts shows very clearly how a group of vehicles proceeding on the Progressive System and starting from Common Street may run right through to Felicity Street, hitting the green light at each controlled intersection, and making an average speed of 19.5 miles per hour on

St. Charles Street and St. Charles Avenue. The average speed under present conditions is only 13.8 miles per hour.

It is to be hoped that something definite may be done in the matter of a signal showing distinctly and unmistakably whether a left turn at certain intersections shall be made on a green light or on a red light. There is great confusion in the minds of the majority of motorists in this city as to the regulations about this point, and apparently the regulations are different at different intersections. Even some traffic officers appear to be in doubt about the rules.

Some of this may be due to the fact that New Orleans has so many very wide streets, with neutral grounds, occupied by double lines of street railways.

It would appear to be a comparatively simple matter to place a small but very clear and distinct sign at each intersection to show when to make the left turn. There are already such signs showing when no left turn is allowed.

This is one phase of the traffic light problem ,but a very important one.

What Has the Future in Store?* "Those who planned this celebration with its review of achievement, have suggested that there be coupled therewith a forecast of what the future has in store. Therefore a few words of speculation. The young engineer of today sees his background clearly. He has unsurpassed facilities for becoming acquainted with the present state of the art of engineering. It is therefore with confidence in the ability of the engineers of a younger generation to achieve further successes that the older members of the profession, in reviewing what they and their predecessors have done, are willing to speculate a little on 'what may be.'

"The use of machinery and of appliances to reduce manual labor will be further increased. There will be more time for study and recreation. With the decrease in the relative number of those who are producers of the food, clothing, shelter, and other things that are considered essential for well-being and comfort, there will be an increase in the number of those

* From Dr. Grumky's Address at the 50th Anniversary of the A.S.M.E.

engaged in research work in teaching, in art, music, and literature. There will be vastly increased activity in the construction, operation, and care of public works. There will be carefully directed effort to secure at public expense a conservation of natural resources particularly of the water of the lakes and streams. There will be great improvement in downtown traffic facilities, with much substitution of large capacity busses for the cars on rails. The removal of street cars and the substitution of welding for riveting will go far toward the elimination of the offensive and disturbing downtown noise. There will be aviation fields conveniently located near every populated area, and aerial transportation opportunity across the whole breadth of the country within 24 hours. There will be reels of photographed speech, and song, and music, so that entire operas and books may be listened to without leaving the home. Elimination of drudgery in the home will be brought within reach of all, and also light with all the properties and virtues of sunlight. Purified and tempered air will add to the attractiveness and comforts of home life, perhaps, indeed, persuading the masses that single family houses are to be preferred to apartments. And there will be a thousand other things, with the engineer in the background, which will exert a profound influence on the structure of society—an influence, let us hope, making in the main for more comfort, more happiness, and for constant improvement in living conditions, the world over."

PAPERS AND DISCUSSIONS

ACOUSTI-CELOTEX AND ACOUSTICAL CORRECTION

By WALLACE WATREFALL,

Read before the Society, March 10, 1930.

When a speaker announces that he intends to talk on some of the problems of architectural acoustics and the means of solving them, he is apt to meet with tolerant sighs from the audience. The impression is immediately created that the talk is to be a very technical one and devoid of interest to any except possibly those few architects or engineers who have some immediate problems which involves the acoustics of buildings. It can be truly said, however, that very few engineering sciences have had so romantic a history as architectural acoustics.

As one of the pioneer products in the acoustical field, Acousti-Celotex has played an important part in the development of the field and, in the enlargement of the market which this product serves. The Celotex Company has had an opportunity to be in intimate contact with the important steps in the history of architectural acoustics. Rather than enter into a lengthy discussion of Acousti-Celotex or of the more technical phases of acoustical correction, I should like to spend a little time tonight outlining to you the present status of this somewhat highly specialized engineering field.

Architectural acoustics is usually divided into three parts according to the three general types of problems which are presented. The first part we speak of as acoustical correction and in that part we include all problems which are concerned with the improvement of hearing conditions. Auditoriums of all kinds and theatres fall in this classification. The second part includes all problems involving the reduction of noise. This includes the quieting of offices, machine rooms, restaurants, banks, hospitals, etc. The third part is sound insulation. This classification includes all problems involving the prevention of sound transmission from one room to another through floors and walls.

We cannot discuss all three of these divisions fully. The subject of sound insulation itself is one which requires a great deal of study. There is a crying need for information on the effectiveness of various partitions and floors and full data are not yet available. We will therefore touch this subject but lightly and describe more fully the two other branches.

We will start first with acoustical correction.

Reference to methods employed for the improvement of hearing conditions in auditoriums can be found in literature dating back to the Roman Empire and it is surprising to find that some of the methods advocated today are as antiquated and as much without scientific foundation as those which were tried in Caesar's time. The scientific development of architecturaly acoustics, however, started with the work of the late Professor Wallace S. Sabine of Harvard University. Professor Sabine was given the task of improving the hearing conditions in a lecture room and the studies which he made in the correction of that room and the principles, there discovered, which he applied subsequently to other rooms, are the very foundation of the present engineering science.

Without further discussion of the history behind it all, I should like to plunge into the consideration of the action of sound in a room, the reasons for poor hearing conditions, and how faulty acoustics can be remedied.

As I stand speaking to you in this room, sound waves are coming from my mouth and traveling out rapidly in all directions. They are traveling approximately at the speed of a rifle bullet and striking all of the surfaces present in the room. These surfaces each have their peculiar ability to absorb or reflect sound just the same as various surfaces absorb and reflect light. The average plaster wall is a better reflector of sound than a mirror is of light. When a sound wave strikes such a wall only about 3% of its energy is absorbed and the other 97% is reflected. The energy reflected travels in the form of a sound wave to other surfaces, where it is again partly absorbed and partly reflected. If the interior surfaces of a room are all good reflectors of sound, it is evident that the sound will continue to "bounce" around the room striking one surface after

another and continuing in the room for a considerable period of time before it finally becomes inaudible. A person in the room does not hear these reflections as separate echoes like the "hello" that a cliff throws back at him because there are so many reflections coming from so many surfaces, one so quickly after the other, that the ear does not separate them. He hears them as a ringing continuation of the sound which we speak of as reverberation. If you have ever gone into a large empty room, clapped your hands, and listened to the continuing sound, which takes several seconds before it dies out, you are familiar with what I am speaking of. This is what we call reverberation and the length of time which a sound of standard loudness persists in the room after the source of sound has stopped, we speak of as the period of reverberation and express it in seconds of time.

The effect of reverberation on the hearing conditions in a room is quite apparent when it is realized that an average speaker says four or five syllables each second. If the sound from each one of these syllables persists in a room for a number of seconds it will obviously be difficult for the auditor to pick each successive syllable from the jumble of sound present.

It is quite plain that the way to reduce excessive reverberation is to install materials in the room which have a considerable ability to absorb sound. By the application of a sufficient quantity of such materials the reverberation can be reduced to any point desired. Fortunately, it is neither necessary nor desirable to eliminate reverberation completely. Experience has shown that auditoriums which are acoustically satisfactory usually have periods of reverberation between 1 and 2 seconds when in use. A considerable amount of work has been done in determining the proper periods of reverberation for rooms of various size. Different investigators have published different values but they are in quite close agreement. These periods of reverberation which are considered satisfactory are usually spoken of as the "optimum" periods.

So far we have spoken of reverberation as if it were the only cause of poor hearing conditions. This is not wholly true. There are a number of other factors which must be taken into consideration but it can be safely said that the major fault of

most auditoriums in which hearing is difficult is excessive reverberation. This much is true: Most rooms which are acoustically unsatisfactory can be greatly improved by the proper addition of absorption, whereas a room which may be excellent so far as its other acoustical features are concerned will never be acceptable if the reverberation is greatly in excess of the optimum value.

It might be well to mention some of the other factors which influence hearing conditions. The proper distribution of speech is obviously necessary. Sufficient sound energy must reach each auditor so that it will come satisfactorily within his range of hearing. For auditoriums of average size the unaided voice of a speaker will furnish adequate loudness. In very large rooms special amplification may be necessary. Sound distribution may be effected by the shape of the room. Curved surfaces cause the concentration of sound energy in one part of a room to the detriment of some other part and in that manner produce an unequal distribution of sound. Curved surfaces may also cause discrete echo effects. You are all familiar with the fact that a properly shaped dome or cylindrical ceiling will produce a sharp echo. Such curved surfaces should be avoided wherever possible. Noise is also a factor which contributes to poor hearing conditions. Traffic noise from outside, the noise of the audience itself, noise from ventilating fans or other mechanical equipment—all these partially mask the speech or music and make it less intelligible.

The development of talking motion pictures has given somewhat of a new problem to the acoustical engineer but it has been found that the same old principles still apply and it is only necessary for him to make some changes in the application of these principles to meet the new problem.

Although a large part of our work at the present time has to do with the improvement of hearing conditions in auditoriums, we have been giving more and more of our time to the developments in the second branch of the field which I have previously spoken of as noise reduction. Acoustical correction is now on a very substantial engineering basis. Hearing conditions can be predicated before construction with a great deal of accuracy. Many tests have been made which have shown

that the results predicated by calculation have actually been obtained. When any engineering science reaches such an established position, those who are interested in pioneering push on to new fields where less is known. Noise reduction has been just such a virgin field.

About three years ago we were awakened to the realization that a large amount of Acousti-Celotex was being sold for the reduction of noise in offices. If a room was too noisy, absorbing material was added. Sometimes the result of such a treatment was much more noticeable than at other times. No very definite method of attack was used and although the results were mostly all satisfactory it was very apparent that they were not uniform.

Before attacking the more technical problems of noise reduction it was logical first to ask the question, "why reduce noise?" Almost this exact question was asked in a number of letters which I wrote to psychologists, efficiency engineers and others, whom I thought should best be able to explain why people were willing to spend money for the reduction of noise. I was very surprised to find that all of these men said they considered noise harmful and that they were sure actual benefits were derived from its reduction, but none of them were able to supply any actual evidence on the subject. This seemed like a very insecure basis on which to build a business and so we thought it best to set out first to find out whether any real benefits could be derived from the reduction of noise or whether it was merely a matter of imagination. The first work in this direction was started with the co-operation of Dr. Donald A. Laird, Director of the Psychological Laboratory at Colgate University. It seemed evident that the problem was a psychological one and the solution of it could best be found by a psychologist. The work which Dr. Laird and others have done within the last three years has been very interesting as well as convincing. Because it is interesting I believe you will like to hear about some of it.

To start the investigation it seemed advisable to find out just what types and levels of noise were encountered by the average person during his daily life. What were the noise conditions while he slept? To what noises was he subjected in

the early morning hours between the alarm clock and the time clock? How noisy was his transportation? Under what noise pressure did he work? How much din was there in his dinner hour? We set out to answer all of these questions, in short to make a cross section of the noise pressure under which the average man lives during the twenty-four hours of his daily life. A large number of noise measurements were made in Chicago, Boston and New York, to determine the noise level in homes, offices, airplanes, taxi cabs, subways, dining rooms, factories, etc. Our experiences were very interesting and cannot be recounted here. They included many startling discoveries. We compared the noise in a rather exclusive and highly fashionable men's grill with the noise in a large bare dining room in an insane asylum where about 1500 demented people ate their food from tin plates placed on bare wooden tables on a concrete floor. To our surprise and chagrin we found that our perfectly sane brethren produced far more noise than the others.

After this noise cross section had been made it was then decided to try to reproduce the various noise conditions in the laboratory and to determine their effect on workers under carefully controlled conditions. One of the first experiments was on typists. A room was fitted up with a noise making machine which produced a noise level similar to that which had been found to exist in an average office. A number of different typists were placed in the room and set to work copying printed matter while a careful record was kept of their output and energy consumption. The typists worked under two conditions. The first condition was with the walls and ceiling of the room bare. In the second condition the noise machine was kept running as before but the ceiling and part of the walls of the room were covered with movable panels of sound absorbing material in such a way as to cause a certain reduction in the loudness of noise. This work was done in the Colgate Psychological Laboratory and Dr. Laird found that the reduction in noise effected by the absorption caused a 5% increase in output and a 19% decrease in energy consumption.

Typing can be considered as somewhat mechanical and so it seemed advisable to try some other sort of task which required

greater concentration. A rather difficult type of mental multiplication was decided upon and in this case the quieting furnished by the absorption was found to produce a 30% increase in output.

Other experiments have followed in which Dr. Laird has measured the effect of noise on the growth of white rats, its effect on muscular tension and its effect on the stomach. All of these measurements, as well as observations which have since been conducted on actual installations in business offices, have indicated definitely that noise does produce an economic waste and that the increased efficiency which can be obtained by the use of sound absorbing materials in offices is enough to pay for the cost of such materials.

All of this work on the physiological and psychological effects of noise was done for the primary purpose of finding whether the reduction of noise was actually desirable and whether it formed a sound basis upon which an industry could be built. As a by-product of the investigation of the effects of noise there has been a rapidly growing "noise consciousness." People are always interested in those things which effect their physical well-being and business efficiency and when they are shown that the advancement of our machine age adds to the noise of their daily life and that this noise is a handicap to them, it is to be expected that they will insist upon measures for the reduction of noise. The recently formed noise commissions in our large cities and the increasing use of the word "quiet" in advertisements of new home and office equipment is in answer to public demand.

Engineers have had an important part to play in this field of noise reduction. Methods of measuring noise have had to be developed. Noises have been carefully analyzed to determine their frequency components and loudness levels. The effect of sound absorbing material in reducing noise has been measured and formulas have been developed by means of which it is possible to calculate noise reduction.

The necessity of a means of rating noise is apparent if you are ever called upon to explain the loudness of a definite sound. When you leave this room suppose someone asks you how loud the speaker talked. You have no definite means of describing

it and you will probably have to resort to something like "well I think he spoke about this loud." In other words, you will try to reproduce the loudness of the sound as best you can yourself. The lack of an adequate means of expressing the loudness of sounds was apparent about a year ago when the village fathers of a small town on the edge of a lake passed an ordinance intended to curb the disturbance caused by unmuffled outboard motors on boats. The question naturally arose "what is to be the limit of tolerance and how are we to determine when the noise exceeds the limit?"

We are familiar with the meaning of 32 degrees Fahrenheit. If a friend tells you it is 70 degrees outside you have a very good idea of the sensation which you will experience when you step outdoors. Then why not have a loudness thermometer? Such a scale for rating the loudness of various sounds has been developed and I will illustrate it as follows: The logical place to begin the scale is zero and the loudness level of zero should be the least sound which it is possible for a normal ear to hear in a very quiet place. Few people are ever in places where there is a zero loudness level. The top of the scale will be marked 108 and represents the point at which a sound becomes so loud that it can be actually felt, as well as heard, and a small additional increase in loudness will produce a painful sensation. The scale is divided into 108 steps of approximately equal loudness. The steps are known as "decibels" and a loudness change of one decibel represents about the smallest change in loudness which can be detected under average conditions. This particular scale is adapted from the 3A Audiometer made by the Western Electric Company and has been found to be very useful in illustrating loudness effects.

To give you an idea of various points on the scale, the rustle of leaves in a gentle breeze furnishes a loudness of about 10 decibels. An average whisper, four feet away, is about 20 on the scale. As I whisper to you now even those close to me can scarcely hear a sound. This illustrates the fact that we are seldom entirely away from noise. Even the average quiet home has a noise level of about 15 decibels. Thirty-five on the scale represents the loudness of very soft radio music when your volume control is turned to the point where the sound does not in-

terfere with conversation. Average speech, as you hear it, will range somewhere between 40 and 70 decibels. The loudness of my voice, as you are listening to it, is probably between 50 and 55 decibels. The noise on an average busy street is 60. The noise measured in a stenographic room was 70. The noise in the New York subway measures 80. The noise riding in an open airplane reached 95 on the scale.

With such a wide range of loudness it would at first seem that a reduction of 8 or 10 decibels would be scarcely noticed but in actual practice it is found that even a comparatively small reduction in loudness causes a great reduction in annoyance. Placing the hands tightly over both ears gives a loudness of only about 20 decibels and this will be found to be a great relief in the presence of loud noises. An aviator's leather helmet with powder puffs over the ears reduces noise of the airplane approximately 15 decibels and this is a very much appreciated relief. The change in loudness which can be effected by the use of sound absorbing materials in offices is usually somewhere between 8 and 12 decibels. The absorbing material which was used in Dr. Laird's experiments on typists produced a loudness reduction of 10 decibels and this reduction caused the remarkable difference in annoyance which has been previously mentioned.

This loudness scale has been given to you to give you some idea of noise levels and to show you some of the engineering developments that have accompanied the branch of architectural acoustics which we speak of as noise reduction.

Sound insulation is the third branch of architectural acoustics and one which I have said would only be mentioned briefly. In fact, the only comment which I wish to make on sound insulation at this time is in regard to the part which sound absorption in the source and receiving rooms plays in sound transmission. Assume that we have two rooms, separated by a partition. If both of these rooms have very little absorption in them the sound in the source room will build up to considerable intensity and the sound which penetrates the partition to the receiving room will also be built up in intensity by the non-absorbent walls of that room. If we assume that the proper duce the average loudness of sound in each room by 8 decibels,

it follows that the apparent insulating value of the partition will be increased by approximately 16 decibels. Most of the partitions in common use will give a loudness reduction somewhere between 30 and 45 decibels and the addition of 10 or 15 decibels, by the adequate use of absorption, certainly seems worth while. There are many points along this line which deserve further comment but time cannot be given to them now.

This evening I have spoken repeatedly of sound absorption and sound absorbing materials and have said that Acousti-Celotex was one of the best known sound absorbing products on the market. Without discussing Acousti-Celotex in particular, perhaps you will be interested in knowing what are the properties of materials which make them absorb or reflect sound.

Adequate absorption over the entire pitch range requires porosity of surface. When a sound wave strikes a wall it causes an alternate increase and decrease of the air pressure at the surface. If the material composing the surface is porous there is a tendency for the air to flow into and out of the pores at the alternate compressions and rarefactions. As the air flows in and out through the minute channels or interstices in the material there is a certain friction against the sides of the channels. This friction serves to change the sound energy into heat and in this manner the sound is absorbed.

Occasionally, when I have spoken of the transformation of sound energy into heat I have been asked how hot the sound absorbing material gets. In some of our legislative halls, where a rather high loudness level is maintained over long periods of time, it can be safely said that the material itself never reaches a temperature comparable to that of the speakers. In fact, when we are dealing with sound we are dealing with very small quantities of energy. The pressure which a sound wave creates on the ear drum is equal to the weight of a small slice off of a human hair about one-third as thick as the diameter of the hair. Another way of expressing the quantity of energy in terms of heat is this. If a million persons talked continuously for one and a half hours and all of that sound energy is transformed into heat you will have just about enough heat to make a cup of tea.

Another question which I am frequently asked is why we put the holes in Acousti-Celotex. These are not the pores which I was previously speaking of, in which friction takes place and the sound is converted into heat. Those pores are in the body of the Celotex—the small interstices between the fibres themselves. The holes which you see are channels extending into the fibrous body of the material to permit the easy access of sound energy to the interior. These holes also serve to make the entire body of the material accessible to sound energy even though the outside surface may be heavily painted.

I have now finished the outline of the subject which I wished to present to you. It is one which has engaged my attention for a number of years. It has been very interesting to me because it is new. Perhaps during the course of my talks some questions may have come to your mind and I shall be glad to answer any of these questions so long as time permits.

DISCUSSION

COL. GARSAUD: I was listening over the radio the other night to speech from Municipal Auditorium and could distinctly hear an echo in the auditorium. What is the explanation of that condition?

MR. WATREFALL: If you would ask someone who attended the speech to which you were listening whether he heard an echo in the Auditorium he would probably tell you he did not. I have understood that the acoustics of the New Orleans Auditorium are very satisfactory and my own tests in the room indicate them to be such.

The explanation is this. There is a very considerable difference between the acoustical conditions required in a room for broadcasting and for an audience. Early in our experience in treating broadcasting stations we found that it was necessary to reduce the reverberation to a much lower value than was ordinarily considered necessary for small music studios. A radio broadcasting studio which is made just right for broadcasting purposes usually sounds far too "dead" to the artists or to a listener in the room, whereas it will sound just right to you through your receiving set.

Satisfactory broadcasting from a large auditorium is quite a difficult trick. The reverberation will almost always be apparent to the radio listener but if microphones are placed very carefully the result can usually be made satisfactory, if the acoustical conditions in the auditoriums are good for the auditors present.

MR. NAQUIN: I would like to ask if there are any standard commercial noise-meters on market for sale at present time?

MR. WATREFALL: The only standard instrument on the market at present which is usually [illegible] for the measurement of noise levels is the 3A Audiometer made by the Western Electric Company. Some practice is required to handle this instrument successfully as it involves matching the loudness of a standard tone with the loudness of a tone which is to be measured. I understand that the Bell Telephone Laboratories are now working on a more accurate instrument, by means of which the loudness of sound can be registered on a dial without any personal factors being involved in the measurement.

MR. GREHAN: Does painting of Celotex impair its efficiency?

MR. WATREFALL: Painting of Celotex Standard Building Board does reduce its sound absorption because it forms a coating over the surface which is more or less impervious. The amount which the efficiency is reduced depends entirely upon the kind and quantity of paint used. Certain types of paint can be used which have practically no effect but the standard types of oil paint will produce a marked reduction in absorption at the most useful frequencies.

Acousti-Celotex is quite different. The holes in Acousti-Celotex permit the entrance of sound energy to the interior fibres of the board where the absorption actually takes place. When we first made Acousti-Celotex we thought that the increased absorption of the perforated board was due to the increased surface area presented by the sides of the holes and we calculated what reduction in sound absorption there would be with the face of the tile painted with glue size and oil paint. When we had tests made, however, we found that the painting had no measurable effect on the absorption and we sought an explanation of the unexpected results.

When a sound wave strikes a surface it produces a rapidly alternating increase and decrease of air pressure at the surface. When the air pressure is greater than atmospheric pressure there is a tendency for the air to be forced into the surface. The reduction in pressure causes the air to come back out. When the surface is Acousti-Celotex the pressure wave apparently flows in through the holes and spreads out laterally through the fibres in such a way that the entire fibrous interior of the board is reached by sound energy whether or not the surface is covered with [illegible].

A MEMBER: How does the use of Acousti-Celotex effect the fire hazard in buildings of [illegible] ise fire-proof construction?

MR. WATREFALL: This is a [illegible]y difficult question to answer. In talking to underwriters I find that there is no definitely established means of determining fire hazard and that there are as many opinions on the subject as there are rating bureaus. It would seem that fire departments, which actually have the repeated experiences of fighting fires, should be able to judge the actual hazard which a material furnishes in a fire. We have a number of statements on record from fire chiefs which show that Celotex and Acousti-Celotex may actually help prevent damage due to fire because of the slow burning qualities and the insulating property of the material.

In most buildings the Acousti-Celotex is applied to the ceiling much in the same manner as linoleum or rubber tile is applied to the floor. In other words, it is a part of the furnishings of a building. Most all of the furnishings of buildings are combustible to a certain degree and yet they are not considered as adding greatly to the fire hazard if the building itself is of fire-proof construction. Our experience with Acousti-Celotex is that underwriters and fire prevention authorities regard it as furnishing no greater fire hazard than the other furnishings normally present in buildings.

STREET TRAFFIC CONTROL LIGHTS

By A. J. NAQUIN.

Read before the Society, April 14, 1930.

HISTORICAL DATA.—Street traffic congestion is as old as civilization, if we think of the beginning of civilization as that time when men first sought each other's companionship in large numbers, and thereby founded villages, towns, and cities. History tells us that "Nebuchadnezzar had to send couriers ahead to clear the streets of traffic so that the royal chariot could pass,"[1] and that "The Roman gladiator was delayed on the way to the arena by traffic."[2] Mr. J. Rowland Bibbins[3] and Mr. E. J. McIlraith[4] point out that Rome and Pompeii had one-way streets in order to facilitate the free movement of Roman soldiers, and that these cities prohibited parking in the market place.

The mechanical devices used by the ancients for the regulation of traffic seem to be lost to posterity, but Dr. Miller McClintock[5] tells us this is not surprising when it is impossible to determine when or where the first traffic signals were used in America. We do know, however, that a system of traffic control lights was installed in 1918 on Fifth Avenue, New York City, and that they were at first manually operated. In 1923, a system of synchronized lights was installed on Michigan Boulevard, Chicago, and by 1925 there were six cities which could boast of the possession of traffic control lights. Of this group, New Orleans was a member, for the first automatic traffic control light was installed in November, 1925, at the intersection of Napoleon and St. Charles avenues. During the month of April of the following year, automatic signals were installed on Canal street.[6]

STREET TRAFFIC CONTROL SYSTEMS.—Perhaps the simplest form of traffic control consists of the lone police officer stationed on foot at a street intersection, waving his hands to direct traffic.

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[1] and [2] "The Traffic Problem." Mr. A. W. Robertson, Chairman of the Board, Westinghouse Elec. & Mfg. Co.

[3] Consulting Engineer, Washington, D. C.

[4] Staff Engineer, Chicago Surface Lines, Chicago, Ill.

[5] Director, Albert Russell Erskine Bureau for Street Traffic Research, Harvard University, Cambridge, Mass.

[6] Information supplied by the office of the Commissioner of Public Safety.

If we mount the officer on a horse, or provide him with a simple umbrella type of "STOP" and "GO" signal, we have given him a tool that will aid him in his work. If a manually controlled traffic signal light is placed at his disposal, we have given him a better tool to work with, and if we replace the traffic officer with an automatically operated traffic light, we may regret it forever after.

Street traffic control signal lights may be grouped into seven distinct systems as follows:

1. Single isolated light; manually or automatically controlled. (As at Washington avenue and Broad street.)
2. Small group of isolated lights; manually or automatically operated. (As at Rampart and Canal streets prior to the beginning of the Canal street beautification work.)
3. Row of lights along a street, lights not connected electrically; manually or automatically controlled. (As along St. Charles street and St. Charles avenue.)
4. Row of lights along a street, lights electrically connected for synchronized movement of traffic; manually or automatically controlled. (As along Fifth avenue, New York.)
5. Row of lights along a street, lights electrically connected for reverse-synchronized movement of traffic; manually or automatically controlled. (As along Sixteenth street, Washington, D. C.)
6. Row of lights along a street, lights electrically connected for progressive movement of traffic; automatically controlled. (As along Carnegie avenue, Cleveland, Ohio.)
7. Many rows of lights along parallel and cross streets, lights all electrically connected for progressive movement of traffic along each street, and co-ordinated movement of traffic throughout the entire area; automatically controlled. (As in the "Loop District," Chicago, Ill.)

When To Begin Signaling.—All too many signals have been installed with the idea of stopping traffic instead of expediting its movement. Many a traffic light has been placed at a street intersection to commeomrate the occurrence there of a fatal or near-fatal accident, which no signaling de-

vice would have prevented. Obviously, a flow of twenty vehicles per hour through a given street intersection will not require the aid of a traffic light, but if the number is increased to two thousand, then some form of signaling device will probably be required. When, therefore, is the proper time to begin signaling? There are listed below in brief tabular form the "yardsticks" used by the Commonwealth of Massachusetts, the City of Chicago, and by Mr. J. Rowland Bibbins, of Washington, D. C., to gauge the necessity for installing traffic control lights.

Minimum Rate of Flow of Vehicles per Hour for All Lanes That Will Permit Use of Traffic Lights

	Major Street	Minor Street	Total for Intersection
Commonwealth of Massachusetts	.....	125	500
*City of Chicago	.....	300	1200
*Mr. J. Rowland Bibbins	500-1000	400	.....

