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of the

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CONTENTS

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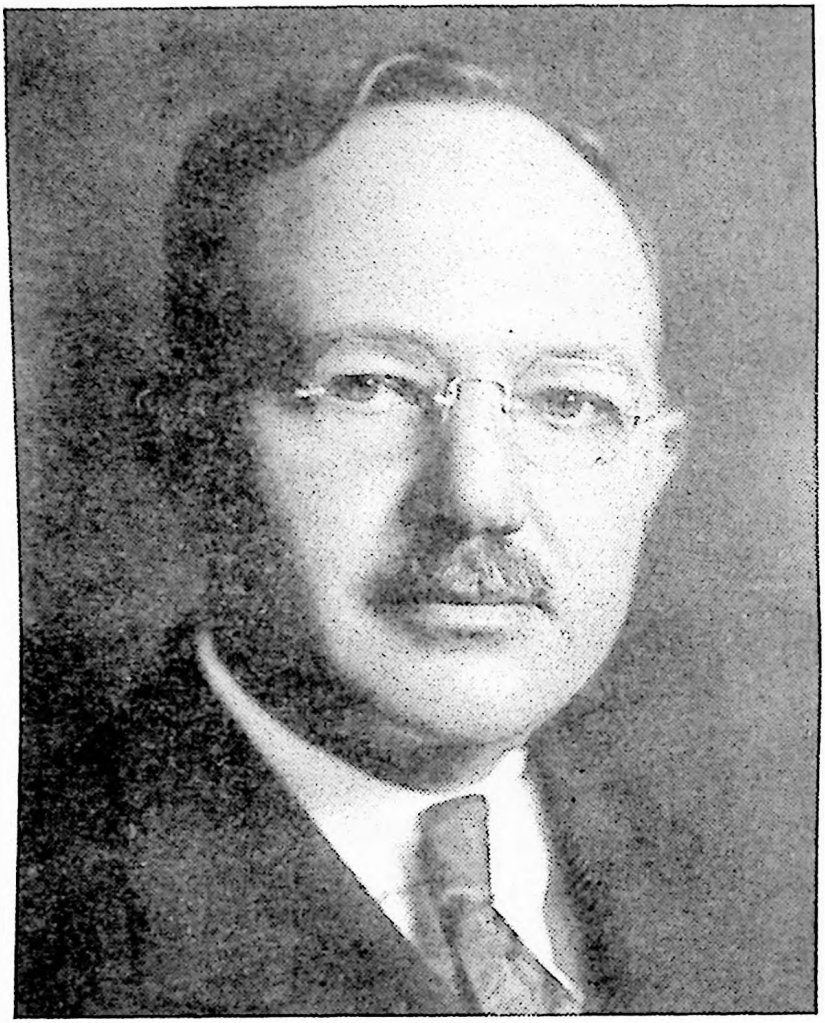

C. Glenn Cappel

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXVIII. FEBRUARY, 1942 NO. 1

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EDITORIAL NOTES AND COMMENT

Our New President. Facing this page is the picture of C. Glenn Cappel, our jovial leader for the year 1942. "Cap" as he is affectionately called, is a graduate of the Civil Engineering class of 1912, Louisiana State University. Later he took graduate work at R. P. I.

For a number of years he has taken an active interest in the affairs of the Society. He has done a particularly fine job in securing new members for our organization.

Mr. Cappel is a member of the firm of W. Horace Williams Company. In a paper before the Society a few years ago, he described the method he used in moving a five-story brick building a distance of 262 feet without damage to the structure. At the annual meeting in January he presented a paper on some problems of cantonment construction.

His friends are legion, and almost as numerous are his stories. In addition to being an outstanding civil engineer, he is an authority on goat raising at his country estate. Ask him why billy goats smell so smelly!

Our Officers and Board. Our First Vice President is Karl P. Kammer, Assistant Superintendent of Electric Department with the New Orleans Public Service, Inc. Mr. Kammer has in the past been identified with numerous committees, particularly that of Chairman on Arrangements for the Annual Meeting in 1940.

Our Second Vice President, Professor Frederick F. Pillet has been a member of the Society since 1922, and Professor of Civil Engineering at Louisiana State University for a number of years. He frequently attends the meetings in New Orleans, and is actively interested in the Baton Rouge Section, being their Second Vice President also.

Professor Reinhard A. Steinmayer is Head of the Department of Geology at Tulane University, and was selected as a Board member for two years. In the past he has given several interesting papers before the Society on the geological conditions in our State.

The other newly elected Board member for a two-year term is Mr. Robert J. Kuhn. "Bob" is a consulting engineer and a real live wire. We are fortunate in having the association of such an aggressive personality.

Other members of the Board are: Mr. Charles M. Kerr and Mr. Richard B. Kohnke, both finishing out the last year of their term of office, and retiring President David W. Stewart.

Our Secretary-Treasurer is again John K. Mayer, who deserves much praise for his efficient handling of the many details connected with the affairs of the Society.

The Society is fortunate in having the services of these engineers. Your officers and board are confronted with many problems, and always foremost is how the membership can best be served. If you have some suggestions, send them in; they will be welcome. The activity of the Society cannot be limited to the comparatively few officers, board members and committee chairmen. All must take part in order to make it a live, vital organization of engineers. Do your part!

A Message From Our President. During times of national emergency and stress such as these we are now undergoing, each one of us must do his utmost for the benefit of all of us. If, however, each one of us tries to do a part of all things, total accomplishment will be small. It behooves us, therefore, to concentrate on certain major problems where we can accomplish the most.

Apparently the Louisiana Engineering Society has two major problems confronting it now; first, of course, is defense. We should marshall our forces and throw them into the line of endeavor where we can actually accomplish the most. In this we should necessarily be guided by properly constituted authority, giving them every assistance and cooperation.

Our second major problem is unification of the engineering profession. During times like these when the ratio between salaries and hourly wages is out of proportion, the Engineer should realize his position of leadership and steadfastly maintain his position. We are one of the oldest and most dignified professions. We are also one of the most essential—I might say the most essential—profession. It is therefore our duty to maintain our position in society in a proper and dignified manner, but also in a forceful and determined manner.

More than ever before will we officers need the cheerful and full and unhesitating cooperation of every member. We all expect every member to give of his effort and time and ability —not until it hurts—but beyond, to whatever point may be necessary.

C. Glenn Cappel,
President, Louisiana Engineering Society.

In This Issue. The February issue is one of the most important of the six issues of the year. There is the picture of our new president and his message, and the membership list. Remember the list not only gives the name of member, but also gives his business connection and address.

In the front of this and other issues will be found the standing committees for the year. These committees cover the major activities of the Society.

In the technical paper section there are two articles on different phases of the petroleum industry; Prospecting for oil and tetraethyllead manufacture. Both are interesting, informative and up-to-date. Read them.

New Members. The following list comprises two ballots on members elected during the last quarter of 1941. Read it over; there are probably a number of them already known to you.

Angelo, Ernest James, Jr. Junior Member. Age 24. Endorsed by: C. W. Ricker, C. S. Williamson, C. B. Norris. 1939—B. E. E., Electrical Engr., North Carolina State College. July '39-April '40 Student Training Program, Southern Bell Tel. & Tel Co., Kentucky Div. April '40-August '41 Kentucky Div., Engr. Office, Sou. Bell Tel. & Tel. Co. September '41 to date Instructor in Electrical Engineering, Tulane University. 7031 Freret St., New Orleans, La.

Buck, N. Lewis. Member. Age 29. Endorsed by: J. M. Robert, D. Derickson, C. S. Williamson, J. K. Mayer. 1938 B. S. in M. E., Kansas State College, Manhattan, Kan. Sept. '38-March '39 Cost & Inventory Engr., Assoc. Gas & Electric Co., Dover, N. J. March '39-August '39 Graduate Student Engr., Westinghouse Elect. & Mfg. Co., Pittsburgh, Pa. September '39 to date Instructor in Experimental Engineering, Tulane Univ. Summer 1940 graduate work on Master's degree at Univ. of Mich., Ann Arbor, Mich. Member of A. S. M. E. 735 Exposition Blvd., New Orleans, La.

Cassidy, John F. Member. Age 33. Endorsed: H. P. Newton, K. Ward, Jr., H. J. Molaison. 1930—B. S. in Ch.E., Montana State College. 1930-34 Investigating smelter fume dam-

age caused by Canadian smelter in Northeastern part of state of Washington for Bureau of Chemistry & Soils, U. S. Dept. Agriculture; involved measurement of SO_2 concentration in atmosphere. 1934-40 Insecticide research in connection with control of apple insects in Wenatchee & Yakima, Wash. & in Vincennes, Ind. 1940 to date Asst. Engr., Engr. & Development Div., Southern Regional Research Laboratory. 846 Bungalow Court, New Orleans, La.

Dunn, Edgar M. Member. Age 29. Endorsed by: C. W. Ricker, A. J. Fransen, Wm. Cater. 1933—B. E. in M. & E., Tulane Univ. 1935 M. S. in E. E., Tulane Univ. 1935-February '41 Instructor of Industrial Arts, Orleans Parish School Board. March '41 to date Office Engr. for Louisiana Shipyards, Inc. Member of Tau Beta Pi. 934 Howard Ave., New Orleans, La.

Earl, Thomas Collins. Member. Age 26. Endorsed: J. L. Porter, Wm. Hardy, A. M. Hill. 1938—B. E. in M. E., Tulane. Jr. Engr. Inspector in regional headquarters for P. W. A. in 7 states. Mechanical & civil resident engr. for Lewis Chambers Construction Co. on levee construction work. Mechanical engr. on estimating, sales & supervision of installation of plumbing, heating & mechanical equipment for Wilton M. Ellin. Mechanical engr. with Glenn L. Martin Co. in aircraft engr. training course & bomber construction work in the engr. dept. Mechanical engr. with W. Horace Williams Co. at Camp Claiborne on gen. mechanical engr. work. Head of Mechanical Engr. Div. of Engr. Dept. with W. Horace Williams Co. at Camp Polk in charge of all mechanical engr. work. c/o W. Horace Williams Co., Camp Polk, Leesville, La.

Hebert, Joseph I., Jr. Member. Age 27. Endorsed by: L. J. Lassalle, W. L. Argus, R. F. Legeai. 1937—B. S. in C. E., L. S. U. '37-'40 Junior Engr. with Shell Oil Co., Houston, Tex. '40 to date Commercial Representative of New Orleans Public Service, Inc. Licensed Civil Engineer in Louisiana. 94 Fontainebleau Drive, Apt. A., New Orleans, La.

Helm, Malcolm Boord. Member. Age 46. Endorsed: H. E. Crump, G. C. Rackerby, L. P. Raynor, W. F. Standke, Jr. 1917—B. S., U. S. Military Academy; 1920—Rodman, Midwest Re-

fining Co.; Casper, Wyoming. 1921—Draftsman, La. Oil Refining Corp., Shreveport, La. 1925-30—Draftsman, The Texas Co., Shreveport, La. 1930-33—Chief Draftsman, Texas Co., Shreveport. 1933 to date—Assist. Div. Engr., Texas Co., Shreveport & New Orleans. Registered Professional Engr. (Civil), State of Texas. Member Society American Military Engr., American Society of Engineers. 1727 Broadway, New Orleans, La.

Pominski, Joseph. Junior Member. Age 26. Endorsed: H. J. Molaison, W. N. Tuller, F. H. Fenn. B. S. in Ch. E. from L. S. U. in 1935. September 1935 to August 1938—Junior Engr. Aide (Chemical) with U. S. Engr. Aug. 1938 to May 1941—With U. S. Food and Drug Administration. May 1941 to date—Junior Chemical Engr. with Southern Regional Research Lab'y. 337 Hillary St., New Orleans, La.

Scofield, W. Fleming. Member. Age 31. Endorsed: J. M. Robert, Donald Derickson, J. K. Mayer. B. S. in C. E. Univ. of Kansas. Rodman, instrumentman & draftsman, Kansas Hwy. Comm.—4.3 yrs. Instructor, Civil Engr., Kansas Univ.—2 yrs. Asst. Resident Engr. & Designer, Black & Veatch—1.3 yrs. Instructor, Civil Engr., Rice Inst.—2 yrs. Engr. Designer, Lockwood & Andrews—0.3 yrs. September '41 to date—Asst. Professor, Civil Engineering, Tulane Univ. Registered Civil Engr. in Louisiana. Junior Member of Univ. Registered Civil Engr. in Louisiana. Junior Member of A. S. C. E.; member of S. P. E. E. 723 Fern St., New Orleans, La.

Sens, Charles Lee. Member. Age 46. Endorsed: D. W. Stewart, K. Ward, Jr., H. P. Newton. Technical Studies of machines & methods in textile manufacturing plants. Installed complete mill unit of textile experimentation plant. Employed by Mt. Vernon-Woodberry Mills, Inc., for 16 yrs. For 12 yrs. general supt. of their 3 Baltimore mills in charge of manufacturing, purchasing, maintenance & repairs, employment & reorganization of machine layouts & labor schedules. Present—Senior Cotton Technologist, Cotton Purchasing Div., Southern Regional Research Lab'y. 1620 Mirabeau Ave., New Orleans, La.

Stevenson, Frank M. Member. Age 44. Endorsed: F. R. Adams, E. L. Erickson, J. P. McCullough. 21 yrs. service with Southern Bell Telephone & Telegraph Co. 1923-1926—Office Engr. to Div. Plant Engr. in Mississippi Div., Jackson, Miss. 1926-28—Exchange Engr., field telephone engr. work. 1928 to date—Right of Way Engr. in charge of Right of Day Dept. of Louisiana Div. 84 Maryland Drive, New Orleans, La.

TRANSFER FROM STUDENT TO JUNIOR MEMBERS

R. W. Adamson, H. J. Bultman, Jr., John Culbertson, J. T. Dwyer, Jr., M. J. DeLerno, L. P. Fadrique, S. C. Murphy, F. J. Ory, J. A. Polack, G. H. Thompson, W. A. Wood, Jr., R. A. Herrod.

Will You Help? Below Is An Appeal for Books for Men in the Service. The Campaign, sponsored by the American Library Association, American Red Cross, and United Service Organizations, seeks ten million books for U. S. O. houses, Army "dayrooms," ships, Naval bases, etc. Books should be taken to libraries, where they will be sorted, repaired if necessary, and sent on as quickly as possible to the spots where men in the service want books. In many communities schools and other conveniently located places will be designated as collection centers. Unbound magazines and newspapers will not be handled.

Although the Government provides libraries in the larger camps, the smaller units have no library at all, and even in most camps where libraries do exist, the demand for recreational reading is usually far greater than the supply. Books provided through the Book Campaign will thus supplement the Government's existing library facilities. Men on leave—and in "off hours"—depend on the dayroom of their company and their U. S. O. house for their leisure-time reading.

About the kinds of books to be collected—well, what kinds of books do **you** like? Our soldiers and sailors have a wide range of reading interest and like those very titles, too! They are particularly eager for up-to-date technical material to help

with their problems, as well as books on current affairs and plenty of good fiction.

Put your name and address in the books you give—the boys will be so interested to know "who gave what".

Bring or send your books to the Society's rooms, 422 St. Charles Hotel, New Orleans, La.

Here Are Some Facts in Connection With the Louisiana Library Commission Services. Perhaps they can be of assistance to you:

What Types of Books are Available? The Louisiana Library Commission's collection of books consists of informational books on all subjects—business, religion, fine arts, science, education, health, recreation, farming, useful arts, house plans—in fact, on every subject that might be of interest to any citizen or group of citizens in the State.

How Can These Books Be Used? These books may be borrowed through one's local library—at the request of the librarian —or, if you live in a community where there is no library, they may be borrowed direct from the Louisiana Library Commission by merely writing for specific titles or for books on a given subject.

How Will We Know What You Have? The Louisiana Library Commission will be glad to prepare lists of available or recommended titles on any subject. If you wish a list of books for distribution at your annual meeting, or on some special topic of timely interest on which your organization is focusing its attention between meetings, we shall be glad to prepare such lists in mimeographed form in sufficient quantities for distribution to your local units or individual members.

How Much Does This Service Cost? The services of the Louisiana Library Commission are free. No fees are charged for the use of books, and the only expense to the borrower is that he must pay the return postage. A special book postal rate makes this amount very nominal.

Are Exhibits of Books Available? Book exhibits are loaned to organizations upon request. Some have used them at their annual meetings; many prefer to use them at local meetings in connection with particular programs.

Can the Individual Member Receive Similar Service? Yes, any resident of the State may use the books in the library of the Commission, and may ask for help from the staff of trained librarians, in findings any information needed for his business, for his work in organizations, for civic improvement, or for his own cultural and recreational reading.

The Louisiana Library Commission is Organized to Serve You—Use Its Services.

P. O. Box 131, Baton Rouge, La.

Attention Members in Military Service: During this time of war and consequent transfer of our military members from one point to another, difficulties in getting your Society mail to you arise.

Won't you help by advising us now of your change in address? If you are on the move so much that even this is not feasible, how about an address from which your mail can be sent on to you?

To make this easy a card is printed inside the rear cover—cut out and mail. We want to keep you posted about your Society's affairs, so let us have the new address today, please.

PAPERS AND DISCUSSIONS

THE MANUFACTURE OF TETRAETHYLLEAD

O. E. KURT*

Mr. Chairman, members of the American Institute of Chemical Engineers and of the Louisiana Engineering Society and guests, I appreciate the honor of being invited to address this group, and, in accordance with the request which was passed on to me from your Executive Committee, I shall give you a brief description of the processes employed in Baton Rouge in connection with the manufacture of tetraethyllead and of some of the related chemical and engineering problems.

A unique opportunity is presented in the consideration of tetraethyllead to review the complete history and development of a process, to contemplate the development of an idea from a laboratory experiment into a key industry which has had an important effect upon both the oil and automobile industries. Tetraethyllead is used as an anti-knock agent in 85% of the gasoline sold in the United States and Canada. The Ethyl Gasoline Corporation is the sole manufacturer and supplier in this hemisphere.

The idea of an anti-knock compound and of hydrocarbon fuels which would show less knocking tendency was presented by Charles F. Kettering, now in charge of the General Motors Research Laboratory, before the Society of Automotive Engineers in January, 1919. He called attention to the problem of knock which occurred at higher compression ratios and, therefore, prevented further increase in compression ratio to increase the power and efficiency of engines. He mentioned that the property of fuels to knock was not related to the ordinary physical properties of which gasoline was graded, but did

* Manager, Technical Division, Ethyl Corporation, Baton Rouge, La.
Presented at the joint meeting of the New Orleans Section, American Institute of Chemical Engineers and the Louisiana Engineering Society on November 10, 1941.

seem to be related to the molecular structure of the fuel since some hydrocarbons would withstand much higher compression ratios than others. Furthermore, compounds such as ethyl iodide could be added to the fuel which would reduce its tendency to knock.

Thomas Midgeley, Jr., T. A. Boyd, and a staff of workers under the direction of Mr. Kettering spent years in a systematic study of chemical compounds to determine which would most effectively reduce knock. Their studies culminated in the discovery of tetraethyllead, an obscure compound, which possessed unique anti-knock properties, and gasoline containing tetraethyllead was first put on public sale at a single service station in Dayton, Ohio, on February 1, 1923. This gasoline was sold under the now familiar name of Ethyl gasoline and was immediately accepted as a superior fuel for the low compression automotive engine of that time.

The discovery of the unique property of tetraethyllead was followed by the problem of developing a suitable method for producing this compound. Organic chemists among you will recognize this compound as belonging to the less common class of organo-metallic compounds concerning whose production, even in the laboratory, very little was known. There was no "prior art" in the large scale production of organo-metallic compounds. The General Motors Corporation found a reasonably economical method of manufacture, but meantime, chemists with the Standard Oil Company (N. J.) developed a more economical method of manufacturing tetraethyllead by reacting ethyl chloride with an alloy of sodium and lead. In August 1924, in conjunction with General Motors, they formed the Ethyl Gasoline Corporation. Considerable work was necessary, both of chemical and chemical engineering natures, to develop the process to its present satisfactory state and for this the engineers and chemists of the du Pont Company deserve a great deal of credit. For years the du Pont Company produced tetraethyllead for the Ethyl Gasoline Corporation, and, at the present time, it operates the sodium and tetraethyllead plants for the Ethyl Gasoline Corporation.

The use of tetratethyllead gasoline also gave rise to certain problems, and it was early recognized that by itself this compound was unsuitable because of the effects of its combustion products. Halogen compounds were therefore added to convert the combustion products to a volatile form which would be blown from the combustion chamber with the exhaust gases. Extensive tests, both in the laboratory and on the road, led to the selection of the present corrective agents, ethylene dibromide and ethylene dichloride.

The sale and the use of Ethyl gasoline increased rapidly from the day that it was first sold until in 1932 when, as in the case of many other premium products, the sales volume began to decline rapidly. In the meantime, the quality of regular gasoline had improved as a result of developments in refinery practice, and engine improvements in the automotive industry necessitated fuels of increased anti-knock quality. In 1933 tetraethyllead was first added to regular grade gasoline as an economical means of achieving a part of the required anti-knock quality. In spite of the improvements made in regular fuels, the demand for premium fuel has increased to the point where Ethyl gasoline is being sold in greater quantities than during the peak in 1931. 85% of all the gasoline sold in the United States now contains tetraethyllead, while in the aviation field practically all of it contains tetraethyllead. In fact, the performance of modern military and transport planes is due in large part to the development of high octane gasoline, a development in which tetraethyllead played an important role.

Tetraethyllead is unique in a number of respects, one of which is that it is still the best anti-knock compound after having been on the market for 18 years. In fact, it has not even had serious competition because all of the many other anti-knocks which are known as a result of studies in our own and other laboratories over these many years possess either economic or technical disadvantages.

Five years ago it became evident that the continued increase in the demand for tetraethyllead would require an increase in the manufacturing facilities over those then available at Deepwater, New Jersey. New sites were considered and

Baton Ruoge, Louisiana, was selected on the basis of availability of raw materials, power, and transportation. The Ethyl Gasoline Corporation purchased a plot of land and construction was began by the du Pont Company on October 6, 1936. In less than one year, on September 7, 1937, operation was started and by the end of 1938 a plant had been built equal in capacity to the facilities at Deepwater. During 1937 and 1938, also, a sodium plant and two ethyl chloride plants were constructed, one ethyl chloride plant starting operation on July 16, 1938, the other on April 25, 1939, while the sodium plant started production March 15, 1939. Since that time further additions have been made. The total capacity of the plant at this time is about 100,000,000 pounds per year which provides considerable standby capacity.

The description which follows concerns only the Baton Rouge Plant since it is more modern than the Deepwater Plant and holds more local interest for you. The ultimate raw materials for the manufacture of tetraethyllead are, pig lead, brine, alcohol, hydrogen and refinery stabilizer gases. The brine obtained from the adjoining works of Solvay Company is evaporated to produce salt which is then melted and electrolyzed to produce sodium and chlorine. The sodium is melted with lead to form the alloy which, after grinding, is ready for the reaction with the ethyl chloride to form tetraethyllead. Chlorine formed in the electrolysis is burned with hydrogen which is obtained from the adjoining refinery of the Standard Oil Company of Louisiana to form gaseous hydrogen chloride.

Ethyl chloride is produced from hydrogen chloride by two distinct processes: first, the familiar reaction with ethyl alcohol; second, by reaction with ethylene. In this process refinery stabilizer gases consisting largely of propane are cracked and the cracked gases fractionated at low temperatures to separate the ethylene formed. This is allowed to react with hydrogen chloride gas at low temperatures in the presence of a catalyst to produce ethyl chloride. The Baton Rouge plant is the first commercial development of this method of manufacturing ethyl chloride. Ethyl chloride produced by either process is

subjected to appropriate purification processes and is then ready for the final reaction with the lead-sodium alloy.

The reaction may be represented by the equation:

$$4\ PbNa + 4C_2H_5Cl = Pb(C_2H_5)_4 + 4\ NaCl + 3\ Pb$$

In the manufacturing process the alloy and ethyl chloride are allowed to react at moderate pressures and temperatures. At the completion of the reaction the product is distilled with steam to separate the tetraethyllead and the lead sludge is collected and resmelted to pig lead. The reaction appears simple, but the conditions have to be carefully controlled in order to reduce side reactions to a minimum and to prevent decomposition of tetraethyllead which is thermally unstable. Following the steam distillation of the tetraethyllead, it is taken to the blender where it is carefully mixed in the required proportion with ethylene dibromide, ethylene dichloride, and dye.

Throughout the manufacturing process careful control is exercised to check on the efficiency of the process by weighing exactly the reactants and the product and to control the quality of the final Ethyl Fluid product by weighing exactly and analyzing the ingredients which go into it and analysis of the final product. The manufacture of tetraethyllead is a batch process with a number of units, and this provides an excellent opportunity for the evaluation of various operating factors in the plant itself by careful control and variation of the various conditions which may affect the process.

The operating technique must also be carefully controlled in order to prevent exposure of the operators to tetraethyllead which is poisonous and may be absorbed into the body by skin contact and inhalation of vapor, as well as by ingestion. Specialized equipment was necessary to accomplish this control of the exposure hazard. This equipment consisted of ventilating equipment of unusual capacity, valves, stuffing boxes, and gaskets of special design to prevent leaks completely, and to provide for emergency conditions. Despite the difficulties inherent in this problem, the safety record of the tetraethyllead industry has for many years been far better than that of any other lead industry, according to the best available figures.

From the beginning, research has played an important part in the activities of the Ethyl Gasoline Corporation. The Chemical Research Laboratory at Detroit is doing fundamental research in the chemistry of tetraethyllead, organo-metallic compounds and hydrocarbons; on problems arising in the use of tetraethyllead; as on other anti-knock compounds. The Engineering Research Department laboratory at Detroit and its road test laboratory at San Bernardino, California, studies the properties of motor fuels related to knock and the problems of high compression engines. The Medical Research Department at the Kettering Laboratory at Cincinnati, conducts investigations to protect the health of the employees. The Technical Division of the Manufacturing Department at Baton Rouge does development work on problems related to the manufacture of tetraethyllead. In addition, the Corporation maintains research fellowships in chemistry and automotive engineering at various universities, and in much of its work cooperates with the research organizations of other members of the automotive and oil industries. The Refinery Technology Division, for example, is especially set up to cooperate with the customers and assist them in developing and selecting the proper methods for refining and treating gasoline so as to utilize tetraethyllead most effectively.