As an indication of how these "yardsticks" would measure the necessity for traffic lights at several of our well-known street intersections, the following data are tabulated, which give the observed traffic flow at these points:

	Major Carondelet	Minor Poydras	Total for Intersection
8:00—9:00 A. M.	1206	775	1981
1:00—2:00 P. M.	843	625	1468
4:00—5:00 P. M.	838	622	1460
	St. Charles	Poydras	
4:00—5:00 P. M.	863	621	1304
5:00—6:00 P. M.	910	750	1660
	St. Charles	Calliope	
4:00—5:00 P. M.	740	180	920
5:00—6:00 P. M.	1367	186	1553
	St. Charles	Thalia	
4:00—5:00 P. M.	928	99	1027
5:00—6:00 P. M.	1389	123	1512

Functions of a Traffic Congrol Light.[7]—The efficiency of any traffic signaling system may be fairly well measured by the

*For two lanes.

[7] Largely extracted from "Correct Timing of Signals" (Elec. Ry. Journal, February, 1930), by Theodore M. Matson, Chief Engr. Citywide Traffic Committee, Kansas City, Mo.

ability of the system to perform certain traffic governing operations, which may be listed as follows:

1. Prevent the accumulation of traffic in any block or series of blocks.
2. Prevent the simultaneous flow of conflicting streams of vehicular traffic, or vehicular and pedestrian traffic.
3. Permit traffic to flow at that speed which is normal for the area traversed by varying the traffic speed in accordance with the traffic volume throughout the day.
4. Allocate "Green" or "Go" time in accordance with the relative volume of traffic flow per lane at each intersection.

The first and last of these operations deal principally with the delay time caused by stopping vehicles. If one traffic light system causes less delay to a given number of vehicles than another system, then the former system is considered the better of the two.

Traffic signals are usually equipped with three-color lights—(red, amber and green)—and the total length of time in seconds during which these lights are consecutively displayed is called a complete cycle. (Red, amber, green and amber.)

If the length of time assigned to each color light is proportionately maintained, and if a long cycle is used instead of a short one, then, in the former case, vehicular traffic is held for a longer period of time by the red light than is the case when short cycles are used. It may be proved mathematically that in any cycle, the total delay time equals the number of vehicles stopped, times half the sum of the delays to the first and last vehicles. Or, expressing this as a formula:

$$\left.\begin{matrix}\text{Total delay}\\ \text{time to all}\\ \text{vehicles}\end{matrix}\right\} = \left\{\begin{matrix}\text{Total}\\ \text{vehicles}\\ \text{delayed}\end{matrix}\right\} \times \frac{\text{Delay to First vehicle} + \text{Delay to Last vehicle}}{2}$$

Based on this mathematical expression, the curves shown in Fig. 1 have been derived, and observed delays made by field surveys have varied less than 2.5% from the calculated amount. Based on this data, the American Engineering Council has recommended for general use a cycle length varying between 40 seconds and 80 seconds.

THE AMBER SIGNAL.—Of the three colors, red, green and amber, it is believed that the latter has provoked more discussion and conflicting arguments than the two other colors added together. The interpretations placed on the meaning and use of the amber signal vary in practically every locality, and may in-

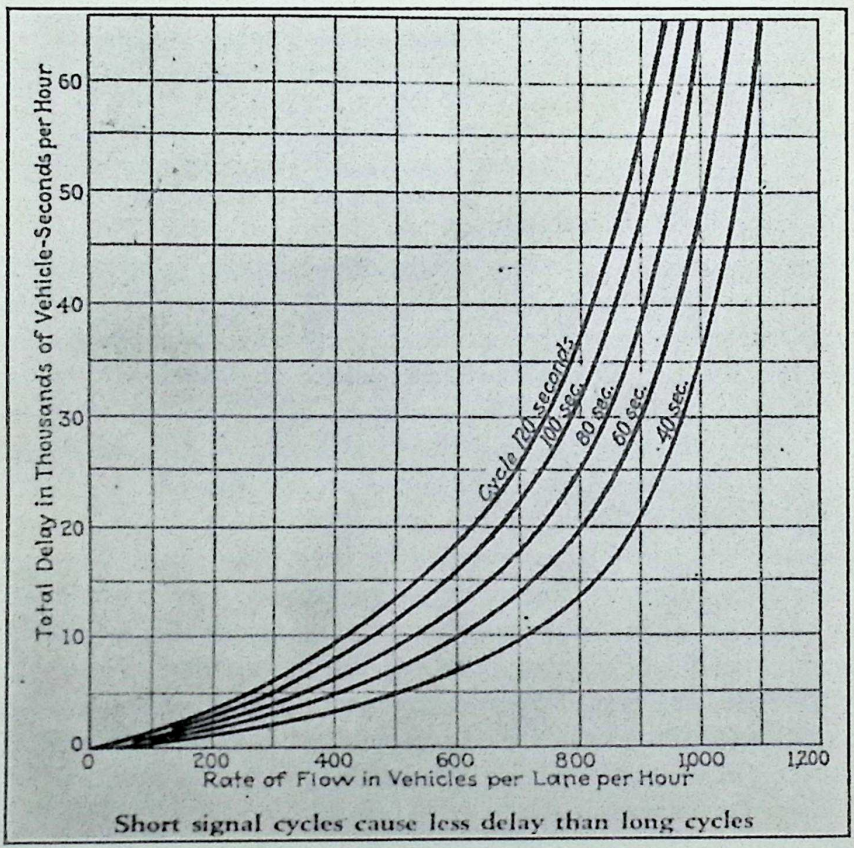


FIG. 1

dicate anything from permission for pedestrians to proceed with the signal, to absolute prohibition of movement of all traffic.

Two cities, New York and San Francisco, do not use amber signals, and there are many exponents of the belief that all amber signals should be discarded. However, the majority of cities do use them, and so certain interpretations will be given with their effect on the movement of traffic.

Considering the amber signal as indicating a clearance period for vehicular traffic, we can determine the length of this period if we know the width of the intersecting street, and the speed of the clearing vehicle in miles per hour.

Let W = Width in feet of intersecting street from property line to property line.
V = speed of clearing vehicle in miles per hour.
T_c = time required for clearance of vehicles.

Then—

$$T_c = \frac{\frac{W}{5280\ V}}{3600} = \frac{.682\ W}{V}$$

Assuming a vehicle speed of 17.75 miles per hour, and a street intersection 39 feet in width, the clearing time required would be:

$$T_c = \frac{.682\ W}{V} = \frac{.682 \times 39}{17.75} = 1.5 \text{ seconds}$$

Now, assuming the same vehicle speed used above, the safe stopping distance of the vehicle may be calculated by assuming a braking rate for the vehicle. Let

R = Safe braking rate of vehicle = 5.9 miles/hr./sec.
T_b = Safe braking time of vehicle in seconds.
D = Safe braking distance of vehicle in feet.

Then—

$$T_b = \frac{V}{R} = \frac{17.75}{5.9} = 3 \text{ seconds}$$

And—

$$D = \frac{\frac{V}{.682} + 0}{2} \times T_b = \frac{\frac{17.75}{.682} + 0}{2} \times 3 = 39 \text{ feet}$$

Now, if we wish to calculate the proper time that should be given the amber signal at this same intersection, we should add

to the safe stopping time the time required for clearing the intersection. Or—

$$T_s = \frac{.682\ (W+D)}{V} = \frac{.682\ (39+39)}{17.75} = 3.0 \text{ seconds}$$

The example used above had a safe braking distance equal to the width of the street intersection. If the width of the street intersection had been fifty feet, then the length of the amber signal should have been 3.4 seconds. Usually the width of the street intersection may be considered equal to the distance from property line to property line, less the width of the sidewalk on the far side of the intersection.

If we consider the amber signal as indicating that part of the cycle during which vehicular traffic should not cross a street intersection, then the amber period following the red signal when added to the amber period following the green signal will give the total time per cycle during which no vehicular traffic is permitted to use street space at an intersection. Obviously, the longer we make the amber period, the less time we assign to the moving of traffic each cycle. Hence, the efficiency of the street intersection is decreased so far as the moving of vehicular traffic is concerned. This efficiency may be determined by formula as follows:

Let E = efficiency in per cent. of street intersection for moving vehicular traffic.

C = length of cycle in seconds.

T_r = length of amber period in seconds following the red period.

T_g = length of amber period in seconds following the green period.

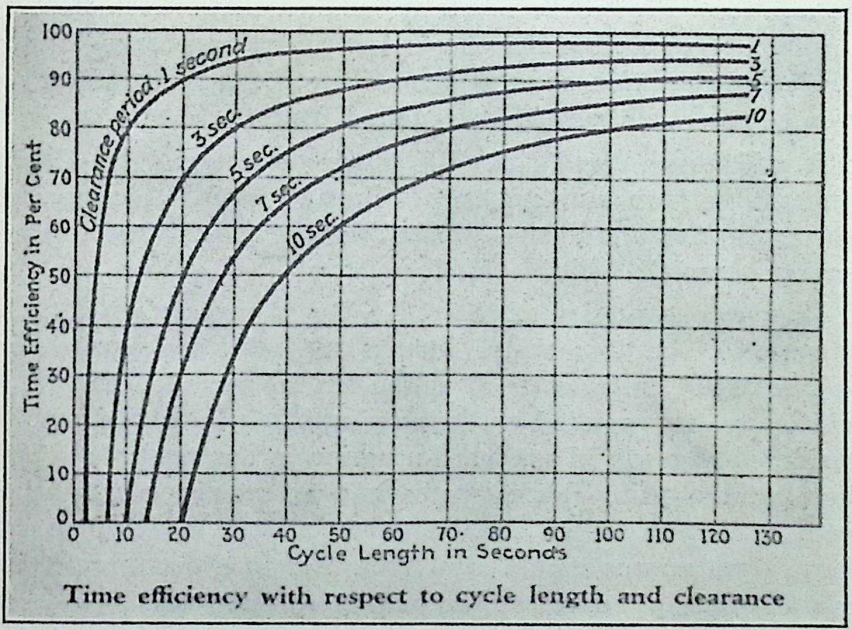
Then—

$$E = \frac{C - (T_r + T_g)}{C} \times 100 \text{ (expressed in per cent.)}$$

The curves in Fig. 2 show the relation between the length of a cycle in seconds, and the efficiency of a street intersection (as defined above) for various lengths of amber period. The curves indicate that this efficiency increases as the length of the cycle

increases, but the effect of increasing the length of the cycle as shown by the curves in Fig. 1 must not be forgotten. Hence, it is preferable to use as short a cycle as possible, and then hold the amber period to a minimum.

The amber period is sometimes used to facilitate the movement of pedestrian traffic at street intersections. The advisability of this is questionable, however, if we calculate the average



Time efficiency with respect to cycle length and clearance

FIG. 2

amount of time that must necessarily be given for the amber period.

The average walking speed of a pedestrian is between 4½ and 5 feet per second. Using the faster walking speed, we find that the time required for a pedestrian to walk across a 60 ft. intersection is 12 seconds (60/5=12). Now, if we add to the 12 seconds a 3-second clearance period, we have 15 seconds devoted each half cycle for pedestrian movement and clearance. This amount of time has proven practically prohibitive in most cities, and the pedestrian is permitted to infiltrate through vehicular traffic, which is exactly what he prefers to do.

THE SYNCHRONIZED SYSTEM OF TRAFFIC CONTROL.—Of the seven systems of street traffic control lights listed on page 115, the first three may be dismissed as unimportant so far as efficient signaling systems are concerned. The fourth is known as the "Synchronized System" and represents the first attempt made at inter-connecting traffic lights electrically.

Chart No. 2 shows graphically how this system might be applied to St. Charles street and St. Charles avenue. "Time in Seconds" is indicated horizontally, while "Distance in Feet" is shown on a vertical scale. Assuming an average speed for all vehicles, the position of any car on the street or avenue for any given elapsed time may be determined from the chart.

It will be observed that St. Charles street and St. Charles avenue have been laid out on a "linear" basis. A comparison between the actual and the "linear" layout of the streets may be seen by consulting Chart No. 1.

Further observation of Chart No. 2 will reveal that all lights change color simultaneously. That is, all lights are synchronized to show "red" in the same direction for the same length of time. Vehicles are represented by the sloping black lines, and must be considered as being in tandem formation in one traffic lane only. There are eighteen vehicles shown in the first group at Common street, and there are an equal number of vehicles in the second group. Two groups should always be used in order to determine the "slowing-up" effect of the first on the second.

Each car is spaced two seconds apart on a time basis. Thus, if the first platoon is moving along at a uniform rate, the last car will pass a given point thirty-six seconds after the first car.

In order to compensate for the length of time required to accelerate each vehicle from rest to the selected speed, a longer length of time (6 sec.) is allowed each vehicle to cover the distance required for acceleration, as compared with the time required to cover the same distance at normal speed. This acceleration period is represented by the short, slanting lines shown just above each signaled intersection.

The speed selected is 17.75 miles per hour from Common street to Calliope street, and 24.5 miles per hour from Calliope street to Felicity street. Based on repeated traffic checks, these

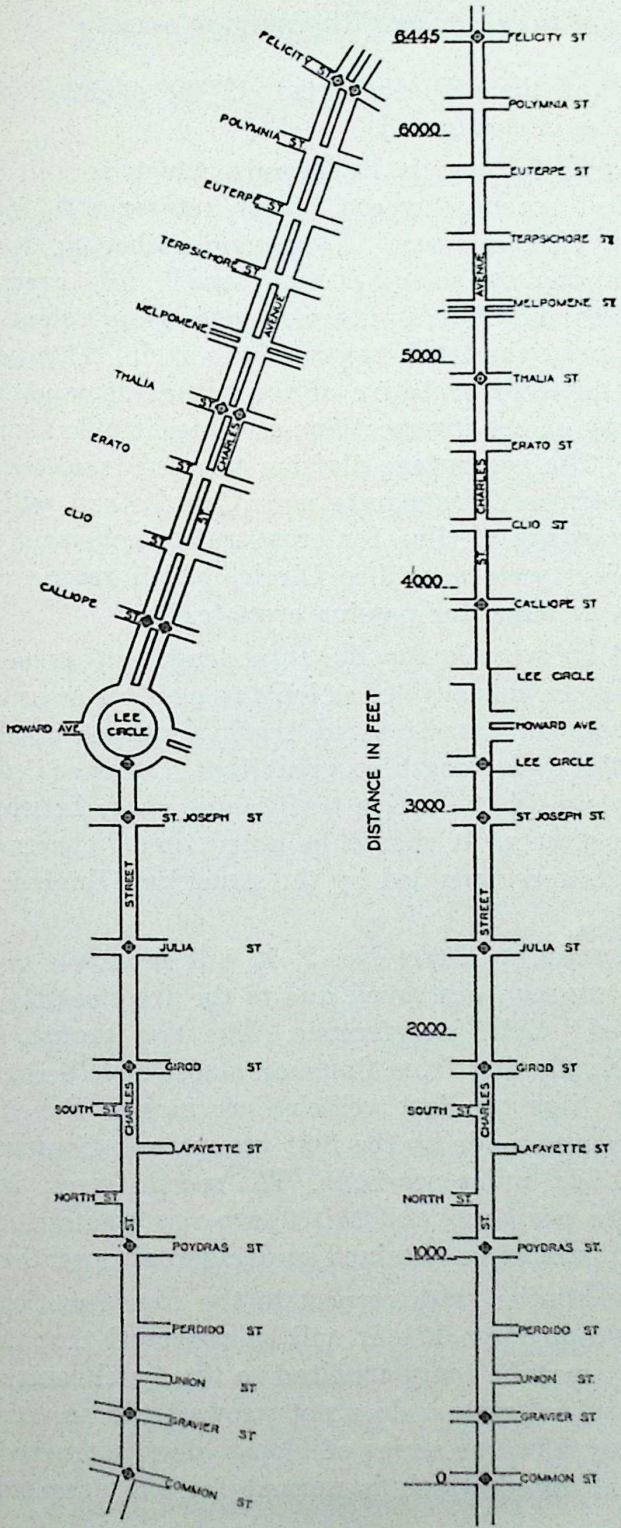

FELICITY ST
POLYMNIA ST
EUTERPE ST
TERPSICHORE ST
MELPOMENE ST
AVENUE
THALIA ST
ERATO ST
CLIO ST
CALLIOPE ST
CHARLES ST
LEE CIRCLE
HOWARD AVE
ST. JOSEPH ST
JULIA ST
GIROD ST
SOUTH ST
LAFAYETTE ST
NORTH ST
POYDRAS ST
PERDIDO ST
UNION ST
GRAVIER ST
COMMON ST
STREET
6445
6000
5000
4000
3000
2000
1000
0
DISTANCE IN FEET

CHART NO. 1

speeds are normal for the area indicated, if the effect of the present stopping time is eliminated.

The length of cycle selected is 70 seconds, which is split 25 seconds "red" and 45 seconds "green," with reference to traffic movement up St. Charles street. A 3-second amber or clearance time is superimposed at the end of each "red" and "green" period. The 25—45 second split timing per cycle is equivalent to a 36%—64% division of the total length of the cycle. This percentage division is not representative of the actual demand for time by traffic at any of the intersections at which traffic signal lights are indicated. The percentage division selected is necessarily a compromise between those streets near Canal street which demand a high percentage of time for cross-traffic movement as compared with those streets near Lee Circle, which require as little as 8% of the total time for passing cross-traffic.

The selection of 70 seconds for the total length of cycle is based on the tendency to make cycles as long as possible in order to facilitate movement of synchronized traffic, without at the same time making the cycle length so great that "stopped" vehicles would completely fill the active traffic lane space between Canal and Common streets. It should be noted that 70 seconds falls within the limits recommended by the American Engineering Council.

Upon further examining Chart No. 2, it will be noted that individual platoons are soon destroyed due to the frequent stopping caused by "red" light interference. The two groups of eighteen vehicles each starting from Common street have become four groups by the time the last vehicle has passed Felicity street. The average speed made by the first group from Common to Felicity streets is 14.0 miles per hour. The second group averages only 12.5 miles per hour, and this figure represents more nearly the speed that would be obtained under actual operation.

If Chart No. 2 is studied with respect to the four functions of traffic lights listed on Page 121, it will be observed that the second function only may be truly credited to the synchronized system. The synchronized system does not prevent the accumulation of traffic in any block or series of blocks, does not permit traffic to flow at that speed which is normal for the area tra-

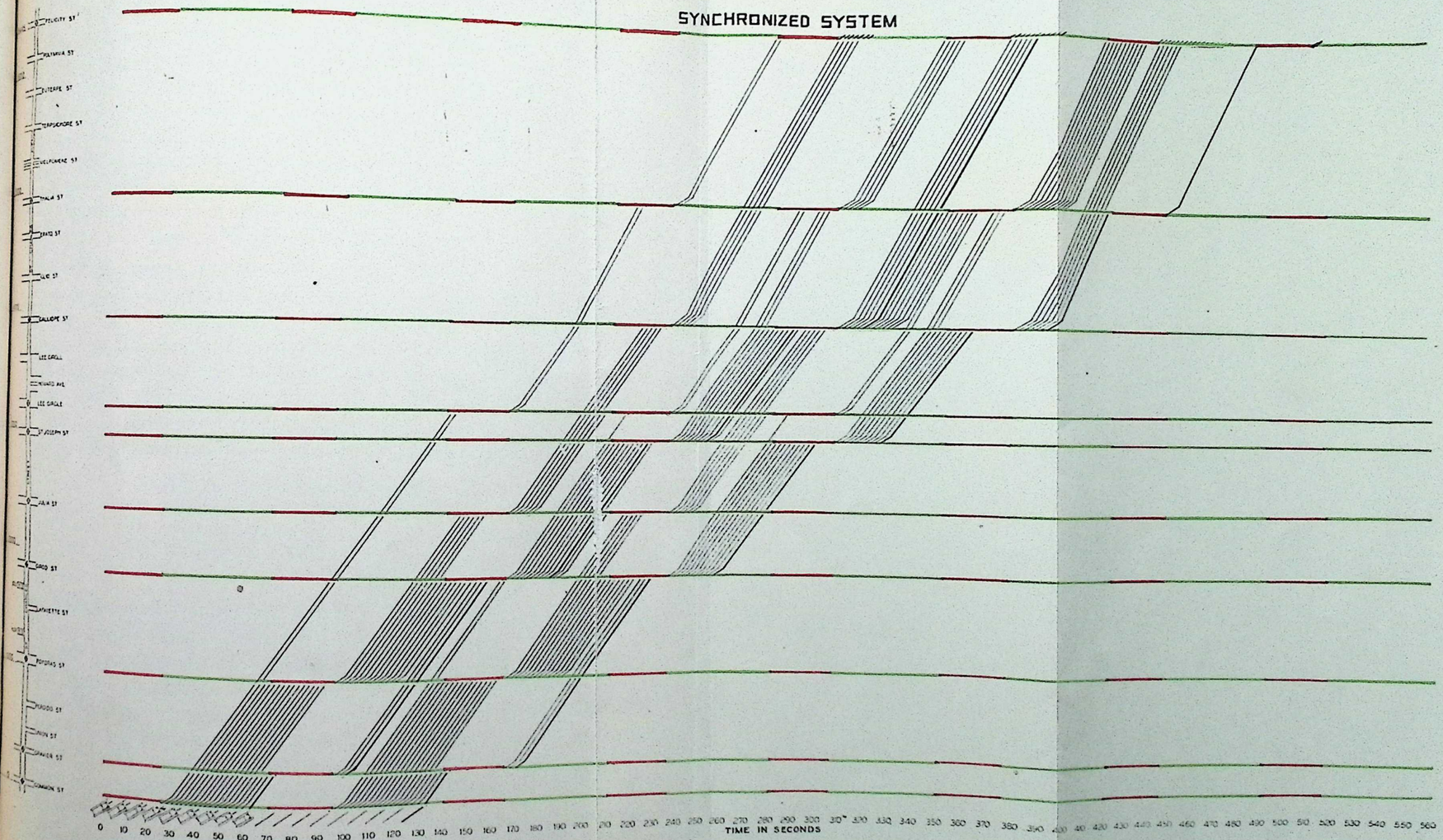


CHART NO. 2

The amount of stopping shown on Chart No. 2. Hence, the 10

versed, nor does it allocate "green" or "go" time in accordance with the relative volume of traffic flow per lane at each intersection. Finally, the synchronized system does not lend itself to those streets on which electric street cars operate. The simultaneous starting of a large number of street cars will cause a heavy power surge in the overhead trolley distribution system, which will in turn result in too large a reduction in trolley voltage. From the viewpoint of the driver of a fast automotive vehicle, the synchronized system invites him to speed past as many "green" lights as he can before the signals turn "red." Many of these disadvantages are overcome by operating the same traffic lights as a Reverse-Synchronized system.

THE REVERSE-SYNCHRONIZED SYSTEM OF TRAFFIC CONTROL.—The Reverse-Synchronized system secures its name from the manner in which some of the traffic lights are reversed in color with respect to the others. For example, if we look at Chart No. 3, we will observe that the lights at Lee Circle and at Poydras, St. Joseph and Thalia streets, show "green" when the others are "red." All lights are synchronized to change at the same instant.

The Reverse-Synchronized system is sometimes called the—

1. Alternate-synchronized system.
2. Staggered-synchronized system.
3. Stagger system.
4. Reciprocal system.
5. Limited progressive system.

The division of time per cycle into "red" and "green" periods is rigidly fixed at 50%—50%. If, for example, the "red" period was shortened for Common and Gravier streets, then the "green" period at Poydras and Thalia streets would be correspondingly shortened. If block lengths are exactly equal, then the reverse-synchronized system can be made a very efficient one. However, most cities have block lengths unequal in distance, and St. Charles street and St. Charles avenue are not exceptions to the rule.

Observation of Chart No. 3 shows that platoons of traffic remain fairly intact as they progress along the signaled street. "Red" light interference is greatly reduced as compared with the amount of stopping shown on Chart No. 2. Hence, the re-

verse-synchronized system permits traffic to flow at a speed approaching normal for the area traversed. The average speed of the first platoon is 17.5 miles per hour, or an increase of 25% over the 14 m. p. h. speed made by the first platoon shown on Chart No. 2.

The second platoon on Chart No. 3 makes an average speed of 14.15 miles per hour. This is an increase of 13.2% over the 12.5 m. p. h. speed made by the same group on Chart No. 2.

Finally, the reverse-synchronized system eliminates to a large extent the accumulation of traffic in any block or series of blocks. But, this system is inferior to the synchronized system in allocating "green" or "go" time in accordance with the relative volume of traffic flow per lane at each intersection. As a result of this wastefulness of time, only sixteen cars can be handled by the reverse-synchronized system. There is, however, a Progressive System, which possesses none of the bad features of the two systems just described.

THE PROGRESSIVE SYSTEM.—This system secures its name from the manner in which platoon after platoon of traffic may progress along the signaled street at a speed which is normal for the area traversed.

Chart No. 4 shows how the same length of cycle (70 seconds) used on Charts Nos. 2 and 3 may be used to pass traffic without any "red" light interference. Close examination will show that the time split of the cycle is apparently different for each signaled street intersection. This is quite true, as the "green" or "go" time at each intersection has been allocated as nearly as possible in accordance with the relative volume of traffic flow per lane. Hence, the four functions of a traffic light as listed on page 117 are fulfilled by the Progressive System. In addition to this, the temptation to "speed" is removed, as the speeder will soon run into a "red" light. In the same way "straggling" is discouraged, as the straggler soon learns that a "red" light will overtake him.

The average speed made by the first group of vehicles shown on Chart No. 4 is 19.5 miles per hour. This speed is the same for the second platoon, and for every preceding and following platoon. A speed of 19.5 m. p. h. is 39% and 56% greater than the

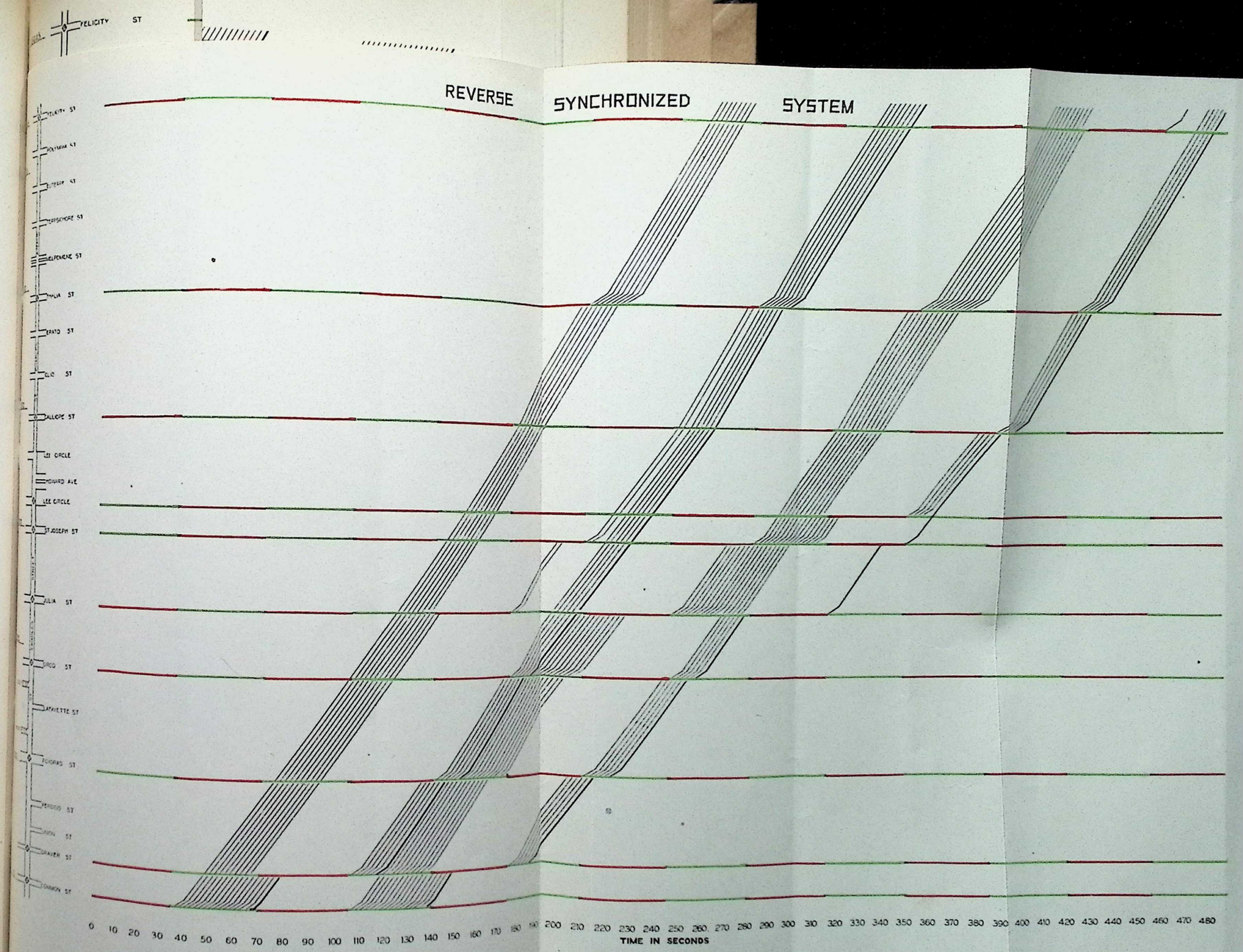


CHART NO. 3

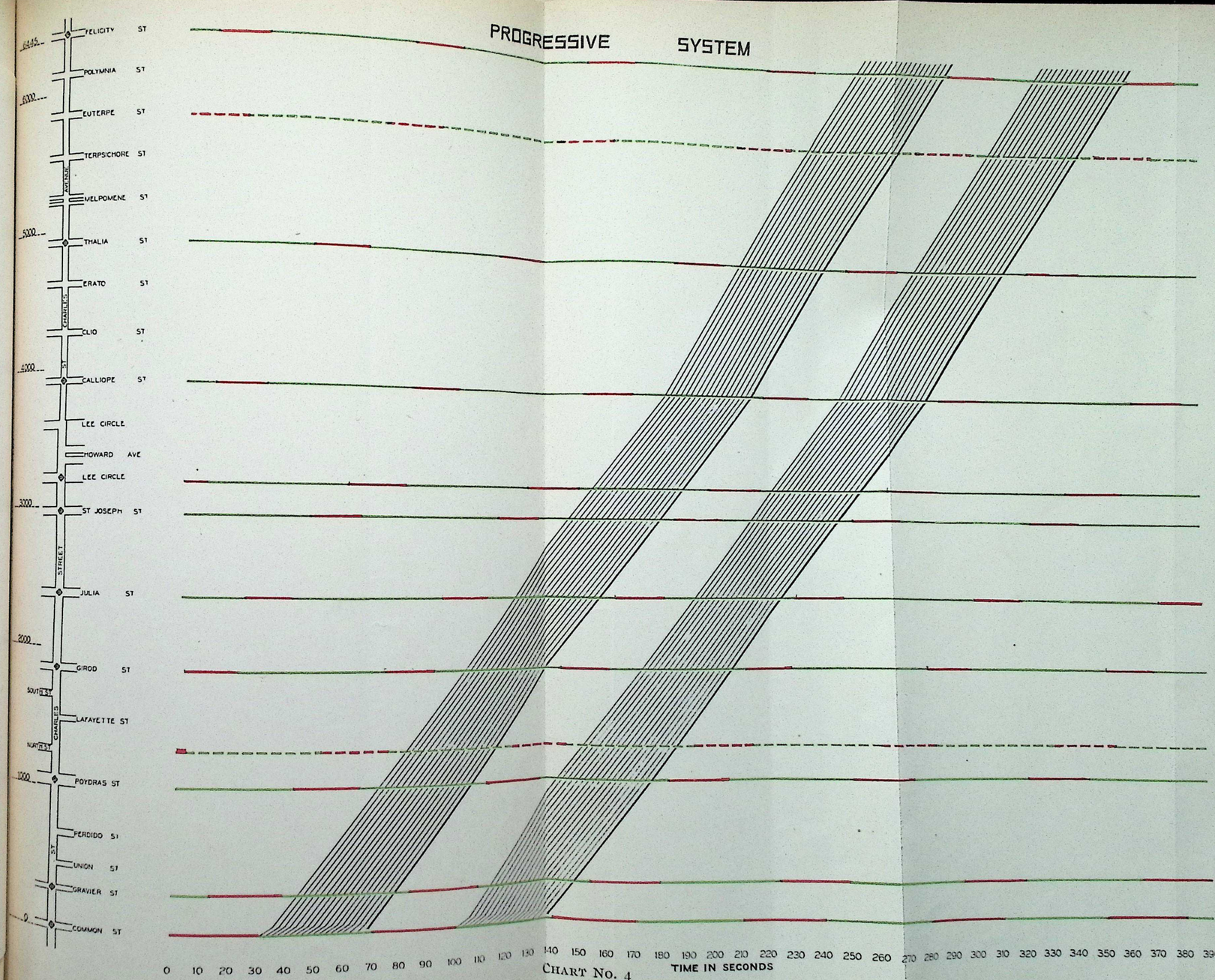

PROGRESSIVE SYSTEM
FELICITY ST
POLYMNIA ST
EUTERPE ST
TERPSICHORE ST
MELPOMENE ST
THALIA ST
ERATO ST
CLIO ST
CALLIOPE ST
LEE CIRCLE
HOWARD AVE
LEE CIRCLE
ST JOSEPH ST
JULIA ST
GIROD ST
LAFAYETTE ST
POYDRAS ST
PERDIDO ST
UNION ST
GRAVIER ST
COMMON ST
ST CHARLES AVENUE
CHARLES ST
SOUTH ST
NORTH ST
6445
6000
5000
4000
3000
2000
1000
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390
TIME IN SECONDS

CHART No. 4

speed made by groups Nos. 1 and 2, respectively, of the synchronized system shown on Chart No. 2. Or, a speed of 19.5 m. p. h. is 11.4% and 37.8% greater than the speed made by platoons Nos. 1 and 2 respectively of the reverse-synchronized system, shown on Chart No. 3. Finally, a speed of 19.5 m. p. h. is 41.3% greater than the average speed of 13.8 m. p. h. which is being made at the present time on St. Charles street and St. Charles avenue during the P. M. peak hour period.

The time split per cycle as shown in Chart No. 4 is based on P. M. peak hour traffic. With the modern signaling equipment available today, the length of cycle, time split per cycle, and time phase between intersections may be rapidly changed to take care of varying traffic flow conditions. For this reason, the Progressive System of street traffic control is the most efficient type yet devised. Over an area composed of many parallel and cross streets (as in the "Loop District" of Chicago), the Progressive Systems operating on each street may be so co-ordinated that delays caused by traffic lights within the area are so reduced that the time saving effected is of economic proportions.

In conclusion, when the flow of traffic at an intersection is no longer sufficient to justify the operation of the "red" and "green" lights, then the "amber" signal should be displayed continuously in all directions, or else operated intermittently as a "flasher." It is believed that the displaying of the "amber" light is preferable to stopping the signal light entirely, as the presence of the "amber" signal serves to identify the intersection as one to be approached with caution. Apparently, this causes the "amber" signal to serve for a dual purpose. In reality the "flasher" operation is very satisfactory.

DISCUSSION

MR. MARKS: How do you arrive at speed of 17¾ miles per hour?

MR. NAQUIN: According to the charts, it seemed to be the natural speed for St. Charles street. At the present time, an average speed of 13.8 miles per hour is being made during the P. M. peak hour. If the time required for stopping at the va-

rious intersections was eliminated, a speed of 17¾ miles per hour would be the normal speed.

MR. MARKS: An investigation of traffic on the Michigan avenue bridge by the Illinois Highway Commission showed that one line of traffic over the bridge would carry more vehicles at 17¾ miles per hour than at any other speed.

A MEMBER: In a progressive system, how are the various lights timed with respect to each other?

MR. NAQUIN: A master controller is used to keep the various lights in step with each other; that is, it is the job of the master controller to change the second light, say, ten seconds after the preceding light has changed in color. Another controller is used at each signaled intersection to properly proportion the stop and go time in each direction. In order to keep all of these controllers in proper relation with each other, synchronous motors are used.

PROFESSOR ROBERT: What progress is being made in this city towards installation of this particular kind of progressive system?

MR. NAQUIN: Some work has been done along these lines, but nothing definite has materialized.

MR. BILLINGSLEY: I have just returned from a visit to a city of some 250,000 people which has a large portion of its retail stores and commercial activities concentrated along one street. The traffic movement consequently is very heavy during the peak hours of the day. I was impressed with the smoothness and facility with which the traffic was flowing along the main business street during these peak periods under signal light control. The signals were set on a short cycle length and regulated both pedestrian and vehicle traffic. I am unable to say just what cycle length was used, but, judging from the length of the blocks and the fairly uninterrupted movement of pedestrial travel from block to block, I would say that the cycle length was set at from 70 to 80 seconds. The amber light periods were almost eliminated, the change from green to red and *vice versa* taking place very rapidly.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Board of Direction of May 12, 1930.

The meeting was called to order by President Todd, and the following members were present: Messrs. O'Neill, Moses, Dunlap, Frost and Muth.

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

A communication from the Association of Commerce was read relative to the proposed bill for making a survey of State Administrative Offices. Owing to the lateness with which the letter and bill were received, proper consideration could not be given to the communication, therefore, on motion duly seconded, it was voted to advise the writer of the letter that the matter would be considered at the next meeting of the Board.

The President announced that the following paragraph, which had previously been under discussion in the meetings of the committee, would be included in the proposed draft of the registration bill: "Section 16. Be it further enacted, etc., That the Attorney General of the State is hereby authorized and directed to prosecute any violation of this Act when proper evidence is submitted to him by the Board."

After careful consideration, the matter was submitted to the local chapters of the A. S. C. E. and A. S. M. E., and their approval was given to the inclusion of this paragraph in the proposed draft of the bill.

After careful consideration by the Board, on motion duly seconded, it was voted that the Board endorse the inclusion of this paragraph in the draft.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Society, May 12, 1930.

The meeting was called to order about 8:10 P. M., James M. Todd, President, in the chair, F. A. Muth, Secretary, and 48 members and guests present.

The minutes of the regular meeting of April 14, and the special meeting of April 21, were read and approved.

Report of the Employment Committee was read.

The technical exercises of the evening consisted of a most interesting paper on: "New Developments in Smokeless Fuels," by Mr. Robert Glenk. This paper was illustrated with lantern slides and charts, and Mr. Glenk provided numerous samples of foreign and domestic smokeless fuels.

A rising vote of thanks was then tendered the speaker, and the meeting adjourned to the usual collation.

F. A. MUTH, Secretary.

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PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XVI. AUGUST, 1930 NO. 4

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EDITORIAL NOTES AND COMMENT

Smokeless Fuels. At the May meeting of the Society, Mr. Robert Glenk read a paper entitled "New Developments in Smokeless Fuels," which sets forth in a most interesting and instructive manner the recent advances which have been made, both in this country and abroad, in the processes and methods for the low temperature carbonization of raw coal for the purpose of producing a fuel at low cost having the qualities and advantages of anthracite.

This is a problem of interest not only to the large users of coal, such as the power companies, but it is of very special interest to the smaller users, particularly domestic consumers. Such pre-treated coal has been used for many years in the continental countries under conditions in which anthracite was used here due to the abundant supplies of the latter. Anthracite has the desirable qualities of cleanliness, both in han-

dling and in burning; it burns without smoke and has uniformly high heating power. Until the time of the World War the Eastern and New England States would use no other fuel for domestic heating, and in some of the larger cities it was also extensively used for power plants.

The South has always been an extensive consumer of bituminous coal for domestic purposes, but in many instances, particularly in the larger cities where good servicing is available, automatic oil burners are supplanting coal.

This "smokeless" fuel in the form of semi-coke has many advantages, not only for fire-box combustion, but also for open fires with their pleasing radiant glow. Experiments have shown that in open grates the radiation efficiency of these fuels is 20 to 25 per cent greater than that of the untreated bituminous coal.

In power plant operation pulverized coke can compete with pulverized coal in proportion to the net credit to be allowed for the tar and gas by-products.

In his paper Mr. Glenk described a number of different processes which have been developed for the making of smokeless fuel and states at the conclusion of each description the different products, with the amount of each, which are obtained from one ton of the raw fuel. For example, the Parr process gives from one ton of Pittsburgh slack 16 gallons of tar, 8700 cu. ft. of gas with heat value of 700 B. T. U. and 1350 lbs. of semi-coke containing an average of 7 per cent of volatile matter.

Some of the processes are also adapted to the use of lignites from which a very valuable type of fuel may be produced. This new fuel technology opens up a tremendous field for the utilization of lignite, cheap slack, screenings and other forms of low-grade coal which a few years ago would have been looked upon as a liability rather than an asset.

Wolmanized Lumber. The preservation of lumber for structural purposes has given rise to one of the most important of technological problems as well as the development of an industry of amazing proportions. It is a problem of particular

interest to this section of the country on account of conditions which demand the taking of special precautions to insure a reasonable length of life to the timbers used in many forms of structural engineering. There have been several very excellent papers on this subject presented before the Society and published in the *Proceedings*, and Dr. Kreer's presentation of the subject of "Wolmanized Lumber" adds a new chapter to the list. The name of the process is that of the student of chemistry, Dr. Karl Heinrich Wolman, who made the original investigations leading to the discovery of the preservative materials and processes. These discoveries were made when he was commissioned to conduct a series of tests and researches for the purpose of finding ways and means to protect the timbers of the Silesian coal mines.

As set forth in Dr. Kreer's paper the result of these extensive investigations was the production of Wolman Salts under the trade names Triolith and Tanalith or Minolith or Balilith when fire-retardent salts were added.

These preservatives have been used almost exclusively in the timbering of the mines in Germany and the German Government Railways have used them for the preservation of over a million sap pine crossties. The Wolman processes have also been extensively adopted by one of the great fruit companies operating in Central America.

As compared with creosoting the Wolman process adds only 20 to 30 lbs. of weight per thousand board feet as against 1000 lbs. for the oil treatment. Wolmanized lumber will also take paint where it is used in structures which require to be painted.

It appears to be a deterrent against all kinds of vermin and Dr. Kreer is of the opinion that it would be very effective against termites.

The National Hydraulic Laboratory. The names of John R. Freeman and Joseph E. Ransdell will always be linked together in the future whenever the National Hydraulic Laboratory is mentioned. The distinguished hydraulic engineer, on account of his unalterable belief in the great value of such a laboratory for the solution of hydraulic problems in general,

and the Senator from Louisiana on account of his interest in the problems of flood control in his own state, were the pioneers in this movement.

It required seven years to secure the proper legislation for the authorization of the project, but the bill in its final form was passed by the Senate on May 7, 1930, concurred in by the House on May 8, 1930, and President Hoover signed it on May 14th.

The principal credit for the final passage of the bill is due Senator Ransdell and Congressman James O'Connor, for during these seven years they were persistent and untiring in their efforts toward this end.

John R. Freeman was the father of the idea, giving time, money and untiring effort to the cause. Looking forward to the ultimate realization of his plans, he established traveling scholarships so that young American hydraulic engineers might have the opportunity to become acquainted with the use and application of hydraulic laboratories in Europe; he also undertook for the American Society of Mechanical Engineers the editorship of their great work "Hydraulic Laboratory Practice."

The bill provides for the establishment of a national hydraulic laboratory in the Bureau of Standards of the Department of Commerce. "No test, study, or other work on a problem or problems connected with a project the prosecution of which is under the jurisdiction of any department or independent agency of the Government shall be undertaken in the laboratory herein authorized until a written request to do such work is submitted to the director of the Bureau of Standards by the head of the department or independent agency charged with the execution of such project."

Any state or political subdivision may also have the privilege of obtaining tests or studies of projects which may be under their jurisdiction. A sum, not exceeding $300,000, is appropriated for building and equipment.

Dr. George K. Burgess, Director of the Bureau of Standards, has requested the formation of an advisory committee on the laboratory which shall have representation from the Corps of Engineers, War Department, Bureau of Public Roads,

Department of Agriculture, Bureau of Reclamation, U. S. Geological Survey, Federal Power Commission, Interior Department, Coast and Geodetic Survey, Department of Commerce,

John R. Freeman is to be Chairman of the Committee, and it is a source of great satisfaction as well as an honor to the Louisiana Engineering Society that one of its most prominent members, Professor William B. Gregory, has been appointed a member of the Committee.

Professor Gregory and Mr. Freeman are now in Europe making a tour of inspection of the principal hydraulic laboratories on the continent.

The Registration Bill. The full text of the proposed Registration Act was published as a matter of record in a previous issue of the *Proceedings*. Before it was reported out of the House Committee, however, a slight change was made, with the approval of the parties concerned, in the reading of the last sentence in the last paragraph of Section 3. This sentence in the original draft read "Qualifying as a Professional Engineer under the Act shall entitle the person, when registered and licensed, to practice Surveying." It was changed to read "Qualifying as a Civil Engineer under this Act shall entitle the person, when registered and licensed, to practice Surveying."

The Committee having in charge the handling of the bill in the Legislature consisted of James M. Todd, Chairman; F. N. Billingsley, E. S. Bres, Donald Derickson, G. R. Hammett, Ira W. Sylvester and F. A. Muth, Secretary.

As a matter of record and for the information of the members of the Society, the Committee desires that the following statement be published in the *Proceedings*:

> It is the desire of the Committee, charged with the responsibility of handling the Professional Engineers Bill in the 1930 State Legislative Meeting, to inform the membership of the Society, as to its activities in the matter, and the final disposition of the measure.
>
> This Committee made numerous trips to Baton Rouge to appear before the various Legislative Committees, and succeeded in having the measure pass the House of Representatives by a vote of 79 for and 2 against.

In the Senate, we succeeded in having the measure reported favorably, by unanimous vote of the Senate Committee. Under normal procedure, the bill had ample time to pass the floor of the Senate, and inasmuch as there was no objection, we felt its passage was assured.

Our membership, no doubt, knows of the events of the last days of the Legislative Meeting; and we regret to report that the measure died on the Senate Calendar.

It is to be hoped that the good results obtained by a discussion of the subject, such as was held during the period of drafting the bill, be not lost. This Committee strongly urges that the matter be simply held in abeyance until the next State Legislative Meeting, and at that time the attempt be made again to put through the measure, substantially as drawn.

That the Committee deserves great credit and the thanks of the Society for its good work goes without saying. It is only a matter of regret that our bill met the fate of so much other good legislation, when all efforts had to be concentrated upon the defeat of measures which would have done incalculable harm to the State of Louisiana.

National Recognition of Louisiana Engineers. Reference has already been made in previous issues of the *Proceedings* to honors which have come to Mr. Ernest Lee Jahncke, Mr. Coleman and Mr. Dusenbury.

It is now a source of gratification and pleasure to add the names of Professor W. B. Gregory, member of the Advisory Committee on the National Hydraulic Laboratory, and Mr. Marcel Garsaud, recently appointed by President Hoover as a member of the Federal Power Commission.

While, of course, this recognition comes to these gentlemen on account of their own individual abilities and activities, the Louisiana Engineering Society has a share in such honors that come to its members, all of whom have taken a prominent part in its welfare and development.

The Ransdell Testimonial Dinner. As its name implies, the *Proceedings* aims to preserve as complete a record as possible

of the Society. With this end in view there is published elsewhere in this issue an account of the dinner held under the auspices of the Society as a testimonial to the devotion and untiring efforts of Senator Ransdell, which culminated after seven years in the passage of the bill for the establishment of a National Hydraulic Laboratory.

New Members. Since our last issue the following new members have been elected to the Society:

Resident Members

Joseph J. Friedler, Jr., Southern District Sales Manager, Ilg Electric Ventilating Co.

Ralph E. Lind, Inspector U. S. Corps of Engineers.

Non-Resident Member

Robert P. Linfield, Cuyamel Fruit Co.

Associate Members

L. Villere Cressy, Sales Engineer and Representative for C. A. Dunham Co. and Modine Mfg. Co.

Walter J. Folse, Machinery Business.

Transfer From Student Member to Resident Member

Lucien T. Vivien, Jr., New Orleans Public Service, Distribution Engineering Department.

Transfer From Student to Non-Resident Member

Robert L. Atkinson, Jr., with Shell Petroleum Corporation, St. Louis, Mo.

Rodney B. Rougelot, Electrical Engineer, Colonial Sugars Co., Gramercy, La.

Non-Resident Associate Member

Norman C. Estes, Monroe, La., Sales Manager, Wallace & Tierman Co.

Resident Junior Member

F. Robert Mendow, Class 1930, College of Engineering, Tulane University.

Awarded the Louisiana Engineering Society Prize as an outstanding student in Engineering.

Non-Resident Junior Member

Fred Hadley Penn, 204 Church St., Baton Rouge, La., Class 1930, Louisiana State University.

Awarded the Louisiana Engineering Society Prize as an outstanding student in Engineering.

PAPERS AND DISCUSSIONS

NEW DEVELOPMENTS IN SMOKELESS FUELS

By Robert Glenk

Read before the Society, May 12, 1930.

In reviewing the recent literature on the subject of fuel technology, the fact of the widespread and growing interest in low temperature carbonization of raw coal and the development of cheap and effective anthracite substitutes, becomes surprisingly evident.

At the International Conference on Bituminous Coal in Pittsburgh in November, 1928, sponsored by the Carnegie Institute of Technology, and attended by some 2000 coal experts, a preponderance of the papers presented had reference to phases of this low temperature treatment of coal.

Further inquiry discloses the fact that over two hundred patents were taken out in this one field alone and that important industries founded on low temperature carbonization principles are already in operation at home and abroad and still others in prospect. In the effort to get more information on this subject, search was made for data on the various processes and samples of products were collected from all possible sources. The results of this work have been compiled for presentation to the Society tonight.

Coal is one of the most useful of raw materials with which man has been endowed and is one of the greatest factors of national potential wealth in our industrial age.

The United States produces in round numbers 560 million tons of coal annually or just about one-half of the total world production.

Under the prevailing wasteful methods of coal consumption, only a small fraction of this wealth is being realized and hence every forward step that is taken by the fuel technologist to give it increased value, is a form of conservation of natural resources that will benefit not only ourselves, but generations to come.

In the domestic heating field, which consumes about 12% of our coal production, bituminous coal has to its credit the

advantages of cheapness, wide distribution, ample reserves and the potentiality of improved usage. Its one great drawback is its uncleanness.

Burned in the raw condition it gives off dense black smoke, which pollutes the atmosphere, weakens the sunlight by shutting out the violet rays, and actually is a menace to health of the city dweller in winter. Seventeen dollars per capita or seventy million dollars is the amount of damage incurred yearly to merchandise by the smoke laden atmosphere of New York, according to the N. Y. Merchants' Association estimates, and New York is not the smokiest city of the country.

This smoke represents much concentrated value and when recovered and used, eliminates waste of useful products for which there is ever increasing demand.

On the other hand, anthracite possesses the desirable attributes of being clean in handling, burning without smoke, and of having uniformly high heating power. It is regarded as the ideal fuel for heating the home.

Approaching the coal problem, then, from the point of view of the domestic users, we find that the homes of this country are prepossessed in favor of anthracite in so far as its use is not excluded by high cost or excessive distance from the point of production.

But anthracite is a luxury and combines the distinction of quality with limitation of supply. Its cost of production is approximately twice that of bituminous coal, besides a big fraction of the available reserve is already exhausted and, hence there is no likelihood of getting cheaper supplies. The home therefore, restricted in its choice in the matter, has no alternative but to turn to other sources for its fuel requirements.

While some of the earliest research on the subject of anthracite substitutes and smokeless fuels was made in the United States, it has been most energetically extended by foreign countries with limited or no petroleum resources and mainly with the object of obtaining oils and motor fuels from the volatile products of coal distillation.

The World War gave great impetus to investigations of this sort, particularly in England and Germany. In the United

States experiments were carried on by Prof. Parr and his various co-workers at the University of Illinois as early as 1902.

The British Board of Fuel Research, established in 1917 to promote fuel economy and to co-ordinate experimental work in the development of smokeless fuels, and the Kaiser Wilhelm Institute for Coal Research have done similar service for England and Germany.

These efforts have resulted in the establishment of new industries on a comparatively large commercial scale in both of these countries.

Foremost among the procedures for anthracizing bituminous coal for domestic heating purposes are the low temperature carbonization processes closely associated with the production of coal gas. The distinguishing feature of these processes is that the coal is heated to temperatures below the cracking temperature of the hydrocarbons of primary tar, that is from 300 to 750° C. Within this range of temperature, the char produced by distillation is characterized by having a large proporton of volatile matter remaining in the coke, to which fact is attributed the desirable properties of this product as a fuel. The reactivity or tendency to combine with oxygen is one of the distinctions of low temperature coke, its ignition point being nearly 250 degrees C. lower than that of oven or metallurgical coke. In this respect it resembles wood charcoal. It is also an excellent fuel for producer or water gas plants, but is unsuited for the blast furnace, the coke being too soft to stand the strain of blast furnace stoking, as a general thing, although exceptional semi-cokes are hard and dense.

Logically, the greatest potential use for low temperature coke is as a household fuel. Semi coke is ideal for this purpose, since it is clean and requires little attention during combustion and its heat value is equal to or higher than that of anthracite. Fireplaces emit a large portion of their heat by radiation, and experiments have shown that in open grates the radiation efficiency of smokeless fuels is 20 to 25% greater than that of raw bituminous coal. As a boiler fuel for power plants, its high combustibility insures a higher rate of combustion and the pulverized semi-coke flame is correspondingly shorter than

that of raw coal and smaller furnaces may be used for boilers of equal capacity with corresponding saving in equipment cost.

The safety with which powdered semi-coke may be stored without fear of explosion is a consideration in marine power plants. The limited space on shipboard and on locomotives also, makes the short flame of this coke and its associated small furnace volume of importance to the transportation industry.

The gaseous products of low temperature carbonization consist mainly of the low saturated or unsaturated aliphatic hydrocarbons. Aromatic compounds are mostly absent. The gas, owing to but slight secondary decomposition of original products, is not liberated in large volume but is of high thermal value and composed mainly of hydrogen and methane. The tar is quite unlike ordinary coal tar, its chief constituents being neutral oils of the paraffin series, ulmin like substances, and a high tar acid content, chiefly cresol and the homologues of phenol. Naphthaline is absent—specific gravity also is lower than coke oven tar.

The low boiling constituents of the tar may be recovered as motor fuels and the higher boiling fractions as lubricating or Diesel oils. By relatively simple treatment, a good grade of preserving creosote may be obtained. The tar acids, too, are profitably recovered in a pure form for use in the synthetic resin industry.

As is to be expected, the ammonia yield is rather poor in the low temperature processes, the evolution of ammonia gas being the result of decomposition of the nitrogen compounds at elevated temperatures.

To go into details of even the most promising of the various processes now operated on a commercial scale would be tedious, hence only the salient features of a selected few representative methods of procedure will be touched upon tonight.

Specimens of the products from many parts of the world and of every available type, however, are here for inspection, the result of diligent search.

A rational classification of the various methods of treating coal listed and described in recent literature on fuel technology, is no easy matter because of the number and complexity of processes. Roughly, the low temperature processes fall un-

der the following systems: single stage and double stage heating; externally heated retorts; internally heated retorts; stationary and rotating retorts; horizontal and vertical retorts; charge of coal in thin layers or in bulk; pulverization of the charge; and briquetting of end product.

In the final analysis, each process has its points of novelty, certain advantages, peculiar operating difficulties and distinctive end products, so that the selection of a process of low temperature carbonization or the design of a retort to attain that end is not a matter of simple choice merely, but one which at best is a compromise and which takes into account the characteristics of the raw material to be utilized and the market for the final products.