It is impossible to measure exactly the extent of the many investigations, theoretical and practical, that were stimulated by this discovery, or the improvements in automotive and aircraft engines made possible by anti-knock fuels or the benefits which have been enjoyed by the public as a result of this discovery. If we take as a conservative estimate that the average horsepower of each motor car has been improved by 40 horsepower as a result of this discovery, then, in an average year's production of 4,000,000 motor cars, there has been made available to the public an additional 160,000,000 horsepower capacity, the equivalent of 100 Boulder Dams; or perhaps this can be made more tangible and more immediately applicable to each of you personally, by showing the following. Some years ago a compression ratio of 5.25 was high for the industry. Since that time higher compression ratios have been used so at

40 miles per hour the miles per gallon improved from 12.5 at 5.2 compression ratio to 18 at 8.0, which would have required 95 octane number, and 21 at 10.3, which required somewhat better than 100 number octane fuel. The average increase in economy between 10 and 60 miles per hour is about 45%, going from 5.25 to 8 compression ratio under the conditions of constant performance.

There have resulted chemical engineering developments in related industries to supply the raw materials such as sodium, ethyl chloride and bromine for which the demand had hitherto been relatively small and negligible. There is an ethylene dibromide plant at Wilmington, North Carolina, in which the bromine is extracted from the sea water and reacted with ethylene. Supplies of bromine were limited and for this reason recourse was had to the great reservoir of raw materials, the sea. The dramatic success, both technical and economic, of the Ethyl Dow Plant at Kure Beach, North Carolina, has been described by chemists connected with this development. In fact, much of the material that I have presented here this evening could have been more ably presented by other men in either my Company or the du Pont Company and most of it has already been described in an article in *Industrial and Engineering Chemistry* in December, 1939 by Dr. Graham Edgar, Vice President of the Ethyl Gasoline Corporation. I wish to acknowledge the use which I have made of his material and to quote him in summary as follows:

"We can say that the discovery of the anti-knock value of tetraethyllead has played an important role in the development of the petroleum and automotive industries; that many problems of manufacture and utilization have been solved, and it can be expected that others will be solved as they arise; that after 18 years we find tetraethyllead a well-established factor in the economic life of the petroleum industry; and finally, that there is every expectation that it will continue to play its part in the fuel and automobile of the future, either unchanged or in the form of an improved substitute."

GEOPHYSICS IN OIL PROSPECTING

KEARNY Q. ROBERT*

Geophysical prospecting for oil, because of its invaluable aid in the discovery of new oil pools, has in its short life span of only twenty-one years established itself as a most important factor in our way of life. Some idea of the tremendous part petroleum plays in the world today may be obtained from the fact that in the United States alone the present rate of consumption is in excess of one and one-half billion barrels a year.

This enormous demand is supplied from numerous pools and fields each having a definite ultimate recovery and which collectively form our known reserve. It is obvious that if we are not to exhaust our reserve, new pools must be discovered each year to offset the annual drain. These new pools must be discovered, not at a constant rate, but at an ever increasing tempo due to the steadily rising rate of consumption.

At one time structures and prospects were obvious and actually stood out for anyone to see. These topographic structures, oil and gas seeps, and other such visable prospects were absorbed by the industry and became increasingly difficult to find. As the demand for oil and its products steadily grew, it became evident that this method of locating prospects would have to be aided or augmented by other means. Thus geological methods came to be developed.

By observing the various geological beds at their outcrops and determining their dips, strikes, and other pertinent facts about the way in which they were laid down, structures which had no visable indications at the earth's surface directly over them could be located. The geologist, however, was in turn limited by the fact that he had to make his deductions and predictions from visable observations. That is, the geologist examined these beds where he could see them at such places as

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at their outcrops on the surface, in ravines, highway and railway cuts, well logs, and other such sources. To overcome this obstacle methods to aid the geologist began to be developed.

Thus geophysics in oil prospecting had its beginning. By use of geophysical methods information about the various geological beds could be obtained at almost any desired point regardless of whether these beds outcropped locally or were thousands of feet under the surface. In other words, structures which were hidden from sight by hundreds or thousands of feet of overlying beds and had no indications on the earth's surface could be ferreted out and located by geophysical means.

In all types of exploration it is important to bear in mind a few cardinal facts. Oil has no properties, as yet known, which in themselves lead to its discovery. Irregularities exist in the various geological beds which form possible traps for the oil, and these traps or structures are the things which can be located. While some structures produce oil, it is also true that for one reason or another there are many structures which as yet have no production. Geophysical methods allow us to locate these traps and structures and to predict which are the most likely to produce.

These structures appear in the earth in several distinct forms. In the coastal plains bordering on the Gulf of Mexico large masses of salt have been pushed up into the subsurface beds which cover these areas. These large salt masses, or domes, like all other types of structures vary both in size and in proximity to the earth's surface. In areas other than these coastal plains a similar condition exists for large rock masses intrude into the subsurface beds of these regions. A noteworthy difference exists, however, in that these rock masses have a higher density than that of the surrounding beds while salt domes have a density lower than that of the beds which surround them.

Stratigraphic and anticlinal traps are other common types of reservoirs. Faulting may appear with any of the foregoing or may in itself be mainly responsible for the accumulation of oil. Stratigraphic traps exist in various forms some being formed by thickening or thinning of the regional beds, some

by changes of porosity, and still others by the existance of comparatively small beds of oil producing sands which appear locally and lie between the regional beds. They are deformities in the existing beds. These stratigraphic traps are therefore more difficult to locate than those caused by large displacement of the beds by materials of entirely different physical characteristics.

Various geophysical methods are available each having its own advantages and disadvantages and each using some physical property of the earth as the basis of exploration. By examining these different properties structures can be located, because these non-uniform areas in the earth produce similar regions of non-regularity in the charts of these properties. Therefore, by charting the various properties an insight can be had into the makeup of the area and into what would be the most likely places for the existance of oil pools.

One of the first types of geophysical exploration to come into general use was that which made use of the magnetometer in mapping the various properties of the earth's magnetic field. The vertical intensity, the horizontal intensity, and the dip are measured at various points in the area to be exploded. If the subsurface magnetic layer is the same distance under the surface at all points then these magnetic properties would be the same at all points. Any irregularity in these subsurface beds would cause a corresponding distortion of the magnetic field over that point, and the readings closest to this point would show the greatest deviation from the regional trend. A contour map of the magnetic values determined at the various points throughout the area would then show the subsurface regional high and low points as well as the local irregularities just as an elevation contour map shows topographic relief. From this indication of the subsurface topography the prospective oil producing regions can be determined.

The anomalies produced by oil bearing structures are small, making an accurate survey of utmost importance, and care must be taken to eliminate distortion of the map due to railroad rails, pipe lines, transmission lines, and other similar sources of possible error. Magnetic surveying is fairly rapid and

among the cheaper types of exploration, but it is usually used today for regional exploration to determine areas which will justify detailed exploration by seismograph or some other method.

The electrical resistivity type is that in which the electrical resistivity of the earth is measured. This is done by planting one electrode in the earth and then measuring the resistance to a charging current when the other electrode is moved to different points in the area to be surveyed. On the theory that part of the current passes through some of the subsurface beds before returning to the other electrode, the resistance encountered is an indication of the subsurface pattern between the two electrodes. Each bed has its own individual value of resistance. As long as the distance between the electrodes is held constant any change in the resistance must be due to a change in the beds encountered. Since this change is due to the various subsurface beds being closer to or farther from the surface, it can be resolved into a depth analogy for some particular bed and thus a subsurface picture can be obtained. If the distance between the electrodes is not held constant for all readings, then the resistance values have to be corrected accordingly so that the final resistance values apply to some standard electrode separation.

This type of exploration is slow and affected by water conditions on or near the surface. One resistivity technique in use today uses a tractor with metal wheels as the movable electrode and is about the only type of geophysical exploration with which a continuous profile can be obtained.

In the soil analysis method, samples of soil are taken at various points and are then analyzed for various hydrocarbon content. The oil and gas molecules filter up through the beds which overlie the productive strata and therefore the surface earth over these areas will have a higher hydrocarbon content than the surrounding areas. These determinations are extremely fine measurements for this hydrocarbon content is calculated in parts per billion by weight!

In 1921 the first refraction seismograph made its appearance in this country. The recording instruments were spread

out in fan shape four or five miles from the shot point or place where a tremendous charge of dynamite was detonated. Dynamite charges of a ton or more were not uncommon. The sound or mechanical waves set up in the earth by the force of this explosion would radiate out and be picked up by the recording trucks. The surface waves which traveled along the top of the ground were disregarded. Those which traveled through the earth considerably under the surface and by refraction were also picked up by the recording instruments. The time required for these waves to travel from the shot point to each of the recording points was accurately measured—to the thousandth of a second, and since the distance from the shot point to each pick up point was known by surveying, the velocity between the shot point and each pick up point could be calculated.

The velocity of sound waves in any medium is directly dependent upon the density and Young's modulus of elasticity for that medium. If the area were uniform in pattern then all of the paths from the shot point to pick ups would be similar and the velocities would be the same. Any pick up which had a velocity different from the others would indicate that the wave in going from the shot point to that particular point had passed through a structure of different material. By spreading the recording trucks on one side of the path of abnormal velocity and cross-shooting from shot points on the other side, other paths of abnormal velocity could be determined. The structure would then lie at the intersection of these abnormal velocity paths.

Refraction shooting while it was successful in locating salt domes and other large structures, has been almost entirely replaced by the later reflection type of shooting. Refraction shooting is still used occasionally, however, in areas where satisfactory reflections cannot be obtained.

In the reflection type of seismic exploration a small charge of dynamite is exploded in a hole drilled for that purpose. Each surface between the various subsurface beds acts as a reflecting surface and part of the sound wave is returned by each of these reflecting surfaces. The dynamite charges used vary

from a pound or two to about one hundred pounds and the shot holes vary from a few feet to two or three hundred feet. These factors are determined by local conditions for loose sand beds on the surface cut down the energy and larger shots are necessary. Some beds are better to shoot in than others and so the shot holes are usually drilled to the most favorable bed for that particular area.

A pick-up, or geophone, is placed at the surface of the ground at the shot hole and other phones are strung out at surveyed points. These phones are connected by electrical cables to galvanometers which make a permanent record on photographic paper of any disturbances of the phones. The time from the detonation until the various reflections return to the phones is measured to the thousandth of a second. Since the overall velocity of sound waves in the earth at that area is known approximately, the distance the wave has traveled can be computed. The wave travels from the shot down to the reflecting surface and then returns to the phone so that one-half of the total distance traveled is the depth to the reflecting surface.

One or more reflecting surfaces which give good reflections throughout the area are chosen as surfaces to be contoured. The area is criss-crossed so that the depths to these reflecting surfaces are known at enough points to allow the results to be accurately contoured. With this information about the subsurface beds it is then possible to determine the most likely places for oil production.

The average overall velocity of sound waves in the earth varies from approximately six to twelve thousand feet per second according to geographic locality and the time is measured to thousandths of a second. The greatest source of inaccuracy is due to the surface weathering bed for the characteristics of this bed may change materially in a few hundred feet. While it may appear that depth determinations could be made to three to six feet, determinations within twelve to fifteen feet are considered very good due to errors in determining the exact velocity for any particular point. The reflection seismograph is probably the most successful type of geophysical ex-

ploration in use today, but it is very slow and costly. A mile and a half to two miles of line a day is considered a good average. It is therefore used for detail work in favorable geological areas or areas determined as favorable by other methods of regional exploration.

Gravity exploration may be divided into three classifications—pendulum, torsion balance, and gravity meter. The pendulum was the first type of gravity instrument to make its appearance. Some base point in the area was taken as a starting point in making the survey. The period of a very accurate pendulum was then observed at this point. The pendulum was then moved to other points in the area to be surveyed and the period was observed at each station. The change in gravity between the starting point and each of the other stations was then computed from the difference in period between the starting base and each of the other stations. Enough stations were scattered throughout the area to assure good control over the gravity contours as determined from the gravity differences of the stations.

If the earth were a homogeneous mass the gravity force acting on the pendulum at any point would be that of the pull of the center of the earth. If, however, the subsurface pattern were not uniform but had some structure present in them, the force of gravity over this point would be augmented by the mass attraction of the structure on the pendulum. If the structure were of a hard rock source the resultant pull would be greater because of the greater density of rock. Salt has a very low density and the resultant pull over a salt dome would therefore be a minimum.

These gravity values as observed by the instrument have to be corrected for elevation and latitude. To have the final values for the stations represent the changes in gravity due to local anomalies it is necessary that the observed values be corrected for changes due to things other than these anomalies. Mass attraction varies inversely as the square of the intervening distance. Any change in elevation causes a change in the distance between the instrument and the center of the earth and will cause a corresponding change in the pull of gravity

due to the center of the earth. The earth is an oblate spheroid with the poles closer to the center than the equator. An instrument at the equator would therefore be farther from the center than at the poles and would have a smaller pull of gravity. Also, while there is no centrifugal force at the poles, the centrifugal force at the equator counteracts the pull of gravity and causes it to be diminished still more.

The pendulum method at best is only sensitive enough to determine regional trends and in addition is very slow.

The torsion balance made its first appearance in this country in the quest for oil in about 1922. This instrument like the pendulum and the gravity meter works on the principle of mass attraction. It differs from the other two in that it measures the horizontal gradient instead of the vertical pull.

The force of gravity exerted by the center of the earth is vertical and does not affect the instrument. A structure in the earth, however, will exert a vertical pull only when the instrument is over the center of the structure and at all other points it will exert an oblique force. The amount and direction of the horizontal component of this force is the quantity measured by the instrument.

Since the effect is negligible at a great distance from the structure and the component is zero at the center of the structure there is a point of maximum effect between these two extreme positions. As the instrument is moved from a great distance toward the structure the effect will increase up to the critical point and then decrease to zero at the center of the structure. As the instrument is moved on across the other side the effect will increase up to the critical point and then decrease, but the vectors on this side will be in the opposite direction to those on the other side of the structure.

If the structure were of a hard rock source then the density would be greater than that of the surrounding beds and the direction of the vectors would be toward the structure. Similarly, because of the low density of salt the vectors would be away from a salt dome.

Since the instrument records the horizontal gradient and the direction then the gravity change between any two points

can be calculated. Starting with some point as a datum, the gravity change between this point and each of the other stations is calculated. These values are then contoured and the various subsurface anomalies can be ascertained. An idea of the sensitivity of the torsion balance can be obtained from the fact that the forces to which it responds vary from one to a few billionths of the vertical force of gravity.

Surveys by means of the torsion balance are extremely effective in the location of salt domes in the coastal areas, and are necessarily limited to areas of little or no topographical relief. It is easy to see that a small hill close to the instrument can have a greater effect than a large structure two or three miles distant. Since the forces are so extremely small the balance system is necessarily delicate and requires a long time to settle. It is a slow method and like other gravity methods is generally used for regional surveys.

The gravity meter is the latest type of geophysical instrument to come into universal usage. It is many times faster than the torsion balance and has opened areas to geophysical prospecting in which other methods, for one reason or another, had been found unsatisfactory.

The torsion balance is not successful in areas of considerable topographic relief just as there are areas where loose beds of sand or other conditions make it impossible to get satisfactory seismic reflections. As the gravity meter is insensitive to horizontal forces it can be used in almost mountainous country before terrain effects can be noted in the results. A gravity meter crew normally covers territory five times as fast as a torsion balance crew and about fifty or sixty times as fast as the reflection seismograph.

The gravity meter like the pendulum measures the vertical pull of gravity and the same conditions apply, but it is many times more sensitive and many times faster. The sensitivity of the gravity meter is about one tenth of a millidyne or one part in ten million. A one foot change in elevation of the instrument in free air will cause a change in the pull of gravity of about one tenth of a millidyne due to the increase in the distance between the instrument and the center of the earth. It is

sensitive to the extent that an earthquake, regardless of its location on the earth, will disturb the instrument violently from five to thirty minutes. A change in latitude of only about 440 feet at this latitude will cause a difference of one tenth of a millidyne. An amazing thing about the present day gravity meter is that in spite of this extreme sensitivity it will stand up under field usage and can set up and read in about a minute.

The observed readings for the various stations have to be corrected for elevation and latitude as do the pendulum observations. The residual values when contoured will show the anomalies due to subsurface conditions.

While it is true that the gravity meter is effective in the location of structural prospects, it is also true that stratigraphic traps because of the resulting small density changes are difficult to isolate. Large faults can be determined, but as yet the smaller faults seem to elude the gravity meter.

Of 3938 wildcats drilled in 24 states in 1940, 320 located on technical information were completed as producers while only 46 located on non-technical information were completed as producers—15.6 per cent as against 4.2 per cent. Locations on combined geophysical and geological information showed 22 out of 103 for a percentage of 21.3, geophysics alone showed 100 producers out of 546 holes for a percentage of 18.3, and locations on geology alone showed 198 out of 1402 for a percentage of 14.3.

With geophysical exploration showing completions for 18.3% while nontechnical shows only 4.2% it is evident that geophysical exploration does pay substantial profits. As the depth of the average wildcat increases and with the corresponding increase in cost, exploration by these methods will pay higher and higher dividends.

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MEMBERSHIP LIST

C. M.: Charter Member
H. M.: Honorary Member
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L. A.: Local Associate Member
L. Aff.: Local Affiliate Member
N. R. Aff.: Non-Resident Affiliate Member
J.: Junior Member
N. R. J.: Non-Resident Junior Member
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ROBERT MALLARD SEAGO, (1938), *Mechanical Engineer*, Efficiency Engineer, Market Street Station, New Orleans Public Service, Inc., Market and So. Peters St. *Mail*: 3411 Octavia St., New Orleans, La.

PAUL T. SEASHORE, (1934), Vice-President, Louisiana Land & Exploration Co., Pontchartrain Apt. Hotel. *Mail*: 1006 Whitney Bldg., New Orleans, La.

G. ARTHUR SEAVER, (1919), *Engineer*, Member of Firm, Geo. J. Glover Construction Co., 1430 Whitney Bank Bldg. *Mail*: 1219 Eleonore St., New Orleans, La.

SOLIS SEIFERTH, (1927), *Architect*, Secretary-Treasurer, Weiss, Dreyfous & Seiferth, Inc., 608 Iona St. *Mail*: 600 Maison Blanche Bldg., New Orleans, La.

CHARLES LEE SENS, (1941), Senior Cotton Technologist, Cotton Purchasing Division, Southern Regional Research Laboratory, 2100 Robert E. Lee Blvd. *Mail*: 1620 Mirabeau Ave., New Orleans, La.

ARTHUR M. SHAW, (Nov. 14, 1910), *Civil Engineer*, Supervising Engineer, W. Horace Williams Co., 833 Howard Ave. *Mail*: 1622 Cadiz St., New Orleans, La.

RICHARD M. SHAW, (1937), *Engineer*, U. S. Engineers, 6308 Camp St., New Orleans.

HERBERT M. SHILSTONE, (1931), *Chemical Engineer*, 1662 Valmont St. *Mail*: 510 Gravier St., New Orleans, La.

HERBERT M. SHILSTONE, JR., (N. R.), (1923), *Civil Engineer*, Shilstone Testing Laboratory, 301 M. & M. Bldg., Houston, Tex.

HARRY H. SHUTTS, (S.), (1915), *Civil Engineer*, 921½ Ryan St., Lake Charles.

WALTER S. SIMPSON, 1933), *Engineer*, 1103 Soniat St., New Orleans.

LESTER C. SMITH, (N. R.), (1920), Vice-President, Doullut & Ewin, 304 Wilson Bldg., Mobile, Ala.

S. C. SMITH, (S.), (1939), *Civil Engineer*, Resident Engineer, Dept. of Highways. *Mail*: Box 31, New Roads, La.

T. BAKER SMITH, (S), (1919), *Civil Engineer*, P. O. Box 266, Houma, La.

EDWIN J. SONIAT, (J.), (1940), Assistant *Electrical Engineer*, 2807 Bell St., New Orleans.

WILLIAM F. STANDKE, Jr., (J.), (1940), Junior *Structural Engineer*, U. S. Engineers, Ft. of Prytania St. *Mail*: 8236 Cohn St., New Orleans, La.

DAVID STAYER, (N. R.), (1933), *Electrical Engineer*, Assistant Engineer, U. S. Army Engineer Corps., Federal Bldg., Room 552. *Mail*: 2709 Virginia Ave., Louisville, Ky.

REINHARD A. STEINMAYER, (1924), Associate Professor of Geology, Tulane University. *Mail*: 7933 Oak St., New Orleans, La.

ERIC R. STEPHAN, (1938), *Mechanical Engineer*, Assistant Professor of Mechanical Engineering, Tulane University, 11 Marlborough Gate. *Mail*: College of Engineering, Tulane Univresity, New Orleans, La.

FRANK M. STEVENSON, (1941), *Right of Way Engineer*, Southern Bell Telephone & Telegraph Co., 820 Poydras St. *Mail*: 84 Maryland Drive, New Orleans, La.

DAVID WHYTE STEWART, (1919), *Mechanical Engineer*, Chief Engineer, Market Street Power Station, New Orleans Public Service, Inc., 1623 Pine St. *Mail*: 317 Baronne St., New Orleans, La.

HERBERT C. SWAN, (1933), *Mechanical & Electrical Engineer*, Instructor Air Corps Technical School, Delgado Trades School, 615 City Park Ave. *Mail*: 6314 Magazine St., New Orleans, La.

E. H. SWICK, (S), (1940), Junior Highway Engineer, Bureau of Public Roads, 725 Concordia St., Baton Rouge, La.

IRA W. SYLVESTER, (L. M.), (March 25, 1901), City Engineer, Rapides Bank Bldg., Alexandria, La.

— T —

BRETCH TAULBEE, (S. Aff.), (1941), *Construction Engineer*, Secreary-Treasurer, Houma Boat & Contracting Co., Houma. *Mail*: P. O. Box 326, Houma, La.

FRANCIS M. TAYLOR, (1938), *Chemical Engineer*, Assistant Professor, Chemical Engineering, Tulane University, 7018 Jeannette St. *Mail*: Chemical Engineering, Tulane University, New Orleans, La.

WILLIAM W. TENNANT, (S.), (1937), *Civil Engineer*, Head Coordination Dept., Standard Oil Co. of La. *Mail*: 520 Convention St., Baton Rouge, La.

L. W. TERRY, (S.), (1940), *Building Contractor*, Manager & Owner, Terry Lumber Co., 115 No. Stewart St., 502½ No. Pine St. *Mail*: P. O. Box 349, DeRidder, La.

S. A. THEARD, (S.), (1920), *Civil Engineer*, Engineer & District Sales Manager, Oyster Shell Products Corp., Morgan City, La. *Mail*: 8114 Freret St., New Orleans, La.

IRA L. THOMAS, Jr., (S.), (1939), *Civil Engineer*, Traffic & Planning Engineer, La. Dept. of Highways. *Mail*: P. O. Box 1284, Baton Rouge, La.

ENS. GEORGE H. THOMPSON, (N. R. J.), (1941), *Chemical Engineer*, Ensign, SC, U. S. N. R., Receiving Station Boston Navy Yary. 8236 Panola St., New Orleans, La. *Mail*: Receiving Station, Boston Navy Yard, Boston, Mass.

W. L. THOMPSON, (S.), (1939), *Civil Engineer*, District Engineer, La. Dept. of Highways. *Mail*: 1511 No. 7th St., Monroe, La.

STEWART TICKNOR, (S.), (1922), *Civil Engineer*, 155 Royal St., Baton Rouge, La.

LT. JOHN PAUL TOBIN, (N. R. J.), (1940), 1st Lt., Corps of Engineers, U. S. Army, Commanding Officer, Co. D., 3rd Battalion, ERTC, Ft. Belvoir, Va. *Mail*: 110 So. Columbus St., Alexandria, Va.

JAMES M. TODD, (1923), *Mechanical & Electrical Engineer*, Consulting Engineer, James M. Todd, 17 Richmond Place. *Mail*: 405 Citizens Bldg., New Orleans, La.

LOUIS MILTON TOGNONI, (1933), *Mechanical & Electrical Engineer*, Industrial Sales Engineer, New Orleans Public Service, Inc., 317 Baronne St. *Mail*: 4466 Spain St., New Orleans, La.

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SIDNEY E. TROUARD, Jr., (1928), *Electrolysis Engineer*, New Orleans Public Service, Inc., 317 Baronne St., New Orleans.

WILDAY TUDURY, (J.), (1941), *Mechanical Engineer*, Dixie Machine Welding & Metal Works, 1031 Annunciation St. *Mail*: 155 Homestead Ave., Metairie, New Orleans, La.

WILLIAM NEWTON TULLER, (S.), (1937), *Chemical Engineer*, Engineer in Charge of Water Treatment, Freeport Sulphur Co. *Mail*: P. O. Box 691, Port Sulphur, La.

GEORGE H. TUNNER, (1939), *Safety Engineer*, Resident Engineer, Travelers Insurance Co., 2830 Palmer Ave. *Mail*: 611 Union Bldg., New Orleans, La.

W. O. TURNER, (1931), President and General Manager, Louisiana Power & Light Co., 142 Delaronde St., Algiers, La.

— V —

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LUCIEN T. VIVIEN, Jr., (1930), *Mechanical & Electrical Engineer*, Assistant Superintendent of Construction, Gulf Refining Co., 941 Maison Blanche Bldg. *Mail*: 3129 Derby Place, New Orleans, La.

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GEORGE D. WADDILL, (L. M.), (1911), *Civil Engineer*, U. S. Engineers, M. R. C., Ft. of Prytania St. *Mail*: 7433 Maple St., New Orleans, La.

RICHARD E. WAGNER, (1933), *Civil Engineer*, 4201 Elba St., New Orleans.