PARR PROCESS. The process developed by Prof. Parr of the University of Illinois, is the culmination of 25 years' study of the fundamental conditions involved in low temperature carbonization. This process operates in two stages: a conditioning stage in which the coal in a closed rotating drum is quickly brought to within 25 to 50° of the temperature at which it becomes pasty, about 300° C., and secondly the coking stage conducted at a temperature of 750-800° for 4—5 hours in a vertical retort which has been preheated and which quickly raises the temperature of the mass.

The retort is of the standard type manufactured by the Russell Engineering Co. of St. Louis.

The results of the operation of this process with Pittsburgh coal slack are as follows: Tar 16 gallons; gas of 700 b.t.u's, 8700 cu. ft.; and semi-coke (of 5—8% volatile matter), 1350 lbs.

The tar is of a good grade for creosoting purposes and the semi-coke is dense and strong and of high heating value even when made from cheap coal screenings. It is well adapted for metallurgical use.

K. S. G. PROCESS. A plant of this type, with a large daily capacity, is now operating at New Brunswick, N. J., by a subsidiary of the International Combustion Engineering Co., which has acquired the process.

The K. S. G. or the German Kohlenscheide Gesellschaft process, belongs to the general type of externally heated, rotary

kiln retorts, in which the coal is preheated before actual distillation.

The K. S. G. retort consists of two concentric cylinders securely fastened together and mounted at an inclination upon rollers and rotating as a unit. The entire weight of the retort is carried by the cooler inner cylinder, which is an important advantage in that the supporting structure is never heated above 300° C. and sagging is thus avoided.

The crushed raw fuel is introduced by a special screw conveyor which projects well into the lower end of the inner or preheating cylinder. Spiral flights convey the coal to the upper end of the retort, where it falls through discharge ports into the outer carbonizing cylinder. This preheating is designed to prevent the sticking of the charge to the walls of the outer chamber, as the preheated coal falls directly into the hottest zone of the carbonizing cylinder. By this procedure the charge is rapidly brought through the plastic stage before the semi-coke is discharged, giving the material sufficient time to cement the coal particles together, to harden and to prevent the production of fines.

The volatile products are withdrawn through a hollow shaft at the upper end of the retort. Provision is made for introducing superheated steam into the outer cylinder at a pressure of 7½ pounds per sq. in. and at a temperature of 450° C. The temperature of preheating ranges from 200° to 300° C, while that of carbonization ranges from 600° to 750° C.

The charge requires 2½ hours to pass through when the speed of revolution is one in 1½ minutes. Using a coking coal containing 25 per cent volatile matter, the average yield was 1837 pounds semicoke; 12 gallons of dry tar; 2420 cu. ft. of high grade gas; and about a gallon of light oil scrubbed from the gas.

The low temperature distillation plant of the International Combustion Engineering Corp. at New Brunswick, N. J., has been in continuous operation since February of 1929, and at the present time close to three and a half million cubic feet of gas is being delivered daily to the Public Service Electric & Gas Co., and large quantities of tar and light oil have been produced.

It is understood that the fuel for the central station power plant of the new Industrial Power Corp. recently formed to supply the manufacturing district of Chicago with electric power, gas and steam, will be secured from a plant using the K. S. G. process, with an ultimate capacity of 45,000,000 cubic feet of gas daily.

To treat the tars produced at the New Brunswick plant, one of the largest and most up to date tar acid plants in this country has been completed at Newark and this company will also undertake the manufacture of synthetic resins on a very large scale in the near future. The domestic fuel produced is sold under the name of Disco Smokeless Fuel, and is a very desirable anthracite substitute.

McEwen-Runge Process. The McEwen-Runge process of the International Coal Carbonization Co., which is in operation on a commercial scale in Milwaukee, is described by the manager of the plant in the following words: "McEwen-Runge coke is produced in a process of carbonization in which the time required to complete carbonization has been reduced from the 12 to 14 hours of a conventional by-product oven to less than one minute.

The essential carbonization apparatus involved consists of a steel tower 80 feet high, lined with a course of insulating brick and an inner course of fire brick. In beginning the operation, the combustion products of gas burned in chambers at the bottom of the retort are made to flow upward through the retort and are met by a shower of finely divided coal particles sprayed in at the top. This coal is pulverized to such a fineness that 65% passes through a 200 mesh and 100% through 40 mesh sieve. The coal, as it falls downward against the rising current of hot gasses, is carbonized to a point such that the volatile content of the coke is about 12% or about one-third. The coal gas and tar vapors evolved from the coal are withdrawn from the top of the retort together with the combustion products of the heating gas.

Once the process has been started and a temperature of 750° C. established at the bottom of the retort, it is possible to eliminate the combustion products of the heating gas at the bottom of the retort and to blow in a small current of air in quantity

sufficient to combine with the coke dust and generate heat sufficient to maintain the process. The carbonization temperature inside the retort is approximately 600° C.

The major product of this operation is a finely divided coke which is burned under the boilers of the Milwaukee Electric Railway & Light Co. The economic purpose of this process is to reduce the cost of boiler fuel by replacing pulverized coal by pulverized coke. The coke is to be cheaper than the coal in proportion to the net credit obtained for the tar and the gas over and above the cost of coal. The capacity of the Milwaukee installation exceeds 200 tons of raw cial daily.''

Using a high volatile Illinois coal, containing 34.6% volatile; 57.6% fixed carbon, and 7.8% ash, on a dry basis, the yield per net ton in extensive tests was 1400 pounds semicoke; 25 gallons tar ;3 gallons light oil scrubbed from the gas, and about 4000 cubic feet of surplus gas with a calorific value of 540 b.t.u's. per cubic foot.

THERMOLIZED COAL PROCESS. The heat treatment of coal by the process originated by the Thermolized Coal Corporation of New York, is somewhat similar to the McEwen-Runge process in that the coal is reduced to one-eighth inch granules, heated with furnace gases in a rotary retort by externally applied heat, so as to raise its temperature approximately to the temperature at which decomposition of its substance takes place usually between 400° F. and varying with different coals. With this treatment the total loss of heat value is ordinarily less than 1%. The friability of the coal is increased from 30 to 50% and its structure is expanded from 15 to 30%, materially aiding in its pulverization and suspensive quanity when pulverized.

The necessity for the production of these alterations in coal and the absorption of heat to bring them about is what occasions and constitutes the preliminary phase of combustion, during which smoke is produced and waste occurs. A specially designed feeder is used in delivering it to, and suspending the processed coal in, the fire box during its combustion.

GREENE-LAUCKS PROCESS. The Greene-Laucks process is controlled by the Old Ben Coal Corp. of Chicago and a semi-commercial plant was built at Waukeegan, Ill. This process be-

longs to the class of vertical retorts, externally heated with internal spiral conveyor.

The retort has undergone a number of modifications with respect to minor details but consists essentially of a cast iron shell 15 times longer than the diameter. Mounted centrally within this casing is a hollow shaft with a spiral web cast on its exterior. Each pair of retorts is fed from a common hopper by a screw conveyor which introduces the raw coal at the bottom of the retort. The central core is mounted upon a thrust bearing at the bottom and is geared to rotate slowly so that the charge is forced upward by the motion and discharged at the top after carbonization. The speed of rotation varies from 1 to 3 revolutions per minute, depending upon the material being processed and upon the percentage of volatile matter which is permitted to remain in the coke. Each retort is mounted in a firebrick setting leaving a 4-inch heating flue surrounding the metal shell.

The sticking of the charge to the rotor is prevented by heating the interior walls of the shaft by gas burners.

This process is designed primarily to produce domestic fuel from low grade bituminous coal screenings.

The average yield of products per ton of coal was 1400 pounds semicoke; 35 gallons of tar; 4000 cu. feet of gas and 12 pounds ammonium sulphate.

About half of the gas, which has a calorific value of 700 b.t.u's. per cubic foot, is required for heating the retort.

In a letter received from Mr. Greene, one of the inventors of the process, he says: "Old Ben Corporation considers this process fully developed and ready for commercial use when the time is ripe in the coal industry at the mines (which may be some time hence.) However, should it seem to you that there is a present demand for such fuel in your region ,we should be glad to confer with you or interested parties.

In welded design, the G. L. P. retorts can be erected for about $30,000 for 100 ton daily output. This process is well adapted for use with lignite."

CARBOCOAL—MCINTIRE PROCESS. The carbocoal process was developed in 1918 by the International Coal Products Co. and under the financial support of the U. S. Government. A large

plant with a daily capacity of 575 tons of raw coal was erected at Clinchfield, Va., by the Clinchfield Carbo Coal Co., but operating difficulties, together with changing economic conditions, made it necessary to discontinue the plant in 1922. The patent rights were acquired by the Consolidated Coal Products Co., which further developed and greatly improved the process and have erected a plant at Fairmount, West Virginia. The Carbo coal process is a multistage system involving primary carbonization, briquetting of the char or coke, and the secondary carbonization of the briquettes to make smokeless fuel.

In practice, the primary retort is charged with crushed coal by means of a screw conveyor and two cast-steel shafts, equipped with revolving paddles serve to transport the charge to the delivery end and stir the coal during coking to facilitate the escape of the volatile products. Heat is applied externally to the retort in the process of carbonization and a temperature of 760° C. and about three and a half hours time is required for distillation.

When completely carbonized the semicoke is pushed into a discharge chute, at the bottom of which a crusher reduces the coke to fine particles. These are carried by means of a spiral extractor through a water seal to a continuous conveyor that delivers the hot crushed coke to a mixer where hot pitch is incorporated. Finally the mass is run through a roll press which turns out a hard, dense briquette. These briquettes are suitable for fuel purposes but are not smokeless on account of the pitch binder. To insure smokeless fuel further treatment of the briquettes is necessary.

The secondary retort is charged with the raw briquettes at the upper end and the inclined horizontal position of the oven for this purpose is for easy charge and discharge. A horizontal partition divides the retort into two chambers in order to reduce the crushing pressure until the briquettes are thoroughly hardened by heat. The secondary retort is operated at a temperature of 650° C. and approximately eight hours are required for distillation. The gases are removed from the crown of the oven.

The finished briquettes are delivered as a hard, silvery product, reduced through shrinkage about 25%.

The improvements now made by McIntire to the secondary retort are said to consist of five superimposed horizontal retorts into which the briquettes are charged on trays by special machinery, which minimizes breakage and results in better carbonization. Eight to ten per cent volatile matter is allowed to remain in the finished product.

Yields obtained by this process from Pittsburgh coal were: 1480 lbs. smokeless fuel; 31 gallons tar; 2 gallons light oil; 3000 cu. ft. gas of 950 b. t. u's and 10 lbs. ammonium sulphate, from each ton of raw coal.

Carbocite Process. C. B. Wisner, the inventor of this process, interested the American Gas & Electric Corp. in the economic possibilities of the process in connection with central power generating plants, and in 1927, a subsidiary, the Ohio Power Co., erected a semi-commercial unit which is successfully operating now at Philo, Ohio.

The carbocite process consists essentially of the continuous treatment of coal slack or crushed coal in horizontal rotary furnaces, the raw coal being charged into a bunker over the oven, and then automatically conveyed into the carbonizing furnace, where it is heated for 8 hours at a temperature of 500°—600° C. by producer gas made from coal in a generator alongside the oven. The lower part of the chamber is not heated, but serves as a cooler for the descending carbonized material which is discharged intermittently. The coke leaves the carbonizer through a rotary extractor designed to minimize gas leakage.

The final product is globular in form, size being controlled by the rate of drying and heating, is fairly dense in structure, contains 12 to 14% volatile matter, and is of excellent burning quality. The coke fines are used for boiler fuel and the larger sizes are sorted by screening for domestic consumption. No briquetting is attempted.

The carbocite process is used for sub-bituminous coals in Switzerland. The primary aim in that country is not to obtain the volatile by-products but to effect their removal and combustion and to recover the char for domestic fuel with high density and high volatile content. Three tons raw coal are required to produce one ton carbocite.

The gas is low in quantity, but of high heat value. The tar is a good wood preservative. A favorably located plant of this kind utilizing lignite as raw product might eventually form a nucleus for important industrial developments in Louisiana or Texas.

Bitumenoil Process. The Bitumenoil Process of the International Bitumenoil Corp. was developed by J. A. Vandegrift of New York in 1927 and plants are in operation in Tennessee and in England on a commercial scale.

The distillation unit consists of an inclined rotating, tubular retort and the procedure is to carbonize the charge at uniform temperature; to apply treatment for preventing agglomeration in the fines and slacks of bituminous coal particles; the accurate zoning of the heat in separate furnace compartments along the tubular retort, together with varied methods of withdrawing vapors; introducing gases; feeding and discharging material; condensing the volatile products; air sealing and other features which produce distinctive results.

In the treatment of coal, less than 2000 cubic feet per ton of the high b.t.u. gas is used in retorting, the surplus being available for sale or power generation.

The heat zoning is regulated to reduce the volatile content of the coke to 8%, the product being smokeless fuel comparable to anthracite.

With a regulated temperature of 300—600° C., recovery of 49 gallons of tar with relatively a small pitch fraction, and 5200 cubic feet of gas per ton is possible. The oil vapors released in the maximum heat zone are immediately withdrawn by light suction without any secondary decomposition. The continuous process at atmospheric pressure makes it possible to recover this high quality tar and high b.t.u. gas and using only hot inert gases for the distillation of the fuel.

By converting most of the volatiles of coal into salable by-products, a central power plant may generate electric power cheaply from the semicoke residue obtained at little cost, as the sale of the by-products covers the cost of raw coal and processing.

Piron-Caracristi Process. The Piron-Caracristi process is in the class of internally heated retorts and the carbonization is

effected by means of molten lead. It consists essentially of a long horizontal tunnel kiln through which the fuel is transported in thin layers by an endless conveyor. Two units of this design, each with a daily throughput of 50 tons of raw coal, were erected by the Ford Motor Co., one at the River Rouge plant and one in Canada at the Walkerville plant. Both of these installations, however, were dismantled because of operating difficulties which have now been overcome.

The distillation chamber consists of an arched brick tunnel 47 feet long, 14 feet wide and 6½ feet high, the floor of which is formed of molten lead which is maintained in the fluid state by the heating flues, gas fired and built into the firebrick setting alongside the distillation chamber so that the hot gases can be drawn through the transverse cast iron flues to keep the lead at the required temperature.

The crushed raw coal is fed in thin layers to the apron conveyor and is carbonized in about 5 minutes, which is the time it takes to pass through the distillation chamber. The entire heat for carbonization is transmitted by metallic conduction from the molten lead, kept at a temperature of 650° C. At the rear end of the retort the coke falls in slabs upon the return conveyor, on which it is cooled during the return passage through the lower tunnel before being discharged.

The results obtained by this process, using coal containing 38% volatile matter, were 1425 lbs. semicoke; 26 gallons of tar, and 4000 cu. ft. of gas of 800 b.t.u.'s calorific value. For firing the steam boilers the coke is pulverized.

The lead losses are very small and only mechanical. No lead is lost by oxidation and no difficulty is experienced in retaining the molten metal within a refractory structure. Having a low melting point and high boiling point, loss of vapor and congealing is prevented by the use of lead and thereby eliminating the necessity of close temperature regulation.

Trumble Process. This process was developed by M. J. Trumble of California in 1922, using the principle involved in pressure distillation of oil shale, and a plant is in operation at Green River, Wyoming. The process consists of the following cycle: The raw fuel passes from storage bins into thermostatic controlled pre-heating chambers, where it is dried. From

the pre-heaters the dried fuel is fed intermittently into the distillation apparatus. The charging and discharge gates to the retort are distinctive, being of the interrupted thread, artillery breech block type. These valves are of the same open diameter as the body of the retort and are insulated against excess heat action. The apparatus consists of a bank of retorts set in batteries of two, and each bank may consist of a number of batteries and interconnected so that any cycle may be maintained.

Steam from the primary boiler, after superheating to the necessary heat and pressure, passes through the first battery of retorts and from this battery the steam carrying the gases and vapors passes through an interstage oil separator before going back to the superheater. Stone Canyon coal, containing 5% sulphur and absolutely useless as a steam coal, yields by this process 61% of semi-coke of 14,300 b.t.u.'s.

By varying the temperature and pressure and by keeping down and as lean as possible the fixed gases and handling by hydrogenation at the proper point, this process gave for that useless coal: 1220 lbs. high grade smokeless fuel; 12½ gallons motor fuel; 10½ gallons lubricating oil; 6 lbs. creosote; 25 pounds ammonium sulphate and 82 lbs. sulphur per ton of coal.

A modification of this process is in operation in Tokyo, Japan.

Hayes Process. The Hayes process was originated at Moundsville, West Virginia, and is operated by the West Virginia Superfuel Co.

The carbonizing units consist of externally heated, horizontal, rotating cylinders for continuous operation and made of special alloy metal. The speed of revolution is 1½ times per minute.

The coal gas, tar vapors and steam generated are withdrawn from the coal feed end of the retorts through offtake pipes connecting with one tar main and then through standard condensing and gas washing equipment and tar settling tanks and reservoirs.

The char is discharged from each retort into a main collecting screw conveyor and thence transferred on to a quenching conveyor, where it is cooled by water sprays. The cooled char

is then transported to the grinder, which reduces it to the fineness required for the briquetting operation.

The coal processed is the slack produced by the Ben Franklin Coal Co. mining operations and which has a low market value and needs little crushing to put it in condition. The average yield per ton of coal slack by the Hayes process is: Semi-coke with 12% volatile matter, 1326 pounds; tar 30 gallons; gas of 800 b.t.u.'s, 5000 cubic feet, of which one-half is consumed in operation, and light oil, 2 gallons, scrubbed from the gas. The briquettes weigh 2½ ounces each and are formed in the Belgian type rolls with the aid of the pitch from the tar.

Sutcliffe-Evans Process. The Sutcliffe-Evans process, developed by the Pure Coal Briquettes Corporation of Leigh, England, is an internally heated, continuous vertical retort, the chief novelty of which resides in the preliminary preparation of the coal, particularly in superpressure briquetting before carbonization.

This process depends largely for its success upon the washing, blending and grinding of the raw material. The crushed coal is usually washed so that its ash content does not exceed 6%, it is then dried to less than 3% moisture and ground to pass a 30-mesh screen. Non-coking coal or coke breeze is next mixed with the charge in suitable proportions to prevent swelling of the briquettes during carbonization. The briquettes are formed in a special rotary press, subjected to a pressure of 20,000 lbs. per sq. inch without the use of a binder.

The Sutcliffe-Evans retort consists of a vertical steel cylinder lined with refractory and provided with a charging hopper at the top and discharge chamber at the bottom. The raw briquettes descend the carbonization shaft by gravity. Two regenerators are used in connection with the retort and part of the gas formed is burned in one of these regenerators to produce superheated steam, while the superheated steam mixed with another portion of the gas is circulated through the other regenerator until the mixture of steam and gas is intensely superheated. It is then led to the base of the carbonization shaft and introduced into the retort to carbonize the charge of briquettes. The mixture of volatile products and steam is removed by a gas offtake at the top of the retort.

With Lancashire coal and a distillation temperature of approximately 400° C., there was obtained per ton of briquettes, 1400 lbs. semi coke; 18 gals. of tar; 4 gals. light oil; 17,000 cu. ft. of 430 b.t.u. gas and 50 lbs. of ammonium sulphate.

The high yield of ammonia is remarkable. Approximately 9000 cu. ft. of the gas yield is required for heating the regenerators. The carbonized briquettes retain about 5% volatile matter and form a highly valuable smokeless fuel.

C. T. G. Process of the Chemisch-Technische Gesellschaft of Germany. The C. T. G. circular cell retort was designed for use with coal slack, and a large plant using this system is in operation on the Thames near London.

The coal slack is conveyed through pipes by means of compressed air from the pit head to the bunkers. From this point the coal is brought to the distributing bunker, which is centrally located on the upper platform of the furnace, and two spiral drives revolving with the shell take the coal from the distributing bunker and feed the two coal chutes equally and continuously under pressure to the several coking chambers. The heating of the coking chambers takes place by an internal system of heated gases being constantly circulated through the piping by a blower and reheated by the addition of hot combustion gases before re-entering the retort. Owing to the fact that the coal is tightly packed in the retort and at rest, during the procedure of the carbonization, while at the same time the operation is continuous, a coherent, lumpy coke is produced of about 90% of the density of the original coal. The finished coke is extracted from the chambers by means of scrapers and drop through the two coke chutes onto the conveyor wheel located in the lower part of the furnace until it finally reaches the coke discharge.

Owing to the central arrangement of the ducts for the heating gases, a high degree of thermal efficiency is attained.

The coke yield is dependent upon the extent to which devolatilization of the coal is carried. The ultimate consumer in the domestic market is better pleased with a product having a volatile content of 10—12%. Thus made, the yield is about 75% of the original coal weight. Gas from screenings is about 1000 cu. ft. per ton of a calorific value of 800 b.t.u.'s and the

tar yield is about 20 gals., of which 12% is light oils. The low temperature coke carries most of the nitrogen, but about 10 lbs. per ton of ammonium sulphate is the expected yield.

COALITE PROCESS. The Coalite process is based upon patents issued in 1890 to F. Parker, one of the pioneers in low temperature carbonization, and is controlled by the Low Temperature Carbonization Corporation of London.

The Coalite retorts are all stationary and externally heated and involve distillation of shallow layers of fuel within tubes. The temperature is maintained at about 650° C. for approximately 4½ hours for complete carbonization. The semicoke is finally rammed from the tubes and allowed to cool in the closed chamber beneath the retort until the next charge is ready for removal. The unique feature of the Coalite process is the mechanical device for facilitating the escape of the gas generated and the discharge of the semi-coke. Two perforated cast iron plates are connected by linkage and suspended within the carbonization chamber in a parallel position separating the charge of coal into two thin layers. The center of the retort is thus formed into a free space for the passage of the liberated gas during the coking and from which it is withdrawn at the top. When coking is complete, the linkage mechanism permits the plates to be collapsed so that even though much swelling has taken place in the charge, easy removal is facilitated.

A plant of this kind, erected near Barnsley, England, with a daily capacity of 50 tons, consists of 32 retorts, each composed of a single iron casting containing twelve vertical tubes.

Yields obtained by this process are about 1560 pounds semi-coke (of 10% volatile matter); tar 24 gallons; 15 pounds ammonium sulphate, and 6000 cu. ft. gas of 700 b.t.u.'s.

MACLAURIN PROCESS. The Maclaurin process is an internally heated process of the partial gasification type. It combines both the principles of low temperature carbonization and of the producer gas furnace.

A large plant of this type has been erected by the Dalmarnock Gas Works of Glasgow, Scotland.

The unit retort consists of a carbonizing shaft and gas producer built into a single setting with a connecting conduit, so

that the hot producer gas can be led directly into the bottom of the carbonizing chamber and into the layers of fresh coal which are distilled by the heat given off by the hot gas. The semi-coke is extracted at intervals from the bottom of the chamber, a portion of it being used to recharge the combustion chamber for the supply of producer gas.

It was subsequently found, however, that both operations could be conducted advantageously in a single chamber and that the ash from the partial gasification can be easily separated from the semi-coke.

A "V" shaped dividing wall extending across the retort just below the combustion zone divides the charge so that it can be withdrawn from two discharge doors at the bottom of the chamber. The mixture of producer and low temperature gas is withdrawn at the top of the retort, the metal cylinder being built with hollow walls to form an annular gas collecting chamber. The temperature in the retort ranges from about 900° C. in the combustion zone to about 70° C. at the top, the bulk of the volatile products, however, being removed at temperatures from 300° to 500° C.

The yields obtained with Grangemouth coal were: 1096 pounds semicoke; 19 gallons tar; 14 pounds ammonium sulphate and 27,000 cu. ft. of gas of 247 b.t.u.'s heating value.

Laing and Nielsen Process. This process, originally designed and controlled by Laing & Nielsen, is now owned by the Sensible Heat Distillation Corporation of London, and a plant of this type with a daily capacity of 100 tons is now in operation.

The "L. & N." process is designed for the use of superheated producer gas mixed with superheated steam as the heating medium. A portion of the producer gas is consumed in a superheater to raise the temperature of the heating gas to the required degree for carbonization, and a waste heat boiler surmounting the superheater, serves to generate steam for mixing with the heating gas.

Once the process is started, a portion of the gas evolved in the distillation may be drawn from the system and recirculated to replace the lower calorific producer gas, giving a final product of superior heating quality.

The retort is built of sheet steel and is lined heavily with refractory to protect the metal from the influence of hot gases introduced at the lower end of the cylinder to secure the benefit of counter current heating.

The retort is mounted upon rollers at each end and in the center, being tilted at a slight angle so that the combined action of rotation and inclination causes the charge to travel through the retort. Near the discharge end there is an annular cooling chamber separated from the retort by a hand operated sliding valve. A second sliding door permits the cooled char to be extracted from the apparatus.

The average temperature of the heating gas as it enters the retorts is 750° C. About 2½ hours are required for the charge to pass through the kiln.

The yield obtained, using bituminous slack as fuel, was 1475 lbs. semicoke, of which 620 lbs. were consumed in the gas producer; 21 gals. of oil; 15 lbs. ammon. sulphate and 44,000 cu. ft. of gas, with a heating value of 230 b. t. u. per cu. ft.

ANTHRACINE PROCESS. The coal slack produced at the mines at Vicoigne, France, is compressed into ovoid briquettes with the aid of pitch binder and these briquettes are then treated in a series of static retorts, progressively and systematically with steam superheated to a final temperature of 650° C. for the production of synthetic anthracite, or anthracine, as the finished product is called.

The entire operation, outside of briquetting, is conducted with the aid of superheated steam. Steam was chosen by preference as the heating fluid because it does not react on the coal at the temperatures used, has a high specific heat and it can be separated easily and completely from the volatile products which are carried off with it.

The apparent lack of heating efficiency of such a plant is overcome by the production of electric power in turbines driven by the expansion of high pressure steam, which is then again passed into special superheaters before entering the final carbonization apparatus.

The novelty of the process is in the method of heating of the retorts. This is done in four phases, the last phase being marked by the reversal of the direction of circulation of the

steam and during which the charge meets steam coming directly from the superheater which finishes the carbonization. The carbonized briquettes are cooled by the steam which has given up its heat in passing through the first carbonizing phase and are finally discharged by being run into vats of water. They are then loaded directly into delivery cars. The gas obtained by this process is of high heating power; the tar is light and oily, with a 23% phenol content and is worked up so as to recover its various constituents. The briquettes are good synthetic anthracite fuel and readily salable at a profit.

Trenthracite Process. The method of procedure in the manufacture of artificial anthracite fuel as practised by the French Purified Combustibles Company at Lapugnoy, differs radically from the processes sketched previously in that it embraces several features of the Trent process originated in the United States for the utilization of the New England graphitic coals.

The operation as conducted at Lapugnoy takes place in three stages and the raw material is a mixture of coal from various sources and received in the form of an ashy slack and of very low grade. These fine coals must be put through an initial purification or reduction of the ash content by selective washing with water in contact with crude oils or tars and with the aid of grinders, screeners, amalgamators and dryers. The oil used for purification serves as the binder for the agglomerated mass or putty, and is nearly all recovered in the distillation which follows.

The amalgam is put through a hydraulic press and made into briquettes, which constitutes the second stage of the process.

The third stage is the distillation of the dry briquettes. The distillation furnace is composed of four cylindrical chambers of sheet steel and connected with an independent superheater by pipes permitting the circulation of steam by means of turbo superchargers in the following manner: First, superheater; chamber 3; chamber 2; chamber 1; cooler; tar recovery apparatus; turbo supercharger and back to the superheater. The distillation is performed by superheated steam at 650° C.