J. D. WALKER, (L. M.), (Jan. 8, 1908), *Civil Engineer*, Engineer, Craven-Lang Co., 1104 Nashville Ave. *Mail*: 1703 American Bank Bldg., New Orleans, La.

WAYNE PAUL WALLACE, (S.), (1936), *Civil Engineer*, Instructor in Civil Engineering, Louisiana State University, University, La.

WILLIAM WALLACE, (L. A.), (1931), *General Contractor*, 131 No. Jefferson Davis Parkway, New Orleans.

STEPHEN J. WALLBILLICH, (1926), *Engineer*, 4214 State St., New Orleans.

KYLE WARD, Jr., (1941), *Chemical Engineer*, Chief, Cotton Film Research Division, Southern Regional Research Laboratory, 2100 Robert E. Lee Blvd. *Mail*: 937 Wilson Drive, New Orleans, La.

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W. S. WHITE, (L. M.), (Jan. 1, 1898), *Civil Engineer*, Surveying, Box 82, Sulphur, La.

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W. HORACE WILLIAMS, (L. M.), (1908), *Civil Engineer*, Member of Firm & General Manager, W. Horace Williams Co., 221 Northline Ave., Metairie. *Mail*: 833 Howard Ave., New Orleans, La.

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LT. GEORGE F. WILLIAMSON, (N. R. J.), (1939), *Civil Engineer*, U. S. Marine Corps., Quantico, Va.

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

CHARLES J. WYLER, (1919), *Mechanical Engineer*, Assistant Chief Engineer, A. M. Lockett & Co., Ltd., 308 Whitney Bank Bldg. *Mail*: 530 Jackson Ave., New Orleans, La.

— Z —

ANTHONY MICHAEL ZIBILICH, (1941), Lieutenant-Commander, U. S. C. G., Assistant Maintenance Office, Senior Coast Guard Officer, 8th Naval District, 327 Customhouse Bldg. *Mail*: 119 Ringgold St., New Orleans, La.

ROBERT W. ZIFFLE, (1937), Research Dept., New Orleans Public Service, Inc. 715 Pelican Ave. *Mail*: 317 Baronne St., New Orleans, La.

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HAL C. BECKER, 1024 City Park Ave.
RALPH BLAKE, 2234 State St.
JOHN S. BURWELL, 7911 Freret St.
HUBERT CLOTWORTHY, JR., 1418 Hillary St.
THOMAS C. CREAGAN, 2023 Fern St.
THEODORE W. DIETZE, 5923 Chestnut St.
STANLEY G. DINKEL, 2540 Wisteria St.
W. E. DOUGLAS, JR., 5534 So. Liberty St.
HOLMES EARL, 2125 Leonidas St.
FAURIE E. FERCHAUD, 3512 St. Charles Ave.
IRWIN FRANKEL, 4608 Freret St.
FRANK C. FROMHERZ, 1430 Henry Clay Ave.
W. SCOTT GOLDMAN, 2107 Pine St.
ALVIN G. GOTTSCHALL, 1716 Pine St.
BERNARD A. GREHAN, 1670 Soniat St.
FRANCIS JOHN HIGGINS, 8002 Plum St.
ROY E. JOHNSON, 4807 St. Claude Ave.
EDWIN LAFAYE, 911 Lowerline St.
LOUIS J. Le CARPENTIER, 2929 Castiglione St.
JOSEPH T. LEE, 140 So Gayoso St.
ELLIS LEVIN, 805 Exposition Blvd.
S. KENAN MANSON, JR., 4125 St. Charles Ave.
TRIST BRINGIER McCONNELL, 1333 Webster St.
J. M. MIAZZA, 1611 Pine St.
IRWIN A. RABENOVITZ, 3625 Napoleon Ave.
R. M. SANDERFORD, JR., Meraux, La.
ROBERT E. SCHNEIDER, JR., 221 So. Genois, St.
ROBERT WILLIAM SCHUPP, 1925 So. Dupre St.
RAYMOND SHERRARD, JR., 2818 Cambronne St.
SANTOS VINCENT SHIELDS, 4100 Leonidas St.
SPENCER G. SMITH, 5912 St. Charles Ave.
A. DALE STANCLIFF, JR., 4735 Carondelet St.
HAROLD H. STREAM, JR., 1518 Henry Clay Ave.
JOHN Y. TAYLOR, 20 Newcomb Blvd.
JOHN R. TUSSON, 400 Newton St., Gretna, La.
WALTER J. VERLANDER, 1140 Louisiana Ave.

Summary

Honorary Members	2
Charter Members	4
Life Members	32
Local Members	226
State Members	93
Non-Resident Members	52
Associate Members	2
Local Affiliate Members	12
State Affiliate Members	2
Local Junior Members	39
State Junior Members	6
Non-Resident Junior Members	15
Members: Unknown Address	6
Student Members	37
Total	528

Past Presidents

Sidney F. Lewis.....1898
Thos. L. Raymond.....1899
Henry J. Malochee.....1900
Frank M. Kerr.....1901
Alf. F. Theard.....1902
Alf. Raymond.....1903
J. F. Coleman.....1904
W. B. Wright.....1905
W. H. Hoffman.....1906
G. W. Lawes.....1907
C. W. Wood.....1908
J. T. Eastwood.....1909
W. B. Gregory.....1910
J. C. Haugh.....1911
D. S. Anderson.....1912
A. M. Shaw.....1913
W. H. Williams.....1914
L. C. Datz.....1915
Samuel M. Young.....1916
A. T. Dusenbury.....1917
John Klorer.....1918
Ole K. Olsen.....1919
John Riess.....1920
R. S. Manley.....1921
Donald Derickson.....1922
J. S. Bareli.....1923
James M. Robert.....1924
Marcel Garsaud.....1925
Farrar P. Hamilton.....1926
Edward S. Lanphier.....1927
John L. Porter.....1928
Frederick H. Fox.....1929
James M. Todd.....1930
Frank G. Frost.....1931
Frederick N. Billingsley.....1932
John H. O'Neill.....1933
A. L. Dunlap.....1934
Edward S. Bres.....1935
Allen S. Hackett.....1936
C. S. Williamson.....1937
Bernard H. Grehan.....1938
David W. Godat.....1939
William H. Rhodes.....1940
David W. Stewart.....1941

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Meeting of the Board, November 4, 1941

The meeting was called to order by President Stewart with the following present: Fromherz, Rhodes and Mayer.

The minutes of the last meeting were read and approved.

A copy of the letter sent the local sections of the various engineering societies by President Stewart concerning the unification movement was read.

A report on the Second Annual Picnic submitted by Chairman Olsen was read and the expenditures approved.

A report by Chairman Billingsley of the Building Code Revision Committee was read. Accompanying the report was a summary of changes, revisions and modification to the proposed New Orleans Building Code which had been recommended by a sub-committee composed of members of the American Institute of Architects, Associated General Contractors, American Society of Civil Engineers and the Louisiana Engineering Society. The Board voted to endorse the recommendations of the Committee and to approve the adoption of the proposed code only if the recommendations of the committee are incorporated in said code.

A letter from Mr. Bernard Graff, Secretary-Treasurer of the Coalition of Operating Engineers, was read offering the support of the Coalition in securing an engineers' license law in Louisiana. The Board expressed their appreciation of this kind offer.

A letter offering the Society the services of the Louisiana Library Commission was read. It was decided to announce this at the next regular meeting of the Society.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Society, November 10, 1941

The meeting was called to order by President Stewart with approximately 110 members and guests present.

The minutes of the last meeting were read and accepted.

President Stewart announced the appointment of a Nominating Committee composed of W. W. Rhodes, Chairman, F. G. Frost and J. M. Robert. Several other announcements were made.

Chairman Ole K. Olsen reported on the 2nd Annual Picnic held at Camp Salmen on October 19th. Chairman F. M. Taylor announced the tentative program for the Annual Meeting in January and Chairman L. J. Cucullu reported on the progress in organizing the Junior Engineering Group.

The meeting was then turned over to Mr. Ed Gastrock of the American Institute of Chemical Engineers. Dr. O. E. Kurt, Manager, Technical Division, Ethyl Corporation, Baton Rouge, Louisiana, was introduced and presented an interesting illustrated paper on "The Manufac-

ture of Tetraethyl Lead''. The speaker answered several questions at the conclusion of the paper.

Mr. Gastrock thanked the speaker and turned the meeting back to President Stewart.

The meeting adjourned with a rising vote of thanks to Dr. Kurt.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Board, December 2, 1941

The meeting was called to order by President Stewart with the following present: Cappel, Fromherz, Kammer, Kerr and Mayer.

The minutes of the last meeting were read and approved after correction.

Several replies to President Stewart's letters concerning the unification of engineering societies were read. It was decided to turn the matter over to the Committee for Professional Advancement for further study and recommendations.

The proposed By-Laws of the newly organized Delta Junior Engineers were approved.

A letter from Mr. J. M. Todd was read which suggested that the Board find some means of preventing conflict of various engineering meetings in the city. It was the consensus of opinion that conflicts are infrequent and that schedules can be arranged satisfactorily by each organization.

A motion was passed that a letter be written all members delinquent for more than one year in dues, said letter to request payment in whole or in part by January 10, 1942 and advising that if payment is not received by the above date that they will be dropped from membership in the Society. A copy of the letter and list of delinquent Baton Rouge members is to be sent to the president of the Baton Rouge Section with the request that the officers endeavor to contact the delinquent members of that section.

The following names were ordered placed on a letter ballot: For members—N. Lewis Buck, Edgar M. Dunn, Joseph I. Hebert, Jr., W. Fleming Scofield. For Junior Member—Ernest James Angelo, Jr.

It was decided to submit a list of Junior members elected before January 1, 1938 to Membership Committee ''B'' for recommendations on transfer to the grade of Member.

Mr. C. M. Kerr reported on the progress of arrangements for the Annual Meeting.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Society, December 8, 1941

The meeting was called to order by President Stewart with approximately 100 in attendance.

The minutes of the last meeting were read and accepted.

Chairman W. H. Rhodes reported for the Nominating Committee. The following nominations were submitted:

C. Glenn Cappel for President
Karl P. Kammer for First Vice-President
Frederick F. Pillet for Second Vice-President
John K. Mayer for Secretary-Treasurer
Reinhard A. Steinmayer, Robert J. Kuhn } for Directors for two years

No nominations were received from the floor.

President Stewart turned the meeting over to Chairman E. D. Meacham of the New Orleans Chapter, Illuminating Engineers' Society, who introduced the speaker of the evening, Mr. Frank B. Lee, Division Engineer, Lamp Division, General Electric Company, St. Louis, Missouri. Mr. Lee presented a very interesting illustrated paper on "Lighting for National Defense". Several types of fluorescent lamps were demonstrated.

Chairman Meacham thanked the speaker and returned the meeting to the President.

The meeting adjourned to the usual refreshments.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Board January 6, 1941

The meeting was called to order by President Stewart with the follow present: Cappel, Fromherz, Kammer, Kerr, Kohnke and Mayer.

It was decided to dispense with the reading of the minutes of the last meeting.

The Financial Report for 1941 was read and the work of the Employment Committee for the year summarized. President Stewart reported that there had been little change in the total membership during the year.

A letter from Mr. B. L. Kiernan was read proposing the establishment of an organization for rendering technical advice to operating engineers in connection with civilian defense plans and operations, said organization to cooperate with the Office of Civilian Defense for the New Orleans Area. It was decided to discuss the matter further at the next meeting of the Board when a new Defense Committee will be appointed.

The question of waiving the dues of members serving in the armed forces was discussed. It was suggested that payment of dues be left to the option of these members. The question is to be discussed further at the next meeting.

The adoption of a new Society pin recommended by the Baton Rouge Section was considered. It was decided to retain the present emblem since it has been used for many years and has become well known.

The following resignations were accepted: C. N. Bott, M. J. Cramer, E. R. Gurtler, W. R. Major, Jr., C. M. Nilson, L. P. Raynor and H. L. Thackwell.

The following Junior Members were transferred to grade of Member as of January 1, 1942:

John C. Bendler
Albert R. Boelte
August J. Brodtmann, Jr.
Harwood I. Brown
Harold F. Favret
Albert J. Fransen
Edward H. Gessner
Martin M. Gurtler, II
E. J. Hagstette, Jr.
Louis I. Korn
Arthur F. Landry
Edward Joseph McNamara
Waldemar Stanley Nelson
William Minor Payne
Crawford Powell
Richard M. Shaw
Herbert M. Shilstone, Jr.
William N. Tuller
Alvin A. Voss
Wayne Paul Wallace
Robert W. Ziifle

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the General Meeting of the Society January 9, 1942

The meeting was opened by President Stewart with approximately 130 members and guests present.

The Presidents or Chairmen of the local sections of the founder societies were introduced.

A very interesting keynote address on "The Engineer in War Times" was delivered by Major General Campbell B. Hodges, President of Louisiana State University.

A summary of the Financial report for 1941 was presented by the Secretary-Treasurer. The complete report is to be published in the February issue of the Proceedings.

Mr. J. E. Johnson, the recipient of the Louisiana Engineering Society scholarship at Louisiana State University, was introduced since he could not return for the banquet.

President Stewart reported on the principal activities of the Society during 1941 and thanked all for their cooperation and services.

Mr. W. H. Rhodes reported for the Tellers Committee stating that from the 129 ballots returned, the following were unanimously elected:

President	C. Glenn Cappel
First Vice-President	Karl P. Kammer
Second Vice-President	Frederick F. Pillet
Secretary-Treasurer	John K. Mayer
Director for 2 years	Robert J. Kuhn
Director for 2 years	Reinhard A. Steinmayer

The newly elected officers were escorted to the front and presented to the members. Retiring President Stewart presented President Cappel with the new gavel and turned the meeting over to him.

Several announcements were made regarding the program for the balance of the Annual.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Obituary Of

JAMES R. ADAMS

Life Member of the Louisiana Engineering Society

New Orleans, January 9th, 1942.

It becomes our sad duty to record the sudden death on January 6th, 1942 of James R. Adams, in Washington, D. C. where he was officially engaged in the interest of Flood Control for Louisiana and the lower Mississippi River Valley.

Mr. Adams was universally recognized as one of the Valley's foremost authorities on Flood Control, and it was largely due to his tireless alertness, persistence and efforts, that not only the levee systems protecting the valley areas of the State of Louisiana from the danger of overflow were successfully provided and maintained, but that adequate Federal aid was obtained for the purpose. He knew every inch of the several levee lines entrusted to his care and supervision, and shouldered the responsibilities involved in a masterful way. In addition, he knew intimately the capacity and Civic worth of every person available for the strenuous task of holding the levees intact during the emergency periods of high water, and enjoyed the co-operation, confidence and respect of every one of them.

The State's representatives in the Congress of the United States and their confreres from the other States in the Union held him in the highest of esteem and it was very largely due to this fact that Louisiana and its Sister States were able to obtain so large a share of Federal appropriations for protection against overflow. His worth in this respect, together with his proficiency as an outstanding specialist and expert in River Hydraulic Engineering will long be remembered. He was commissioned a Member of the former Board of State Engineers in 1924 and served in that capacity continuously thereafter until the duties and functions of that Board were transferred by law to the State's recently created Department of Public Works, under the provisions of the Re-organization Act of the 1940 State Legislature. So valuable were his services considered to be that he was made District Engineer of the Northeastern quarter of the State where he was completely familiar with every form of its Internal Improvements, Public Works and other kindred projects.

The State at large and his section thereof in particular will sorely miss him and bemoan his untimely death.

Therefore, **Be It Resolved** by the Louisiana Engineering Society, at its meeting held this day, that we express our genuine sorrow over his loss; and **Be It Further Resolved**, That a copy of our tribute to his memory and of these Resolutions be sent to his bereaved Family.

Respectfully submitted,

to his bereaved family.

CHARLES M. KERR
RICHARD KOHNKE
GERVAIS LOMBARD (Chairman)

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

FEBRUARY, 1942

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

LASEC NEWS

SECTION OFFICERS

President
F. N. BILLINGSLEY

1st Vice-President
COL. V. J. BEDELL

2nd Vice-President
ALVIN M. FROMHERZ

Secretary-Treasurer
DAVID W. GODAT
314 Terminal Station Bldg.

NEW ORLEANS, LA.

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CHARLES M. KERR, Chm.
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GEORGE J. JANVIER, Jr.
J. T. BULLEN
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LASEC NEWS
5831 S. Robertson Street
New Orleans, La.
Walnut 5811

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To The Membership
Louisiana Section, A. S. C. E.

It appears to be customary for the incoming president of the Section to commence his tenure of office by writing a brief letter to the Membership for publication in LASEC NEWS. I welcome the opportunity it affords to express to you directly my deep appreciation of the honor you have bestowed upon me in electing me to the presidency of the Louisiana Section, American Society of Civil Engineers. It is my earnest desire to prove worthy of the trust you have imposed in me.

Your new Board of Direction takes office during a very critical and trying period in the life of the Nation. We do not know what the ensuing year will bring forth, but it is apparent that the activities of our Society and the work of the Section as such may be materially curtailed.

Our ranks here are already becoming thinned out due to absentees who are on active duty in the armed forces of the Nation or who are engaged in a civilian capacity on works necessary for national defense. This is as it should be. However, it is all the more incumbent upon those Members whose work permits them to remain here or to

maintain a close contact with Section activities to wholeheartedly assist your Officers in carrying on the work entrusted to them and necessary for the preservation of the Section as a going concern. I can assure you that you will not be called upon to perform any duties or accept any assignments which are not essential to the best interests of the Society.

You have given me a fine group of Officers with whom to work, and I feel absolutely confident that if and when the call for assistance comes to you individually, the Board of Direction will have the benefit of your best efforts and most thorough cooperation

Sincerely yours,

F. N. BILLINGSLEY,
President.

NEWS ITEMS

President F. N. Billingsley called the first meeting of his Board since the recent election of the officers of the Local Section, and in addition to the usual routine business being transacted, the following standing committees were selected, to function during the coming year.

Committee on Licensing Engineers:

W. H. RHODES, *Chairman*
Prof. Donald Derickson
Col. Marcel Garsaud
A. T. Dusenbury
Col. E. S. Bres
J. T. Bullen
J. H. O'Neill
Prof. B. W. Peques
B. H. Grehan
George Janvier, Jr.
Jack S. Burk
Alvin M. Fromherz
H. A. Sawyer
William Tennant

Committee on Awards:

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Prof. B. W. Peques
F. P. Hamilton
S. W. Wilson

Membership Committee:

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I. W. Sylvester
A. H. Guillot
Prof. B. W. Peques
F. C. Culpepper, Jr.
Jerome C. Baehr
Robert E. Haas
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Col. E. S. Bres

Publicity Committee:

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N. E. Lant
Mace Bell

Employment Committee:

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Sargent Jones
John Riess

Aims-Activities and Professional Objectives Committee:

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J. A. Miller
E. C. Paulet
Col. E. S. Bres
A. T. Dusenbury
Frank Riess
Ian M. Davidson

Special Committee on Civilian Protection in War Time:

The duties of this committee is to work in co-operation with the National Committee on Civilian Protection in War time.

ALLEN DUSENBURY, *Chairman*
Alvin M. Fromherz—Structures
John O'Neill, Sanitary Public Health
E. L. Mire, Transportation
Frank Carey, Emergency Control, Local Applications
Fred N. Billingsley, Power

Committee on Foundation Study:

F. P. HAMILTON, *Chairman*
C. G. Cappell, *Vice-Chairman*
Prof. Donald Derickson
A. J. Negrotto
John Riess
Martin M. Gurtler, II
Geo. P. Rice
Lieut.-Com. T. C. Bruns

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Alvin M. Fromherz, *2nd Vice-Pres.*
J. A. McNiven
N. E. Lant
David W. Godat, *Secretary-Treasurer*

The Annual Meeting of the Louisiana Section of the American Society of Civil Engineers was held as usual at the residence of Ole K. Olsen. Following the usual business session and election of offices, a very interesting and instructive talk was made by Allen J. Negrotto, State Director of Public Work Reserve. Mr. Negrotto explained in detail the aims and purposes of the Public Work Reserve, and his talk was well received by the members and guests present

Following Mr. Negrotto's talk, the meeting was adjourned and those present repaired to the Olsen's well known Rathskeller where all participated in an old time get-to-gether.

PERSONALS

Charles C. Bernard is now in Shreveport representing the firm of Barnard, Godat and Heft, where he is Resident-Partner on the contract for the design and construction of the Shreveport Holding and Reconsignment Point Depot for the United States Engineers.

J. A. McNiven has been appointed as contact member to the Tulane University Student Chapter.

Who is the energetic member of the local Section who landed in New Orleans at eight A. M., because engaged at ten, and left town the same afternoon. Good luck and happy landings.

Col. Arthur M. Shaw is down in British Guiana, where he is in charge of some important contract work for the W. Horace Williams Company.

The message which President Billingsley has sent to our local Section is both pertinent and timely. We are facing a crucial situation in world affair and while the final issue will find us reaping the rewards of a well deserved victory we will be called upon individually and as group to aid in all details of National Defense and Offense. Upon the shoulders of the Civil Engineers will rest the burden of responsibility affecting every factor of war activity and in this crisis we will not be want wanting.

DO YOU KNOW THAT:

It is a heck of a job getting dope for this LASEC NEWS.

Your Publicity Committee, which is entrusted with the duty of getting out this paper—(or what ever you may call it), is busy like the rest of you earning three hots a day, and has no means of gathering news except by contact with all of you. If you know of any item of interest to the rest of us, write or telephone us, and we will be both appreciative and thankful.

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THE PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

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ARTHUR M. HILL, Editor.

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New Orleans, La.

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Suite 422 St. Charles Hotel

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Worden Waring, Secretary, Dept. of Chemistry, Tulane University

Baton Rouge Section

Dr. Arthur G. Keller, Chairman, La. State University, Baton Rouge
Sumner B. Sweetser, Secretary, 2960 Hyacinth Ave., Baton Rouge

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American Public Works Association, New Orleans Chapter

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PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXVIII. APRIL, 1942 NO. 2

CONTENTS

EDITORIAL NOTES AND COMMENT

Are You Guilty? Much has been spoken and written about how to "help win the war.". Certainly all of us have noticed the quantities of food left by patrons in cafeterias and restaubecause of "over enthusiasm" in ordering. Think of the millions of pounds wasted each day. Are you guilty?

Cantonment Construction. President Cappel has painted a quick but graphic picture of some problems of the contractor in high speed construction of camps. You will enjoy reading it. It is a timely article.

Committee Functions. Each standing committee has a definite field of activity. Following is a list of committees and function of each. However, if you are not at present on a

committee, don't be hesitant about offering suggestions or recommendations. It is only by concerted action of every member that our Society can progress.

DUTIES OF STANDING COMMITTEES

Awards: Considers Junior Membership and Scholarship awards.

Civic and Industrial Affairs: Assists in obtaining recognition of engineering profession in civic and industrial affairs.

Defense: Assists in providing engineering services for National Defense.

Employment: Assists in finding employment.

Entertainment and Outings: Main functions are golf tournament and picnic.

Engineering Education: To consider matters concerning this subject.

Finance: Considers budget; chairman signs warrants for checks.

House: Concerns itself with quarters which the Society occupies.

Legislation: Functions in connection with laws affecting the profession.

Library: Considers ways of operating library to best advantage.

Membership "A": Secures members for the Society.

Membership "B". Studies qualifications, decides as to eligibility.

Professional Advancement: Deals with matters pertaining to the advancement of the profession.

Publications "A": Determines policy, etc. of "Proceedings."

Publications "B": Committee is charged with securing advertising.

Public Relations: Assists in obtaining recognition in public functions.

Publicity: Advises the press of our meetings, etc.

State Sections: To promote the establishment of sections throughout the state.

Student and Junior Activity: Sponsor activities of Junior and Student members.

Technical Papers: Selects papers to be presented during year.

New Members. Below is a list of engineers who have recently joined our Society. Perhaps some you already know. A brief review of their names will help you remember them when you meet them. Knowing their qualifications may benefit you at some future time.

And speaking of new members, have you a prospect? Bring him to the next meeting!

Cowherd, Robert D., Member. Age 30. Endorsed by: D. W. Stewart, K. P. Kammer, R. M. Seago. 1935, Ch. E. Univ. of Cincinnati. 1930-34—Epidemic Disease Bacteriologist. City Dept. of Public Health, Louisville, Ky. 1934-35 Lab. Instructor. Industrial Bacteriology & Metallurgy, Univ. of Cincinnati. 1935-37 Supt. Coal Tar & Asphalt Div., Kentucky Color & Chem. Co., Louisville. 1937-40 Field Engr., Bristol Co., Waterbury, Conn. 1940—to date Sales Engr., Bristol Co. Member of Alpha Chi Sigma, Sigma Xi. 613 Codifer Blvd., Metairie, N. O., La.

Marcotte, Walter A. Local Affiliate Member. Age 47. Endorsed by: W. H. Rhoades, D. W. Stewart, S. V. Massimini. Served apprenticeship as Machinist, Machine Designer & Draftsman with A. T. & S. F. RR., Albuquerque, N. M. and with H. & T. C., Ennis, Tex. 4 yrs. U. S. Navy Chief Machinist Mate (CPO). 5 yrs. as Chief Engr., SS Waxahatchie, J. W. Steele SS Co.; 1st Asst. Engr. SS Waxahatchie, Lykes Bros. SS Co.; 1st Asst. Engr., SS Ruth Lykes, Lykes Bros. SS. Co.; Supervisor in Los Angeles Shipbldg. Co. 7 yrs. in Merchandis-

ing (own business) in Culver City, Cal. 9 yrs. Shell Oil Co.; Lubricating Engr. for Shell for last 5 yrs. Holds Unlimited Tonnage Chief Engineer's License. 2559 Metairie Road. N. O., La.