The formed briquettes are loaded into cylindrical receptacles of perforated steel, the size corresponding to that of the

furnace chambers. The bottoms of the chambers are capable of being opened to permit removal of the cylinders of briquettes into cavities to prevent loss of heat in transfer from one chamber to another in the course of distillation and in the sequence named. Controlling and locking devices are provided in order that the operation of the rolling frame work and of the jacks takes place in the order desired and that the circulation of steam may be shut off and shifted while the chambers are open. The total duration of the simultaneous charging and drawing off operation is less than two minutes and the losses by convection and combustion are quite negligible. The distilled fuel comes out of the chamber sufficiently cooled to be loaded on cars. Each cylinder remains the same length of time in each of the chambers (about one hour); (3 hours heating, one hour cooling). The finished fuel is a very hard and compact semi-coke, uniform in size and free burning, with a volatile content of 7 to 10% and ash, 5%. The yield is satisfactory from an economic standpoint and the product is readily salable for household fuel.

The tar and oils recovered in the distillation are used in the operation of heating and power production for briquetting.

Trent Process. The Trent process has been invented and developed by Walter E. Trent of Boston for the manufacture of superfuel from the high ash graphitic coals of Massachusetts and Rhode Island.

A review of the important steps in the process as it is now being worked commercially was obtained from Dr. Arthur D. Little of Cambridge and is essentially as follows: The coal is given a preliminary coarse crushing to reduce it to a size suitable for milling. It then passes to a rod mill, where it is ground with water in the same way that ores are ground. The fineness of grinding depends upon the kind of coal to be treated, and particularly upon the nature of its ash. It was found that the highly graphitic coals require fine grinding which enables us to reduce the ash from 35% to 10% or lower. The suitably ground coal passes to the amalgamator, which is a long box equipped with baffle partitions and paddles to give violent agitation, with the addition of two or three parts of water per unit of coal. Low gravity, asphalt base, fuel oil in the propor-

tion of one barrel of oil per ton of coal is fed into the stream of ground material entering the amalgamator and in passing through, forms the coal into globules about the size of green peas, caller "caviar." This is a phenomenon of selective wetting, in which the water more readily wets the ash and the oil more readily takes the coal. The result is a clean separation of the two, the ash passing off with the amalgamating water. The caviar is removed on a continuous screen and after a short period of draining, goes to an extruding machine similar to a continuous brick making machine, where the putty-like amalgam of coal and oil is forced out in sausage form through a die, and cut off into small discs by a rotating wire cutter. The discs then pass through a revolving tumbling barrel, where all sharp edges and corners are eliminated. Trays, upon which the briquettes are distributed, pass through a baking oven heated to 250°—300° C. for about eight hours, which reduces the volatile matter of the fuel to about 10% and permits of the recovery of 35 to 50% of the original oil added and which is used over again in the process. The briquettes are in the form of hard, high grade smokeless domestic fuel. Coals, which are practically incombustible in their natural state, when made into briquettes by the Trent process, burn with an even glow, throwing out large quantities of radiant heat and can be made to last twenty-four hours without attention. The Osborn Development Co. of Rhode Island has erected a large plant for manufacturing this fuel. Samples of the various stages in the process were generously donated by Dr. Little, the consulting engineer and chemist of the company. Neither gas nor tar are produced from the raw material used, and hence are not taken into consideration.

Lurgi Process for Lignites. The procedure of the distillation of lignite differs from that of the coking of bituminous coal ,due to its characteristic property of having a moisture content of 15 to 50 per cent, in retaining its original structure and of shrinking and disintegrating into smaller particles in the process of carbonization.

The distinctive features of the Lurgi process are: the predrying of the charge; heating by hot gas currents produced outside the furnace and blown through the bulk of fuel under-

going treatment; economy of heat in the use of fire brick construction instead of metal retorts, and in the utilization of the entire yield of gas in the operation of the process.

In practise the pre-dryer is charged with raw lignite automatically from a bin above the furnace and the drying is effected by the circulation of gases at a temperature of 250° C. until all moisture is removed.

From the dryer the fuel falls by gravity into the big single stage carbonizing furnace of firebrick, where the distillation is completed at a temperature of 550°—750° C. The lower portion of the furnace is unheated and permits the char to cool before removing by a sliding device, after which it is conveyed to storage. The gas coming from the carbonizer is led through a Cottrell electric tar condensor. The yield of product per ton from raw lignite by the Lurgi process is as follows. Char, 800 lbs.; tar, 6 gallons; ammonium sulphate, 15 lbs., and about 4000 cu. ft. of gas, all of which is consumed in the operation.

The char is of high calorific power and is very desirable fuel for domestic and industrial purposes. For use as a household fuel the carbonized lignite is formed into briquettes with pitch from the tar used as binder. The fuel, however, is not entirely smokeless, but withstands shipment and weathering, ignites easily and does not slack in the fire.

Owing to its high porosity and reactivity, the char is a valuable raw material for chemical purposes. It absorbs 145 volumes of chlorine gas and may be used as a catalyzer for chlorinating methane or natural gas yielding carbon tetrachloride and other products. As a filler for gas masks it is very effective.

Carbonized lignite specially treated yields an activated carbon which has properties similar to boneblack as decolorizing agent in the sugar, syrup and chemical industry. A large plant at Marshall, Texas, makes the product called "Darco," which is more efficient than boneblack in sugar and oil refineries and has the essentials of hardness and density and can be revivified a number of times.

In German producer gas practices, by the Winkler system, it was observed that the hydrogen production with lignite char at temperatures of 600—600° C., follows the equation:

$$C+2H_2O=CO_2+2H_2$$

producing twice as much hydrogen as the reaction with ordinary coke, viz:

$$C+H_2O=CO+H_2.$$

Lignite tar consists mainly of hydrocarbons of the aliphatic series. From the presence of sulphur compounds, it has a disagreeable odor. Its average composition is:

Light oil	7%
Lubricating oils	33%
Paraffins	5%
Phenols and cresols	11%
Pitch	30%

With suitable fractionation it may be used for motor and lubricating oils, for timber preservation, and the pitch for paving, water proofing, insulation and as a binder for briquettes.

A large plant for the treatment of lignite by the Lurgi process is now operating at Lehigh, North Dakota. This process utilizes the fine coal slack as fuel for the power plant, and the clean large pieces being used for the production of a high grade char. The finely ground char is the base of the briquettes which are sold for domestic fuel and for which the market is unlimited in the Northwest.

Lignite in Louisiana has long been recognized as a potential asset of great promise. Large areas could be mined by the open cut method after removal of the surface layers. So far, no efforts have been made for its utilization, but it is safe to predict that on the basis of its scientific treatment, a big industrial development is bound to take place in the future in the production of available energy for electrical power and for use in chemical industry.

Conclusion. That a great demand exists for anthracite substitutes that are cheap, that are clean in handling, that will eradicate the civil nuisance of smoke, ignite easily, burn freely in open grates and stoves, and that radiate an abundance of heat, there is no disputing. Under such an impetus, the course

that lies ahead is towards continual progress in the production of patent fuels to meet this need.

The economics of the situation will, naturally, control the development of specific methods of processing coal, since the products must be worth more than the raw coal plus cost of processing, and profit must come from the change in form value.

No interpretation of the future can be premised on a sound basis which fails to include the study of the potentiality of the low temperature carbonization processes in the production of smokeless fuels, as the results so far attained in apparatus of demonstrated efficiency and durability, indicate that it is profitable to conduct the industry here and in foreign countries with present prices of recoverable products.

The new fuel technology as revealed by the scientists at the recent International Coal Conference, will draw to the coal fields new industries which were not thought of a generation ago, through the conversion of the immense available amount of cheap slack and screenings and the utilization of our latent lignite resources to high grade domestic and boiler fuel.

Processes now in the developmental stages are certain in the future to take an assured and important place in industry, the ultimate scope of which it is idle to predict.

WOLMANIZED LUMBER

By JOHN G. KREER

Read before the Society, June 9, 1930.

Evidence of more or less successful attempts to protect timber from decay has come down to us from remote antiquity. As an organized industry it has existed for more than one hundred years; but wood preservation as a science is just a recent arrival that has originated in the present generation. Its pioneers are active amongst us yet, its principles are still pliant and only beginning to be translated into technical application.

Less than thirty years ago Hartig and Tubeuf revealed, as the result of investigations as brilliant as they were painstaking and thorough, the real nature and cause of decay in wood. The spread of this knowledge has been curiously slow in finding its way into the convictions of practical users of forest products. Even now there are a great many otherwise well informed operators and designers that have to do with timber who look upon decay as an inherent property of wood that unfortunately has to be reckoned with, instead of as an infection, like many of the diseases from which mankind suffers, which can be guarded against by preventive or preservative treatment. But at the beginning of the 20th century this new knowledge of what caused rot and how it worked at once attracted attention amongst research men and opened the way to experimental work to find suitable means of correction.

Another helpful step was taken when standard methods were evolved for measuring the normal progress of decay and the rate at which protective measures checked or prevented the destructive growths. After many years of patient observation these have been checked sufficiently against field experience so that we can use them to reliably forcast the results to be expected over periods of years from the showing of accelerated tests made in the course of a dozen weeks in the laboratories.

Like all laboratory work, a fine precision of method, correctness of observation and a sound genius for interpretation are required to lead us to true progress and guard us from

pitfalls. There is a heavy penalty exacted from the user to pay for errors of judgment in the wood preserving industry, since so long a time element enters into most applications before a buyer can have any knowledge of what measure of protection he has really secured. This is specially the cast when claims are presented for some radically new principle that is so different in operating mechanism that there has been no opportunity for what we might call the calibration of the means used for measurements. I do not mean to imply that laboratory evidence can not ever be accepted, but that when a very novel principle is involved it is of the utmost importance to have all the basic data checked and confirmed by unbiased investigations before accepting them as conclusive.

The most successful material used in preservative treatment heretofore has been the distillate of coal tar known as creosote. The tar is a by-product of the coke ovens that have been erected in ever increasing numbers to serve the steel industry. All through that period of expansion there seemed to be assurance of an endless and unlimited stream of this by-product to replenish the content of the tar-pot, no matter how much we might find use for what we had learned to take out of it.

However, the unquestioned success of preservative treatment of timber, as the substantial economies attained came to be recognized, in the course of time increased the demand to such an unexpected volume that it has become evident the industry will ultimately have to look for additional sources of supply of preservative material. Then too the need for treated lumber in applications for which creosote was not wholly suited, has in recent years become more and more pressing.

The astounding story of the modern chemist dipping his finger into the tar pot and pulling out of its sticky messiness the thousands of useful things that have become so essential to modern ways of living, a tale more potent than any of Aladdin's magic lamp, has been so often told it needs no repetition; but it may be worth noting that that finger is still dipping in, finding new wonders to be taken out of tar and increasing the demands upon what may before long turn out to be a dwindling supply.

These were among the factors that led far-seeing men here and there to take up the task of seeking for the right material or combination of materials that would effectively supplement the use of creosote in wood preservation. In some ways it is an unpromising field of effort, with high hazard of its proving to be a lifetime of thankless labor. Ten or twelve years of service experience are required to establish confidence in the dependability of a preservative even after years of patient research and experimental investigation have given hopeful indications of a valuable discovery. Nevertheless these isolated men in the outposts of the battleground against destructive fungi struggled on like the Hunger Fighters Paul de Kruif tells us about, who vanquished the smut on our wheat, overcame the insidious evils that threatened ruin to our corn crops, and routed the dreadful hoof and mouth disease from amongst our herds.

One of these quiet persistent workers was enlisted when as a young Heidelberg chemistry graduate Karl Heinrich Wolman (now a Dr.-Ing. *honoris causa*, in grateful recognition of the great service done for the German people by his development of the art of wood preservation) was commissioned to solve the baffling problem of finding a way to care for the timbering used in the deep damp warm passageways of the Silesian coal mines. Two thousand feet down in the earth, with temperatures constantly hovering about the optimum for fungus growth, the air always heavy with moisture and kept in movement sufficiently to insure prompt distribution of the infecting spores from the fruiting bodies of one decaying piece to every new prop or collar or set of lagging installed, these mines were like incubators for fungi. Untreated wood of any kind is destroyed within less than a year in the worst spots and an average service life of about two years.

Mining conditions inhibited the use of creosote; the movements of moisture laden air caused any hygroscopic salt like zinc chloride to leach very rapidly. The amount of zinc salt that can be securely fixed upon cellulose fibres is too low a percentage for the remainder to be able to even seriously check fungus growth. One after another all the different chemicals have been tried, sulphates and sulphides, silicates, fluorides and

silico-fluorides, salts of copper, iron, lead and mercury; while the waste products of every chemical industry that suggested a possible source of cheap material were included in the tests. Slowly, from the observation of failures as well as of successes, from experiences now good, now distressingly bad, certain rather definitely settled principles have been established that serve to guide us along the path of progress. The advance is being made against the hampering hostility of prejudice, struggling against indifference for each step ahead. But step by step we are forging ahead, telling men how to protect timber structures from premature destruction by decay fungi or by wood consuming insects and to some degree lessening the hazard of fire.

While polemic discussions still continue to rumble concerning nearly every phase of the subject, the following considerations seem to be powerfully supported by both laboratory and field observations:

1. Toxicity, the measured rate at which a preservative is effective to prevent growth or to kill an organism, is a primary requirement, but not an exclusive one.

2. To be toxic a preservative must be soluble in the digestive fluids or secretions of the fungi, and it is very probable that it must be water-soluble at least to the extent of the inhibiting percentage.

3. In view of the long time element involved, extreme stability both physical and chemical are indicated as being essential.

4. Fixation on the fibres of the treated wood, somewhat in the manner in which fast colors are produced in the dye industry, is an essential element for permanence of the protective value of a preservative.

5. Different kinds of fungi react to any specific toxic material within such a wide range of inhibiting value and with the maxima and mimima so variously placed that it seems unlikely that any one chemical but rather a prudently chosen mixture will be found best. This is further recommended by the well-established fact that in many mixtures, for instance such as sodium fluoride with dinitrophenol the toxic value of the combination is not merely additive, but often 2

or 3 times as great as the sum of the ingredients would call for.

6. Technical considerations such as paintability, freedom from odor and from any possibility of exudation, must be taken into account. Cost, or the commercially available price at which preservative treatment can be secured, enters into the problem, and must be carefully distinguished from mere cheapness by weight unit of the preservative. Thus a preservative costing say 6 cents a pound, of which 0.25% is required to prevent fungus growth, is evidently much more expensive than one at 30 cents a pound of which only 0.025% is needed to exercise the same deterrent effect upon growth of fungus. If a net retention of 1 pound of the former salt per cubic foot of wood is considered sufficient protection, then only 1/10 of a pound of the latter would be needed for an equivalent service and the real ratio of price would be 2 to 1 in favor of the highly toxic material, while in cheapness there is a delusive advantage of 5 to 1 for the low toxic material. If, as often happens, a relatively larger quantity of the higher toxic material is recommended and specified, due regard must be had for the far greater assurance of permanent protection when the comparison of cost is made.

About 1904 the peculiarly valuable properties of dinitophenol as a toxin began to attract attention. Dr. Falck's determination of its high rating was followed by the Wolman discovery of its peculiar enhancement of toxicity when mixed with fluorides. Wolman further discovered how to neutralize its acid reaction upon metals, contact with which in the case of dinitrophenol alone not only corroded the metal but destroyed the efficacy as a preservative of a corresponding and very considerable quantity of the salt.

Within a few years the Wolman Salts under the trade names Triolith and Tanalith or when fire-retardent salts were added as Minolith or Basilith had come into extensive use. For example 95% of the mines of Germany use wolmanized timber. By 1914, with a ten year service record to support them, plans were being made to introduce Wolman Salts into the United States, when the World War broke out. War conditions and the post-war financial tangle continued to interfere, until finally

in 1923 the American rights were acquired by an organization of American interests that is now engaged in the manufacture and distribution of Wolman Salts in this country.

Now in the year 1914 there were treated with Wolman Salts for the German Government Railways a little more than one million sap pine cross ties which were installed in track during the early spring of 1915. A rigid guarantee of replacement in case of decay during a twelve year period after installation ran out in 1927 without the government having found cause for any claim whatever in the final or in any intermediate inspection of these ties. The last available report shows less than 5% of replacement and indicates an average service life quite as good as that with any other preservative. The specified quantity and the plants records of impregnation show in these ties a net retention of 0.225 pounds of dry salt per cubic foot of wood, somewhat more than the usual stanlard that had become customary for mine timbers, 1/6 pound per cubic foot, and slightly less than is generally used in this country. Performance records of wolmanized ties in the tracks of the Swiss and of the Norwegian Railways have been equally conclusive as to the substantial merit of Wolman Salts as preservatives of timber even in exposed locations.

Early in 1924 the first installation in the United States occurred, and in the summer of that year a most important step was taken when one of the great fruit companies operating in the sub-tropic lands of Central America began to operate its treating plants on Wolman Salts and to install the wolmanized lumber not only as cross ties and telegraph poles but also for all sorts of construction work, including houses and farm buildings as well as bridges and wharf decking. Twenty to twenty-five million feet of lumber have been put into service in Honduras, Nicaragua, Panama and Jamaica, the earliest lots now being in the sixth year of service exposed to the worst possible attack of rot fungi and of termites as well. The service has been closely checked against and compared with that of some eighteen years' experience with other preservatives. Treating operations have been difficult to control at times and always there is the threat of the quick attack by decay on lumber which is seasoning in the yards before treatment. But that

was equally true for other preservatives and it is probable that there was no difference in the effect of such incidental factors.

In all the extensive exposures of wolmanized lumber, there has been no case of termite attack found during the several thorough inspections that have been made, so that it is certain that there is a high degree of immunity against termites secured from the use of wolmanized lumber. This statement does not refer to any limited application but in all sorts of locations under all sorts of circumstances and for a great variety of service. There is an administration building where interior woodwork is kept fairly dry; but there is also a barn where it is very wet and where bacteria are present as well as the spores of fungi and the termites are at hand. There are miles of telegraph poles in dry places across the hills, but there are also miles of poles in swamps and inspection shows the latter to be in just as good shape as those in the dry locations.

There are wolmanized timber bridges over dry arroyos, some where the water level varies up and down on the wolmanized piling and some that are across rivers where there is water at all times. In the wet location, in the dry location, in the alternately wet and dry, wolmanized timber has made at least as good or a better record than that treated with other preservatives previously used.

It has been necessary to dwell somewhat on the mine timber and tie records of Europe on the score of long time service; and on Central American data because the great severity of the exposure there is demonstrably equal to a much longer exposure in our milder conditions. There are however some worth-while conclusions to be drawn from installations in the United States since 1924, even if it is too short a time to quote as service records.

Some of the finest mill buildings in the country have been erected with wolmanized lumber, and nearly everyone of the original customers has given repeat orders. In these buildings the under surface of the roofing is given the finest quality of mill white finish obtainable. There is at present being treated with Wolman Salts the roof lumber for the fifth successive

building of this character for this one company alone, which rather clearly establishes that this lumber takes and properly holds paint. It is of course essential for wolmanized lumber as it is for untreated lumber that it be dry before painting, for the bad effect of putting paint on wet lumber will be the same in either case. It might be noted that wolmanized lumber after treatment dries much more quickly and thoroughly than either of the other two salt treatments available commercially. Wolman Salts are non-hydroscopic and are applied in hot solutions under pressure in closed retorts.

When pressure is removed and the charge taken out of the retort, there is warmth enough to supply latent heat for evaporation of a good deal of the water used as a carrier to impregnate the salts so that it air dries more readily than would be possible with cold solutions.

Another interesting phase has been worked out in connection with the use of wolmanized lumber for bridges. In some quite important structures the possibility of preframing before treatment was considered and adopted with entire success. Every bit of the framing and boring of more than a million feet of lumber in the approach to the bridge across the Mississippi at South St. Louis was done at the plant so that no cuts would be necessary after treatment; and although there was a pretty complicated layout due to the compound of curve and slope, no trouble in putting up the timbers was experienced. In several other bridges for which the same procedure was followed the feasibility and economy of preframing has been demonstrated.

Besides the lessened fire hazard salt treatment offers quite an advantage in the very small addition made to the weight of the lumber, 20 to 30 lbs. per M board feet instead of 1000 lbs. for oil treatment. Especially in the case of bascule bridges where any weight in the span has to be counterbalanced with a correspondingly greater weight, which also has to be carried on the trunnions and supporting frames, and for which any material change in weight of span necessitates a change in the counterbalance, the salt treatment offers decided advantages. In a moderately large bascule span there will be 40 to 50 M bd. ft. of lumber in the floor and sidewalk system. Oil treatment adds

40,000 to 50,000 lbs. of extra weight for which with leverage ratios of 3 to 1 there would be 120,000 to 150,000 pounds of counterbalance weight. Now in the course of a year or two when moisture absorbed during wet spells emulsifies with some of the oil, dissolves other soluble parts and then during evaporation as it dries carries off the volatile ingredients, there may be a gradual loss of a considerable part of this weight. To meet this the counterbalance has sections made that can be removed as required. Salt treatment of a net retention of ¼ to ⅜ pounds of dry salt adds only 20 to 30 pounds per M ft. of lumber; total for the 40 to 50 M ft. being only 800 to 1500 pounds and no future adjustment necessary.

Whenever there is discussion of treated lumber, the query is always made as to whether it fireproofs the wood. While I am inclined to believe that the losses caused by decay and termite destruction far exceed those that would be preventable even by fireproofing all lumber in our structures quite effectively, yet the interest in fire prevention is certainly dominant. Now there is a distinct effect of fire retardation in the ordinary salt treatment. Both inflammability and combustibility are lessened, but there is nothing like a fireproofing. The retardation is such as to insure against a rapid spread of fire from moderate exposure such as the burning of an accumulation of paper ignited by a cigarette or the burning off of insulation from short circuited wres. Numerous tests and not a few cases of practical experience in service have proved that there is a beneficial effect, but to secure substantial fireproofing a supplementary treatment that is much more expensive than prevention of decay or insect attack is required. While the cost of the latter is of the order of $20.00 per M bd. ft., fireproofing cannot be expected in the present state of the art for much less than $75.00 to $80.00.

How serious is the menace of destruction by termites. I have listened to expressions from men apparently equally qualified to judge that range all the way from "pooh, pooh! nothing to it!", to solemn warnings that it is already a frightful plague, growing worse day by day, jeopardizing every building that carries load on timber members.

My own observations have convinced me that it is a widely prevalent infection and can bring about in particular cases quite serious damage before it is detected in a building. I have read a good many didactic publications about termites but in hundreds of cases I have seen, there has been a lot of variance in behavior different from what they were supposed to do. I doubt if any set formula can be made up to cover all cases so as to provide a sure cure by any routine procedure when existing buildings have been attacked.

It does seem to me however that in most instances the habitat of the colony is well out in the ground from the building. When the ground connection has been made impassable to the workers of the termite colony by thorough drenching of all surfaces going down into the ground with a hot water solution of the Wolman Salt Tanalith, there has been immediate cessation of termite activity within the building in every case within my knowledge, and there have been a good many such cases. From Kansas City, where this method has been extensively used for the past three years after a very severe attack in 1926 and 1927, I am informed that it has not only been generally effective, but, somewhat surprisingly, there have been no recurrences after the one treatment even in this the third subsequent season. Now at any rate this is a simple and inexpensive first step that may be tried if any of you face such a condition. We have been too preoccupied with our tasks in connection with the preparation of treated lumber for the construction of new buildings to give this curative treatment the careful study necessary to deal with it as authorities. All we can do at present is to point to many instances in which Tanalith has put an end to termite infestation in residences, and a few sphoradic cases of larger buildings. A couple of years ago the rumor reached me that buildings constructed of Wolmanized Lumber to prevent termite attack were curiously free from other vermin as well. In this direction too, I have been too preoccupied to gather really conclusive data, although a few simple experiments in places where I managed to locate bedbugs and roaches seem to bear out the probability of their being such an effect. One further item on which just a little more experimental work

was done has been in the spraying of chicken coops and roosts with Tanalith to drive away lice and mites, with excellent success in every case.

Dr. Wolman has informed me that in both Hamburg and Bremen harbors it has become regular practice to scatter dry Tanalith under the floors of the great warehouses, especially those handling foodstuffs, to provide a check upon vermin infestations.

Can wolmanized lumber be readily procured, and how should it be specified?

There is a treating plant admirably equipped for the purpose right here in New Orleans. Another at Texarkana, and others at points from which any locality can be served. Orders will be executed readily and promptly for any desired quantity for rail or truck delivery. Specify lumber to be treated by full cell process with at least 12½ lbs. impregnation of treating solution or to refusal at 125 pounds pressure, after preparatory vacuum and submergence under vacuum; concentration of solutions of the Wolman Salt Tanalith in water at a temperature of 140° F. (which may be brought up during pressure period to 180° F.) being so proportioned as to leave a net retention of 0.25 lbs. of dry salt per actual cubic foot of wood. This retention may be increased to 0.375 lbs. for special cases where an exceptionally high class treatment for any reason is deemed to be desirable.

This is a simple form of specification that will, generally speaking, insure you a good job. There are various refinements that can be included in specification writing if your job is important enough for you to provide a real inspection service. The proper seasoning of timber, whether by air drying or artificially by steaming in the retort so that it will take treatment well, may be covered by usual standard forms. If there are large quantities of different kinds of wood they should be kept separate and not be permitted in the same charge in the retort.

While the full cell refusal treatment specified will give the deepest attainable penetration, it may be of interest to test the penetration secured. This may be done with the alizarin sul-

phonate reagent for fluorides, suggested by the Forest Products Laboratory or with the Iron-Cyanide reagent. The former stains untreated wood a blood-red color, but a vivid yellow where Wolman Salts are present. The latter gives a reddish-brown stain to untreated wood, colorless where Wolman Salts are present. A cross section cut from a treated test piece may be employed, or the core taken from an increment borer when heavy timbers or poles are to be tested.

Orders for treated lumber should be placed as long in advance as possible and after impregnation the material put up in open well-aired piles at the treating plant or at building site, to permit drying down to normal air-dry moisture content before use. This is essential when the shrinkage due to drying after installation would be harmful. When treated lumber is to be painted the drying must proceed to the upper range of air-dry lumber before paint is applied. This may be permitted to take place in part after installation if the structure is such that there will actually be drying out from the position occupied.

Where should treated lumber be used? As to protection against decay, the determining factor is moisture. The temperature-growth curve varies for different species of fungi, but for all of them is a gradual nearly straight line increase from about 38° F. to 88°-96°, with a sharply rounded drop beyond that back to zero. Moisture-growth curves however are nil up to about 60 or 70 per cent saturation of the air in the growing spaces when it shoots up to full vigor and remains constant until precipitation occurs. During dry spells growth ceases abruptly as relative humidity goes below the 60%, to be resumed when the moisture again increases beyond that critical point. Infecting spores are so generally present everywhere that rot is almost sure to occur wherever conditions bring about continuous or frequent stages of interior moisture over the limiting minimum. It is sound economy to use wolmanized lumber wherever this may occur. For termite protection all the lower courses of the building should be treated, sills, posts under the first floor, first floor joists, porch material and perhaps the studs, as the subterranean termite follows the grain

of the wood with his borings. I have tried to arrive at some decision as to what to recommend by visiting a great many infected houses here in New Orleans during the past few weeks, but the further I go the more confused I become by the frequent cases of erratic behavior I meet. While I have seen the comejans in the tropics climb 35 feet up creosoted poles with their runways and out the creosoted arms to get at and eat up the untreated insulator pins, they do not seem to be quite as enterprising as that here in New Orleans. I have seen the runways emerge on the inner face of a concrete basement wall and branch up five or six feet of concrete then across a creosoted sill to enter the studding above. And I have seen their runways emerge from a pine post where a sap corner ran out and continue up on the outside of the pitchy heart wood until they came to sapwood again or less pitchy portions, where they reentered only to reappear with another two feet or runway a little higher, finally reaching point or floor material within which they proceeded on their restructive errand. I can only plead that the evidence is too confusing for me and say I am sorry I cannot be more helpful, but you will have to use your own judgment as to where to leave off treated material to feel secure against termite depredation. The one sure thing is to treat it all.