Sage, William C. Member. Age 48. Endorsed by: C. M. Kerr, D. W. Godat, F. N. Billingsley. B. S. in E. M., Colorado School of Mines. M. S. in M. E., Mass. Inst. of Tech. 1935-38 Consulting Engr., Private Practice, Manila, P. I. Feb. 1939-Jan. 1940 Chief Engr., Cord Interests, Los Angeles, Cal. Jan. 1940-Mar. 1941 Design Engr., Phelps-Dodge Copper Corp. March 1941-August 1941, Resident Engr., J. G. White Engr. Corp., New Orleans. Sept. 1941 to date Design & Construction Engr., U. S. Navy, Algiers, La., 5517 Hurst St., N. O. La.

Wintz, William A., Jr. State Member. Age 26. Endorsed by: L. J. Lassalle, B. W. Pegues, T. J. Jones. 1936-B. S. in C. E., La. State Univ., 1938-M. S. in C. E. & E. M., La. State Univ. 1939-40 Asst. in C. E. Lecture, Lab. & Drawing, La. State Univ., 10 hrs. Grad. work. June '36-Feb. '37 Plane Tableman, A. A. A. of La. June '38-Sept. '38 Scale Checking Aerial Photos, A. A. A. of La. May '40-Nov. '40 Engr., A. Farnel Blair, Decatur, Ga. on Gen. Const. of Bldgs., Roads & Pipe Tunnels. Nov. '40-Feb. '41 Draftsman & Instrumentman for Thos. J. Jones, New Iberia, La. on Gen. City Improvements. Feb. '41-June. '41 Instructor, Engr. Mech., La. State Univ. June '41-Sept. '41 Engr. for Thos. J. Jones as above. Sept. '41 to date Instructor in Engr. Mech. & Civil Engr., La. State Univ. Jr. Member of A. S. C. E. Civil Engr. License applied for. Carville, La.

Urban, William, Jr. Non-Resident Affiliate. Age 28. Endorsed by: Geo. Lambert, Ralph Earl, J. B. Converse. 3 yrs. college engr. 2 yrs. Gen. Land Surveying. 2 yrs. Refinery Const. 4 mths. preliminary surveying for Rockland Dam, Tex. 1 yr. street paving & airport. 1 yr. drafting & lay-out work. 1 yr. as petroleum engr. In all cases rated as Party Chief or Engineer. At present Engr. on Const. of outfitting docks, trestle & dredging for same, Pascagoula, Miss. Box 331, Pascagoula, Miss.

Our Technical Papers Committee. Hats off to Elmer May, Chairman, and to members of his very important committee. Theirs is not a "month to month" plan, but speakers are engaged far ahead of the meeting date. They have in prospect a number of good papers but if you have some suggestions for meetings, get in touch with Mr. May at New Orleans Public Service, 317 Baronne Street, New Orleans.

Society Scholarships for Engineering Students. We wish to call attention to the fact that each year the Louisiana Engineering Society awards one scholarship at Tulane University and one scholarship at Louisiana State University to deserving students in engineering. The rules for making awards are printed below:

1. The announcement of the Scholarship Award shall be set up and carried in the *Proceedings.*

2. The cards sent out by the Secretary for the notice of the April meeting shall include a statement relative to the Scholarship Award and request members to make recommendations or nominations. The April issue of the *Proceedings* shall also carry an article on the Award.

3. The scholarships shall be set up as honor awards to the children of the members of the Society or to other worthy students who are financially unable to begin or continue their Engineering studies. Awards shall be made, preferably, to a dependent of a member of the Society or of an Engineer.

4. The scholarships shall be awarded in the Colleges of Engineering for undergraduate study only. The scholarships awarded to a student in Tulane University will be $125.00 per annum, and to a student in Louisiana State University $40.00 per annum.

5. The Award shall be made for one year and may be renewed annually until the undergraduate course of study has been completed, provided proper scholastic grades have been maintained in accordance with the regulations set up by the Universities for the annual renewal of scholarships.

6. An Awards Committee consisting of three members of the Society shall be appointed annually by the President.

7. Applications for Scholarship appointments shall be made to the Awards Committee. In the event that no award is made by the Awards Committee, the Dean of the College in question shall be requested to nominate a candidate for the scholarship.

8. All applications shall be referred to the Dean of the College of Engineering of the proper university. The Dean shall rate the applications and submit the entire list to the Awards Committee together with all available information and such recommendations as he may deem fit.

9. The President shall make the award on the recommendation of the Awards Committee.

The Chairman of the Awards Committee is Prof. Boykin W. Pegues, Head of the School of Civil Engineering, Louisiana State University.

Talk So Your Audience Will Like It. To speak or not to speak is the question. In these times of stress and turmoil many speeches must be made at civilian meetings, at public rallies, at conferences and at conventions.

Because matters of an engineering nature are among the paramount issues of the day, it is essential and necessary that members of the engineering profession address various audiences onsubjects of extreme importance.

Therefore, if you must speak, why not do it as efficiently and effectively as you would solve an engineering problem. In designing a reinforced concrete beam you do not blur the figures showing the size of the steel, you do not smear the lines giving the shape of the structure, nor do you let one end of the beam hang in the air without any visible means of support.

Why in a speech is it considered fitting and proper to mumble and jumble the words, to talk only to persons in the first three rows when the ones in the thirtieth row also came to listen, and to attempt to speak without preparing a good

design of the address. The audience is entitled to have some fair idea of the premise, probably and potentiality of what is being expounded.

Most everyone has attended meetings and left with a headache because the speaker was so inconsiderate as to neglect the common courtesy of speaking loud enough for most of the audience to hear. In addition the talker may have ignored the simplest rules of enunciation, he may have stumbled along without any definite line of action, he may have said "and-a" a thousand times, and in general put you in a state of exhaustive boredom.

Now let it not be said that any member of the American Association of Engineers is so lacking in the amenities of fair conduct as to make a meeting at which he speaks a disagreeable and trying occasion for his audience. Learn to speak to the man in the last row and then you will gain the gratitude of every one present—when you have something worthwhile saying—when your talk is orderly arranged—and when you present it concisely and clearly.

—"PROFESSIONAL ENGINEER".

The story is told of a secretary with a passion for detail and exactness. It seems her boss died very suddenly and left an important business letter unmailed. Before posting it, the secretary added the following explanatory note below her employer's signature: "Since writing the above, I have died."

Shapely Showgirl: "I want you to vaccinate me where it won't show."

Doctor: "Okay! My fee is ten dollars in advance."

Showgirl: "Why in advance?"

Doctor: "Because I often weaken in such cases and don't charge anything!"

"Pick 'em fat, boys," advises a man who claims to know. "It's a lot easier to live with 200 pounds of curves than with 100 pounds of nerves."

The second hand of the clock is the line dividing the infinite past from the infinite future.

PAPERS AND DISCUSSIONS

PROBLEMS THAT PRESENT THEMSELVES IN THE CONSTRUCTION OF CANTONMENTS

C. Glenn Cappel *

I shall attempt to give you a brief summary of the problems which present themselves for solution in the construction of cantonments, as we have experienced them in the construction of Camp Claiborne near Alexandria and Camp Polk near Leesville, Louisiana.

There are many problems which present themselves and none of them are small. There are many things that have to be done first. It would be hard to specify in order of importance the various things which have to be done and problems which have to be solved. It seems that they must all be solved simultaneously, due to the speed required by the national emergency.

First, let me give you an idea as to how these contracts are initiated. When it appeared that this emergency was upon us, the War Department let it be known that they desired to have contractors submit to them presentations of their experience and qualifications along the lines which would be required in the construction of a cantonment. Following this public request, a large number of contractors prepared statements of their experience, list of jobs done, detail of their permanent organization and statement of their financial ability, and submitted them to the War Department. To assist the War Department in this tremendous undertaking, a committee under Chairmanship of Colonel Harvey, reviewed the experience statements of various contractors, selecting certain ones for questioning in regard to specific projects. They then requested these contractors to appear before them for personal examina-

* President of the Society. Paper delivered at the Annual Meeting Jan. 8 and 9, 1942.

tion so that they might determine whether in their good judgment the particular contractor was qualified to execute the work in question in the best interest of the Government. The number of contractors who were selected for each project, I do not know. As well as I can understand, however, three contractors were selected for each project and submitted to a Negotiating Committee under Chairmanship of Mr. Harry W. Loving, who went into the detailed qualifications of the contractors, and after specific negotiation for a particular project, they determined which of the contractors selected by Colonel Harvey's Committee was to be recommended to the Secretary of War to perform the work specifically under consideration.

The same procedure was followed in regard to Architect-Engineers for the projects, the burden of total construction being divided into three parts: the Constructing Quartermaster representing the Quartermaster General's Department of the War Department, the Architect-Engineer who in general were to prepare the plans of utilities, do the layout work et cetera, being furnished by the Government with standard structural plans, and the contractor. These three functions were supposed to be fused into a coadventure or partnership to perform the work required in the shortest possible time for the least money.

From the contractor's viewpoint a fee was determined upon in negotiations with Mr. Loving's Committee, which was computed by the War Department under a certain formula, details of which I do not know, but most of the contracts depending on size were based on a fee of somewhere between 2% and something less than 4% of the preliminary cost estimate, which cost estimate apparently was based on the type of construction used for cantonments in the last war!

The Architect-Engineer's problems were, first, to determine that there was an adequate water supply at the site which had previously been selected by the War Department. The selection of general site was governed by military provisions, requirements for open areas, feasibility of securing these areas, National Preserves being used in some instances. With the general location selected by the War Department, the Archi-

tect-Engineer in collaboration with the Constructing Quartermaster, made the detailed location, taking into consideration drainage, character of terrain, availability of power and fuel, availability of communications, telephone and telegraph, main state highways and railroad lines. The Architect-Engineer actually had to design and lay out a super-modern town in general to accomodate a population of, say, 20,000 to 30,000. These camps have more facilities and more up to date facilities in the way of sanitary systems, water supply system, heating, lighting, et cetera, than any towns of which I have any knowledge.

Whereas the cantonments built in the last World War were heroically simple, these have every modern convenience and safeguard to the health and comfort of the boys in training, the finest of hospitals, roads, amusement centers, and the like.

Now to the problems of the contract. Having been awarded the contract and knowing that immediate start of operations was essential, the contractor had to visualize what it would take to build the job. He was acquainted only with the brief description of how many buildings of certain types, which was given in the negotiations and listed in the contract. In the case of Camp Claiborne we had to do as many other contractors had to do—start from scratch in this visualization.

It immediately became apparent that all of the problems we would encounter, would be major ones. Banking facilities and the payment of invoices, is a major problem. The processing of such a vast amount of documents in regard to the purchase of materials, was a Herculean task in itself, and certain definite and iron-clad regulations in regard to forms of receipts and certification on standard invoice forms, had to be conformed to in order for the contractor to secure reimbursement. You can readily see that with thousands of vendors, some of them through neglect or non-cooperation or for any other reason, would not of their own volition furnish the papers, receipts, et cetera, required by the Government, if they had their money at hand. Believe me, this was a major problem and in the instance of our operations was solved by paying with

drafts. These drafts had attached all of the necessary forms and certificates for certification by the vendor, and when the draft having been deposited through the vendor's usual banking facilities, arrived at our bank, a fiscal auditor checked them and if all papers were in proper order, the draft was honored. If papers were not all in proper order the draft was refused and sent back to the vendor for proper certification of papers. We found this to be a most effective method of securing the documents required by the Government.

The question of the method and type of organization for keeping time and paying off, as well as employment, was another major problem. Many methods were used on various jobs throughout the country and probably each method used had both good and bad qualities. With the employment, timekeeping and paying off of some 20,000 men at Camp Claiborne and some 11,000 men at Camp Polk, it can readily be seen that stringent safeguards had to be placed about this function. The original conception was to have the men check in and out through gates, as is customary with ordinary size jobs. This was found to be wasteful of time and awkward and was localized to expedite the checking in and out of the men. Originally at Camp Claiborne, as I understand was the custom at many other camps, the men were paid off at the same windows where they checked in and out. It soon became apparent that this was entirely unsatisfactory with such a large number of men, it consuming from 3 to 4 hours to pay off each week. Particularly was this unpleasant to everyone concerned during inclement weather. The solution of this problem we found in the old method of the railroads, where the pay car came to the men. We prepared trucks with pay booths mounted on them. These trucks would drive right into the area where the men were working and call them over for payment in small groups. In this way we found the average time of paying off dropped from two hours per man to ten minutes per man.

The housing of employees was a major problem. It more or less took care of itself at Camp Claiborne inasmuch as a town of considerable size, Alexandria, was only 18 miles away. Even so, there were some people commuting from distances of

more than 50 miles. At Camp Polk, having only two small towns in close proximity—Leesville some 6 miles away and DeRidder some 14 miles away—the housing problem was more serious. We had first thought that we would have to operate a construction camp. However, private individuals threw up quite a number of bunk houses and in order to control the prices which were beginning to skyrocket, we opened up a Trailer Camp, providing roads, skeleton street lighting, water and sanitary conveniences and permitted workers and their families at no expense to them to live in this area in their trailers or tents or shacks, or whatever they saw fit to provide at their own expense. During construction we had approximately 4,000 people living in this Trailer Camp and it seemed to be a happy solution of this major question of housing in this particular instance. Where a camp is located on good highways, a large percentage of employees might be expected to commute for distances of as much as 50 miles. However, this is not economical and serious consideration has to be given to the housing problem where camps are located at isolated sections.

The question of transportation of employees is another one of the major problems, although not provided and paid for in most instances by the contractor. The contractor must view this question as one of his, we might say, moral responsibilities. The cost of this transportation from wherever employees may find housing, must be controlled to a reasonable figure. In the case of Camp Claiborne it was immediately apparent to me that regulation had to be made in this regard, and with the cooperation of the Missouri Pacific Railroad Company we arranged for a shuttle train to run from Alexandria to the job to meet shift time at a round-trip rate of 25c. This was quite reasonable and once it got under way, was operated without loss by the Missouri Pacific Railroad Company and at no expense to the Government. This automatically controlled the cost of all other types of transportation.

The securing of equipment, shall I say, was another major problem. I think I could omit saying that each one of these is a major problem, because they are all major problems. In the beginning of this defense construction last September a

year ago, a great deal of equipment was available but a large part of it was not in very good mechanical condition. The terms for rental of equipment were not immediately known and lots of owners of equipment were most anxious to rent their equipment to the project. Being inexperienced in this procedure and not willing to believe the wording of the contract, lots of them put themselves in position of losing their equipment by recapture. However, that was their problem and only incidentally the problem of the contractor. The contractor's problem was to get the best equipment for the purpose and have it available and at the site ready to work when scheduled. In other words, it took the closest of collaboration between the Constructing Quartermaster, the Architect-Engineer and the Contractor to give the contractor a preview of what his requirements in the way of equipment would be. Constant and untiring vigilance had to be observed in this regard, else equipment not suitable would be gotten, or suitable equipment would not be available at the time needed. At Camp Claiborne we had approximately $2,000,000 worth of equipment, which brings up another problem—that of the maintenace and repair of this equipment. Repair work had to be carried on a very large scale; as a matter of fact, a scale commensurate with a $20,000,000 job.

At Camp Polk, whereas we actually used on the project approximately $2,000,000 worth of equipment, $3,000,000 worth was at the site or came through for repairs; approximately $1,000,000 worth of it being recaptured and repaired for other projects. This meant even a greater problem in repair of equipment than we had at Claiborne because of the fact that this additional million dollars worth of equipment was processed through this camp.

Plans, I might say total plans, were usually available, owing to the stress of working under such conditions, AFTER the work was completed. Again I resort to the word "Major" in mentioning this problem. Standard plans for certain units might have been available in large quantities, but total plans and plans for utilities of necessity had to be made as the work progressed. Believe me, this was a major problem!

The organization of a Purchasing Department and an Auditing Department and such like functions to handle such a voluminous amount of work and to secure such tremendous quantities of materials in such a short time, was one consideration which took up all of the spare time of the Project Manager, which sometimes was between 2 and 3 in the morning and sometimes between 2:30 and a quarter of 3. Actually the paper work, in order that the contractor might be reimbursed and in order that he might carry his books of account in accordance with the requirements of the Government, was as big a job as the construction work. The average contractor had to acclimate himself to the vast difference or divergence from normal operation. If there is any panacea to cover this problem, we have not found it. The only solution we found was close supervision of the very best personnel procured.

In the planning of temporary facilities such as job building, roads, et cetera, we immediately saw that if these facilities were combined or laid out with a view of being incorporated in the final picture, that tremendous saving would accrue to the Government. This problem, also a major one, was to determine immediately in the beginning, as nearly as possible what the total picture would be and then fit in the temporary facilities. At Camp Polk every temporary road has been incorporated in the final picture. Every temporary building of whatever nature built by the contractor, is being utilized.

I have not touched on the question of labor supply, rates and working conditions. This is a problem always, but I do not think that a discussion of this phase would be appropriate here. Suffice is it to say that we had no major labor troubles either at Camp Claiborne or Camp Polk.

Now I have taken up as much of your time as I feel justified in taking at this time. As stated in the beginning, there are many problems which present themselves and none of them are small. Through the past year and a half we have encountered so many thousands of these problems that I could not give you a total picture of each one in detail, in less than a week's steady talk, and by that time I think I would spell it "W-E-A-K!"

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Meeting of the Board, January 30, 1942.

The meeting was called to order by President Cappel with the following present: Kammer, Kerr, Kohnke, Pillet, Steinmayer and Mayer.

President Cappel announced the receipt of a letter from Mr. Robert J. Kuhn making two suggestions for the coming year: (1) That the program and meetings cover activities which directly concern the winning of the war, and (2) that certificates of membership suitable for framing be made available to the membership of the Society. The Secretary was directed to determine the cost of printing and lettering such certificates, and also the cost of Louisiana Engineering Society lapel buttons.

President Cappel stated that in his estimation the most important matters confronting the Society this year are (1) active participation in the defense program and (2) the promotion of the unification movement for engineers. It was suggested that the Society might aid in defense by sponsoring a series of talks on air raid protection.

As a means of promoting unification and aiding both engineers and employers, President Cappel proposed that a full-time man be employed to catalogue the qualifications of all Society members and to establish contacts with numerous firms employing engineers, the cost of this service to be partially defrayed by contributions from employer and employee when a position is satisfactorily filled thru this channel. It was also suggested that the Society sponsor an educational program for both engineering students and practicing engineers in an effort to discourage engineers from joining labor unions. These were felt to be excellent ideas by the Board and will be given further consideration.

President Cappel stated that due to the present concentration of engineers at numerous points thruout the state that this seems an opportune time for the establishment of other state sections. A new standing committee on State Sections with Mr. Thomas J. Jones of New Iberia as Chairman and Professor Pillet as Board Sponsor was therefore established.

Other standing committees for the year were selected and the Secretary directed to notify these members of their appointments.

A committee consisting of Mr. Gervais Lombard, Chairman, Mr. Charles M. Kerr and Mr. R. B. Kohnke was appointed to write an obituary for M. James R. Adams, Lake Providence, La. a Life Member, who recently died in Washington.

The following Contact Representatives were selected:

3rd Dist.—Thomas J. Jones, New Iberia, La.

4th Dist.—J. T. Bullen, Shreveport, La.

5th Dist.—S. E. Huey, Monroe, La.

6th Dist.—E. C. Coburn, Baton Rouge, La.

7th Dist.—Harry H. Shutts, Lake Charles, La.

8th Dist.—D. E. Fuellhart, Natchitoches, La.

The question of waiving dues for members in the armed services was again discussed and it was decided that dues should be reduced to $1.00 per year for non-commissioned members and to 50% of the regular dues for commissioned officers. Mr. Kammer is to present this in the form of a resolution at the next regular meeting of the Society.

The Board voted to waive the entrance fee until July 1, 1942 only, the fee to be charged after said date.

The resignation of Mr. Alfred J. Cooper, Jr. was accepted.

The following members, having paid no dues within the past two years were ordered dropped from the rolls.

Sam V. Applewhite
Marshall Ballard, Jr.
Chas. A. Bender, Jr.
A. L. Black, Jr.
Hal. M. Bourg
Jasper L. Bourgeois
Eric P. Breidenbach
Wm. P. Bryan
Peter B. Callac
Neil L. Chavigny
Angus B. Cobb
Chas. A. Cooper
Robt. D. Cosgrove
Orris J. Davieson
Lucien Devall
Eric L. Erickson
Frank J. Fava
John D. Ford
John B. Gates
Eric J. Hanemann
Sidney L. Hebrard
Alvin E. Hotard
James B. Howze, Jr.
Robert H. Hurd
Joseph E. Leininger
John I. McCain
Herbert A. Metzger
A. J. Meyers
John M. Middleton
P. L. Morris
W. U. Moss
Thom. Jos. Mullin, Jr.
Hu B. Myers
Cecil K. Oakes
Wm. E. Padel
W. O. W. Pankey
W. D. Postell
Lt. H. E. Pritchard, Jr.
Stanford Rayne, Sr.
Gerald L. Rhodes
Herford B. Southwood
W. Hobson Spaar
Leroy A. Staples
Frank M. Stone
Thomas M. Sutter
James F. Tompkins
Adam S. Trowbridge
S. J. Van Norman
Robert I. Watts
Irwin C. Weidig
Edward J. Welsch, Jr.
J. Lester White
Armand I. Willoz

The Board decided to purchase a new public address system and directed the Secretary to secure specifications and quotations on several systems.

It was decided to invite all standing committee chairmen to a special meeting of the Board on February 13th for the purpose of discussing plans for the coming year.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Society February 9, 1942

The meeting was called to order by President Cappel with approximately 80 members and guests present.

The minutes of the last meeting were read and accepted.

Those elected to membership on the December ballot were introduced.

The following motion was presented by Mr. K. P. Kammer:

> "In view of the fact that numerous Members are now serving the country in its armed forces and can therefore not derive the full benefits of membership in the Society, it is moved that dues of such members be reduced as follows,
>
> For Commissioned Officers—50% of the regular dues according to grade of membership and location.
>
> For Non-Commissioned Men—to $1.00 per year.
>
> These changes to become effective as of January 1, 1942 and to continue during the period of active service in any of the armed forces."

The motion was ordered tabled until the next meeting when action will be taken by the voting members present.

President Cappel announced that the War Production Board had requested aid in locating men qualified to survey local industrial plants for conversion to the production of war materials. Members of the Society were urged to cooperate in locating such men, thus rendering a definite service to the war efforts of the country.

An illustrated paper entitled "Some Fundamentals of Soil Mechanics" was presented by John K. Mayer, Head, Department of Experimental Engineering, Tulane University, and Secretary-Treasurer of the Society.

An obituary on the death of Mr. James R. Adams, Life Member, written by Messrs. Gervais Lombard, Chairman, Charles M. Kerr and Richard B. Kohnke was read by Mr. Kerr. It was voted that a copy of the obituary be sent the bereaved family and that it be published in the Proceedings.

There being no further business the meeting adjourned to the usual refreshments.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Special Meeting of the Board February 13, 1942

President Cappel called the meeting to order with the following members present: Kammer, Kerr, Kohnke, Steinmayer, Stewart and Mayer.

The Standing Committee Chairmen present were: Cucullu, Fromherz, Hill, Newton and Ross.

The minutes of the last meeting of the Board were read and approved.

Mr. Kerr stated that the total deficit for the Annual Meeting was $475.65, or $24.35 less than the $500.00 allotted for the meeting. The outstanding bills were ordered paid.

President Cappel urged that all Committee Chairmen add to their committees any members of the Society whom they required.

Proposed activities of various committees for the year were discussed. Results of the discussion are briefly as follows:

Committee on Professional Advancement, L. J. Cucullu, Chairman.

This Committee should actively promote the unification movement in the Engineering Profession. It was suggested that the most effective approach to the problem at this time might be an expansion of the employment service of the Society and the sponsoring of an educational program for both senior engineering students and recent engineering graduates.

The Committee was requested to review a recent article in the N. A. P. E. magazine concerning the attitude which young engineers should develop in regard to labor unions. It was voted that if the committee so recommended that this article be printed in the Proceedings and a copy sent each member of the Delta Junior Engineers.

Committee on Defense, A. M. Fromherz, Chairman.

The Society can probably be of greatest service to the State by concentrated efforts to organize a reputable advisory service on a few vital defense subjects. Some subjects mentioned were air raid shelter design, traffic control plans, equipment surveys, and technical advice on the protection of industrial plants and on demolition.

The Society has received a definite request from operating engineers for technical advice on protective and control measures applicable to industrial plants.

The Society has also been requested by the War Production Board to aid in locating engineers capable of converting existing industrial plants to the production of essential war materials.

It was mentioned that the Society might aid to a certain extent by sponsoring a series of meetings on selected defense subjects, the speakers to be trained men who are in close contact with the existing defense organization.

It was brought out that any defense efforts of the Society should not encroach upon the field of the consulting engineer and that the prestige of the engineering profession must be upheld.

Committee on Finance, Ole K. Olsen, Chairman.

It was decided that this Committee should contact members delinquent in payment of dues in an effort to have payments brought up to date.

Committee on Entertainment & Outings, N. H. Ross, Chairman.

It was the sense of the meeting that there was a definite need for entertainment and outings during the war.

A suggestion was made that some instructive talks on defense subjects might be combined with some of these functions. The Committee should cooperate with the Committee on Defense in this matter.

Committee on Membership, Division "A", H. P. Newton, Chairman.

The Board was of the opinion that efforts to obtain new members should be concentrated on outstanding engineers and on recent engineering graduates. Close relationship with the Delta Junior Engineers should be fostered.

A copy of members recently dropped for delinquency in dues is to be sent the Committee in order that these men be contacted regarding reinstatement.

It was suggested that this Committee could render a distinct service by starting to catalogue the qualifications of the members of the Society.

Committee on Publications, Division "A", A. M. Hill, Chairman.

The Committee was advised to continue to carry in the Proceedings articles of pertinent interest to the Society.

Mr. Kerr stated that the "LASEC NEWS" would probably be discontinued by the Louisiana Section, American Society of Civil Engineers.

Committee on Publications, Division "B", G. R. Hammett, Chairman.

The Board felt that a number of new ads for the Proceedings could be secured by active efforts of this Committee.

Committee on Technical Papers, G. E. May, Chairman.

Mr. Kammer reported that the Committee is now engaged in drawing up a program for the year and that it will be submitted in the near future.