I would like to have touched on the economic factors, the proper comparisons of replacement cost to the cost of insurance against the need of replacement. But those of you who would be interested undoubtedly have the data for such figures even more readily at hand than I have. Be honest with yourselves and your clients and make a reasonable assumption as to the hazard. If it is a definite risk, the treating cost of say $20 per M ft. of lumber is cheaper insurance by far, payable only once, than the annual charge for fire insurance, which no sensible man would omit, will capitalize to.

Many men have labored long to make this service available to you. All we can do is to lay the facts before you and hope you will appreciate the advantage there is to you to have timber that you can confidently incorporate into permanent struc-

tures that you wish to have endure, secure from the ravages of decay or of insect infections.

Discussion

MR. GALLAGHER: What has been the experience of treated lumber in marine water or salt water where badly infested with marine borers?

MR. KREER: There is a problem facing us in our efforts to prevent the destruction caused by marine borers distinctly different from that met with in the usual task of wood preservation. Termites and all the wood destroying fungi attack cellulose primarily as a food supply. It is digested by them and absorbed directly into the circulating system as their only source of nourishment. The marine borer however enters the wood primarily seeking a habitat. The principal food supply is found in the animalculae of the surface waters of the sea. The extensile palates of the Teredo and the feeding mechanism of the Limnoria clearly indicate this. While ingested bits of cellulose are reported as being found in their intestinal tracts, it is an incidental occurrence and such particles must have been subjected to a very thorough washing in sea water before being absorbed.

Unless toxic effects are produced by their skin absorption the prevention of attack by them upon wood must proceed along the line of providing a condition which mechanically interferes with their boring. That is one reason why none of the preservatives that have served us on shore have been wholly successful in marine service in salt water. Wolman Salts have been extensively used for piling in fresh water, where these borers do not have to be contended against, with entire success. Wolmanized piling has never been recommended for use in salt waters where Teredo or Limnoria are likely to occur.

MR. O'NEILL: What is the method and cost of material for treatment of foundations and piers under dwellings?

DR. KREER: The cost of plant treated lumber for the erection of new structures will be of the order of $20 per thousand board feet. It may be a little more or a little less, depending upon quantity and character of the lumber to be handled.

The cost of curative treatment for an existing building can not be stated in such terms. It is nearly all labor and depends upon the degree of accessibility to the foundations and other elements of the structure that make ground contacts or come near enough to ground for termites to reach by their runways.

The method of procedure is to drench all such surfaces from a point well above the ground line to the bottom, as well as the soil immediately in contact, with a concentrated solution of Tanalith.

If a small trough, with its bottom sloping towards the wall, be formed by tamping with a blunt chisel-pointed piece of board attached to a suitable handle, along the faces of the foundations and around all sides of post supports or anything else entering the ground, the solution can be poured into the trough from a watering can and will seep down to just where it is effective to prevent the workers from the colony headquarters in the earth down near ground water from passing into and out of the structure.

One pound of Tanalith makes three to four gallons of solution and you see that the cost of the material used is quite a small factor with such inexpensive solutions.

MR. BRASELMAN: Is Wolman Salts poisonous to termites, or is it just unpalatable? Also is it poisonous to handle?

DR. KREER: Tanalith is poisonous to termites but its remarkable efficacy is due rather to its powerful deterrent action, keeping the termites away from the treated wood. We have observed that wolmanized bridge timbers, poles and buildings in the tropics not only do not ever have termites in them, but that there are no runways on them such as are commonly seen on other treated timber. It appears to be something more than unpalatability; probably an odor that is repellent to them. While we do not notice any smell to wolmanized wood, the olefactory nerves of the insects are differently constituted from ours and they do experience something that warns them away, since it is quite evident that they do avoid Tanalith even when it is only present in very small quantity.

Wolman Salts would be poisonous to human beings if taken in certain quantity. But there is not any danger from the handling of the salts or of the treated materials. In Europe there are some 114 plants in operation with Wolman Salts, some of them continuously for 25 years, and in this country quite a number have been working several years with the salts without there ever having been any case of any sort of injury reported either from here or from there.

MR. DETARNOWSKY: I just want to say a few words in appreciation of Dr. Kreer's very interesting conference. As engineer for the Building Division of the City Engineer's Office, it might be of interest to you to know that for the past year we have been studying very carefully this question of termite infestation and that we are now considering the passage of an ordinance the purpose of which would be the prevention of termite infestation of new buildings. I recently completed an inspection of all the public schools of this city, and am now undertaking the inspection of all buildings in this city of a public and semi-public nature, in order to gather data which would show to what extent these pests are damaging our buildings. So far I find that about 60% of our public structures are infested, and the majority of them are comparatively new structures, which would indicate that termites attack dry kilned lumber in preference to air seasoned lumber found in older structures.

Considering the habits of the subterranean termites and their mode of colonizing, it is logical to consider a termite infested building as a public menace, as the swarms of winged termites can and do infest adjoining structures and often when carried by the wind do spread infection to a great distance; therefore, we consider that the property holders are not only entitled to whatever protection we can give them legally, but above all by giving them such information we may gather and which may help them to control and exterminate these pests. The proposed ordinance will have as one of its main objectives the control of such persons or firms engaged in the termite-proofing of structures and the methods and ingredients employed. In short we hope to make the Building Division something of a clearing house for information and advice. For this reason, I can assure

Dr. Kreer that I can gladly call the attention of the building fraternity to the merits of his products.

DR. KREER: All of us who are interested in Wolman Salts are grateful to Mr. de Tarnowsky for the assurances he gives and in turn beg to assure him that we shall extend the most sincere and earnest co-operation to the Building Division of the City Engineer's Office in their undertakings for the control of the termite attack in New Orleans. There is nothing secret or hidden or mysterious about the Wolman Salts. Just a plain record of very successful accomplishment, that all who will can readily confirm.

THE RANSDELL TESTIMONIAL DINNER

At the Jung Hotel, Monday, July 21, the engineers of Louisiana and their friends, sponsored by the Louisiana Engineering Society, assembled at a banquet to do honor to Senator Joseph E. Ransdell in recognition of his work in behalf of the bill for the establishment of a National Hydraulic Laboratory.

In addition to Senator Ransdell, the guests of honor and speakers included Rear Admiral Thomas P. Magruder, Commander of the Eighth Naval District; Brigadier General Allison Owen, Colonel Mark Brooke, Divisional Engineer of the U. S. Engineers; Dr. George K. Burgess, Director of the Bureau of Standards; Major W. H. Holcombe, Dr. A. B. Dinwiddie, Congressman James O'Connor, Congressman J. Zach Spearing, J. F. Coleman, President of the American Society of Civil Engineers; Lieutenant Herbert D. Vogel, in charge of the hydraulic laboratory of the Mississippi River Commission; Lieutenant John Paul Deane, representing the Chief of Engineers, U. S. Army; A. C. Chick, personal representative of John R. Freeman, and Mr. John Klorer.

Professor James M. Robert, Acting Dean of the College of Engineering, Tulane University, was the toastmaster.

The following account of the banquet is taken from The Times-Picayune, July 22, 1930:

> General Owen spoke in high praise of Senator Ransdell's long period of "splendid and constructive service to the people of the state," and spoke of the problem with which Louisiana and other states in the Mississippi Valley were confronted in the flood of 1912, and of the invaluable assistance which Senator Ransdell gave during this trying period.
>
> "Creation of the laboratory marks an enoch," said General Owen. "I have never found a group of scientific men as widely divergent as they are in this problem of flood control. Research work through the laboratory will give us information upon which we can base sane and sound opinion. We are doing something we should have done years ago."

Colonel Brook characterized Senator Ransdell as the man who "took the pork barrel out of waterway legislation" and referred to the Senator's success in putting through the hydraulic laboratory bill as "a crowning achievement of a long period of efficient service in solving transportation problems."

"For 100 years Congress has delegated to the engineers the duty of making engineering and economic studies upon which our river and harbor projects are based," said Colonel Brook, "and for almost one-third of that period Senator Ransdell has been lending his assistance in this work."

The long fight which preceded the passage of the hydraulic laboratory bill was reviewed by Congressman O'Connor, and of the relentless struggle by Senator Ransdell to impress upon members of the Rivers and Harbors Committee and members of Congress the value of a hydraulic research laboratory.

"The hydraulic laboratory is one of the greatest universities of the world," Congressman O'Connor said. "It will promote the welfare of our country and keep it what the people want it to be."

"In America, lumber and oil will go some day," the Congressman continued, "and something else must come to take their place. There will come a day when our waterways will heat every home and farm in the country, when they will drive the wheels of every factory and when they will light every city, and the advancement toward this period will be speeded as a result of the hydraulic laboratory. The expansion of commerce must come through the extension of waterways."

Congressmen O'Connor and Spearing, both of whom took active part in the fight for the passage of the laboratory bill, disclaimed for themselves and bestowed upon Senator Ransdell all credit for instigating the movement and declared that it was due primarily to the work of the Louisiana Senator that the measure was put through Congress.

The full measure of benefit which will be derived from the laboratory cannot be justly estimated, in the opinion of Mr. Coleman.

"Improvement of conditions on the Mississippi River will be only a relatively small part of the ac-

complishments that will be enabled by establishment of the laboratory," Mr. Coleman said. He explained that hydraulic experiments in the past had been carried on in small laboratories of colleges, whereas the proposed facilities will enable the expansion of this work on a broad scale.

Mr. Coleman said that the interest shown by Senator Ransdell in the laboratory measure had aroused the admiration of the entire engineering profession and asserted that the dinner Monday night was a testimonial from the entire profession. The efforts of Senator Ransdell, the speaker added, have enabled the engineering society to carry forward its efforts in the hydraulic field.

Dr. Burgess said that no single thing had been done in many years which will be of more benefit to the country as a whole than the fostering of the laboratory bill. The opportunities of the laboratory are unlimited, he said.

An effort will be made, Mr. Chick said, to make the national research laboratory the best institution of its kind in the world. He explained that, in the interest of accomplisching this goal, Mr. Freeman was on a tour of Europe, visiting laboratories in that country and gathering data which will be used in setting up and operating the laboratory in this country.

In addition to its functions as an individual unit in solving the hydraulic problems of the country, the national laboratory will aid smaller laboratories in solving local problems by supplying them with data which will be obtained through research work, in the opinion of Lieutenant Vogel.

Admiral Magruder referred to Senator Ransdell as "not a politician, but a worker for his people and his country," and expressed the hope that "when you tried out a Senator and he has done what Senator Ransdell has done you will show your gratitude next November."

Mr. John Klorer was unavoidably absent from the banquet, but he sent the following statement in appreciation of the work of Senator Ransdell:

I wish to add my felicitations on this occasion to those already expressed, in appreciation of the successful efforts made

by Senator Ransdell and Congressman O'Connor, in finally enacting into law the creation of a national hydraulic laboratory.

We all know that hydraulics is an experimental science. The flow of water is based on the fundamental law of gravitation, but the influence of qualifying conditions make the application of the law, even with modifying formulae, a matter of questionable accuracy. The engineer is often confronted with the question as to whether or not the range of experiments responsible for the formula he is to use covers the particular problem he is attempting to solve.

We are familiar with the notable advance made in the past few years in the art of mixing concrete as a result of a discovery of fundamental principles ascertained in the laboratory. Immense savings in building construction expenditures have been accomplished by the engineer's ability to now specify strength concrete, instead of concrete of arbitrary volumetric proportions. Is it not reasonable to expect that some of the principles controlling the movement of flowing waters may be disclosed in the sustained persistent inquiry of some technical laboratory dedicated to hydraulic investigations and similar savings of untold msisions be accomplished in certain kinds of river improvement works?

Some of our local problems may well be given study by the expert talent engaged in such research work as is contemplated to be undertaken at this national hydraulic laboratory. For instance, there is the possibility of determining in advance, the ultimate curvature of caving bends of the Mississippi River, and thus obviating the expense of rebuilding levees that are now located by the application of the average annual recession rate, multiplied by the specified life of the structure in years.

I have been impressed by the fact, that a great many of the curves of the Mississippi River bends assume a nearly parabolical form where the caving diminishes or ceases and, inasmuch as the eroding power is due to velocity of the current, it is possible and probable that the ultimate curve should be a curve of the second degree. If Prof. Halley in the discovery of

the comet bearing his name was able to ascertain from a limited part of the path of the comet the equation of the curve it was following and thus calculate its final shape and dimensions to be an ellipse, it should be possible after obtaining proper values for the factors involved and that enter into the caving of banks to determine the ultimate curvature of river bends from the equations of the curve of the stationary or permanent part of the bend.

Another interesting subject is, how may the deterrent effect of eddies on river discharge be best corrected? There are numerous instances where the river has more than the average cross-section, but where the tendency to caving is still pronounced. These places are usually marked by the presence of deep holes in the river bed, and the abrupt change of cross-section is probably responsible for the eddy. It is possible that if these deep holes were filled, a smaller but more effective cross-section would remove the eddy, promote a better discharge capacity at these places and also arrest the tendency to caving. I understand this method is followed in some of the rivers in Germany.

Another interesting subject for study is invited in attempting to obtain a rational explanation of the disappointing results in gage height reduction that follow the withdrawal of large quantities of water from the main stream through crevasses, spillways, etc. The ratio of increment of discharge to increase in gage height is fairly uniform and constant, while conversely the decrease of the main river discharge as a result of side openings is not accompanied by equivalent reduction in gage height.

These are only a few of the many baffling questions confronting the river engineer engaged in flood control work, and the facility offered for research by the national hydraulic laboratory in the determination of their solution is one of the greatest boons to the engineering profession.

My earnest hope is that the laboratory will be adequately supported financially in the meritorious work it has undertaken, and Senator Ransdell and Congressman O'Connor de-

serve the tribute paid them by the engineers of this country for what they have done in a legislative way.

The Advisory Committee of the National Hydraulic Laboratory, consisting of John R. Freeman, L. F. Moody, S. M. Woodward, N. C. Grover, S. H. McCrory, J. P. Deane, E. W. Lowe, W. B. Gregory, B. R. Van Leer and C. E. Patten, sent the following resolution:

> Whereas, after over seven years of arduous legislative work Senator Joseph E. Ransdell of Louisiana was successful in securing the enactment of legislation providing for a national hydraulic laboratory at the Bureau of Standards; and,
>
> Whereas, the engineers of the State of Louisiana, acting under the auspices of the Louisiana Engineering Society, are tendering to Senator Ransdell in New Orleans on July 21st a testimonial dinner in appreciation of his service to the engineering profession,
>
> Therefore, Be It Resolved, That the National Hydraulic Laboratory Advisory Committee extends its good wishes to Senator Ransdell and the Louisiana Engineering Society upon this occasion, and expresses its faith in the scientific advances which will accrue to our country and the engineering profession through the researches which will be made possible by the laboratory authorized by the legislation sponsored by Senator Ransdell

Letters and telegrams of congratulation were received and read from the following persons:

Letter from Mr. C. E. Grunsky, President, American Engineering Council.

Letter from Mr. C. E. Grunsky, President, American Engineering Council, appointing Mr. John F. Coleman as representative of the Council, to the dinner.

Telegram from Mr. Gano Dunn, of New York City, President of the J. G. White Corporation.

Telegram from Mr. Arthur E. Morgan, Member Flood Control Committee, American Engineering Council.

Telegram from Mr. Gardner S. Williams, Ann Arbor, Mich., Member of Flood Control Committee, American Engineering Council.

Telegram from Mr. L. W. Wallace, Executive Secretary, American Engineering Council.

Telegram from Mr. A. W. Beresford, of New York City, Past President, American Engineering Council.

Telegram from Mr. W. F. Durant, Past President, American Society of Mechanical Engineers.

Telegram from Professor Dexter S. Kimball, Past President, American Engineering Council.

Telegram from Mr. Calvin W. Rice, Secretary, American Society of Mechanical Engineers.

Telegram from Mr. Ellwood Mead, Denver, Colorado, Commissioner, U. S. Reclamation Service.

Telegram from Mr. John Lyle Harrington, Consulting Engineer, Kansas City, Mo.

Telegram from Mr. Max Toltz, Member, American Engineering Council.

Telegram from Mr. R. D. Johnson, 67 Wall Street, New York City.

Telegram from Mr. George T. Seabury, Secretary, American Society of Civil Engineers.

Letter from Professor Thorndike Saville, Chapel Hill, N. C., Professor of Hydraulic and Sanitary Engineering, University of North Carolina.

Letter from Professor Thorndike Saville, Chapel Hill, N. C., Secretary-Treasurer, North Carolina Section, American Society of Civil Engineers.

Letter from Mr. G. M. Braune, Dean, College of Engineering, University of North Carolina, Chapel Hill, N. C.

Letter from Mr. J. W. Harrelson, Director, North Carolina Department of Conservation and Development, Raleigh, N. C.

Letter from Lewis F. Moody, Consulting Engineer, Member Advisory Committee on National Hydraulic Laboratory, Philadelphia, Pa.

Telegram from Mr. C. E. Grunsky, President, Amreican Engineering Council, addressed personally to Senator Ransdell.

Letter from Mr. L. W. Wallace, Executive Secretary, American Engineering Council, addressed personally to Senator Ransdell.

Resolutions adopted by National Hydraulic Laboratory Committee extending its good wishes to Senator Ransdell and the Louisiana Engineering Society.

Letter from Mr. John Klorer, Chief Engineer, Orleans Levee Board, New Orleans, La.

Letter from Dr. George K. Burgess, Director of Standards, Washington, D. C.

Letter from Mr. B. R. Van Leer, Washington, D. C., Member Advisory Committee on National Hydraulic Laboratory.

Communication from Mr. John R. Freeman, Consulting Engineer, Providence, R. I.

Telegram from Professor S. M. Woodward, Dean, College of Engineering, University of Iowa.

Senator Ransdell's speech, in part, in reply to the speeches, letters and messages of congratulation, follows:

> "I appreciate highly this fine banquet given in my honor by the engineers of Louisiana, and sincerely thank the distinguished visitors who have traveled such long distances during the extreme heat of the last few days to participate in it. I am also deeply grateful to the great engineers who have sent telegraphic approval of the act creating the National Hydraulic Laboratory.
>
> "All my life I have felt a deep interest in the engineering profession. The first money I earned after leaving college was in surveying lands in East Carroll Parish, where my first official position was that of

parish surveyor. To indicate the early trend of my mind towards hydraulics, when a student in Union College in 1881, I introduced and passed through the Union College Senate a bill appropriating $100,000 to dam the Atchafalaya River at its source. This early dream of a college student was realized several years later when the Mississippi River Commission placed the big sills across the Atchafalaya at Simmesport.

"The suggestion for this laboratory at the nation's capital was made by the eminent New England engineer, John R. Freeman, who for more than 50 years has been a shining light in the science of hydraulics. After my bill to create the laboratory was introduced in 1922, Mr. Freeman and many of the ablest engineers of the nation supported it vigorously.

"Unfortunately some of the army engineers opposed it because they feared it was an attempt to interfere with their work in connection with rivers and harbors.

"A concrete example of what may be accomplished on any one of thousands of problems before the hydraulic specialists who will work in this laboratory is the fact that as a result of experiments made a few years ago in the Holyoke testing flume on the setting of water wheels, it was demonstrated that very slight and inexpensive changes in the draft tube would increase by 5 per cent the power drawn from the water. In other words, this experiment demonstrated an increased efficiency of 5 per cent in the turbine, which is of supreme importance.

"The United States Weather Bureau recently estimated that the loss by floods in the United States during a period of 20 years from 1902 to 1922 was 1561 human lives and $624,052,651, much of which might have been saved had this laboratory been in existence for some time prior thereto.

"There is the greatest difference of opinion among able engineers about straight versus crooked rivers and about flood spillways, which subjects have been debated since the days of angient Rome.

"In fact, it may be said that hydraulic engineering was an art rather than a science until within the last 100 years, and while there have been marvelous developments in the art, the science of hydraulics still slumbers.

"I expect wonderful results from this great laboratory and hope to see it in operation soon."

The committee from the Louisiana Engineering Society which made the arrangements for the banquet consisted of President James M. Todd, Chairman; A. L. Dunlap, F. G. Frost, F. A. Muth, James M. Robert.

They were assisted by an auxiliary committee composed of F. N. Billingsley, J. F. Coleman, George G. Earl, W. B. Gregory, Allen Hackett, George Hammett, E. S. Lanphier, A. M. Lockett, Allison Owen and John L. Porter.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Board of Direction, June 9, 1930

The meeting was called to order by Vice-President Frost, and the following members were present: Messrs. Dunlap, O'Neill, Moses, Billingsley and Muth.

President Todd was excused because of being absent from the city on business.

Minutes of the previous meeting were read and approved, and vouchers drawn to cover accounts were approved.

The resignations of J. P. Maguire and N. E. Ebaugh were accepted with regret. The following members were dropped with regret: E. Hawkins, F. P. Broussard and R. H. Miller.

The matter of communication received from the Association of Commerce relative to the bill for Co-ordination of State Administrative Agencies was brought up for consideration. Owing to the fact that the matter should be considered at a meeting where the full attendance of the Board was present, on motion duly seconded, it was voted to postpone the consideration of this matter until a larger attendance of the Board could be had.

Report of the Membership Committee, Division "B," was received, and on motion, duly seconded, the following names were ordered to ballot:

Resident Members: Ralph E. Lind, Joseph J. Friedler.

Non-Resident Member: Robert P. Linfield.

Associate Members: L. Villere Cressy, Walter J. Folse.

Transfer From Student Member to Resident Member: Lucien T. Vivien, Jr.

Non-Resident Associate Member: Norman C. Estes.

Transfer From Student Member to Non-Resident Member: Robert L. Atkinson, Jr., Rodney B. Rougelot.

Resident Junior Member: F. Robert Mendow.

Non-Resident Junior Member: Fred Hadley Penn.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

Meeting of the Society, June 9, 1930

The meeting was called to order by Vice-President F. G. Frost at 8:15 P. M., F. A. Muth, Secretary, and 52 members and guests present.

Minutes of the previous meeting were read and approved.

Reports were received from committees.

On motion, duly seconded, and following the usual custom, the Society voted to recess during the summer months.

The Technical Exercises of the evening consisted of a paper on "Wolmanized Timber," by Dr. John G. Kreer. Dr. Kreer exhibited numerous examples and photographs showing treatment of timbers, and the paper was followed by an interesting discussion.

A rising vote of thanks was then tendered the speaker, and the meeting adjourned to the usual collation.

F. A. MUTH, Secretary.

Minutes of Special Meeting of the Board of Direction, July 11, 1930

The meeting was called to order about 12:30 P. M., July 11, after lunch at Kolb's Restaurant. The following members were present: Messrs. Todd, Billingsley, Frost, Dunlap and Muth. Mr. B. R. Van Leer, Assistant Secretary, American Engineering Council, was present on invitation.

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

Letter of July 3 from the American Engineering Council relative to H. R. 10625, A Bill Introduced to Amend an Act to Protect Navigation from Obstruction, etc., was read. On motion, duly seconded, a committee of three was authorized to study the bill and to reply direct to the Council. The President appointed the following as members of the committee: Col. Marcel Garsaud, Chairman, and Messrs. J. H. O'Neill and John L. Porter.

The resignation of R. O. Wine was accepted with regret. The name of Mr. H. L. McLean was reinstated and that of Mr. H. H. Bate was removed from the roll. Mr. E. J. Mary was transferred to non-resident member.

Mr. B. R. VanLeen, Assistant Secretary, American Engineering Council, who was visiting in the city, was present at the early part of the Board meeting upon invitation. He spoke of the successful efforts of Senator Ransdell in securing the passage of the act to create a national hydraulic laboratory and of the interest and enthusiasm of engineers throughout the country in that laboratory. The matter of tendering a testimonial dinner to Senator Ransdell was brought up. On motion duly seconded it was voted by the Board to take this opportunity of commending Senator Joseph E. Ransdell for his constructive work in introducing and carrying through to the end the bill for establishing the national hydraulic laboratory and that a testimonial dinner be tendered him at an early date under the auspices of the Louisiana Engineering Society, also that the President be authorized to appoint the necessary committee with power to act, keeping the cost of the tickets down to about three dollars each. Some members of the Board were consulted before the meeting, as they had advised they would be unable to attend.

One wished to be recorded as being opposed to the dinner, another favored it.

Letter of June 14 from the American Engineering Council in regard to recommendations for the Federal Power Commissioners was read, also telegraphic list of names submitted on June 16 by the Secretary after consultation with the President, it being pointed out that the urgency of the matter did not permit calling a meeting of the Board. On motion duly seconded the method of handling the matter was approved and ordered filed.

Ballots were canvassed for new members, there being 78 formal ballots, and the following were declared elected:

Resident Members: Jos. J. Friedler, Ralph E. Lind.

Non-Resident Member: Robert P. Linfield.

Associate Members: L. Villere Cressy, Walter J. Folse.

Transfer From Student Member to Resident Member: Lucien E. Vivien, Jr.

Transferred From Student to Non-Resident Member: R. L. Atkinson, Jr., R. B. Rougelot.

Non-Resident Associate Member: Norman C. Estes.

Resident Junior Member: R. Robert Mendow.

Non-Resident Junior Member: Fred H. Penn.

The President took this occasion to announce the closing of the State Legislature without the passage of the Engineers' Registration Bill through the Senate, although it passed the House and was reported out of the Senate Committee. He thanked all committeemen, officers and members for their assistance, and stated that a report of the committee would be published in the Proceedings.

There being no further business, the meeting adjourned.

F. A. MUTH, Secretary.

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

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

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XVI. OCTOBER, 1930 NO. 5

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EDITORIAL NOTES AND COMMENT

Proceduce Control in Welding. Both electric welding and gas welding have assumed in recent years tremendous importance in modern methods of production and in the building of various structures. The Society has already heard several papers upon electric welding, and at the October meeting a paper on the oxy-acetylene process was presented by Mr. P. D. Jax, the local representative of the Linde Aid Products Company.

Mr. Jax's paper dealt principally with the subject of procedure control as the important factor in the production of consistent and dependable results.

Six factors in this procedure control are considered and discussed in detail.

Several reels of motion pictures were exhibited in connection with the paper showing the details of construction and

methods of operation of a number of different types of welding equipment.

One of the most interesting of these reels illustrated the application of the oxy-acetylene process to the welding of long lines of pipe for the transmission of oil and gas.

The application of ox-welding to the construction of steel frame buildings was also interestingly illustrated.

September Meeting Postponed. No regular meeting was held in September. Instead the members were invited to meet with the Electrical League at a dinner in the Banquet Room of the Monteleone Hotel. At this dinner the guests and members were addressed by Mr. Harry C. White, Illuminating Engineer of the Edison Lamp Works, his subject being "If I Were a Merchant." The lecture was illustrated and dealt with correct and incorrect illumination of mercantile establishments.

Airport Drainage and Surfacing. The Louisiana Engineering Society has co-operated with the Aeronautics Branch of the Department of Commerce, the American Road Builders' Association and American Engineering Council in their joint study of this important subject. The request for this co-operation came during the recess of the Society, and President Todd appointed Mr. F. N. Billingsley, Chairman, Messrs. Allen S. Hackett, John Klorer and Bryson Vallas, a committee to take up the question and report upon it. Their report was submitted October 1st and transmitted to the Department of Commerce. Such committees have been set up all over the country and reports have been coming in rapidly.

The Twenty-third Engineers. "4880 men lived together as members of one regiment for twenty months. THE TWENTY-THIRD ENGINEERS was the second largest organization of the World War, and had in it many highly trained specialists.

"Most of these men have not seen each other since 1919, as their homes are in every state in the Union. Now, however, a reunion on a large scale is being planned. To make it succeed we need the correct addresses of all former members of the regiment.