It was suggested that the Society sponsor a series of talks on selected defense subjects by qualified speakers. Similar talks might also be made on the subject of "Safety". The Committee should cooperate with the Committees on Defense, Public Relations and Safety in these matters.

President Cappel suggested that at each meeting of the Society one of the older past presidents be invited to speak for ten minutes on the development of the Society during his term of office.

Committee on Public Relations & Safety, A. J. Naquin, Chairman.

It was decided that the scope of this Committee be broadened to include the general field of "Safety". The suggestion was made that a series of talks on some particular phase of safety be sponsored by the Society. The Committee should cooperate with the Committee on Technical Papers in this matter.

Mr. David Moodie was added to the personnel of this Committee.

There being no further business the meeting adjourned.

J. K. Mayer,
Secretary-Treasurer.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

APRIL, 1942

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

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

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXVIII. JUNE, 1942 NO. 3

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EDITORIAL NOTES AND COMMENT

E.S.M.D.T. Those engineers who have not had an opportunity to come in contact with the Engineering, Science and Management Defense Training Program would be amazed at its magnitude. In hundreds of training centers all over the nation, day and night (particularly night) courses are being sponsored by colleges and universities.

The plan is one of up-grading within the industry, or preparation for some special field, rather than mass education. Tuition is free; the work taught is college level. No academic credit is given for the work, however.

The subjects covered are too numerous to list. A program such as this, in which 310,605 are enrolled in engineering work, marks a new era in adult education. Its efforts are far reaching and may establish evening work on a permanent basis in sections where heretofore it has been almost unknown.

Baton Rouge Meeting. On May 11 the annual meeting in Baton Rouge took place. A golf tournament preceded the supper, which was held at the Westdale Country Club.

President Lant of the Baton Rouge Section opened the meeting and introduced officers of the Section. President Cappel presided during the remainder of the session.

Mr. M. J. Rathborn, President of the Standard Oil Co. of Louisiana presented an interesting discussion on synthetic rubber.

Complete details of the entire affair will be found in the minutes. Those present had a most enjoyable time, thanks to the thoughtfullness and hospitality of the Baton Rouge Section.

In This Issue: "Soil Mechanics" is a new subject rapidly receiving more attention in the engineering field. Professor J. K. Mayer, our Secretary-Treasurer, has an excellent paper on the subject in this issue.

"Unionism—an Issue in Engineering" is reprinted from THE FOUNDATION of the Engineering Society of Detroit. It is a survey of what is happening in attempts to unite professional engineers.

Will You Help? At this time of the year thousands of young men are graduating from high school and their thoughts turn to college careers. Many will seek the advice of acquaintances or relatives who are engineers.

It is an enviable opportunity for the engineer to assist a youngster in deciding on what profession to choose. Naturally the civil engineer will tend to color with rosier hues that profession, and so with others. But the greatest service that can be rendered is to try to depict the opportunities and type of work done in all common branches of engineering.

"Engineering as a Career," published by the Engineering Council for Professional Development, is a pamphlet that will be of assistance also to the engineering aspirant. But personal contact is more influential and when you are asked, will you help?

Certificates and Pins.

CERTIFICATES OF MEMBERSHIP. Certificates of membership suitable for framing are now available at 75c each. Those certificates are attractively printed on heavy paper approximately 10″ x 15″. The member's name and grade of membership will be lettered in script and the certificate signed by the President and the Secretary-Treasurer. Orders, accompanied by the remittance, should be sent to the Secretary-Treasurer.

SOCIETY LAPEL BUTTONS. The standard lapel button consisting of the circular Society emblem with a blue enamaled background may be obtained from

William Frantz & Company, Inc.
129 Carondelet St.
New Orleans, La.

These buttons are manufactured upon receipt of order which may be sent either directly to the above or to the Secretary-Treasurer.

Prices are

10 K Gold.....$5.50 each
Silver .....$2.00 each

It is hoped that a number of members will avail themselves of these items.

PAPERS AND DISCUSSIONS

SOME FUNDAMENTAL PRINCIPLES OF SOIL MECHANICS

By John K. Mayer*

Soil Mechanics is that rather recently developed branch of engineering which deals with the behavior of one of the world's oldest, yet most complex, materials of construction. It has received considerable criticism during its developmental stage, as would naturally be expected, but most of the fundamental principles have now been rather well established and it is the aim of this paper to present some of these fundamentals rather than to discuss any recent advances from research in this field.

First, however, it might be of interest to briefly review the development of Soil Mechanics. In looking back over the early literature on the subject we find contributions by such eminent scientists and engineers as Coulomb in 1773, Rankin in 1856 and Benjamin Baker in 1880, their works being chiefly concerned with the problem of lateral earth pressures on retaining walls. Artícles concerning nearly all of the outstanding ideas in soil mechanics have been scattered thru American engineering periodicals during the past fifty years. The development into a specialized branch of engineering, however, is due largely to the efforts of Dr. Charles Terzaghi who came to this country from Vienna in 1925 to teach at the Massachusetts Institute of Technology. Developments have been very rapid in the past five years and the civil engineering curricula of most engineering colleges now include some course in Soil Mechanics. Outstanding research work, particularly in the field of earth dams, has been accomplished by the U. S. Army Engineers.

As might be expected in any rapidly developing field there are still some conflicting ideas, some semi-empirical methods

* Secretary-Treasurer of the Society.
Presented at the regular meeting of the Society, February 9, 1942.

must be employed, theories have their limitations, and the tests, symbols, etc., have not been standardized. The field has not advanced, and will probably never advance, to the stage where the design of earth structures and foundations may be made from theory and laboratory tests alone—experience and correlation of field observations still play most important parts. The intelligent use of theory and laboratory tests together with experience and field correlation will, however, undoubtedly produce a more economical or safer design than dependence upon judgment alone. There is still a great need for keeping accurate observations on all large structures, both during and after construction, so that thru correlation more accurate theories may be developed. No theory can be accepted as satisfactory until it has been adequately checked by field observations. An accurate and complete set of field observations is of permanent value and is worth more than any number of unchecked theories. This point cannot be too strongly emphasized.

In the early days of soil mechanics many attempts were made to develop some test by which soils could be classified and their behavior predicted. It has since been found that no single test will suffice and a number of tests have been more or less standardized. These tests yield data which may be divided into two general groups; (1) those which may be called soil characteristics and which are helpful in providing a general idea of the behavior of the soil under certain conditions, and (2) those denoted as soil properties which may be used to a certain extent in the design of earth structures.

Soil characteristics are determined from such tests as the mechanical analysis, the Atterberg limits of consistency and specific gravity.

The mechanical analysis may be made by means of a set of graded sieves for coarse textured soils, by means of a wet analysis for fine textured soils, or by a combination of the two methods. Results of mechanical analysis are usually plotted as % Finer (by weight) against the log of the grain diameter as shown in Fig. 1.

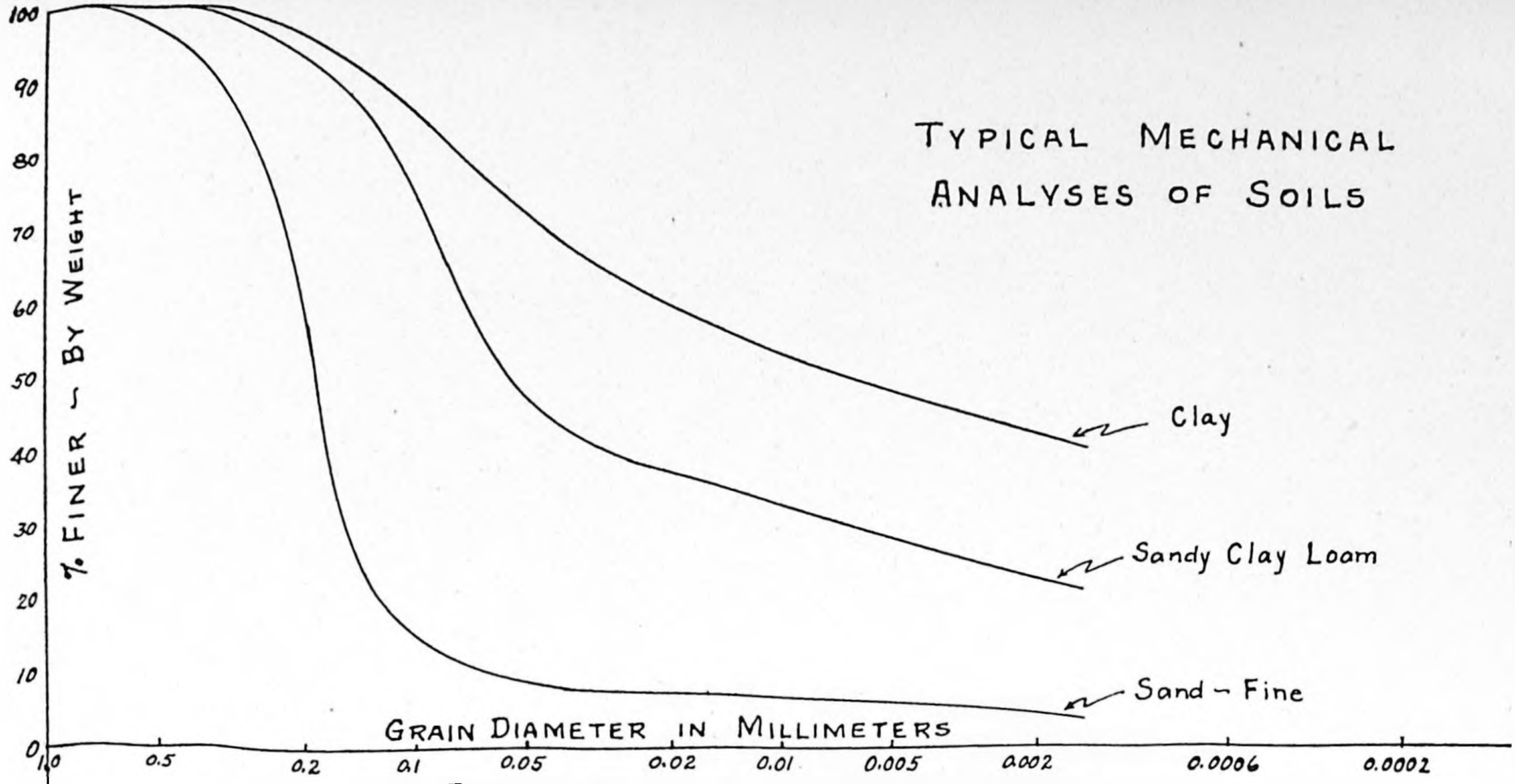

TYPICAL MECHANICAL ANALYSES OF SOILS
% FINER - BY WEIGHT
100
90
80
70
60
50
40
30
20
10
0
Clay
Sandy Clay Loam
Sand - Fine
GRAIN DIAMETER IN MILLIMETERS
1.0
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
0.0006
0.0002
U.S. BUREAU OF SOILS CLASSIFICATION
SAND
Coarse
Medium
Fine
Very Fine
SILT
CLAY
MASS. INST. OF TECHNOLOGY CLASSIFICATION
SAND
Coarse
Medium
Fine
SILT
Coarse
Medium
Fine
CLAY
Coarse
Medium
Fine
INTERNATIONAL CLASSIFICATION
SAND
Coarse
Medium
Fine
MO
Coarse
Fine
SILT
Coarse
Fine
CLAY
Coarse
Fine
ULTRA CLAY
J.K. Mayer '42

Fig. 1

Names have been given to certain textural bands as shown at the bottom of Fig. 1. These bands, however, have not been standardized and we have the International, the U. S. Bureau of Soils, and the Massachusetts Institute of Technology classifications as shown. The Bureau of Soils classification is the most widely used altho the M. I. T. has the most logical basis. It should be remembered that sands, silts and clays are really types of material rather than grain size bands. For example a true clay must have flat or plate-shaped grains. A rock flour of the same grain size will not exhibit the cohesive properties of a true clay and its behavior will be quite different.

After the percentage of sand, silt and clay in a soil sample has been determined from the mechanical analysis curve the soil may be classified texturally by consulting a table or a triaxial chart. These class names are again not fully standardized and may not agree with field classifications. It is a step in the right direction, however, since many drillers develop their own visual classifications which are rather confusing when attempting to correlate data.

The value of a mechanical analysis is debatable. It is definitely valuable in selecting filter sands and when considered in connection with other soil characteristics it gives some general idea of the permeability, drainage and stability of the soil. Attempts to set limits for soils used in earth dam construction have not been entirely satisfactory.

The Atterberg Limits are the moisture contents at which the consistency of a wet soil changes from liquid to plastic to semi-solid to solid states. Thus the Liquid Limit is the moisture content at which the mass changes from a liquid to a plastic state, the Plastic Limit the boundary between the plastic and semi-solid states, and the Shrinkage Limit the boundary between the semi-solid and solid states. Obviously this change of state with reduction of moisture content is gradual and arbitrary methods must be set up to indicate the limits. The time available does not permit discussion of the test procedure.

It might be well to mention at this point that the moisture content is the water driven off at about 105°C, expressed as a per centage of the dry weight of the sample.

Soils vary considerably in structure depending upon the manner of formation and subsequent conditions. The soil particles in a single-grained structure such as sand are sufficiently large that intermolecular attraction is negligible and the force of gravity predominates during sedimentation, thus producing a rather dense mass. In the honey-comb and flocculent structures the particles are so small that the intermolecular attraction is comparable to the force of gravity and the structure formed has considerably more voids. A mixed structure may also result from a combination of these types.

At this time it will be well to define the term "void ratio" which will be used frequently in the latter part of this paper. If it is assumed that all of the solids in a volume of soil, V, could be reduced to a single solid of volume V_s leaving a void volume V_v, then the void ratio, generally denoted by "e", is V_v/V_s. The voids may be filled with air, with water, or with air and water. Void ratios range from as low as 0.3 for dense sands to as high as 10 for some peats.

The reduced volume of solids in a sample may be computed by dividing the dry weight of the solids by the product of the absolute specific gravity of the solids and the unit weight of water. The unit weight of a soil may therefore be easily computed if the specific gravity, moisture content and void ratio are known.

The degree of compaction obtainable in rolled earth dams, highway fills, and the like depends upon the moisture content and thickness of the soil layers as well as the type, weight and number of passes of the roller. The "optimum moisture content" is that which will produce the greatest dry unit weight, other factors remaining constant. This moisture content may be determined in the laboratory by means of the Proctor compaction test. Control in the field is usually maintained by moisture content or unit weight determinations. When soil near the optimum moisture content is properly compacted the subsequent settlement of the fill is usually quite small.

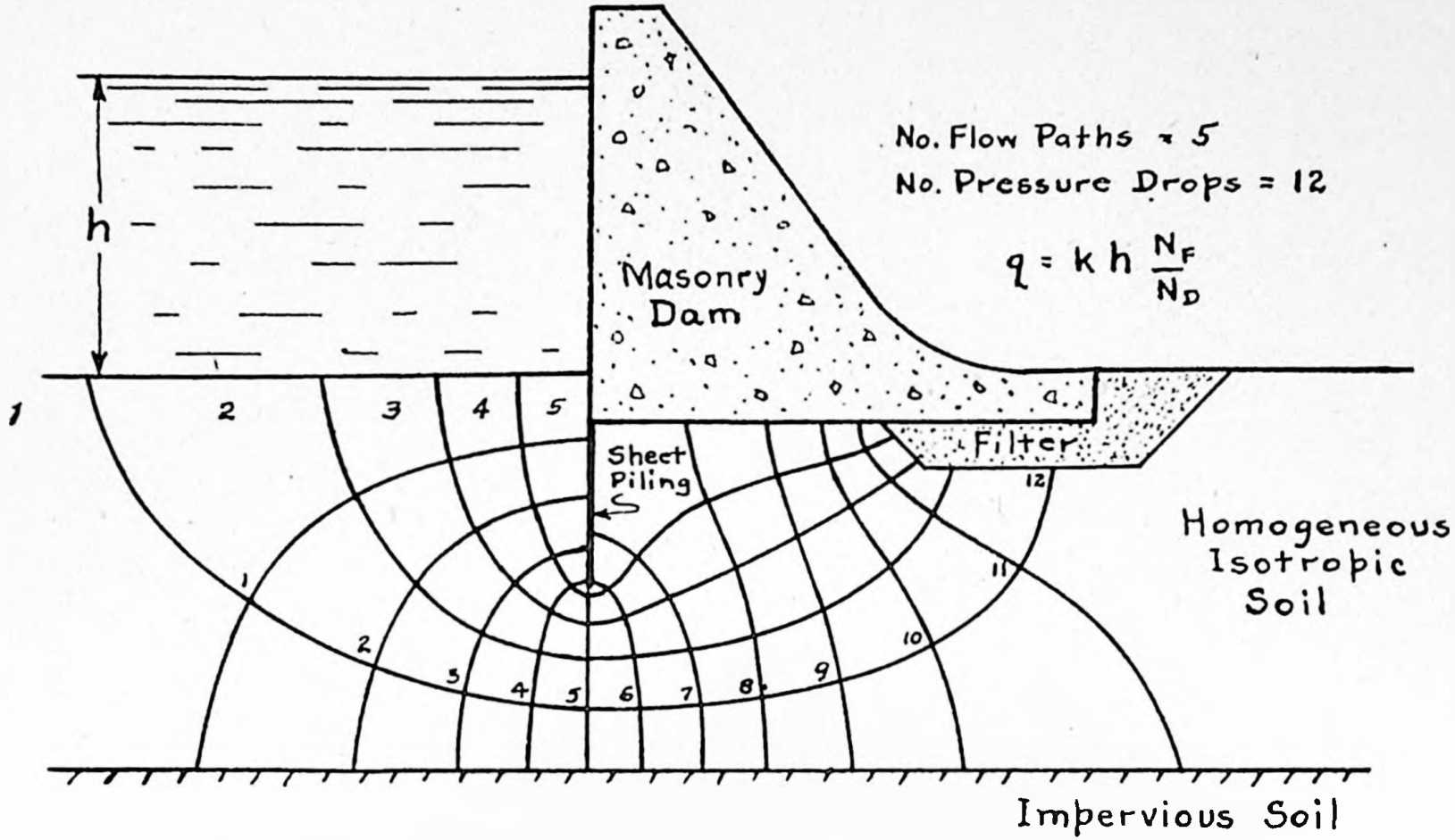
The permeability, or resistance to flow of water thru a mass of soil, is often an important property in the design of dams, reservoirs and the like. Naturally a very coarse material with

large interconnecting voids will permit the percolation of large quantities of water and would not be a suitable material for impounding water, even tho it would probably be very stable from a structural standpoint. The permeability of samples of soil may be determined in the laboratory by means of either the constant-head or the variable-head permeameter. As in all laboratory tests the samples must be representative of the soil mass under consideration. Results are also complicated by disturbance of the sample, stratification of the soil mass and other factors. A number of tests are required in order to obtain a good average value of the permeability.

Several methods may be used for the determination of the quantity of water seeping thru an earth dam or under an impervious dam, but the flow net method is probably the most widely used. A flow net consists of a series of assumed flow lines and equipotential lines drawn on a plane along which seepage occurs. The nets are simply sketched in freehand, the requirement being that the areas formed by the intersection of adjacent flow lines with adjacent equipotential lines must be "squares". These "squares" really consist of four curved sides with corners intersecting at 90°, the lengths across the centers being approximately equal. After completing the flow net the number of flow paths and number of pressure drops are counted. The seepage is then the product of the total head of water, the coefficient of permeability of the soil and the ratio of the number of flow paths to pressure drops. A flow net for an impervious dam with a filter built on a pervious stratum is shown in Fig. 2.

This will probably appear to be a very rough method, but results have shown that even a crude flow net will give the seepage within 10%, which is greater than the accuracy with which the coefficient of permeability is known.

If the permeability of the soil mass is different in the horizontal and vertical directions, the horizontal scale must be transformed by multiplying it by the square root of the ratio of the vertical to the horizontal coefficients of permeability before sketching the flow net. The effective coefficient of permeability is then the square root of the product of the horizontal and vertical coefficients.



FLOW BENEATH A DAM

Fig. 2

In the case of an earth dam the upper flow line is one of the boundaries of the flow net, the location of which is unknown. Several methods have been developed to aid in locating this line, but will not be considered here.

One rather recent development in earth dam construction is the use of a filter bed or a rock filled toe to keep the top seepage line within the dam and thus increase the stability by preventing erosion at the break-out point.

At this time I would like to correct one rather generally accepted erroneous idea, i. e. the cause of quicksand conditions. Quicksand is **not** a particular type of sand, but simply the reduction in intergranular pressure due to upward seepage forces. The same sand will be quite stable when the seepage is downwards. A quicksand condition in the bottom of an excavation may often be relieved by permitting the water to rise to its normal level, then excavating under water. Pumping water from the excavation will only aggravate the quicksand condition.

When designing a foundation the allowable settlement of the structure, or more often the allowable **differential** settlement, is usually the criterion of design. Whether this be the case or whether the ultimate bearing capacity of the soil is the government factor, the question of stresses and strains in the soil mass are involved. The stress at any point below the surface of a soil mass will be made up of that due to the overburden and that transmitted from any superimposed load. The vertical pressure due to the overburden is easily computed, but it must be remembered that we are generally interested in the **intergranular pressure** rather than the total pressure. This means that in the case of a saturated soil, the soil particles are bouyed up and the intergranular pressure is considerably less than that for dry or moist soils. The effective, or submerged, unit weight of a soil below the water table is the saturated unit weight of the soil minus the unit weight of water.

The determination of stresses induced in a soil mass by a superimposed load is more difficult. Mathematicians have given us equations for the stress induced at points within a perfectly elastic homogeneous medium due to the application

of certain types of superimposed loads. Soil masses, however, are not perfectly elastic and homogeneous and the elastic theories can be used only in cases approximating these conditions. It is believed that the elastic equations may be used with fair certainty in the case of very deep soil masses. In other cases they may give some idea of the stress. The stress distribution under a structure also depends largely upon the rigidity of the structure. The time available does not permit a consideration of these computations. The compression of a soil stratum under a given load depends primarily upon the type of soil, its initial void ratio, moisture and drainage conditions. A dry sand will settle very rapidly, and after repetition of the same load a number of times, the rebound will equal the settlement. The action of a saturated clay, however, is very different.

Settlement due to increased loads on saturated clays is explained by the consolidation theory. It must be remembered that clay has essentially a flocculent structure with a relatively high void ratio. Its fine texture, however, makes its permeability very low. If the pressure is thus increased on a confined mass of saturated clay, the load increase will first be carried as excess pressure on the water in the voids and will gradually change to intergranular pressure as some of the water is forced out.

A settlement-time curve for a given structure may be predicted from the results of a consolidation tests made upon representative undisturbed samples taken from the clay stratum underlying the structure, provided that certain factors concerning the underlying soil are known. The consolidometer unit consists of a short vertical cylinder for laterally confining the soil sample; porous stone discs at top and bottom of the sample to permit vertical drainage of water; and a dial micrometer for determining the change in sample thickness. A known vertical load is applied to the sample for 24 hours, the decrease in thickness being read at certain time intervals. Twice this load is then applied for another 24 hours and readings again taken. This procedure is usually repeated for 4 or 5 days. The final void ratio of the sample is computed for each load and plotted against the log of the load as shown in Fig. 3.

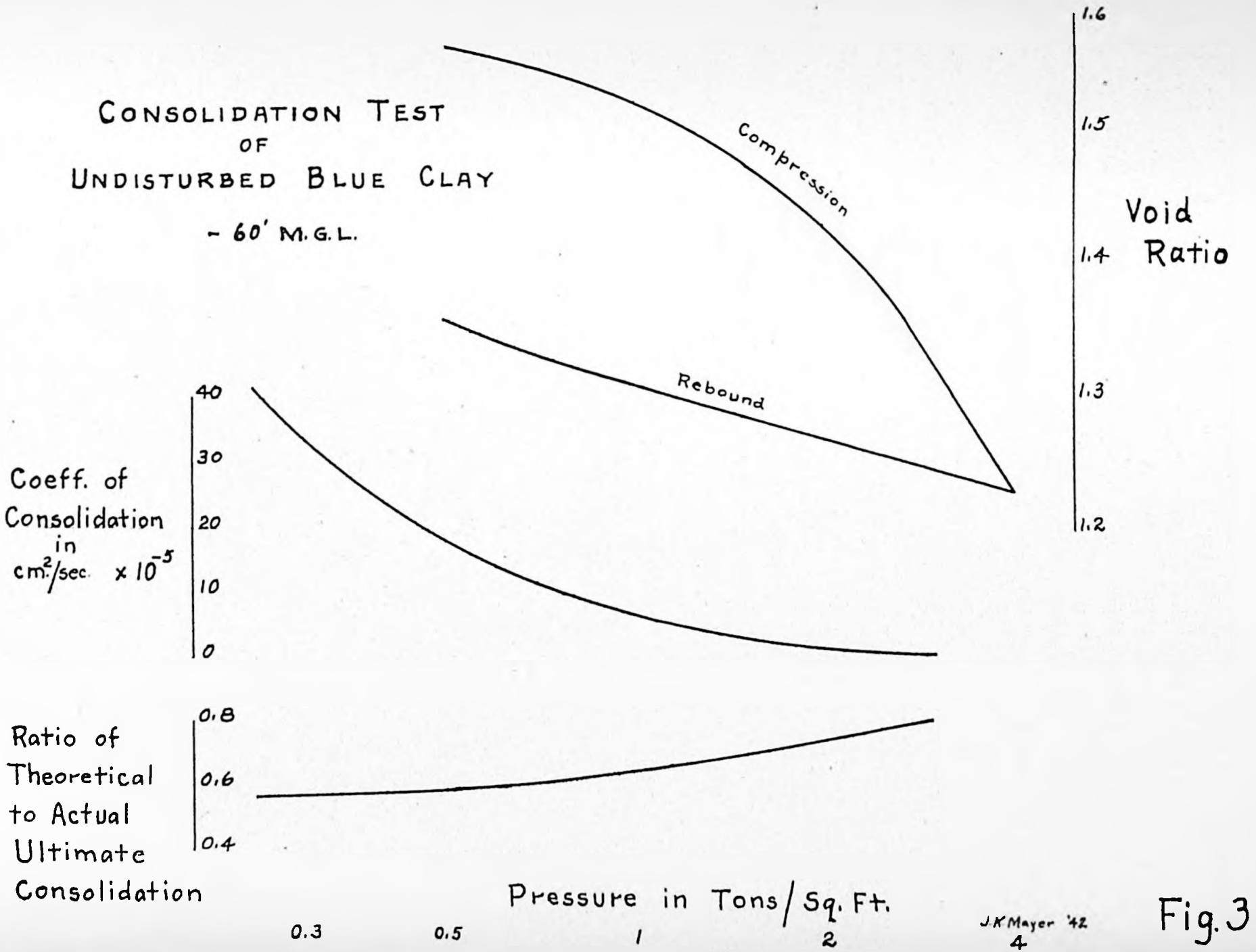

CONSOLIDATION TEST
OF
UNDISTURBED BLUE CLAY
- 60' M.G.L.
Compression
Rebound
Void Ratio
1.6
1.5
1.4
1.3
1.2
Coeff. of Consolidation in cm.²/sec. x 10⁻⁵
40
30
20
10
0
Ratio of Theoretical to Actual Ultimate Consolidation
0.8
0.6
0.4
Pressure in Tons/Sq. Ft.
0.3
0.5
1
2
4
J.K.Mayer '42

Fig. 3

The ultimate settlement of a structure will be proportional to the change in void ratio from its initial value to that after complete consolidation has occurred. In predicting the settlement-time curve it is thus necessary to know the increase in load at one or more points thruout the clay stratum as well as the initial distribution of the excess hydrostatic pressure, the latter depending upon the initial state of consolidation. The clay may be either partially consolidated or completely consolidated under the existing overburden, or it may have been consolidated under a higher pressure in the past. This depends upon the geoligical history of the site and a geologist should usually be consulted, tho some information may be obtained from the consolidation test. Ultimate settlement does not occur until all of the excess hydrostatic pressure has been relieved and all load is carried as intergranular pressure. The time required therefore depends upon the thickness of the stratum, its permeability and initial state of consolidation and the drainage conditions existing above and below the stratum. The settlement proceeds rapidly at first and decreases with time. It continues almost indefinitely as observations on the Leaning Tower of Pisa show that it is still settling slowly, even tho construction was begun in 1174. In many structures the settlementment reaches a negligible rate after a few years.

The differential settlement and also the untimate settlement of a structure may be controlled somewhat by designing the structure to meet existing soil conditions; by the use of deep basements to reduce net increase in load on the subsoil; by pre-loading the site; by proper foundation design; and by maintaining a construction schedule designed to produce essentially uniform settlement of the entire structure. Obviously some of these methods are not practical in any given case.

A structure built on a soft clay stratum near the surface many of course settle by plastic flow of the clay from under the structure. This case can obviously not be handled by the consolidation theory.

Shearing stresses and strains in a soil mass are important in investigating the stability of unretained embarkments and when estimating the pressure on retaining walls. A number of

shear tests have been devised, but those generally used are the direct shear and the cylindrical compression test, often called the triaxial shear test.

The direct shear test apparatus consists essentially of a divided box for holding the sample and appropriate means for applying and measuring horizontal and vertical loads. Shearing of the sample is produced by control of either the horizontal stress or strain, the latter being considered the more desirable.

A strain-control direct shear machine now in use at Tulane University is shown in Fig. 4. This machine is a copy of one developed at the Massachusetts Institute of Technology.

In presenting the results of a shear test on a granular cohesionless material, such as sand, the ratio of shearing resistance to normal load is usually plotted against the horizontal movement, also the change in sample thickness against the horizontal movement. The shape of the curves depends upon the initial void ratio o fthe sample as shown in Fig. 5 (a). The ratio of shearing resistance to normal load at failure is the The ratio of shearing resistance to normal load at failure is the tangent of the angle of internal friction of the material. This angle is usually determined for both the peak and ultimate points, the latter being at the strain which produces the maximum increase in sample thickness. Clean sands will show identical characteristics when tested either wet or dry. The decrease in volume of loose saturated sands due to shearing strains throws the load temporarily on to the water in the voids and a quick condition may result due to the reduction in intergranular pressure.

Results from shear tests on clays are not nearly so reliable as those on sands to disturbance of the sample, the properties of the soil, the normal load, drainage conditions, speed of test, and other factors. The samples may be sheared immediately after the application of the normal load for the "quick" test or allowed to consolidate under the normal load before shearing for the "delayed" test.

Due to the fact that all of the normal load is not carried as intergranular pressure and also because of the cohesion present in clays, it is not possible to determine the angle of in-

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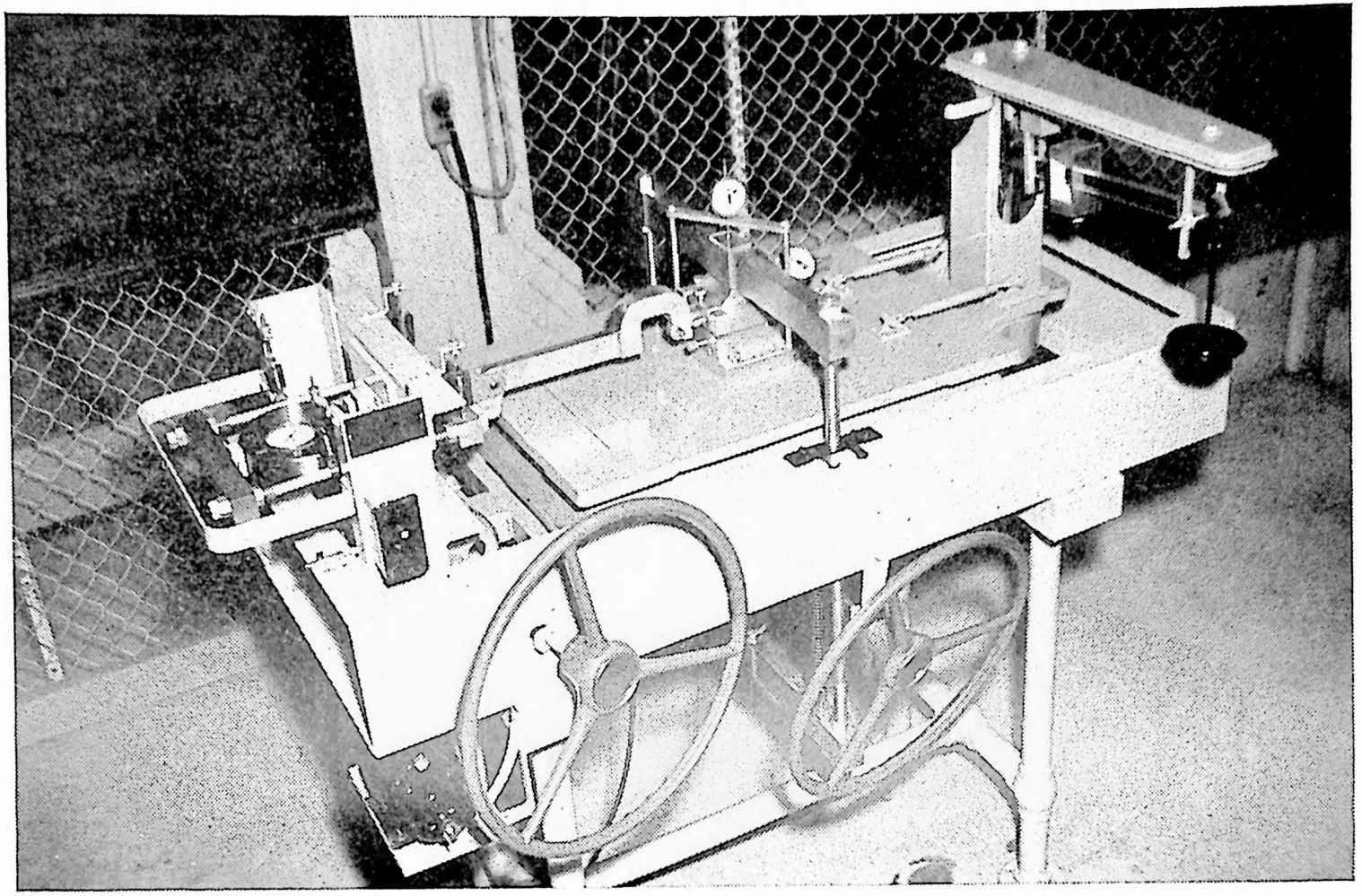


Fig. 4

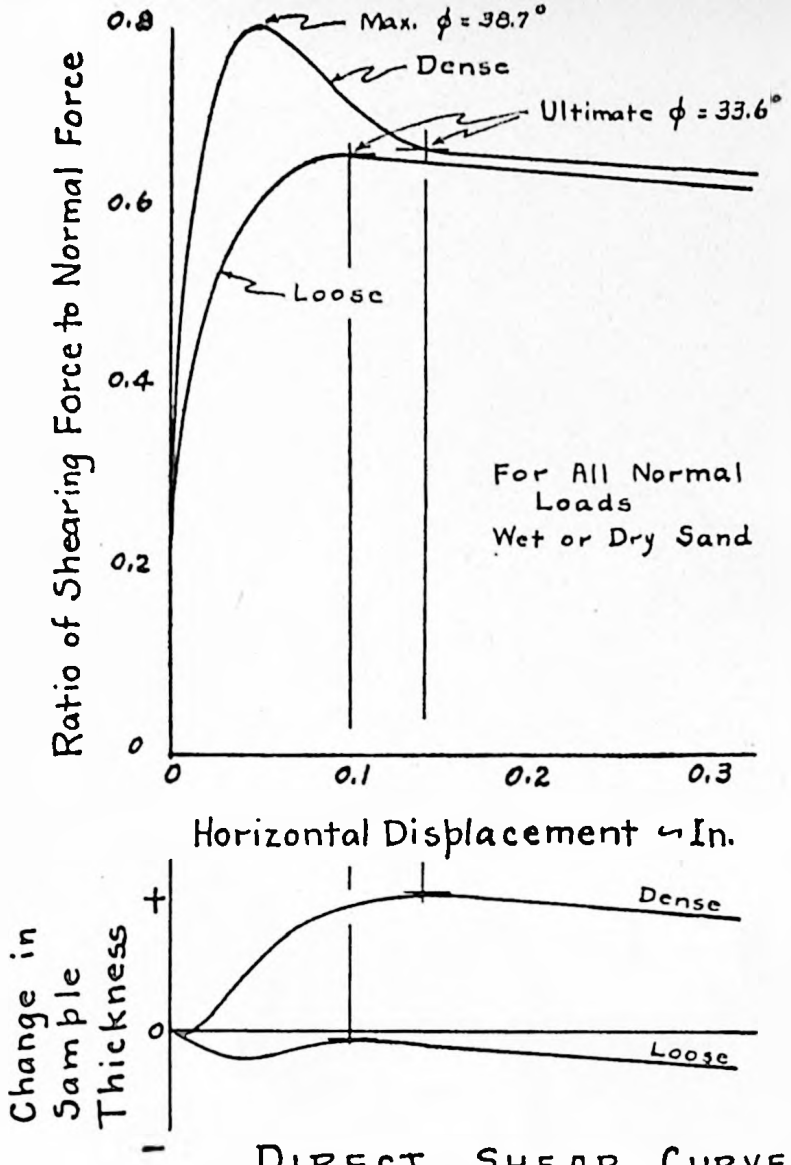
ternal friction from a single shear test. Instead, tests must be run at several normal loads and the shearing resistance at failure plotted against normal load. A straight line may usually be drawn thru these points. The intercept at zero normal load may then be reduced to unit cohesion and the angle of the line with the horizontal is the angle of internal friction. Actually the points do not fall in a straight line for a wide range of loads and values should not be extrapolated much beyond the range of the applied test loads. For some soft clays it is very difficult to select a so called failure point due to the gradual curvature of the shearing resistance-strain curves. Typical direct shear test curves for clay are shown in Fig. 5 (b).

In the cylindrical compression or triaxial shear test the soil sample is encased in a thin rubber membrane, then placed within a chamber so arranged that a known lateral force may be applied by fluid pressure and an independent axial load applied and measured. This type of shear test yields essentially the same data as the direct shear test but has certain advantages. It is much slower in operation however, and is generally considered to be of more value in research than in routine shear testing.

Unretained earth slopes may fail in several ways but only the more common shear failure will be considered here. For stability with cohesionless soils it is only necessary that the angle of the slope be less than the angle of repose of the soil. With cohesive soils, however, the stability of the slope depends upon the height and angle of the slope as well as the cohesion and shearing strength of the soil.

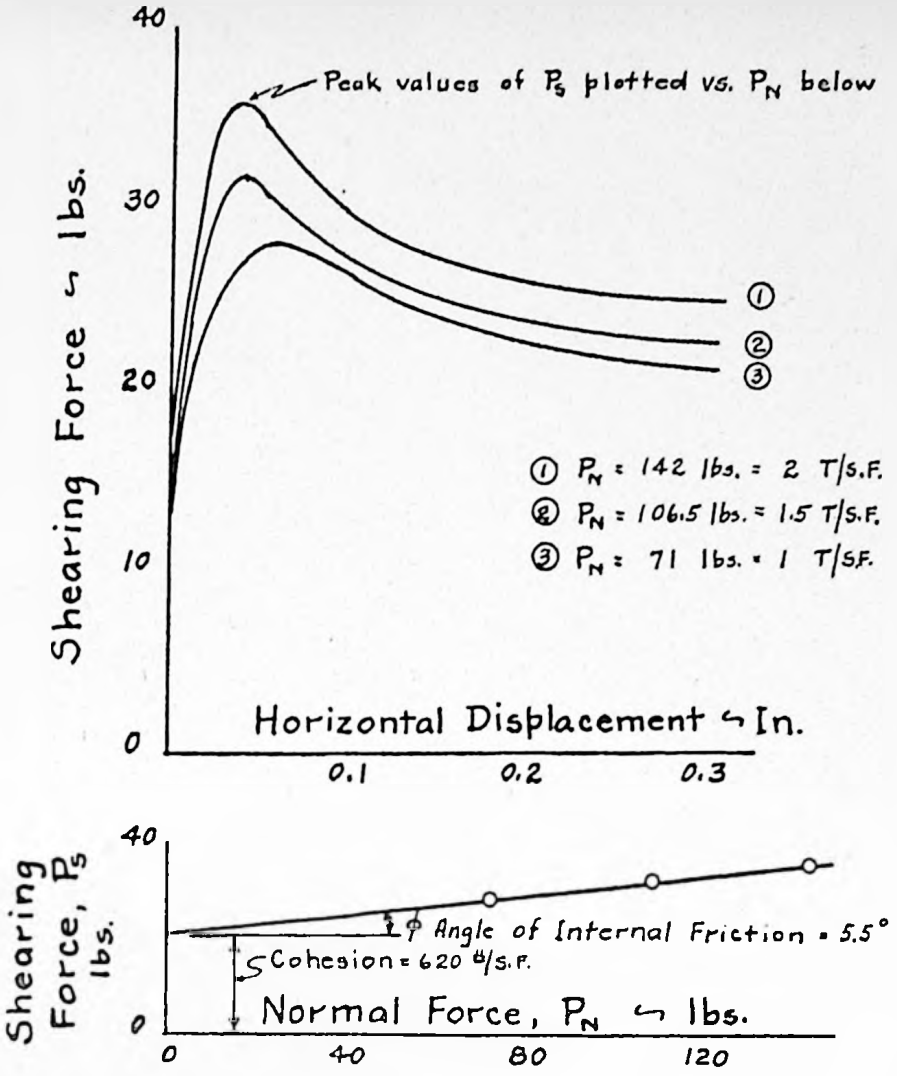
Shear failures may occur along various paths, but it has been found that for homogeneous materials the path closely approaches a circular arc, so only this type will be considered here. For a slope to be stable the moment of all forces such as gravity, seepage, earthquake, wind, etc., tending to cause movement must be balanced by the moment of the forces of friction and cohesion along some most dangerous surface.

To investigate the stability of a slope by the circular arc method it is first necessary to assume some location for the trial arc. Several methods of locating this arc have been devel-



DIRECT SHEAR CURVES FOR CLEAN SAND

(a)



DIRECT SHEAR CURVES FOR UNDISTURBED CLAY

(b)

Fig. 5

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oped but need not be discussed. After the arc is located either of two methods of approach are generally employed, the "method of slides" or the "circle" method. In the first method the area within the failure zone is divided into a number of vertical slices and the total weight vector for each slice broken down into a normal pressure component and a tangential shearing component acting at the center of the portion of the assumed failure arc forming the base of the slice as shown in Fig. 7. The normal component is then divided into the neutral hydrostatic force, U, and the intergranular force, P. The neutral force on the base of any slice will be the product of the unit weight of water, the pressure head, the width of the slice, and the secant of the slope of the arc, i. The total force tending to cause sliding along the arc is then the summation of all W_s vectors, or the vector ad. If sliding is not to occur along this particular arc the sum of the available resistances from cohesion, bc, and from friction, ab, must at least equal ad. Any excess of ac over ad represents an available stabilizing resistance.

Other locations of the failure arc are next assumed until the most dangerous one is found. While this method is based on several assumptions, it is the best available for non-uniform slopes and where the unit weight of the material is not constant.

The Φ-circle method is a graphical method which is very convenient when uniform slopes and soil of constant unit weight exist.

Forces on retaining walls may be estimated by theoretical formulas or by graphical methods. It will suffice here to say that for dry or moist soils the lateral pressure distribution is not hydrostatic and that it depends primarily upon the movement allowed the wall. If the wall can move away from the fill even by a very small amount, the lateral pressure will be only a fraction of that existing when the wall is forced toward the soil. The resultant lateral pressure nearly always acts at a point higher than ⅓ the height of the wall.

For very soft or wet soils it is better to consider the soil as a liquid having a unit weight of about 90 or 100 pounds per cubic foot.

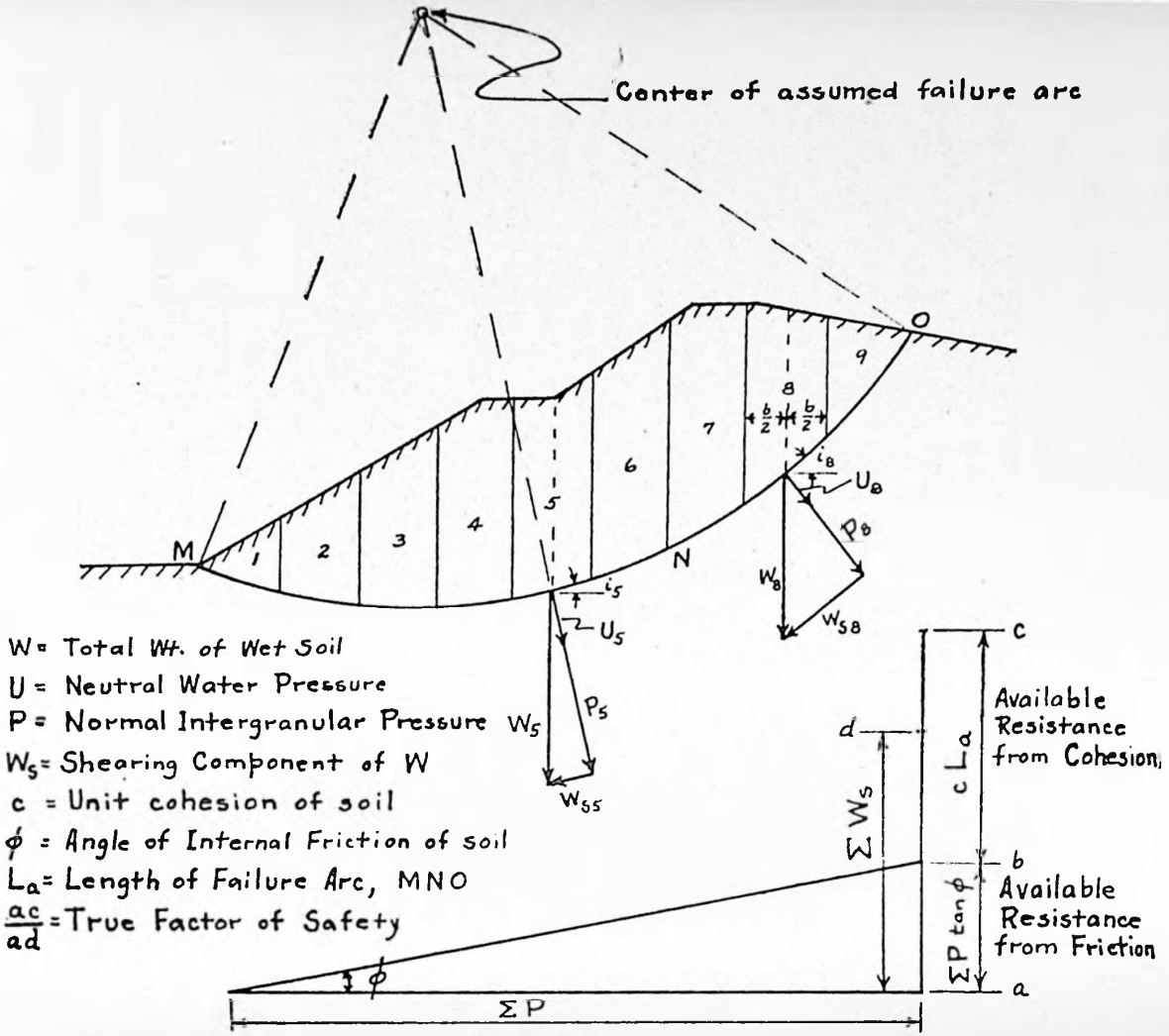

Center of assumed failure arc
O
M
N
1
2
3
4
5
6
7
8
9
$\frac{b}{2}$
$\frac{b}{2}$
i_8
U_8
P_8
W_8
W_{S8}
i_5
U_5
P_5
W_5
W_{S5}
W = Total Wt. of Wet Soil
U = Neutral Water Pressure
P = Normal Intergranular Pressure
W_S = Shearing Component of W
c = Unit cohesion of soil
ϕ = Angle of Internal Friction of soil
L_a = Length of Failure Arc, MNO
$\frac{ac}{ad}$ = True Factor of Safety
c
d
b
a
ΣW_S
$c L_a$
Available Resistance from Cohesion
$\Sigma P \tan\phi$
Available Resistance from Friction
ϕ
ΣP

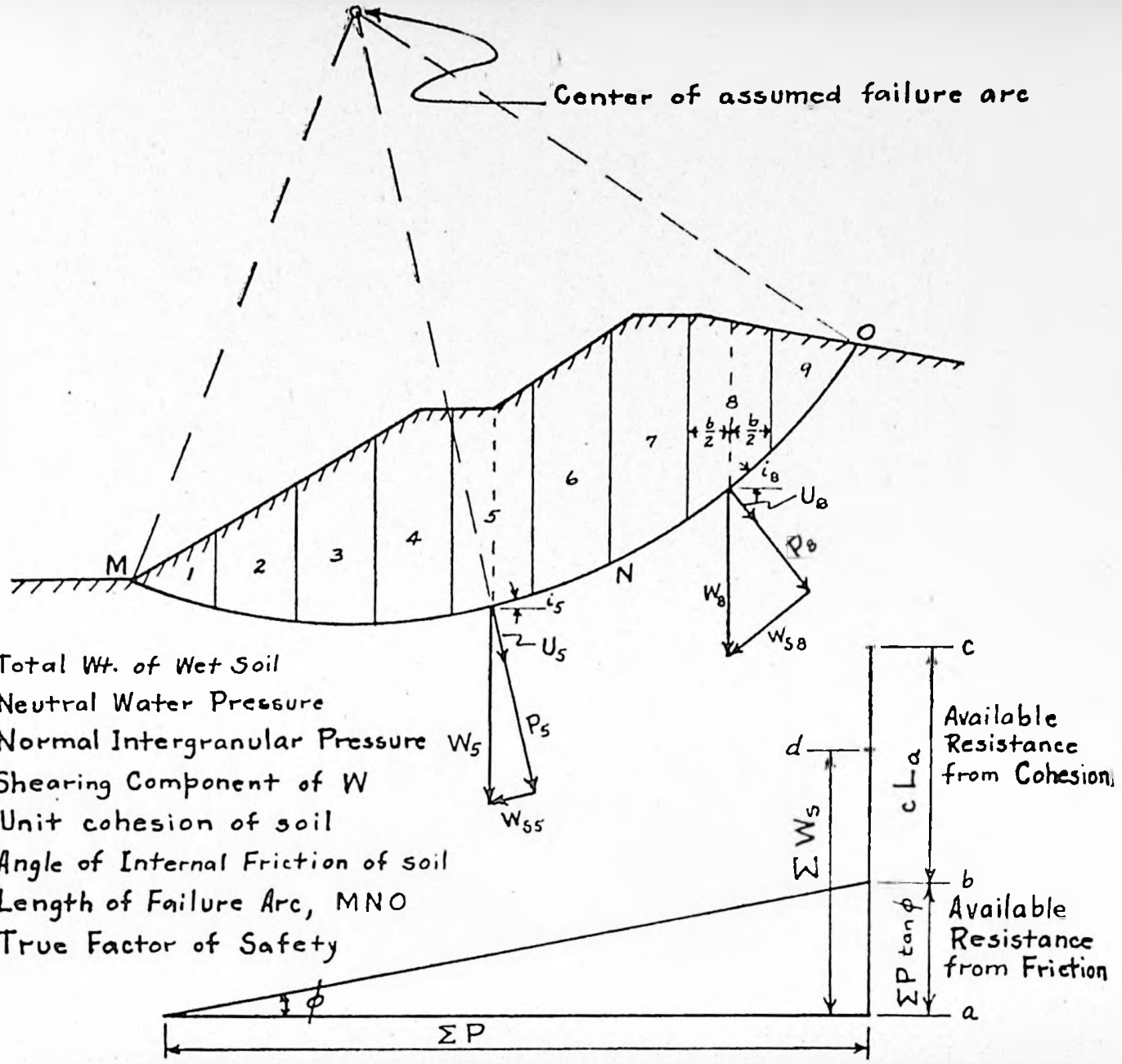
Fig. 6

The use of loading tests on small areas as a means of predicting allowable load intensities and settlements gives the impression of being a scientific approach, and at times may be quite valuable. Extreme care must be exercised interpreting the results, however, as they may be very misleading. In the first place, a loading curve is worthless unless the material affected bythe model is exactly similar to the homologous mass under the prototype to a depth at least equal to the width of the footing. The behavior of a loading test also depends upon the cohesive properties of the soil mass affected and the size and depth of the loaded area. For intermediate types of soils the ultimate unit load will be greater for large footings and the settlement less for small areas with light loads. If settlements are to be predicted from the loading test, then measurements must be made with extreme accuracy.