"Probably some of these men read your magazine. If you feel it would be proper to do so, we would greatly appreciate having you suggest in an early issue that all of our former comrades send their name and correct address to Doane Eaton, 50 Morningside Drive, New York, N. Y."

(We are printing the above notice at the request of Mr. Doane Eaton, President of the Metropolitan New York Society of Twenty-third Engineers.—Ed.).

A Note on Licensing and Registration. The Committee of the Louisiana Engineering Society, having in charge the drafting of the new registration act, has gone on record as emphasizing the importance of careful specification of the educational requirements for eligibility. The following paragraph is taken from the Bulletin of American Engineering Council, printed therein under quotation marks:

"The very genius; the fundamental principle; the key-note of any Registration Act, be it law, medicine, chartered accountancy, architecture, pharmacy or engineering, is the prescribing and developing of a formal system of training for all who would become members of that profession. The actual issuance of a license to practice to the mature man should be of the nature of a formality."

Engineering a Profession. The Editor of this journal attended last summer the Annual Meeting of the Society for the Promotion of Engineering Education, held in Montreal under the auspices of McGill University and of L'Ecole Polytechnique.

At the opening session a brief address of welcome was delivered by Sir Arthur Currie, Vice-Chancellor and Principal of McGill University. A few brief quotations from that address are in line with the paragraphs preceding this:

"There is now a great bond between the university and the engineer. It was not always so. In fact, I do not think it is too much to say that engineering is a profession—a highly respectable and important profession—because the university made it so. On the other hand, it would not be unfair to say that from the time the universities undertook the training of engineers, they became vastly more useful institutions."

"An engineer is a professional man, conforming to those ethical standards which should characterize professional life. He is an educated man. At least, he must have a sound scientific training and above all he should have enthusiasm and imagination. He should be a creator. If he lacks the power of vision, if he cannot create, he becomes little more than a superintendent of works. It is hard to give men the power of vision, but at least I think you should be able to keep the deadwood out of your profession. 'Imagination is the ruler of the human race,' said Napoleon, and he conquered the hosts of his enemies. His deadliest opponent was a man who possessed the soul of a poet, though he thought in ships and guns. The secret of the 'Nelson touch' was the vision which let Nelson presage the confusion his tactics would create in the opposing fleet, and enabled him to forsee a victory won as much by moral as by physical force. Imagination has had no less a share in the conquest of nature. Canada furnishes many examples. The story of the Intercolonial railway and the Canadian Pacific railway are dramatic chapters in our history. Such imagination is the real power which has brought your own profession to the place it occupies today on this continent. That imagination will enable you to do still greater service. The task of the engineer is far from being over. The world has many problems which we must look to him to solve. Our cities have become hives of teeming millions. How are these crowds of human beings to be fed, clothed, and carried from place to place? How are they to be housed in healthy surroundings, furnished with heat, light and power? How can the life of the people be given all the ameliorations that science alone can give it? The problem of human relations is one of vital interest to the engineer, and to him we must look for help and guidance. In our social life, our industrial life, our business life, our economic life, the engineer has played, and still more in the future will play, a most important rôle. His accurate technical knowledge has made him a leader in business and manufacturing. He must work hand in hand with the economist. His counsel is sought by the banker and the statesman. How necessary is it, therefore, that his education and training should be the acme of excellence!"

OBITUARY

Samuel McCain Young

Samuel McCain Young, Chief Engineer of the Board of Commissioners, Port of New Orleans, since 1921, died on October 29, 1930, after a brief illness following an operation.

Mr. Young was born in Carroll County, Mississippi, on December 14, 1873, the son of Dr. John W. Young and Mary Louise McCain. His collegiate education was secured at Washington and Lee University, where he was a student of unusual ability, having won the Mathematics Medal, one of the outstanding honors in that institution. He graduated in 1898 with the degree of Civil Engineer.

He began his professional career with the United States Government on one of their topographical surveys, this being followed by several years of experience in railroad location and construction in the West. Later on he was associated with Mr. J. Frank Coleman in the location and construction of a portion of the New Orleans Great Northern Railroad. He then became a partner in the firm of J. F. Coleman and Co., Consulting Engineers, upon the conclusion of which partnership he was engaged in electric railway construction and superintendence in Rome, Georgia. Returning to New Orleans he formed a partnership with Mr. Guerin to engage in general civil engineering work, at the termination of which he was appointed Chief Engineer of the Dock Board, in which capacity he served two years. This was followed by two years of private practice, during which time he served as Manager of the Industrial Bureau of the Association of Commerce.

During the World War Mr. Young was commissioned Captain of Engineers and was stationed at Camp Humphreys in Virginia. Following demobilization he was engaged in the construction of a shipbuilding plant at Mobile, Alabama, and in the design and construction of extensive improvements to the plant of the Little Rock Railway and Electric Company.

Mr. Young was appointed again to the position of Chief Engineer of the Dock Board in 1921, a position which he held

throughout the many political changes and vicissitudes of that organization during the past ten years.

He was married in 1923 to Miss Katherine Harrison of New Orleans, and is survived by her, by three sisters and one brother, and by his father, a distinguished member of Forrest's Cavalry during the Civil War.

Brief funeral services were held at his late residence, 1409 Calhoun Street, Thursday morning, interment being at his father's home in Grenada, Mississippi.

Mr. Young was a member of the Delta Tau Delta Fraternity, a Knight Templar, member of the American Society of Civil Engineers, a Past President of the Louisiana Engineering Society, and an active member of that organization since 1911. Last June he was elected an alumni member of the Washington and Lee Chapter of Phi Beta Kappa.

NOW WHEREAS, Samuel McCain Young was recognized by his fellow members as a true friend, as an engineer of high attainments and outstanding ability, and as a man of upright character and unswerving integrity in all his relations, both personal and professional,

BE IT RESOLVED, That in his death the Louisiana Engineering Society has lost one of its most able and conscientious members, this community and city a good and useful citizen, and his many associates a true and loyal friend.

BE IT FURTHER RESOLVED, That a copy of this obituary and these resolutions be spread upon the minutes of the Society and published in the Proceedings, and that a copy be sent to the family of Mr. Young.

Respectfully submitted,

DONALD DERICKSON,
W. B. GREGORY,
DOUGLAS ANDERSON,
Chairman.

PAPERS AND DISCUSSIONS

THE IMPORTANCE OF PROCEDURE CONTROL IN WELDING

By C. D. Jax,
Read before the Society, October 13, 1930.

The oxy-acetylene process is being used today as a standard production method in a variety of industries, because it fulfills nearly all the conditions that could possibly be desired by the manufacturer or the production engineer The vital factor which has led to the adoption of this process for the manufacture of such a wide range of products has been the ability to turn out a better product at a lower production cost. For some time after its introduction, welding seemed to the production manager to be so different from ordinary fabricating methods which had been in use for a long time that its adoption as a production tool was somewhat delayed. Today, however, the wide-spread knowledge of the process combined with new development in managerial control of welding has made the oxy-acetylene process a recognized, universal production too. Leaders of industries who at first hesitated to apply welding are now among the foremost enthusiasts over its growing use. One need only note the number of products formerly turned out by other methods which are today fabricated by welding to be convinced of the merits of this method.

The early hesitancy of production managers to adopt welding as standard practice was in most cases founded on what seemed to them a lack of assurance that the process was consistently dependable. They would admit that welding was a thoroughly sound and advantageous method when properly done, but would always raise the question as to how they could be sure that the welds were all properly made. Within recent years a great deal of research has been conducted upon all types of welding work and the establishment of procedure control welding has applied the principles of production engineering to the welding process. Procedure control has afforded industry complete assurance of successful results in welded

construction and consequently has been a most important step in the development of the process as a production method. Uniform high quality welds in all types of work are assured by conducting welding under strict procedure control methods. The conditions which caused varying results in welds were studied, and a careful study of methods revealed that the proper control of the welding operation would guarantee uniformly satisfactory results in welding.

It is necessary that all those who are responsible for managing production should be thoroughly familiar with the six factors of procedure control, which are:

(a) Check of the welders—to see that only competent operators are used. Further, that they prove their ability by successfully passing the qualification tests, preferably tests simulating the particular operation.

(b) Selection and inspection of material—to make certain that only material suitable for welding is used and that proper welding rod is selected.

(c) Design and lay-out of welded joints—to insure that the joint is correctly designed for welding.

(d) Preparation for welding—to see that preparation and assembly are the best for welding.

(e) Organization and welding technique—to see that the welding is carried on in the most satisfactory and economical manner and that the welding itself is correctly done.

(f) Inspection and test—to check whether the above items of the welding procedure have been followed and to see that proper welding results. The test of the completed work is an additional assurance that the welding installation will give satisfactory service.

Procedure control methods have been adopted today in nearly all industries using the oxy-acetylene process. With the above six factors as a guide procedure controls can be written to apply definitely to any special industry or application. Some of the fields in which procedure control methods have proved vital to success have been those of pipe lines, piping systems, welded pressure vessels, airplane assembly, and structural steel buildings.

As an illustration of how procedure control is applied to a specific type of welded construction, the principal points covered in a procedure control for oxwelded pipe lines will be outlined briefly.

A—Check of Welders

Welders should be experienced in welding either steel or wrought iron piping. As a check upon the welder's ability, he should be required to pass successfully the qualification test before being allowed to weld on the line or piping system.

The qualification test should duplicate as far as practicable the conditions to be encountered in welding joints in the actual installation and should be conducted in the presence of the engineer or representative responsible for the installation. Two short sections at least 8 inches long and preferably of the largest diameter pipe to be used should be bevelled and set up for welding, in accordance with the recommended practice.

A rolling weld is commonly used wherever conditions permit and is made while rotating the pipe so that the welding is always done in a position convenient to the operator in an upper quadrant of the pipe. The welder should be required to make a complete circumferential weld, rotating the pipe during the welding operation in a manner that will provide the most satisfactory welding conditions. During the qualification test, the welding inspector or supervisor should observe the technique followed by the applicant, his practices regarding size of welding head, gas pressure, etc., and satisfy himself that the time taken for making the test weld falls within the limits set for production work.

The procedure control will also specify that welders who will be required to make position welds should also be required to pass a qualification test for this type of weld.

For examining the qualification test specimens, strips at least 1½ inche wide and not less than 6 inches long should be cut from each of the completed weld sections. One of these strips should include the finishing point of the joint. A cutting blowpipe may be used for this operation.

The strip should be tested by gripping the specimen in a vise with the weld flush with the jaws and sledging against the

side from which the weld was made until the piece is bent through 90 degrees. A satisfactory test specimen should not fracture under this test.

The specimen should then be reversed and hammered from the opposite side until fracture occurs. The fracture of a satisfactory specimen should occur outside the weld, or if in it, should show the following characteristics: full weld depth penetration; thorough fusion; no gas pockets, laps or other defects.

If facilities are available, tensile test pieces, conforming to the American Society for Testing Materials standard design for tensile test specimens for steel plate, should be cut out with welds in the center. Tensile tests made on specimens welded with low carbon welding rod should show not less than 45,000 lbs. per sq. in., while specimens made with high test welding rod should either break outside the weld or show a minimum tensile strength of 50,000 lbs. per. sq. in.

In connection with tensile tests, it is interesting to note that there is now available a portable tensile testing machine that has been developed especially to facilitate the testing of welders in pipe line work as well as in other fields where it is frequently inconvenient to send tensile specimens to standard testing laboratories.

B—Selection and Inspection of Materials

For pipe line work, the procedure control gives specification data on pipe material, welding rod and welding and cutting apparatus.

The pipe should be of good weldable quality. The size and weight of pipe should be in conformance with the general specication for the installation as determined by service requirements. Pipe should preferably be purchased machine bevelled for welding.

Low-carbon welding rods should conform to the American Welding Society Specifications for Gas Welding Rods. (A.W.S. Bulletin No. 2). High test welding rod should be used for welding wrought iron pipe or the higher carbon grades of commercial steel pipe. Welding rods should flow freely,

smoothly, and without detrimental action under the blowpipe flame.

Apparatus should be of approved make and in good operating condition. Oxygen and dissolved or generated acetylene are the only suitable gases. When the piping installation is a large one, the use of generated acetylene should prove the more economical. In this case, the acetylene can be generated in some suitable portable generator conveniently located. In the case of large diameter overland pipe lines, acetylene is often distributed from portable generators to the welders in steel pipe along the right-of-way.

C—Design and Lay-out of Welded Joints

This section of a procedure control for pipe welding gives specifications for bevelling, spacing and tack welding as well as for weld dimensions, etc.

D—Preparation for Welding

Under this section the points to be observed in cleaning the pipe line, lining it up and tack welding are considered. This will include such points as the following:

All scale, rust, dirt or other foreign matter should be thoroughly removed from the ends of the pipe lengths before tacking or welding.

The pipe lengths should be lined up straight and the aligned abutting pipe ends should be concentric. Any dents or irregularities should be hammered out. A pipe clamp suitable design may be used to obtain correct alignment and concentricity of abutting pipe lengths.

E—Organization and Welding Technique

The welding and construction organization will necessarily be dependent upon the type of piping system, its location, length, time limit of construction, co-ordination of the different construction gangs, contour of terrain and other factors. In any case, the organization should include welders skilled in making both rotating and position welds and in cutting accurately to a line and beveling with the blowpipe. A man competent to inspect materials, apparatus and the work of the welders should supervise the job.

In making continuous rolling welds, it is usually advisable to have only one welder work on a circumferential weld and he should be responsible for its quality. Once the weld is started, the weld should be continuous until the joint is completed. Welding should be done in the upper quadrant of the pipe, the pipe being turned so that the welding is always done in a position convenient to the operator. Welders should reheat the welds at all starting and finishing points, to a dull red, for an overlapping distance of 3 inches. Welders should melt through all tack welds and reweld these tacks as the welding progresses. The same should be done for a distance of at least 1 inch where the weld ties into a previously welded portion (starting and finishing points).

After the weld is complete, the welder or helper should stamp a designating mark on the weld in an accessible position.

In making position welds, the welder should start welding at the bottom of the joint, and after completing one-half of the seam, should return to the starting point and weld up the other side. On larger sizes of pipe two welders may work simultaneously welding up from the bottom on each side.

Other operations covered in this section of a pipe line procedure control are: leveling; lowering; provision for expansion and contraction; and covering or painting.

F—Inspection and Test

At least one inspector should be employed who should be responsible for the quality of the welding. He may be the welding foreman if the installation is a small one. He should have a general knowledge of the welding and be familiar with the recommended practices herein contained.

The inspector should observe and inspect as follows:

(1) Observe the welding of test specimens when qualifying welders to see that correct practices are being followed.

(2) That only qualified welders, both for rotating and position welds, are used on production work.

(3) That welders follow proper welding technique and recommended practices.

(4) That an identification mark is stamped on the welds.

(5) Select at random from completed welds those from which rectangular sections are to be cut out as a check on the welder's work. If these sections, when properly polished and etched, indicate poor fusion to the side or to the bottom, the inspector should have the right to reject the entire joint and have it cut out and rewelded.

(6) Supervise the various tests run on the line.

The line should be tested in sections, if long, or in its entirety if short. If valves are located in the line at convenient points, they may be used to shut off the section lengths; otherwise, the sections should be capped with standard bull plugs, suitably placed, or with bull plugs welded to the line for the purpose of test.

Tests on the line should preferably be made at a minimum of one and one-half times the designed working pressure. Hydrostatic tests are recommended when practicable. Air tests may be used where it is impracticable to drain the line completely after testing. During a hydrostatic test the joints should be hammered with a 2- to 6-lb. hammer. The hammering should produce sharp vibratory blows without indenting or distorting the metal of the pipe. During an air test, all joints should be tested for leaks with soapy water.

After a line is completed, it should be given a final service test before acceptance.

The foregoing outline will serve to indicate the scope and character of a procedure control for welding. It is evident that such a detailed specification covering all the operations involved, places complete control of the work in the hands of the management.

As noted previously, procedure control has been applied to many types of welded construction with uniformly successful results.

An interesting application of procedure control was in the construction of the first water pipe line in Louisiana to be oxy-acetylene welded throughout, recently completed for the town of Thibodaux as part of its water supply system.

This oxy-acetylene welded 8-inch line will carry water at 250 lbs. per sq. in. pressure from the Mississippi River to a reservoir at the town a distance of 13½ miles. In addition, approximately one-quarter mile of 10-inch pipe connecting the new line with the existing town mains was also oxwelded. For about six miles, the 8-inch line runs through swamp lands, very soft and boggy, and subject to overflow from swamp and salt water. Operating under the procedure control and service assistance provided by the oxygen manufacturer, a contractor who had had no previous experience with welded construction, was enabled to lay this line in a perfectly satisfactory manner.

Another field where procedure control is playing a most important part is in the construction of buildings. The motion pictures to be shown later will present the various features of a large oxy-acetylene welded structure in such a way that detailed discussion is not necessary at this point.

It is interesting to note that the value of procedure control was strikingly demonstrated in obtaining welders for this work. At the time this building was erected, there were no welders available who had had previous experience in oxy-acetylene welding structural steel. Advertisements were placed in local newspapers and the welders who responded were given qualification tests in accordance with the procedure control established for this job. From those who passed the tests, the required number of welders were selected and it was found that with a little additional instruction, they were soon able to do work of high quality. This is typical of the way in which procedure control minimizes the effect of the human element in welding, by providing means whereby the skill of a welder can be quantitatively determined at any time.

Discussion

THE PRESIDENT: Gentlemen, I am sure Mr. Jax will be glad to answer any questions you have to put to him regarding this paper.

MR. LORIO: For commercial pipe lines with carbon content, which makes best weld, high carbon or low carbon rod?

MR. JAX: We usually try to use the same kind of rod as the pipe, usually low.

MR. MOSES: In several instances I notice great emphasis has been placed on the right rod. Do you refer to the proper carbon content?

MR. JAX: Yes, it is the carbon content of the rod.

A MEMBER: That is, the most important quality of the welding rod is the carbon content?

MR. JAX: Yes.

MR. ACKERMAN: What is the comparative cost and advantage of acetylene welding versus electric welding?

MR. JAX: That is a question that I dislike to go into, for this reason: You can talk about that all night and all week, but I do not care to argue one against the other. Both have their places. In their places, they are all right. One is cheaper in one place and one in the other. Taking into consideration the cost of gas, of course, it is cheaper than electric welding. In its place, electric welding has its limitations. I do not think we would get anywhere arguing it.

MR. ACKERMAN: I am asking for information, and I really would like to know in which place you would consider acetylene weld better, and in which electric weld?

MR. JAX: I do not know how to talk on that point unless I start comparing the two. However, we maintain that the acetylene weld will surely serve on anything that must stand pressure. We know there are some pipe lines being put in with the electric process, and I understand they are getting good service from some of them and so on. And we still maintain acetylene is best. I do not have any cost figures, and I would not give them to you unless I had them officially and definitely. There have been some lines laid in which they claimed that the electric process was cheaper, but then others come along and say that it cost more than if they had used acetylene. It is hard to say anything definite on that.

PROF. ROBERT: What progress are you making with the Boiler Code Committee for use of acetylene weld on fire vessels?

MR. JAX: I cannot answer that. I want you to understand, I am not a technical man and many of these questions I cannot answer. I am sales manager. I have tried to do my best for

you. I know they are making some progress! it is rather slow, as you know, over a period of years, but I think that there is some progress being made, and we hope we will reach the ultimate goal in not too long a time.

MR. ACKERMAN: What is the separation between the two main faces of pipe?

MR. JAX: The space between the joints?

MR. ACKERMAN: Yes.

MR. JAX: About one-eighth to one-quarter inch. It depends on the size of your pipe.

PROF. ANDERSON: Does the weld, when completed, show a burr inside the pipe?

MR. JAX: Whatever your penetration is, you must get your molten metal right down to the inside of the pipe. If it is not through, you do not have a good weld. Your finish is the big thing in making them join.

PROF. ANDERSON: You really have a small burr inside?

MR. JAX: Yes. We call them icicles. If the welder is good, you do not have much trouble with that.

MR. STOLLEY: Is there much burning?

MR. JAX: Occasionally a man is burned when cutting, but nothing serious. Sometimes a man will get a spark in his eye, but it is not usual. It is not any more dangerous than many other structural processes.

PROF. ROBERT: When those sections are lowered into the ditch, is the final welding done in the ditch?

MR. JAX: Yes, mostly. In that case you must dig the ditch around so that the welder can get in. That is usually a position weld-overhead for one part, then one side and then the other. Sometimes on light pipe they can weld on the skids and let it down.

MR. ACKERMAN: In the erection of this building (shown in the moving picture) did they take the cost of this welding?

MR. JAX: They took cost figures on the weld construction and I suppose comparated them with rivet costs.

MR. STOLLEY: Is any progress being made in substituting liquid gases for acetylene in cutting operations?

MR. JAX: There is a manufacturer in the east using gasoline and oxygen. That is by no means new. It has been tried several times before, like many other things. Just what success he is having, I do not know.

MR. ACKERMAN: Is there very much danger in the expansion and contraction of the metal?

MR. JAX: Not so much as from oxidizing the metal,—burning it as you weld it, and that is caused by having an overabundance of oxygen in your mixture. If you do not have the right mixture and there is too much oxygen, you will burn your metal and it may break.

MR. LORIO: That is more prevalent in cast iron than in steel?

MR. JAX: Yes, of course you get your worst strain in cast iron.

MR. ACKERMAN: How can you tell a bad weld from a good weld without putting it under pressure?

MR. JAX: You can tell. If you have the wrong mixture on your flame, you have gas pockets, bubbles or impurities in your metal. However, any experienced welder can tell if he is making a good weld. If he knows anything about welding, he knows whether he has a neutral flame. That comes from experience, and anyone with any experience can tell if a weld is good or not. Of course, the safest way is testing. If not, we would not be talking so much about procedure control.

A MEMBER: Is there any advantage of acetylene blowpipe over natural gas blowpipe?

MR. JAX: We believe so. Acetylene has the highest number of heat units of any gas we have in use today. Therefore you get your heat quicker and it cuts down labor cost. Now on very light cutting, possibly that is not true, where you do not need much heat and not very much base metal to heat through. Natural gas is being used in many sections of the country.

MR. LORÍO: I noticed your air pressure was registering about 20. Is that right for oxwelding?

MR. JAX: It depends on the metal.

MR. LORIO: You hardly have a mixture over 60 pounds?

MR. JAX: Very seldom. The bad operator thinks he needs 150 lb. pressure, and it only blows your welding off to the side. That is also taken care of in our procedure control.

A MEMBER: Is the acetylene weld stronger than the electric weld?

MR. JAX: That involves a comparison which I prefer not to make.

A MEMBER: What about ship construction? Has there ever been an entire ship constructed by welding?

MR. JAX: I do not believe so. I have not heard of it.

MR. ACKERMAN: How would you recommend making a four or five foot weld? Would you first spot weld it, and then make your long weld?

MR. JAX: That depends on what you are using. If it is light sheet, you have to separate it and as you weld along it will gradually draw together until it is perfectly welded. If it is heavy, you can lay it up and tack it and then you will not draw it together.

MR. ACKERMAN: If it is long and heavy, you would tack it?

MR. JAX: Yes, but if it is light you cannot tack it. The usual procedure is to keep your two pieces separate and they will draw together as you go along.

THE CHAIRMAN: Is there any tendency for the molten metal in overhead welding to flow away by gravity?

MR. JAX: That must be controlled by your flame, to see that it does not flow away from you. It will either burn through or drop off to the side if not properly done, and that depends on his experience, so that the welder knows when to move his flame. Aluminum welding is perhaps the most tricky, but the easiest, if the operator knows when to stop.

PROF. ANDERSON: You mentioned pyrofax gas. Do you have much demand for that?

MR. JAX: Yes, in areas where we have no natural gas. It is a luxury, comparatively speaking. But there are many hotels, hospitals and homes who do use pyrofax gas. We are selling some in this part of the country, even with natural gas.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of Board of Direction, October 13th, 1930

The meeting was called to order by F. N. Billingsley and the following members were present: Messrs. O'Neil, Moses and Muth; the President and the Vice-President being absent from the Society, had requested that they be excused from the meeting of the Board and Society on this night.

The financial report of the Secretary was read and approved and on motion, duly seconded, it was voted to dispense with the reading of the minutes of the previous special meeting.

Communication from the Secretary of the Louisiana State Board of Engineering Examiners was read, relative to vacancies on the Board, and on motion, duly seconded, it was voted that the President be authorized to submit lists of names of registered engineers to the Governor, recommending the appointment of the two persons whose terms of office have expired.

The Secretary brought before the Board the matter of the request of the Director of Aeronautic Development of the Department of Commerce through the American Engineering Council to have a committee appointed to submit a report upon airport drainage and surfacing. During the recess of the Society the President received this request, and inasmuch as the report was called for by a member first, the following committee was appointed: Mr. F. N. Billingsley, Chairman, Messrs. Allen S. Hackett, John Klorer and Bryson Vallas. Under date of October 1st the report was submitted and transmitted to the Department of Commerce, receipt of which was acknowledged by Director Harry H. Blee with thanks. On motion, duly seconded, it was voted to approve the action of the President in appointing this committee in an emergency and that the committee be thanked for its report and discharged.

The Secretary brought up matters requiring the attention of the Board, which were approved and on motion, duly seconded, the Chairman of the Entertainment Committee was authorized to prepare the features in connection therewith for the annual smoker. The Secretary was also authorized to proceed, in accordance with instructions of the Board, in regard to the matters discussed at this meeting.

There being no further business the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Society, October 13th, 1930

The meeting was called to order about 8:10 p. m., Mr. F. N. Billingsley in the chair, F. A. Muth, Secretary, and 59 members and guests present. The reading of the minutes of the previous meeting was dispensed with.

The report of the Employment Committee was read; the Chairman of the Entertainment Committee and the Chairman of the Technical Papers Committee submitted their verbal reports, which were approved.

The technical exercises of the evening consisted in a most interesting paper on "The Importance of Procedure Control in Welding," by Mr. C. D. Jax. The paper was illustrated with motion pictures and interesting discussion followed. A rising vote of thanks was then tendered the speaker and the meeting adjourned to the collation.

F. A. MUTH, Secretary.

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DOUGLAS ANDERSON, Editor.

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PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XVI. DECEMBER, 1930 NO. 6

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EDITORIAL NOTES AND COMMENT

Hail and Farewell! The next issue of the *Proceedings*, February, 1931, will find the publication in the hands of a new editor.

Sixteen years ago, Louis Datz and A. M. Shaw were appointed a committee to select an editor for the journal, the publication of which the Society had voted to undertake. We had previously been members of an association of engineering societies which published a journal in common. They selected Professor Douglas Anderson for the position, which, after a continuous incumbency of sixteen years, he has just resigned.

His letter of resignation follows:

December 3rd, 1930.

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

In accordance with my announced intention to President Todd, I beg to tender herewith my resignation as Editor of the Proceedings of the Louisiana

Engineering Society, to take effect with the issuance of the December number of the present year.

My reason for this step is simply my fundamental belief that it is to the best interests of an enterprise of this character to make a change at intervals in the person chiefly responsible for its welfare.

I have now carried on this work for sixteen years, and while I have been paid a salary for it, still it has been a source of great satisfaction to me to feel that I have had this opportunity to contribute to the welfare and progress of the Society.

Whatever may have been my own personal contribution to the success of the *Proceedings*, it is still my sincere belief that the greatest factor in this success has been the fact that the Louisiana Engineering Society is an active and progressive organization of the highest character.

I desire to express my appreciation of the hearty support and the sympathetic interest that the successive administrations have given me in this work.

More particularly do I desire to express my thanks to our able and efficient Secretary, Mr. Muth, who has been so closely associated with me in the publication of the *Proceedings*; to my Secretary, Miss Edna Doll, who for a number of years has been serving unofficially as Assistant Editor, and to members of the Committee on Publications, who through their work in securing advertisements, have contributed so materially to the financing of the publication.