The time remaining for the discussion of pile foundations permits only the consideration of a few high spots. Numerous formulas have been developed in an effort to predict the load carrying capacity of a pile from its resistance to driving. It will suffice here to say that in clean dry sands these formulas have some merit, but that in cohesive soils they are absolutely worthless due to the increase in skin friction after driving has ceased.

The results of loading tests on a single pile will depend upon the type of soil. In sand the load gradually builds up but never reaches an ultimate value. "Floating" piles in deep clay beds may show very little settlement up to sudden failure, when they may drop under constant load as much as 40% of their length. Settlement due to a loading test on a single pile is worthless in predicting the settlement of a group of piles. The safe load for a group of piles will be much less than the product of number of piles times the safe load for a single isolated pile. Loading tests on piles in clay must be carried to failure in order to determine the factor of safety at a given load.

Floating piles in clay produce large settlement due to disturbance of the mass in driving and their use is not advisable for all foundations. Close spacing of such piles aggravates


Center of assumed failure arc
O
M
N
1
2
3
4
5
6
7
8
9
$\frac{b}{2}$
$\frac{b}{2}$
i_8
U_8
P_8
W_8
W_{S8}
i_5
U_5
P_5
W_5
W_{S5}
W = Total Wt. of Wet Soil
U = Neutral Water Pressure
P = Normal Intergranular Pressure
W_S = Shearing Component of W
c = Unit cohesion of soil
ϕ = Angle of Internal Friction of soil
L_a = Length of Failure Arc, MNO
$\frac{ac}{ad}$ = True Factor of Safety
c
d
b
a
ΣW_S
$c L_a$
Available Resistance from Cohesion
$\Sigma P \tan\phi$
Available Resistance from Friction
ϕ
ΣP

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this condition. The effective length of piles depends upon the width of the structure. Piles may be seriously damaged by driving too hard—as was brought out in a paper presented before the Society last year by Mr. Bruns. More research on the correlation of soil tests with the driving resistance and bearing capacity of piles is badly needed.

In closing, let me again bring out the point that soil mechanics is still being developed, that it may not give us the solution to a particular problem, but that the intelligent use of its fundamental principles together with experience and correlation of field observations does produce a better or more economical design. This correlation is essential to the development of soil mechanics and all are urged to cooperate in keeping long-time records on all major structures with which they are concerned.

Also let me urge as thorough a sub-surface investigation as possible **before** designing of a proposed structure and its foundations—or better still, before the definite selection of the site for the structure. This may be considered as a good form of insurance.

Investigations to discover to discover the cause of damage **after** it has occurred and the remedial measures attempted are never very satisfying.

UNIONISM—AN ISSUE IN ENGINEERING*

By Dean Clement J. Freund
College of Engineering, University of Detroit

One thing must be clear before proceeding with this more or less delicate discussion. This article is not inspired. There are no secret collaborators. The article does not in any way represent the policy or viewpoint of the Board of Directors of The Engineering Society of Detroit or the editor of The Foundation. It is nothing more or less than it pretends to be. Nobody except myself can be held responsible for it or any portion of it.

But I protest that I have given thought to the problem of unionism in engineering. I have had to because it so happens that it is my business to train young engineers, and in that business I have often enough become entangled in unionism perplexities.

Unionism is an issue in engineering. There is no question about it, whether you like it or not. Labor unions are penetrating into engineering occupations. The leading techincal union is the Federation of Architects, Engineers, Chemists and Technicians (F.A.E.C.T.), affiliated with the C. I. O. Officers of the Federation boast of more than 8000 members, although there is no evidence that they have recruited men of unquestioned professional standing. They have claimed significant progress in organizing the Minnesota Highway Department, Briggs Manufacturing Company of Detroit, Pittsburgh plant of the Carnegie-Illinois Steel Company, Rankin plant of the Bethlehem Steel Company, Ambridge plant of the American Bridge Company and the United States Navy yards. They have claimed strong locals in California, Colorado, Wisconsin and New Jersey. In the Federation's 1940 convention they undertook a campaign to require a union label on "all drawings, erection diagrams, surveys, plans, shop and field details and laboratory reports." I could multiply figures, names, places and facts.

*Reprinted from *The Foundation* of the Engineering Society of Detroit.

Labor Union Policy of Engineers

I have no quarrel with a legitimate labor union in its proper sphere. If business men have the right to join trade associations and chambers of commerce, then employees have the right to join unions. But that is not now the question. The question now is, what shall be the labor union policy of the engineering profession?

The young engineer who is less than five years out of college seldom has more than a meager income. If he is married and has a growing family, his bills for milk, clothing, groceries and rent may amount to more than he earns. If, then, an alert and aggressive union organizer promises to get him more pay, and right away, the young man will certainly at least listen to what the organizer has to say.

But if he is conscientious he does not join immediately. He is puzzled. He is conscious of the traditions and ideals of the profession. Is it proper for him to join a union? He does not know. It seems to me that he is entitled to an answer and that the engineering profession ought to give him one.

I do not know, of course, what kind of answer the leaders of the profession might formulate, what kind of policy they may some day adopt. But if the young man should come to me and say, "The pressure is on me. Should I join an engineering union?", I think I should counter by asking, "Do you or do you not aspire to professional standing in engineering?" He will demand to know "Just what do you mean by professional standing?"

By professional standing I mean the standing of a comparatively small number of creators and leaders, intellectuals, researchers, organizers and administrators of industries and other engineering projects, who face lay officials and the public, fully conscious that they, and they alone, must answer for what they do. They are universally recognized as professionals. Dr. Wickenden calls them the "inner professional nucleus."

Thousands Without Standing

Everybody knows, of course, that there are thousands of men in the broad field of engineering who do not have professional standing, in spite of their skill and excellence. They are

the draftsmen, testers, instrument men, checkers, calculators, experimenters, technicians, subordinate functionaries of one kind or another, who do not assume full responsibility but work under direction. Dr. Wickenden has referred to them as the "great engineering fraternity."

Everybody knows, likewise, that college graduates rarely pass from the outer "fraternity" into the "inner professional nucleus" before they are four or five years out of college. Very many of them, unfortunately, never achieve professional standing at all.

There may be no sharp line between professionals and others, as in medicine or law, and many thinking engineers have no desire whatever to draw such a line ,but it is never difficult to distinguish those engineers who clearly have professional standing from those who clearly do not have professional standing.

I tell the young man all this, or remind him of it, and then say, "If you aspire to full professional standing in engineering and all that it implies, dignity, respect of the community, respect of your fellows, you had better not join a union." I say that to him because it seems to me that a profession and a labor union are so nearly contradictory that he cannot possibly belong to both at the same time. And it requires no painstaking and comprehensive comparison of professions and unions to make this clear; a quick check of one or two points will be sufficient.

Professional Individualism

A common earmark of all professions is the markedly individual character of the professional man and his work. When he performs a professional task he performs it himself. He may have assistants, hundreds of them but the full responsibility rests upon him alone. The surgeon who performs an operation has the direct help of nurses and attendants, and the indirect of more technicians, mechanics and various functionaries than he ever thinks about, but he alone must answer for the outcome, and the patient knows it, and so do the nurses, technicians and mechanics. Dr. Wickenden insists that a profession is "a type of activity marked by high individual responsi-

bility." Professor R. M. MacIver contends that "The doctor, the lawyer, the architect, the minister of religion remain individual practitioners." According to Dr. Abraham Flexner, "Professions involve essentially intellectual operations with large individual responsibility." General Goethals was commissioned to build the Panama Canal because he had a personal individual reputation as an engineer.

On the other hand, solidarity is a common earmark of labor unions. The individual union member is lost in the mass. He expects to accomplish nothing for himself or by himself. The union agent runs his business for him, and the agent represents not him, particularly, but the whole union to which he belongs. The agent never permits employers or the public to forget that they are dealing with no individual workman, but with a powerful workingman's organization. In his "Capital and Labor," Dr. John A. Ryan pointed out long ago that "To attain a position of equal bargaining power, laborers must act as a body." The famous Section 7a of the National Recovery Act ordained that "Employees shall have the right to bargain collectively through representatives of their own choosing." The solidarity of labor unions is really too obvious. Any more discussion of it would be a waste of time.

Must Make His Choice

Surely there is a vast gulf between the professional man's personal work and responsibility on the one hand and on the other, collective bargaining by labor union agents on behalf of multitudes of unknown and unidentified workmen. No young engineer can be big enough to straddle the gulf; he must take his stand on one side or the other.

Hairsplitters will argue that there is no gulf at all, that the professional man is personally responsible only for the tasks which he performs, and that this responsibility need not prevent him from joining others of his kind in a labor union to exert pressure for the largest possible compensation. This is an artificial distinction which cannot be made in practice. Work and compensation for work are too closely bound together in the minds of most people. Can you expect even the

most unselfish and public spirited engineer to accept a rate of pay which a union agent who never heard of him has determined for him and a thousand other engineers, in a single negotiation with client or employer? Hardly.

Again, the chief aims of professions and of unions are as far apart as the poles. The principal purpose of professions is to advance the public well-being, and especially, if need be, the individual member of the profession. The principal purpose of labor unions is to fight for adequate, or constantly more and more compensation for the members, depending upon conditions. There are secondary aims, to be sure—to increase membership, to secure contracts with employers, to exert political influence, to control the workingmen in the steel or shipping or automobile industry, to organize strikes—but these are merely auxiliary to the primary aim. One may read page after page of union proceedings and union publications without finding a single word to suggest that the officers or members ever give thought to the public advantage.

Aim Is Wage Increases

The F. A. E. C. T. is a typical labor union in this respect. Its concern is for the well-being of its members. Prior to the 1940 convention of the Federation, President Lewis Alan Berne declared that the majority of technical employees are "beginning to raise questions relating to job tenure, salary, proper classification, discrimination against older men, their relations to production employees," and announced that "Our coming convention will seek to answer those questions and develop a program of action for their satisfactory solution."

News releases from the F. A. E. C. T. have stressed this position from the start. The first national effort of the Federation "defeated the unfair wage provisions of the N. R. A." When the Society of Designing Engineers affiliated with the F. A. E. C. T., Mr. John L. Lewis wrote to them that "I feel that considerable advantage in bettering the economic position of the technical worker will accrue from this consolidation." The Federation boasts of wage increases in Los Angeles, New Jersey, the Queensborough Housing Project of New York City and in the W. P. A.

All this is as it should be, for a labor union; this sort of activity is the principal business of labor unions. But there has certainly been little or nothing in the history of the F. A. E. C. T. to convince anybody that the organization has, in the words of Mr. James H. Herron, "any serious concern for the public welfare, or at least not that type of concern for the public welfare in preference to personal and group welfare which should be characteristic of any vocation which pretends to be a profession."

It is unlikely that the officers of the F. A. E. C. T. will ever invite Dr. Vannevar Bush to speak before a convention of the Federation and tell the members, as he told the American Engineering Council in 1939, that "In every one of the professional groups, however, will be found the initial central theme intact—they minister to the people. Otherwise they no longer endure as professional groups"; and that "engineers go along heartily in developing a professional consciousness, a code of action, a philosophy which implements a desire to be a truly professional group, oriented primarily toward the advancement of the public health, safety, comfort and progress"; and that engineers should strive for "heights of true professional attainment . . . where the watchword is that old, old theme which has never lost its power, and which may yet save a sorry world, simple ministration to the people."

Union vs. Profession

Can an engineer be a labor union member, attend meetings regularly as a good member should, listen repeatedly to discussion about wage rates, pay increases, strikes, strike votes, strike benefits, picketing organization, contract arrangements, membership campaigns and organization projects, all having to do with getting more and more for the members (however badly they may need it), and still cherish as the paramount objective of his work, his profession and his life, the well-being of the public, "simple ministration to the people"? A few exceptional men possibly can, the preponderant majority cannot. The majority must devote themselves exclusively either to the union, and union aims and purposes, or to the profession, and professional aims and purposes.

At this point my young man may interrupt to say, "All that may be true as far as professional engineering is concerned but I'm no professional engineer, and won't be for a long time. I'm not in responsible charge, I work under direction. Don't you think I should join the union now for what it has to offer? I can use more pay, you know. Afterwards, when I become professional I can quit the union. Why shouldn't I now have what the union can get for me?"

I am quite sure I should reply, "That seems possible in theory but you can't make it work out in practice. While in the union you would, and quite properly, lean on the union, and permit union officials to fight your battles for you. You would inevitably acquire habits and viewpoints of dependence as a result, and you could not be utterly dependent and at the same time build up the kind of personal, individual reputation for engineering competence which professional status calls for. Do you think you can suddenly discard habits and viewpoints of dependence when you are thirty-five years old, resign from the union, trust to your own resources for the first time in your life, and begin that late to build the personal reputation which you should have been building, and which your contemporaries have been building, for fifteen years? I think you could not. The union will not help you build a reputation. The union is not interested in personal reputations, the union is interested in the bargaining power of hundreds like you, massed together.

Offers Advice

"If you desperately need a larger income ,if you and your wife cannot possibly exist on the salary which you can independently obtain, and if you have abundant confidence that the union can actually obtain for you the greater income you must have, then join the union.

"But let me warn you that the price which you must pay for these immediate advantages is almost certain exclusion from professional status later. You cannot be a union man now and a professional man later; you must now choose one or the other. I appreciate that it may be a terribly difficult choice, but you must choose.

"Likewise join the union if you have no desire whatever to become professional, if you lack the confidence to strike out for yourself, if you feel most secure in a group of your fellows, if, perhaps, you are secretly afraid that you will always belong to the multitude.

"If, on the other hand, you and your family can somehow struggle along through the lean and early years, if you can stretch and stretch again to make ends meet, if you are eager to become professional, if you know you can excel and if you are making progress, then you should certainly stay out of the union."

But the young engineer may continue, "It's easy for you to talk that way but you don't know what I'm up against. I am making progress, my wife and I can make ends meet and I want very much to become a professional engineer. But our drafting room is practically a closed shop. I don't care about the union, but I can't stay in the place unless I sign up."

I can think of only one answer. That one answer is, "Quit your job and find another just as soon as you possibly can. Oh yes, I known that that is a harsh thing for me to say, and probably a hard thing for you to do, for many reasons, but I say it because I am most firmly convinced that professional progress and union membership simply cannot go hand in hand."

Conclusions

I do not see how engineers, the engineering profession and labor unions can possibly evade the following conclusions:

1. Draftsmen, testers, technicians, instrument men, calculators, inspectors, operators and others in engineering type occupations will find it practically impossible to achieve full professional standing if they belong to labor unions.

2. Labor unions are just as appropriate among draftsmen, testers, etc., who do not aspire to professional standing as they are in any other high class, skilled craft.

3. If great numbers of professional engineers everywhere affiliate with labor unions, either because they choose to or because they are forced to, engineering occupations may continue to flourish, but the profession of engineering, as such, will most assuredly vanish from the face of the earth.

—From the "Foundation".

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Meeting of the Board, March 2, 1942

The meeting was called to order by 1st Vice-President Kammer with the following members present: Kerr, Kuhn, Stewart and Mayer.

The minutes of the January 30th meeting were read, also the January and February financial reports summarized.

The death of Mr. Thomas J. Jones, 3rd District Contact Representative and Chairman of the Committee on State Sections, was reported. A committee consisting of C. M. Kerr, Chairman, W. H. Rhodes and B. W. Pegues was appointed to draw up an obituary. Appointment of a new 3d District Contact Representative was postponed until the next meeting of the Board.

The Secretary reported that applications for membership from Robert D. Cowherd, New Orleans, Walter A. Marcotte, New Orleans, William C. Sage, New Orleans, William Urban, Jr., Pascagoula, Miss. and William A. Wintz, Jr. of Carville, La. were being considered by Membership Committee "B", but had not yet been returned. The Board directed the Secretary upon receipt of these applications to mail a letter ballot to the voting membership, providing that recommendation by Membership Committee "B" is unanimous.

Prices on membership certificates and lapel buttons were submitted by the Secretary. The Board voted to have 200 certificates printed and to notify the membership that certificates suitable for framing can be furnished on request at $0.75 each. Such certificates are to be issued free of charge to new members paying the prescribed entrance fee. The membership is also to be advised that Society lapel buttons can be secured from William Frantz & Company, 129 Carondelet St., New Orleans, by individual order, prices being $2.00 each for silver and $4.50 each for 10 K. gold.

Discussion on the purchase of a new public address system was postponed until the next meeting of the Board.

There being no further business the meeting adjourned.

J. K. Mayer,
Secretary-Treasurer.

Minutes of the Joint Meeting of the Society with the New Orleans Section, Illuminating Engineering Society, March 9, 1942.

The meeting was called to order by President Cappel with approximately 125 members and guests present.

The minutes of the last meeting were read and accepted.

The motion tabled from the last meeting regarding the reduction of dues for society members in the armed services was brought up for discussion. Mr. H. W. Scales moved that the wording "Non-Commissioned Men" be amended to read "Non-Commissioned Officers and Enlisted Men". The amendment was seconded and passed by vote. The amended motion was then passed by unanimous vote.

President Cappel asked for expressions from the membership concerning a policy to be adopted by the Society regarding engineering education during the war, particularly on the question of deferment for qualified undergraduate engineering students and a few selected graduate engineering students.

The following Committee Chairmen presented brief reports:

Mr. A. M. Fromherz—Some progress is being made by the Committee on Defense. A report will be presented in the near future.

Mr. N. H. Ross—The Committee on Entertainment & Outings is planning to hold the Annual Golf Tournament and a picnic. Other outings may also be arranged.

Mr. Ole K. Olsen—The Finance Committee will endeavor to courteously collect delinquent dues.

A letter from Headquarters, Third Military Area, was read requesting interviews with recent graduates in Electrical Engineering who may be interested in obtaining a commission in the Army.

Mr. E. D. Meacham, Chairman, New Orleans Chapter, Illuminating Engineering Society, introduced the speaker of the evening, Mr. Ivan H. Purinton, Distribution Engineer, New Orleans Public Service, Inc., who presented a most interesting discussion on "The Technical Phases of Blackout Lighting". Numerous pieces of recently developed equipment for this field were demonstrated. Mr. Purinton answered a number of questions at the conclusion of his talk.

President Cappel adjourned the meeting with a rising vote of thanks to the speaker.

J. K. Mayer,
Secretary-Treasurer.

Minutes of the Meeting of the Board, April 10, 1942

The meeting was called to order by President Cappel with the following members present; Kerr, Kuhn, Steinmayer and Mayer.

The minutes of the last meeting were read and accepted.

The question of draft deferment of bona fide engineering and scientific undergraduate and graduate students was discussed. It was decided to bring the subject up for discussion at the meeting of the Society.

President Cappel announced that he had been requested by the School Board to furnish speakers from the several fields of engineering

to address a high school conference on April 27th. Chairman G. E. May of the Technical Papers Committee is to handle the matter.

To fill vacancies created by the death of Mr. Thomas J. Jones, the following appointments were made:

Mr. T. Baker Smith, Houma, 3rd District Contact Representative.

Mr. Earl C. Coburn, Baton Rouge, Chairman, Committee on State Sections.

The question of again attempting to secure a general license law for engineers practicing in Louisiana was discussed. The matter is to be referred to the Committee on Legislation.

The Secretary was directed to order a steel seal made for the Society, as well as a 30 watt public address system.

The resignation of Mr. Charles D. David was accepted with regrets.

A committee composed of Messrs. Gervais Lombard, Chairman, C. M. Kerr and N. E. Lant was appointed to prepare an obituary on the death of Mr. W. S. Henning.

A letter from Mr. Raymond J. Daigle requesting transfer from Junior to Member grade was read. A detailed professional record was attached to the letter. It was decided to refer the matter to Membership Committee "B" for review and recommendation.

A letter from Mr. L. L. Newman accepting the chairmanship of the Committee on Civic & Industrial Affairs was read. At Mr. Newman's request Messrs. J. M. Guillory, A. J. Naquin and C. B. Norris were appointed to the Committee.

A suggestion from the New Orleans Section, American Institute of Electrical Engineers, that the Society send copies of a pamphlet entitled "Engineering as a Career" to the various high schools of the state was considered. It was decided that, while this pamphlet would be of considerable value to those students contemplating an engineering career, the cost of distribution would be too great for the Society to bear.

Recent activity in Washington concerning the St. Lawrence Waterway project was discussed and it was decided to again write the Louisiana members of Congress and other interested officials stating the reasons for which this undertaking is opposed by the Society.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Society, April 13, 1942

The meeting was called to order by President Cappel with approximately 70 members and guests present.

The minutes of the last meeting were read and accepted.

The question as to what attitude the Society should adopt regarding draft deferment for bona fide engineering undergraduate and graduate students was discussed by several members from the floor. The consensus of opinion was that the Society should go on record as advocating deferment for such students, since a great number of technically trained men will be required in the armed services and in plants producing vital war materials. Mr. C. M. Kerr moved the presentation of a resolution advocating that engineering education for especially apt students be not impeded during the war; this resolution to be composed in consultation with the Committee on Engineering Education and to be circularized to the membership in written form before being brought up for vote.

President Cappel asked that all chairmen of standing committees present a report at the next meeting.

Lieutenant-Commander W. J. Harrison, Assistant Director of Naval Officer Procurement, was introduced by President Cappel and addressed the membership regarding the needs of the Naval Service for Officers and the opportunities available for engineers for commissions in the U. S. Naval Reserve.

The technical exercises of the evening consisted of two papers on "The Engineering Phases of Air Raid Shelters for New Orleans". Mr. Frank Riess spoke on the general design of such shelters and Mr. Warren Moses covered the mechanical equipment required for large shelters. Professor W. F. Scofield briefly discussed the papers.

The meeting adjourned with a rising vote of thanks to the two speakers.

J. K. Mayer,
Secretary-Treasurer.

Minutes of the Meeting of the Board, May 4, 1942.

The meeting was called to order by President Cappel with the following members present: Kammer, Kerr, Kohnke, Kuhn and Mayer.

The minutes of the last meeting were read and accepted.

President Cappel announced that Mr. W. H. Rhodes had resigned as Chairman of the Committee on Legislation. The question of again attempting to secure a general engineers license law for the state was discussed and it was decided to bring the matter before the Society at the coming meeting in Baton Rouge.

A report of Chairman Cucullu of the Committee on Professional Advancement was read. The recommendation that an article by Dean

Freund entitled "Unionism—An Issue in Engineering" be published in the Proceedings and reprints distributed to Junior and Senior engineering students in the several engineering colleges of the state was approved. In connection with the recommendation that a list of men and positions available be mailed out each month, it was decided to invite Chairman Bassich and Fithian of the Employment Committee to attend the next Board meeting for further discussion of the subject.

Resignations of C. B. Norris and P. C. Kuhn were accepted with regret.

Dean J. M. Robert recommended that Theodore W. Dietze, Senior in Electrical Engineering at Tulane University, be awarded the annual Junior Membership in The Society. This recommendation by mail was approved.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Society at Baton Rouge, May 11, 1942.

After a splendid supper at the Westdale Country Club President Lant of the Baton Rouge Section called the meeting to order. Approximately 80 members and guests were present. President Lant introduced the officers of the Society and announced that the Golf Match between the Baton Rouge and New Orleans members had again been won by the New Orleans group. Mr. G. R. Hammet accepted the trophy on behalf of the group.

The meeting was then turned over to President Cappel who thanked the members of the Baton Rouge Section for their hospitality and expressed the appreciation of the Society for arranging such an excellent meeting.

The minutes of the last meeting were read and accepted. President Cappel asked that all committee chairman present reports on the activities of their committees at the next regular meeting.

Mr. K. P. Kammer presented the following resolution in written form.

> "Because of the fact that the present national emergency may draw heavily on the ranks of the faculties and the Engineering and Scientific Student Bodies of the colleges and universities in Louisiana through the Selective Service Act, be it resolved that the Louisiana Engineering Society, with proper authority, go on record as favoring:
>
> 1. Deferment of Engineering Students in these colleges from active Military Service until graduation, provided such students show proper aptitude and make grades indicating their ability to com- the course in the prescribed time.

2. That certain few students showing unusual talent be allowed further deferment of from one to two years to do research work in their chosen fields.
3. That essential members of the faculty of these colleges be deferred from active Military Service until proper successors can be trained.

The resolution was ordered tabled until the next regular meeting when it will be brought up for vote. The Secretary was directed to present this resolution to the membership in written form before the next meeting.

After making an announcement regarding the availibility of membership buttons and certificates President Cappel turned the meeting back to President Lant who introduced the speaker of the evening, Mr. M. J. Rathbone, President, Standard Oil Company of Louisiana. Mr. Rathbone presented an interesting and informative paper on "Synthetic Rubber—Past, Present and Future" and answered several questions at the conclusion of the paper.

The meeting adjourned with a rising vote of thanks to the speaker.

J. K. Mayer,
Secretary-Treasurer.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

JUNE, 1942

"PATRONIZE OUR ADVERTISERS"

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PROCEEDINGS
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LOUISIANA ENGINEERING SOCIETY

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CONTENTS

EDITORIAL NOTES AND COMMENT

In This Issue: Mr. Chesnut has in this issue a very interesting paper on a much discussed subject—shipbuilding. Those who heard him enjoyed the unfolding of his story; it makes interesting reading to those who could not attend.