With renewed assurance of my appreciation of the opportunity these past sixteen years have afforded me of serving the Louisiana Engineering Society, I am,

Yours very cordially,

DOUGLAS ANDERSON.

The Board of Direction has selected Professor James M. Robert of the College of Engineering of Tulane University to be Professor Anderson's successor. This is an eminently wise selection, for Professor Robert has not only been a prominent and useful member of the Society, serving on many important committees, a past Secretary and past President, but he is an able and inspiring writer and possessed of a personality which has made him one of the best known and most popular members of the engineering profession in this community.

And so while the retiring Editor lays down his pen, not without a sigh of regret at giving up a work which has been a source of gratification and pleasure to him, at the same time he is sincerely convinced that in the able hands of the new editor the *Proceedings* will enjoy many more years of prosperity and increasing usefulness to the Louisiana Engineering Society.

Alexander L. Black. Several years ago, by resolution of the Society, the six surviving charter members of the organization were made Honorary Members. These were A. L. Black, J. F. Coleman, Walter H. Hoffman, Sidney F. Lewis, Gervais Lombard, Alfred F. Theard.

Alexander L. Black, Vice-President of Ford, Bacon & Davis, passed away at his home in San Francisco March 3, 1930. Elsewhere in this issue is published a brief obituary notice and biographical sketch of his professional life, prepared by his life-long friend and associate, Mr. William von Phul, President of Ford, Bacon & Davis.

Dredge Electrification. Dredging is one of the most important operations with which engineers in this section of the country have to do. Navigable channels must be maintained in the silt bearing streams of this flat alluvial land, extensive canals for drainage must be dug and maintained, levees must be built, and the level of the land in many places must be raised above the surrounding waterways by dredging and filling. Also much valuable construction material, such as sand and shells, is secured by dredging.

Electric drive, on account of its flexibility, economy and reliability, has been applied to so many purposes that it seems perfectly logical to consider its application to the dredge. This has been done to such an extent that now some of the largest and most important dredges in the country use the electric drive.

The Diesel engine has been an important factor in this development, as it furnishes an ideal prime mover to drive the generators which in turn furnish power to the motors.

Mr. Pearce's paper, published in this issue, describes a number of types of dredges with a discussion of the application of the electric drive to each particular type.

Who's Who in Engineering. A new edition of the directory with this title is to be issued in 1931. An advisory committee of American Engineering Council furnished the publishers a set of standards for inclusion in a volume of this nature.

There are quite a number of men in the Louisiana Engineering Society who are eligible for inclusion in the new directory. It does not cost anything to have one's name and biographical sketch included other than the trouble of preparing and furnishing the necessary data to the publishers.

This will be not only an advantage to one personally but will help to advertise the Society as well as New Orleans and the State of Louisiana.

Additional information may be secured from Mr. Muth, and blank forms for the biographies may be obtained by writing to Who's Who in Engineering, 80 East 11th St., New York City.

A Striking Comparison. Speaking upon the occasion of the dedication of the new James Ward Packard Laboratory at Lehigh University, Mr. David E. Ross, President of the Board of Trustees of Purdue University, made this rather significant statement:

"A short time ago the disastrous failure of a dam in California was heralded throughout the world. Such a failure was so extraordinary that it was real news. A distinguished lawyer may have lost a celebrated case in the courts the same day the dam failed, but such an event was so commonplace that it was not news. The lives of our people are today entrusted to the skill of the engineer, whether it be in sanitation, structures, electricity, or transportation. That the engineer is rarely found wanting to meet the instant need of things is constant tribute to the sufficiency and effectiveness of his training."

OBITUARY

Alexander Leslie Black

Alexander Leslie Black, Vice-President of Ford, Bacon & Davis, Inc., died in San Francisco March 3, 1930.

Alexander Leslie Black was born in New Orleans in 1871. He attended private preparatory schools in New Orleans and New York. He graduated from School of Mines, Columbia College, in 1890, and then engaged in mining work in the West and in Mexico for three years, subsequently acting as Assistant Engineer on the topographical survey of New Orleans.

In 1894-1895 Mr. Black had charge of the reconstruction for electric operation of the St. Charles Street Railroad Company in New Orleans, remaining with that company supervising operation and construction extensions for this and other local companies until 1901, when the New Orleans properties were consolidated. He then became Engineer for the New Orleans Railway & Light Company and its predecessors controlling the New Orleans Street Railways & Lighting Companies.

In 1910 Mr. Black became identified with the firm of Ford, Bacon & Davis, Inc., as Engineer in Charge Southern Properties, supervising reconstruction, maintenance and operation street railway, electric light and power, water and gas properties in New Orleans, Birmingham, Memphis, Little Rock, Knoxville, Houston and Pine Bluff. These activities engaged Mr. Black's time until 1914, when he became Chief Engineer of design and construction of public cotton warehouses and terminals in New Orleans. This work was highly diversified in character, including construction not only of warehouses but power plants, cotton compresses, wharves, tracks, cotton handling equipment and land reclamation.

Two years later Mr. Black became Chief Engineer on design and construction of New Orleans Public Grain Elevator. This project included workhouse, grain drier, million bushel storage bins with wharves, conveyors, galleries, trackage and land reclamation. The eight years following this engagement,

which consumed only one year, Mr. Black was occupied with valuation and rate negotiations, Market Street Railway, Sierra and San Francisco Power Company, Coast Valleys Gas & Electric Company in San Francisco, and consulting engineer Way and Structures Market Street Railway. From 1924 to 1925 Mr. Black was Vice-President in Charge of Market Street Railways, San Francisco. Two years following he was Chief Engineer of New Orleans-Pontchartrain Bridge, conducting investigations for foundations, design and construction of bridge over Lake Pontchartrain with highway approaches.

Failing health caused Mr. Black to considerably curtail his activities during the three years before his death and he alternated between the Corporation's New York and Birmingham offices. His last assignment was as consultant during the construction of the transportation system of the Southern Natural Gas Company.

Mr. Black is survived by his widow, the former Virginia Bullitt Grant, and two sons, William Grant Black and Alexander Leslie Black.

He was a member of the A. S. M. E., A. S. C. E., A. I. E. E., A. A. E., and the Louisiana Engineering Society.

PAPERS AND DISCUSSIONS

DREDGE ELECTRIFICATION

By C. T. PEARCE,

General Engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Read before the Society, November 10, 1930.

Technically speaking, a dredge is a floating excavator utilized for the purpose of removing sub-aqueous or underwater material. Although often referred to as a "mud-digger" and laying no particular claims to beauty, the dredge is one of the most useful members of the marine family. The science of dredging has accompanied and assisted that of navigation. The waterways must keep pace with the growth of commerce and the extension of inter-communication by water. Many of the great harbor cities of today owe their importance to the use of dredging. Notable among these are Los Angeles and Boston.

Another very valuable use for dredging is in obtaining material for fill as in formation of new land or creation of dikes and levees. Some of our most valuable real estate has been formed by using dredging for the draining of swamps or extension of water fronts.

Still another application for dredging is that of acquiring sub-aqueous material for its commercial value, as in mining low-grade ore deposits or obtaining sand and gravel for construction purposes.

The earliest dredges were operated by manpower and were somewhat similar in construction to our present-day dipper dredges. History tells us that the canals of Venice were constructed in part by a dredge of this type. The first power dredges, as we know them today, were driven by reciprocating steam engines. With the development of the steam turbine and the Diesel engine, other and more economical means of powering dredge drives were made available. This evening, however, it is my purpose to describe to you the uses and advantages of still another form of drive, one which because of its outstanding qualities of flexibility, economy, and reliability, has taken its place in every form of industry. I refer to that mysterious driving force which we call electricity.

For purposes of this discussion, I have classified dredges under the general headings of the hydraulic type or bucket type, depending upon the method utilized for excavation of the material. Obviously, the hydraulic type pumps the dredged material, mixed with the proper percentage of water, directly into hoppers or impounding basins, whereas the bucket type makes use of some form of bucket or buckets. Hydraulic dredges are of the river or sea-going hopper type. The river dredge is capable of further subdivision into the radial feeding type with spud anchorage, oftentimes called the pipeline dredge, and the self-propelled Mississippi River type utilizing forward feeding. The bucket type may be divided into the ladder dredge, utilizing an endless chain of buckets for digging, the dipper dredge, and the clamshell or grapple dredge. I shall now cite the advantages of electrification of these different types of dredges. Information will also be given concerning the proper type of electrical equipment for each dredge application.

Where it can be successfully applied, that is, if there is a nearby space for fill, etc., the pipeline dredge is a very economical unit and is probably the most commonly used of all types. The chief machinery consists of the main pump, absorbing roughly 75% of the total power, a revolving cutter or agitator for breaking up the material, a mechanism for swinging the dredge across the cut, and hoists for elevating the spuds and main digging ladder.

Where the power plant of a pipeline dredge is self contained, as is usually the case, the fuel economy of the Diesel engine fits it very admirably for use as a source of power. It has an average fuel rate of around .4 pound of oil per BHP. hour as compared to about three times this figure for a corresponding oil-fired steam engine installation. If it is attempted to connect the Diesel engine directly to the main pump, however, it results in a very inflexible arrangement and one which is very apt, in the larger sizes at least, to give trouble from torsional vibration. To maintain the proper trim, it is usually necessary to locate the dredge pump and its engine some distance apart. This gies a system composed of the engine crankshaft, connecting shaft, and pump runner, and one from which

it is almost impossible to eliminate critical speeds throughout the speed range over which dredge pumps are required to operate. If the engine is geared to the pump, the trouble is still further aggravated. With Diesel electric drive, on the other hand, the engines are used to drive generators and are operated always at the same speed. The moment of inertia of the rotating members may be quite readily and accurately predetermined from calculation and the engine generator set operated at a speed which is well removed from the critical.

Because of its greater flexibility, direct current equipment is much better suited for use on this type of dredge than is alternating current machinery. The preferable arrangement is to have two or more relatively high speed direct current engine generator sets placed in parallel to feed the main bus. With this plurality of generating units, operation can be continued at reduced output should one of the engines become disabled. In fact, the engine repairs can be carried out while pumping through short lengths of line when the power requirments are, of course, correspondingly reduced.

The substitution of a number of light, high-speed sets for one large low-speed unit usually results in a reduction in total weight and the equipment may be mounted to a better advantage. Not only are foundations lighter, but due to the distribution of weight, a better trim is obtainable.

With the generators operating in parallel to feed a common bus, the power for driving all auxiliaries, as well as for the main pump, may be taken from this bus. This permits full interchange of power between the main pump motor and the various auxiliaries. The power plant can be worked to full capacity at all times and the power divided between the auxiliaries and the main pump in such a way as to obtain the maximum output from the dredge. This can be obtained with no other type of dredge.

When the pipeline is shortened or the pumping head reduced for any cause, it becomes necessary to reduce the pump speed in order to avoid overloading the equipment. For a direct connected engine, delivering constant torque, the pump horsepower and consequently the dredge output must be re-

duced in proportion to the reduction in pump speed. With the Diesel electric system, on the other hand, the engines operate at constant speed and output, and maximum horsepower is available for any length of line or pump speed as long as all engines remain in operation.

Since direct connected or geared engines do not very readily lend themselves to speed control, the pump speed is often times held constant and the diameter of the pump runner changed to achieve the desired change in pressure. This method is not only troublesome and tedious, but also results in a lowered pump efficiency. With a direct current motor, speed reduction is very readily secured, with no loss in power, by means of field strengthening, that is, by increasing the shunt field current.

A word regarding the characteristics of the main pump motor would perhaps be in order at this time. It may usually be of the conventional open type self-ventilated design operated at any desired standard voltage. Special insulation is used for marine service and drip covers are often provided to protect the motor from dripping water and falling objects. The amount of speed reduction required will, of course, depend upon the intended variations in length of line, but 30% below maximum will be found sufficient in most cases.

Advantages of electrification for the cutter motion will now be discussed. Due to variations in nature and texture of material as well as changes in pipeline velocity, speed control in connection with the cutter motion is essential in order to deliver the correct amount of solid material to the pump at all times. For the usual range of materials, 50% speed reduction on the cutter motion is sufficient. With direct current motor drive, this is usually best obtained by field control. Where a greater speed range than this is required, variable voltage control from a separate generator is often preferable although it may mean an additional motor generator set. Obviously, it would be very difficult to obtain this speed control satisfactorily with any form of direct drive. For this reason, the cutter motion is oftentimes electrically driven even where direct engine drive is utilized for the main pump. In order to provide a simpler means of con-

necting the motor to the cutter, the cutter motor is very frequently mounted directly on the ladder near the base. Since the ladder swings through a considerable arc, the motor for this arrangement must then be equipped with thrust bearings, and is in addition usually totally enclosed and forced ventilated for operation in an unsheltered location.

Regarding the swing motion, in most instances, one motor is utilized to drive both right and left swing motions, both spud hoists, and the ladder hoist through a combination five drum winch with the necessary clutches. This makes a very feasible arrangement, since there is no occasion to have more than one of these motions in operation at one time. In order to obtain the wide variation necessary in swinging speed, this motor must be arranged for operation over a considerable speed range. For this reason, variable voltage control from a separate generator is ordinarily used for this motor. This arrangement provides a large number of economical running speeds between zero and full speed, something which is unobtainable with any other form of drive. As in the case of the cutter, the swing motion is quite frequently driven by an electric motor even where direct engine drive is used on the main pump.

In addition to its outstanding flexibility, the electrified pipeline dredge has no equal for ease and simplicity of operation. The controls for all motors may be located directly in the pilot house or lever room, placing complete control of all equipment at the very elbow of the operator. Switching equipment is provided to give complete flexibility of arrangement and meters are included to give an indication of the operating condition of all units at a glance. This latter feature enables the engineer to load all engines equally and locate sources of trouble such as undue friction, etc., before they can cause any damage.

The economy of the Diesel electric pipeline dredge has been amply borne out by the results of studies conducted by Mr. J. H. Polhemus, Manager of the Port of Portland. These studies covered a comparison of the operating costs between their Diesel electric dredge "Clackamas" using a 2700 h. p. direct current motor on the main pump, and a steam operated dredge utilizing twin 1000 h. p. turbines on the pump. Carefully kept records

over a period of two years showed that the total cost of operation plus maintenance for the steam dredge was 7.4c per cubic yard of material delivered. For the Diesel electric dredge, the corresponding figure was 3.4c or less than one half of that for the steam dredge. The comparison is even more striking when it is taken into account that the average length of line through which the "Clackamas" pumped was about 5,100 feet as compared to 3,200 feet in the case of the steam dredge.

When a pipeline dredge operates over a rather restricted area which is reasonably accessible to a transmission line, it often proves desirable to erect a pole line and shore station in order to obtain power at central station economy, using a submarine cable between the dredge and shore. Since the power requirements of a dredge are very uniform and represent 24 hour operation, this is a very desirable type of load from the standpoint of the central station operator and it will usually be found that he will be willing to grant rather attractive rates. Where more than one dredge is concentrated within a small area, the gain from shore power operation becomes even more apparent.

In order to obviate the additional cost and complication of motor generator equipment, dredges fed from shore power frequently make use of a wound rotor induction motor on the main pump, even though this admittedly does not provide the same flexibility as would direct current motor drive. Speed reduction is obtained, usually at constant torque, by means of resistors in the secondary circuit of this motor. The same type of drive can, of course, be used for the swing and cutter, but it is usually recommended to install a small alternating current-direct current motor generator set for supplying the motors driving these motions. This is particularly true in the case of the swing motor, the advantages of variable voltage control for which have already been described.

I have several times made mention of the term "variable voltage control" without perhaps explaining just what it consists of. A separate generator is used for each motor. Both motor and generator are separately excited from a small exciter. The motor excitation is held constant but the generator excita-

tion is varied. This changes the value of voltage placed across the motor armature, thereby producing corresponding changes in motor speed.

Where power for operation of a pipeline dredge must be supplied by a steam turbine, it is somewhat doubtful as to whether electric drive on the main pump is justified. By gearing the steam turbine directly to the pump, a very simple and economical type of drive is provided which is probably satisfactory in most cases although not giving the flexibility of the electric type of drive.

Although using geared turbine drive on the main pump, it is very advantageous to employ electric drive for the cutter, swing, and other small auxiliaries. This power would be supplied from an auxiliary direct current generator driven either by a small additional turbine or from a separate pinion on the main turbine gear.

The advantages of electrification of the Mississippi River type dredge will now be discussed. This is a special hydraulic type developed by the Mississippi River Commission for maintaining navigable depths in our inland rivers. As you probably know, it differs from the ordinary pipeline dredge just discussed in that it is self propelled, employs water jet agitators, utilizes forward feeding, and pumps through a relatively short pipeline. In general, the advantages outlined for electrification of the pipeline dredge are also applicable in the case of the Mississippi River type. In addition, there are the advantages incident to electric propulsion itself, such as reliability, flexibility, exceptional maneuvering qualities, and pilot house control. Another characteristic peculiar only to electric drive is that the capacity of the power plant need be only sufficient to supply the total load requirements at any one time. With any type of direct engine drive, an appreciable part of the power plant would always be lying idle or operating at very reduced capacity, whereas with electric drive, the total capacity of the power plant need be in most cases only slightly more than one-half of the combined propulsion and dredging capacity.

The hydraulic sea-going hopper dredge is a self propelled type, specially adapted for use in harbors and rivers where it is desired to place as little as possible restriction on traffic. The material is brought up through suction pipes or drags by means of powerful pumps and discharged into hoppers which also serve to transport the dredged material to the dumping grounds. Feeding is accomplished while propelling at a low rate of speed.

The advantages accruing to the electrification of the sea-going hopper dredge are a combination of those applying to the ordinary electrified pipeline dredge and those applying to electric propulsion of any kind. As in the case of the Mississippi River type dredge just described, the capacity of the power plant may be somewhat less than the total maximum requirements for both propulsion and dredging, since the propulsion load is very much reduced when engaged in dredging.

A few years ago, the U. S. Engineer Corps placed into service four all electric sea-going hopper dredges. These vessels are the "A. MacKenzie", the "Dan C. Kingman", the "Wm. T. Rossell", and the "W. L. Marshall". Each vessel is equipped with three 1000 H. P. Diesel engines and each engine drives a 700 K. W., 500 volt, direct current generator. Two of these generators supply two 800 H. P. propelling motors and the other an 800 H. P. pump motor.

The ladder type dredge performs most advantageously in mining of low grade ore deposits or for sand and gravel dredging. The material is picked up with a minimum of agitation and delivered to the screen in a practically continuous stream and with almost no loss.

The chief machinery of a typical ladder dredge consists of the main bucket chain which does the digging, the ladder hoist for changing the digging depth, the main screen for separating and sifting the dredged material, and the secondary bucket chains for elevating the different grades of material to a point where they may be discharged to barges through chutes. For mining dredges, motors are added for driving equipment which disposes of the refuse material after the metal bearing ore has been extracted.

The ladder type of dredge utilizes the principle of tandem operation throughout, the speed and load requirements of any one motion depending upon the material delivered to it by the previous operation. In order to obtain a maximum output from the dredge at all times, a means for accurately controlling the speeds of the digger, screen, and elevator drives is essential. The quality of the dredged material varies considerably from time to time and readjustment of the relative speeds becomes necessary for the efficient operation. In most cases, 50% speed reduction on the motors for the above drives will be found sufficient. Where all motions are driven at the same relative speeds from one common engine, as is the case with some steam driven dredges, it results in a very inflexible arrangement which cannot operate efficiently in all classes of material.

Where the ladder type dredge must be moved frequently and not more than one is located in a given locality, as is frequently the case with sand and gravel dredges, it is usually most satisfactory for each dredge to carry its own power plant. In that case, direct current equipment is much to be recommended because of its superior flexibility. Due to the relatively low power requirements of this type of dredge, one generator will usually be found sufficient for supplying the entire load. This generator may be driven by a steam turbine or a Diesel engine.

When utilized for mining purposes, several dredges are frequently concentrated within a small area and are moved ahead at a rather slow rate. If within a reasonable distance of a transmission line, this justifies the eraction of a pole line and shore station to obtain power at central station economy. In this case, all operations are usually driven by alternating current induction motors, speed control for the variable speed applications being obtained by means of secondary resistance. While this type of drive is not nearly so flexible as that obtained with direct current motors, the added advantages of the latter type of drive do not usually justify the additional cost of motor generator equipment.

The dipper type dredge is the floating counterpart of the ordinary land power shovel. The chief machinery consists of the main hoist which does the digging and raises the bucket, the

swinging and backing motions, and various auxiliary hoists and winches. In the majority of these drives, the torque requirements fluctuate widely and rapidly over cycles of rather short duration. These special torque requirements are met in an ideal fashion by the reciprocating steam engine but probably with no other form of direct engine drive. They can be obtained, however, with electric drive even though it may require a separate generator for each motion in some cases.

The outstanding advantage of electric drive as compared to the steam engine is its superior economy when supplied with shore power or where utilizing the steam turbine or Diesel engine as a prime mover. Another advantage is its unusual flexibility and ease of operation and control.

The next, as well as the last type of dredge in order for discussion is the clamshell dredge with which can also be classed the orange-peel type. While somewhat simpler in operation than the dipper dredge, the clamshell type is equipped with machinery of much the same characteristics. The advantages of electric drive outlined for the dipper dredge will therefore be applicable in the case of the clam-shell dredge and the electrical equipment will be of the same type.

In conclusion, I should like to leave with you the thought of considering electrification as a form of gear—a gear which is simple, silent, economical, and extremely elastic and which is adapted for use between the various dredge drives and the prime mover engines located either on the dredge or in a central power house miles away.

DISCUSSION

THE PRESIDENT: I am sure we have all learned a great deal about dredge electrification. However, if there are any questions you care to ask Mr. Pearce, I am sure he will be glad to answer them.

I wonder if Mr. Pearce can tell us whether existing dredges have ever been changed partially or fully to electrify them?

MR. PEARCE: Cases of that kind are rare since electrified dredges are usually bought as a unit, and electrification of existing dredges involves changes in the hull.

The most notable one which I recall is the electric dredge Norfolk in New York harbor, which had direct drive on the pump with Deisel engine. Later they bought an 800 K. W. generator, and used the old engine for driving the new generator and obtained 1600 or 1800 horsepower on the main pump.

MR. CRUMP: Changed the main pump?

MR. PEARCE: Yes, from direct engine drive to motor drive, and utilized the old engine for driving the 800 K. W. generator. Two 350 K. W. Diesel engine generator sets before used for supplying auxiliary power were used to assist the 800 K. W. unit in supplying power to the main bus.

MR. CRUMP: Was the capacity of the dredge changed?

MR. PEARCE: Yes, I believe the old engine was 1200 h. p. and the main pump was changed to 1800 h. p. with motor drive.

MR. BENSON: What is the usual voltage on these motors?

MR. PEARCE: For direct current, up above 500 or 600 horsepower, it is better to use 500 volts to limit the current and below that, 250. With double armature construction and armatures in series, the above is voltage per armature.

MR. BENSON: What is the usual range of speed regulation? Is it by shunt field?

MR. PEARCE: Fifty per cent for the cutter and for the main pump motor about 30%. It depends on the variations in material and length of pipelines. It is obtained by shunt field control.

MR. BENSON: What is the usual speed of the cutter shaft?

MR. PEARCE: I am not so familiar with that because we furnish the motor only, but I do know it runs as low as six and as high as eighteen or twenty R. P. M. I know that for certain materials they must go at a rather slow speed, and for others higher. Dredge operators usually say about 50% speed range is necessary.

MR. LORIO: Are all motor pumps direct connected?

MR. PEARCE: Yes, for the range of pressure required on dredge pumps, no gears are required. It usually operates from 160 R. P. M. to as high as about 350 or 400. That seems to cover about the pressure required to take care of the pipe line changes.

A MEMBER: What is the advantage of the double armature motor?

MR. PEARCE: The advantages are not so obvious in the case of pump drive as for propulsion service. The chief advantage is a saving in diameter. Space requirements for propelling motors are usually such that you have lots of length but not sufficient diameter for the single armature motor. The reason that probably 75% of motors used for propulsion are of the double motor type is because of the limited space between the propellor shaft and the keel of the boat.

A MEMBER: Throughout your talk you used as a particular argument, flexibility. It seems to me in most cases of dredges, speeds are rather constant. The speed on a pipe line dredge—the speed requirements do not amount to a great deal and can be taken care of by ordinary manipulation of a steam engine, and you have erected two electrical machines that have separate power losses to take care of this added regulation. How do you argue out of that?

MR. PEARCE: My argument was not that the steam engine could not give you everything you wanted, but that the Diesel was more efficient. The Diesel, however, is a rather inflexible piece of machinery to operate and requires a connected generator to give it the desired flexibility. In instances with which I am familiar, the dredge may be pumping through as high as two miles of line, or as low as five or six hundred feet, and that, of course, necessitates a great deal of speed range or control on the main pump. Now as to the matter of the losses. Admittedly it is true that you have the electrical losses between the engine and the drive, but I have endeavored to point out the advantages you gain in flexibility which justifies these losses.

As I said in the conclusion of my talk, electric drive is a sort of gear that permits any type of connection either from a central power station or from power generated on the dredge. This flexibility is purchased at the expense of the *additional cost* which is usually a greater factor than the loss between engine and drive.

PROF. GREGORY: The speaker has referred to the peculiarities of the Mississippi River dredges in that they use an agitator.

Several years ago I was employed by the Mississippi River Commission to test various types of pumps. One was a centrifugal pump, and centrifugal pumps did not furnish the high efficiency now available in steam pumps and in turbine pumps. The other was such as used in water works, and that, of course, is a very clumsy arrangement. I have not seen the Mississippi River dredges in recent years, but I presume those agitators are supplied by centrifugal pumps supplying water?

MR. PEARCE: I am not entirely familiar with this feature but there is a dust pan type of agitator spread over the entire front which provides water to stir up the sand sufficiently to feed the pipe line.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of Board of Direction, November 10th, 1930.

Meeting was called to order by President Todd and the following members were present: Messrs. O'Neill, Fox, Dunlap, Moses, Billingsley, Frost and Muth.

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

The Obituary and Resolutions on the death of Mr. Samuel M. Young, submitted by Professor Douglas Anderson, chairman, were read, and on motion duly seconded, it was voted that the family of Mr. Young be furnished with a copy of the Obituary and Resolutions, that they also be published in the "Proceedings," and a copy be spread upon the Minute Book.

An invitation from Mr. C. S. Williamson, Jr., Chairman, New Orleans Committee of the American Institute of Chemical Engineers, was read, inviting the Society to attend the winter meeting of the American Institute of Chemical Engineers at the Roosevelt Hotel on December 8th. On motion, duly seconded, it was voted to accept this invitation and the Secretary was instructed accordingly. There being no further business the meeting adjourned.

F. A. MUTH, Secretary.

Minutes of the Society, November 10th, 1930.

The meeting was called to order about 8:10 P. M. by President Todd, F. A. Muth, Secretary, and 72 members and guests present.

The minutes of the previous meeting were read and approved.

The Chairmen of various committees submitted reports, and on motion, duly seconded, after hearing the Committee on Entertainment, it was voted to hold the annual meeting and smoker on January 17th—third Saturday.

Professor W. B. Gregory read the Obituary and Resolutions on the death of Mr. Samuel M. Young, and the motion of the Board on this night was approved by the members present.

Announcement of the action of the Board in accepting the invitation to be present at the winter meeting of the American Institute of Chemical Engineers on December 8th was made, and the members were requested to bear in mind this meeting, also the other sessions to be held at the winter meeting to which the members of the Louisiana Engineering Society were invited.

The technical exercises of the evening consisted of an interesting paper on Dredge Electrification by Mr. C. T. Pearce. This paper was illustrated with lantern slides and was followed by an interesting discussion. A rising vote of thanks was then tendered the speaker, and the meeting adjourned to the usual collation.

F. A. MUTH, Secretary.