Hal Bourg **Arthur M. Shaw**
Frank G. Frost **T. M. McCarroll**

Since our last issue we have lost through death four members.

The Society will miss their participation in its affairs and their attendance at the meetings.

Did You Forget to bring a friend to the last Society meeting? How about a prospective member, or a man in military

service who is in the State for a short stay and would like to make some friends among fellow engineers? Think how our influence would spread and membership grow if we brought a friend (not already a member) to each meeting.

Industrial Safety and Accident Prevention. The Society will in the near future hear an address on industrial safety and accident prevention by Mr. Arthur J. Naquin. Man hours lost during 1941 in industry totaled 200,000,000; 20,000 workers were killed; 2,000,000 were seriously injured.

A village of two or three hundred wiped out by the Nazis makes a headline, but we rather calmly accept an industrial accident toll of 1,800 workers killed each month, or about sixty each day. All can help towards a greater accident prevention program in the home, on the highway, and in the factory. What are YOU doing about it?

New Members and Transfers. The following have recently been elected to membership or transferred to another grade:

Boyle, Francis A. Member. Age 57. Endorsed: C. G. Cappel, O. G. Kirby, N. E. Lant. High School Graduate, N.Y.C., attended College of City of New York—did not graduate. Draftsman, Estimator, Supt., Gen. Supt. and Contractor for period of thirty-five years. At present with Aluminum Co. of America as Ass't. Supt. of Const. Held same position with J. G. White Co., Mobile, 1941; Gen. Supt. of Const. for Wm. F. Kenny Co., Engrs. about ten yrs.; U. S. Coast & Geodetic Survey as Engr. teaching triangulation Computations. Assoc. Member of A. S. C. E. from 1918-35. P. O. Box 1031, Baton Rouge, La.

Harrell, Louis W. Member. Age 35. Endorsed: H. L. Lehmann, N. E. Lant, R. B. Richardson. Graduate of Louisiana State University in M. E. With La. Dept. of Highways Testing Laboratory for sixteen years, Engr. Inspector 1933-37; Field Testing Engr. 1937 to date. 1939 University Ave., Baton Rouge, La.

Hough, Leo W. Age 29. Endorsed: H. B. Henderlite, H. L. Lehmann, N. E. Lant. B. S. 1935 and M. S. 1937 in Geology, Louisiana State University. Soils Geologists, La. Dept. of Hwys. June 23, 1935 to Nov. 30, 1939. Asst. Geologist, Soils Conservation Service, 1939-1940. Soils Engr., La. Dept. of Hwys. 1940 to date. 408 Edgewood Drive, Baton Rouge, La.

Saurage, James J. Member. Age 35. Endorsed: N. E. Lant, H. L. Lehmann, R. B. Richardson. 1929-Graduate of Louisiana State University in E. E. 1929 to date La. Hwy. Testing Laboratory—in charge of routine testing since 1937.

Transfer from Student to Junior Members:

B. E. in Ch. E.
Martin S. Baer
Irwin Frankel
Irwin A. Rabenovitz
Harold H. Stream, Jr.
John R. Tusson

B. E. in M. E.
Ralph E. Blake
John M. Miazza
Spencer G. Smith
Walter J. Verlander

B. E. in C. E.
Walter E. Douglas, Jr.
Holmes Earl
W. Scott Goldman
Bernard A. Grehan
S. Kenan Manson, Jr.
Santos V. Shields

B. E. in E. E.
Hal C. Becker
Theodore W. Dietze
Stanley W. Dinkel
Faurie E. Ferchaud
R. M. Sanderford, Jr.
Raymond Sherrard, Jr.

The Golf Tournament and Smoker. Although the day for the gold tournament was slightly damp, the usual high spirits and good cheer were present. The meeting place was Lakewood Country Club.

Prizes were in abundance for horse shoe pitching and golf. Credit for the prizes and splendid arrangements goes to the Entertainment and Outing Committee, headed by O. K. Olsen, B. H. Bell, J. J. Bulliung, J. V. Dugan, C. J. Kelly H. L. McLean, R. L. Nall, R. M. Seago, and H. L. Davis.

PAPERS AND DISCUSSIONS

MODERN PASSENGER-CARGO STEAMSHIPS OF THE MISSISSIPPI SHIPPING CO. DELBRASIL TYPE*

By R. E. CHESTNUT, President,
V. M. Friede, Inc.
Naval Architects & Engineers

Among the many vessels now being constructed for the American Merchant Marine, there is none which will excel in beauty and efficiency the Mississippi Shipping Company's passenger-cargo liners which were built at the Sparrows Point Yard of the Bethlehem Steel Corporation.

These vessels were designed by V. M. Friede, local Naval Architect, especially for service between the Gulf Ports of the United States and the ports on the eastern coast of South America. They were built under the provisions of the Merchant Marine Act of 1936 and to the highest classification of the American Bureau of Shipping, and conform to the rules and regulations of the Bureau of Marine Inspection and Navigation and to Senate Report 184. They were so designed that, in case of a national defense emergency, they could be converted into naval auxiliaries.

The principal characteristics are as follows:

Length, overall	491'-0"
Length, between perpendiculars	465'-0"
Beam, molded	65'-6"
Depth, molded	39'-9"
Load Draft, molded	25'-6"
Deadweight	9,000 tons
Load Displacement	14,210
Gross Tonnage (U. S.)	7,978
Net Tonnage (U. S.)	4,542
Shaft Horse Power, normal	7,800
Shaft Horse Power, maximum	8,600

*Delivered before the Society on July 13, 1942 by R. E. Chestnut, President of V. M. Friede, Inc. Naval Architect and Engineers, a member of the Society.

Speed sustained at load draft and normal S. H. P.	16.5 knots
Number of Passengers	67
Number of crew	78

The ships, built of steel, are two-compartment, Shelter Deck type, having thre complete decks, 'Tween, Main and Shelter. The superstructure, located amidships, also has three decks, Bridge (Promenade), Boat, and Hurricane. The passenger staterooms are located on the Shelter Deck, the deck and radio officers have their quarters on the Boat Deck, and the engineer officers and steward's personnel on the Main Deck amidships. The crew's quarters are on the Main Deck aft.

The transverse system of framing is used on these ships. There are nine sub-division bulkheads extending from the tank top to the Shelter Deck, dividing the ship into six cargo holds with their 'Tween and Main Deck spaces; engine and boiler rooms; fuel oil deep tanks; and fore and after peak tanks. The cubic capacity for cargo, not including refrigerated cargo space, is 495,512 cubic feet grain or 453,273 cubic feet bale. Two refrigerated cargo spaces of approximately 4,000 cubic feet each are located just aft of the engine room at the 'Tween Deck level. The innerbottom tanks, which extend from the fore to the after peak bulkheads, carry fuel oil, except the tanks beneath the engine room in which boiler feed water (raw and distilled) is carried. The deep and settling fuel oil tanks extend the full width of the vessel just forward of the boiler room and are built upward from the innerbottom tank top to within 30 inches of the Main Deck, from which they are separated by a cofferdam. Fresh water is carried in the fore and after peak tanks and in the two wing tanks at the after end of the shaft alley in Hold #6. Culinary water is carried in two cylindrical tanks installed within the boiler room space on either side. The fuel oil tanks have a capacity of 14,091 bbls, or 2,127 tons, giving the vessel an estimated cruising radius of 17,400 nautical miles. The total quantity of fresh water carried is 494 tons.

The passengers' staterooms, twenty-six in number, all on the Shelter Deck and outside rooms, are arranged to provide accommodations for 67 persons. The furniture, as well as all

other furniture throughout the ship, is modern but not modernistic. The wardrobes are built in. Mechanical ventilation and steam heat are provided. Each stateroom has an independent bathroom of adequate size in which hot and cold fresh water under pressure is furnished. The passengers' hospital and dispensary is located on the port side aft of the Passengers' staterooms. The barber shop and beauty parlor are centrally located with respect to the passenger staterooms.

The main embarkation doors are on the Shelter Deck on each side, but arrangements have been made for embarkation on the Bridge Deck during extreme low water on the Mississippi River at New Orleans. The main entrance on either side lead into a lofty lobby, the ceiling of which is two decks above the Shelter Deck. A wide, heavily carpeted staircase leads upward from the lobby to the lounge, the ship's most beautiful public space. Just forward of the lobby, on either side, are the entrances to the pursur's office and to the stairways leading downward to the main dining room, which is located on the Main Deck.

The veranda cafe, which is located on the Bridge Deck, should prove to be the most popular public space aboard the vessel. A large maple dance floor forms part of the forward end of the cafe, while forward and adjoining on the port and starboard sides, respectively, and separated from the cafe by large folding doors are the bar and smoking rooms. There are two entrances to the veranda cafe one from the Bridge Deck and one by means of a broad stairway leading upward from the Shelter Deck. The Bridge Deck provides a splendid promenane running completely around the house and even in inclement weather, the forward end, which is glass-enclosed, may be used.

The wheelhouse, chart, radio, gyro and battery rooms, and the deck and radio ofifcers' quarters are located on the Boat Deck. The tile-lined swimming pool is also located at this level. A considerable portion of the deck is awning covered and appropriate furniture is conveniently placed about the deck. The quarters and other enclosed spaces are mechanically ventilated and steam heated.

The main dining room, which is reached as previously described, extends the full width of the ship, and a private

dining room, having a seating capacity for ten persons, adjoins on the port side. The main and private dining rooms may be converted into a single space by the opening of large folding doors, thereby giving dining accommodations for eighty persons at one sitting. A Carrier Weathermaker provides conditioned, cool or warm air, as required, for the passengers' dining room. The main pantries and service space are immediately aft of the main dining room, with the galley and bakery adjoining them. The equipment used in these spaces is all of the latest design and electrically operated.

The officers', petty officers', stewards', and crew's mess, each with its independent pantry, are also located amidships on the Main Deck. Cooking for the officers and crew, as well as for the passengers, is done in the one galley.

The engineer officers, doctor, and purser have their quarters on the Main Deck amidships, port side. The officers' recreation room is also located on this side of the vessel. The quarters for the Chief Cook, Baker, Second Steward, Room Stewards, Cooks, Pantrymen, Waiters, and Messboys are located on the same deck, on the starboard side. The quarters and gathering places are all mechanically ventilated and steam heated. On the Main Deck, amidships, are also located the ship's dry stores and the ships stores refrigerators, consisting of a chill room, two meat boxes, fish box, and two smaller refrigerated spaces, one in the galley and one in the pantry. The spaces, having a combined storage capacity of approximately 2,850 cubic feet, are all refrigerated by Freon, direct expansion, automatically controlled. An ice-making machine, having a capacity of 500 lbs. per 24 hours, is also installed. A scuttle-butt, located in the chill room, furnishes iced water which is circulated to outlets on the Shelter and Main Decks and in the engine room.

The crew's quarters, recreation room, hospital, toilets, and showers are located on the Main Deck aft. The roms are all spacious and well-furnished and insulated against heat at the ship's shell and on the under-side of the deck above. They are mechanically ventilated and steamheated.

The deck machinery, manufactured by the American Engineering Company, is all electrically-driven by General Electric Company motors. Fourteen cargo winches, each powered

with a 50 H. P. motor, are installed adjacent to the hatches. Two of the winches, those located at the forward end of Hatch No. 2, are back-geared for handling loads up to thirty tons. A thirty ton boom is provided for this purpose; all other booms have been designed to handle five tons. Two 35 H. P., single drum, warping winches are located on the after Shelter Deck. The 75 H. P. anchor windlass is spur-geared, having two wildcats for 2⅛" chain and two warping heads keyed to the main shaft. The windlass will lift, simultaneously, two anchors, each weighing 9,400 lbs. from a 30 fathom depth, at a chain speed of not less than 30 feet per minute. The line pull available when warping is not less than 29,000 lbs. at 30 feet per minute.

The steering gear, of American Engineering Company manufacture, is an elecrto-hydraulic opposed ram type, having the rams mounted athwartship. The main steering gear has two power units, each consisting of a variable stroke hydraulic pump driven by a 40 H. P. General Electric Company motor. Each unit is capable of meeting the full operating requirements. The main steering gear control is from a hydraulic telemotor stand in the whelhouse to a receiving unit in the steering gear room, and from a two-unit Sperry Gyro Pilot, with transmitter in the wheelhouse and receiver connected to the mechanical control in the steering gear room. A stand is also provided on the Shelter Deck aft with mechanical connection to the differential control. An auxiliary hydraulic steering gear, consisting of rams and cylinders, separate from the main ram and connected to an independent tiller, is manually operated from the after Shelter Deck. Each of the main steering gear power units is capable of moving the rudder from hard-over, to hard-over, a total of 70°, in 30 seconds, with the vessel going ahead at 17½ knots.

The fire-proofing and fire-fighting requirements for these vessels have been particularly stringent. All of the paneling and joiner work is of fire-resisting materials. Non-combustible furniture and fixtures are used throughout. The accomodation spaces are divided into three zones, the fire-resisting bulkheads of which are fitted with automatic, self-closing fire doors.

The cargo compartments are protected with a Rich-audio system, which provides an audible and visual means of detecting smoke in any of the cargo spaces. Part of the same pipe lines used for smoke detection convey the CO-2 gas to the compartment for fire-extinguishing. CO-2 fire fighting equipment is also installed for the boiler room and the emergency Diesel generator space.

Public spaces are provided with a Bendix electrical system of fire protection. Three fire pumps of 450 G. P. M. each, supply water for the fire mains throughout the vessel. Numerous outlets are spaced about the various decks at points of vantage for fire fighting.

Three Welin 26 foot, 46 person lifeboats and one 26 foot, 27 person Diesel motor-driven lifeboat, as well as two 20 person life-rafts, are located on the Boat Deck.

The navigation equipment includes a radio direction finder, a Sperry gyro compass and a two-units gyro-pilot and course recorder, a fathomer, two Negus binnacles, an engine revolution indicator, a rudder angle indicator, an 18 inch searchlight, and two 12 inch floodlights.

PROPELLING MACHINERY

The steam generating plant consists of two Babcock & Wilcox single pass, marine boilers with water wall side tubes, "U" tube interdeck type superheaters and horizontal air heaters. Each boiler is provided with four B. & W. Decagon oil burners. Forced draft is supplied by two American Blowers, each capable of supplying 11,500 C. F. M. of 100°F. Air with a static pressure of 5.17 inches of water at the air heater. The blowers are so arranged as to be operated singly or together. The boilers are installed with their drums in the fore and aft direction, thereby permitting a wide firing aisle on the ship's centerline.

Although the boilers are designed for 500 #/sq. in., the vessel is to be operated with steam at 450 #/sq. in., and 750°F. total temperature at the superheater outlet. Each boiler has a water heating surface of 5,65 square feet and an air heating surface of 3,322 square feet. The designed normal output of both boilers is 71,200 lbs. per hour with an evaporation rate of 6.34 lbs./sq. ft. of heating surface. Desuperheater coils

within the main drums furnish approimately 5,000 lbs. of desuperheated steam for the steam-driven auxiliaries. The boilers are equipped with Diamond soot blowers and Diamond smoke indicators. Bailey combustion and feed water control equipment is installed.

The boiler uptakes are led to a single stack of 7'-"6 diameter. An outer casing of 8'-2" diameter extends the full height of the stack. To eliminate the use of dampers, while only one boiler is in operation, a division plate, which divides the stack and uptakes into two equal area sections, extends to within one foot of the stack top.

Three Griscom-Russell G-fin type, fuel oil heaters are installed on the forward boiler room bulkhead. Each heater has sufficient surface to heat one-half the amount of fuel required at maximum operation. Thermostatically-controlled steam at 125 #/sq. in. is used for heating.

A Leslie-Tyfon, deep-toned, diaphram type, steam whistle is installed at the forward, upper end of the dummy stack. It is equipped for manual or electrical operation.

The main propelling unit, manufactured by the General Electric Company, is a high speed, cross-compound, double reduction geared turbine. The speed of the H. P. turbine is 6,487 R. P. M. and that of the L. P. 3,809 R. P. M. The turbines are connected to the reduction gears by means of flexible couplings. The turbines and gears are designed for a maximum of 8,600 S. H. P. at approximately 112 R. P. M.; it is expected, however, to operate the vessel at 7,800 S.H.P. at 105 R. P. M. when maintaining a sustained sea speed of 16½ knots. The design pressure and total temperature at the throttle are 440 #/sq. in. and 740°. The astern turbine, located in the low pressure casing, is designed for at least 40% of the normal ahead power. Steam is bled at two points for feed water heating, make-up feed evaporator and other minor services. The main thrust bearing, Kingsbury type, is arranged in a housing on the forward end of the low speed gear casing. The turbine operating platform is located at the forward end of the engine room at the generator flat level. The main instrument panel is so located that all instruments are clearly visible from the throttle control position. The telegraphs and

telephone to the wheelhouse and the emergency steering gear station are conveniently situated.

There are five equal length sections of 17″ diameter, forged steel line shafting between the slow speed reduction gear coupling and the tail shaft coupling, making the total length of line shafting 156′-8″. Each section of shaft is suported by two cast iron, white metal-lined, ring-oiled steady bearings; the shaft's size at the bearings is 17¼″ in diameter.

The propeller shaft has a total length of 32′-6½″ and a maximum diameter of 18⅞″. The portion of the shaft which extends through the stern tube is fitted with a bronze liner in two sections, the total length of which is 26′-4⅝″.

The cast iron stern tube is built in two sections and is provided with two bronze bushings, lignum vitae lined, pressed into position. The stern tube, which extends through the after peak tank, is pressed into the stern frame boss and the after peak bulkhead. A stuffing box is formed in the inboard end of the tube.

A four-bladed, right hand, solid, variable pitch, manganese bronze propeller is fitted to the outboard tapered end of the propeller shaft. The propeller is 19′-3″ in diameter and the effective pitch at two-third radius is 17-0″. The pitch varies from 15.65 ft. at .2 of the wheel's radius to 17.54 ft. at the blade tips.

The main condenser, manufactured by the Bethlehem Shipbuilding Company, is a single-pass condenser, having a total cooling surface of 8,500 square feet and will operate at 28½″ Hg. vacuum when supplied with 14,500 G. P. M. of cooling water at 75°F. The condenser is mounted athwartship directly beneath the turbine and is supported entirely by the low pressure turbine flange. The main air ejector unit, manufactured by the C. H. Wheeler Co., consists of two 2-stage ejectors mounted on a surface type inter and after condenser.

Two, General Electric, 350 K. W., 3-wire, 240/120 volt, direct current, turbine-driven generators are the main source of electrical power and light for the vessel. They are capable of delivering 125% load, continuously, for two hours without excessive heating. The generator is driven through a single helical reduction gear (5636/1200 R. P. M.). The generators

are installed on the starboard engine room flat with their axes fore and aft. Under normal operating conditions, the turbines will use superheated steam of the same quality as that furnished to the main turbine. An auxiliary steam line supplying desuperheated system is also installed. At sea, the turbines will exhaust to the main condenser; an auxiliary condenser is provided for port use. An atmospheric exhaust is installed for emergency use. Each unit is equipped with a complete, self-contained oiling system.

The auxiliary condenser, manufactured by the Bethlehem Shipbuilding Company, is a two-pass condenser having a total cooling surface of 1,100 square feet and will operate at 28½" Hg. vacuum when supplied with 1,800 G. P. M. of cooling water at 75°F. The auxiliary air ejector unit, manufactured by the C. H. Wheeler Co., consists of two 2-stage ejectors mounted on a surface type inter and after condenser.

The temporary emergency source of power and light is supplied by an Exide Ironclad, 11-plate, 120 cell battery, rated 140 ampere hours on an eight-hour discharge basis. The final emergency source of power and light is a 75 K. W. Superior Diesel-driven, 240/120 volt, direct current, generator which, with its switchboard and fuel oil supply tank, is installed in the dummy stack at the Hurricane Deck level. Sufficient fuel is carried to operate this generator, continuously, for 48 hours.

The first stage heater is an Elliott, vertical, marine, direct contact type deaerating feed water heater, with self-adjusting steam atomizing nozzles and is located in the engine room casing. The unit is capable of delivering a total of 78,500 lbs. per hour of feed water at not less than 240°F. when supplied with sufficient steam at 10 #/sq. in. gauge pressure and with inlet water to the vent condenser at 95°F. The heater has a storage capacity of 1,500 gallons.

The second stage heater, manufactured by the Bethlehem Shipbuilding Company, is a closed, vertical, 4-pass, tubular heater having a total heating surface of 168 square feet. Feed water is to be heated from 240°F. to 300°F. at this stage.

The make-up feed evaporator is a Davis Paracoil, vertical, high-pressure type unit with submerged coil heating surface. The evaporator has a capacity for evaporating 2,400

lbs. per hour of 76°., raw fresh water to vapor at 10 #/sq. in. gauge when supplied with steam to the coils at 70 #/sq. in. in gauge pressure. The make-up feed evaporator and the salt water evaporator are installed on the port engine room flat.

The salt water evaporator, which is to be used only in case of emergency, is of the same type and manufacture as the make-up feed evaporator. The capacity is 60,000 lbs. of vapor per twenty-four hours when evaporating sea water at a temperature of 76°F., with steam to the coils at 70 #/sq. in.

The distiller is a Davis Paracoil unit having a capacity of 6,000 gals. of distillate per 24 hours when supplied with vapor from the salt water evaporator and with cooling water at 84°F. inlet temperature.

Two lubricating oil coolers, Bethlehem Shipbuilding Company manufacture, each having a capacity to cool 300 G. P. M. of oil from 140° to 120°F., using 500 G. P. M. of cooling water at 84°F., are mounted on the after starboard engine room bulkhead.

A Sharpless lubricating oil purifier of sufficient capacity to treat 200 G. P. H. and a heater of like capacity are installed on the lower engine room level.

Two lubricating oil gravity tanks and two storage tanks, each capable of holding 1,000 gallons, are installed in the engine room casing at such height as to give a pressure of 12 #/sq. in. at the turbines and gears. The gravity tanks are provided with steam heating coils for use when the tanks are used for settling purposes.

The lubricating oil tump tank is located beneath the main gear and is formed by a recess in the innerbottom tank. The capacity at normal operating level is sufficient to assure proper submergence of the pump suction under all conditions, including a 20° list of the ship.

The engine room and boiler room auxiliaries, which will be used normally while at sea, are electrically operated, except the main feed pumps which are Westinghouse turbine-driven and the evaporator feed, steam-driven reciprocating pump. A vertical, steam-driven reciprocating pump is used for boiler feeding while in port and a number of other reciprocating pumps are used for stand-by service.

Of particular interest is the vertical, motor-driven, submersible bilge pump. This pump, of 600 G. P. M. capacity has a diving bell casing which will exclude water from the motor, permitting it to be operated even if the engine room should be completely flooded to the Shelter Deck level. The valves for the entire bilge pumping system can be operated from the Shelter Deck level, as well as at the engine and boiler room floors. The pump is powered by the emergency generator and the main generators. The fire pump located in the shaft alley recess, is similarly powered but it is not operable under flooded conditions, although the shaft alley is separated from the engine room by a watertight door which will be closed in case of engine room flooding.

A Sperry salinity indicator is installed. It measures the concentrations of sea water from 0 to 10 grains per gallon in the ship's boiler feed system at five points; namely, main condensate pump discharge, auxiliary condensate pump discharge, condensate to feed heater, distiller test tank drain, and the feed suction from the reserve feed tanks. The alarm mechanism, with the selector switch in the alarm position, gives an audible and visual warning when the salinity reaches a dangerous concentration.

The refrigeration and air conditioning compressors, with their condensing and receiving equipment, are installed on the port side, lower engine room level. Three Carrier, Freon compressors, all of equal capacity, are each V-belt driven by a 15 H. P. General Electric motor. The refrigeration is divided into three plants—ship's store (4 tons approximately), refrigerated cargo (6.8 tons approximately), and air conditioning (12.6 tons approximately).

The engineers' store-room and the machine shop are located on the port, engine room flat. The machine tools, consisting of lathe, shaper, drill press, and grinder are all independently electric motor-driven.

The engine and boiler rooms are mechanically ventilated. Sufficient air is forced into these spaces to give a complete change of air at approximately two and one-half minute intervals. Ducts carry the air to various outlets at different levels.

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Meeting of the Board, May 29, 1942

The meeting was called to order by President Cappel with the following present: Kammer, Kerr, Kuhn, Steinmayer, Bassich, Fithian, Olsen and Mayer.

The minutes of the last meeting were read and approved.

President Cappel reported that a number of encouraging replies had been received from his letter reiterating the Society's opposition to the proposed St. Lawrence Waterway undertaking. He also reported that the wage scale for engineers as se up for the State Civil Service Commission is quite satisfactory.

A letter from Mr. Alcee Legendre was read announcing that an Industrial Plant Protection School would be held on June 12th and 13th and asking that the Society send representatives. It was decided to request the Defense Committee to represent the Society at this school; also that the notices for the June meeting carry an announcement regarding the school.

A letter from Mr. F. H. Waddill was read proposing the passage of a state law to license engineers to practice only in those fields of engineering in which they have qualified. No action was taken.

The question of expanding the employment service of the Society was discussed. Chairman Bassich and Fithian were requested to consider the matter further and report at the next Board meeting.

At the request of Chairman Ross of the Entertainment and Outing Committee the advisability of holding the Annual Golf Tournament this year was discussed and it was decided to hold the tournament sometime in July.

Chairman Olsen of the Finance Committee announced plans for endeavoring to collect delinquent dues and to secure reinstatement of some members previously dropped for delinqueneyof dues.

The Secretary was directed to mail a letter ballot to the voting membership when application for membership now under consideration by Membership Committee "B" are approved.

The following Committees were appointed to prepare obituaries:

For T. M. McCarroll—John Klorer, Chairman, R. B. Kohnke, C. M. Kerr.

For Hal Bourg—H. L. Lehmann, Chairman, N. E. Lant, Chas. Myers.

The resignation of E. H. Swick was accepted with regret.

A letter from Chairman H. W. Waterfall of the Committee on Engineering Education was read. The letter recommended that no resolution recommending deferrment of engineering students and faculty be adopted. In view of the fact that a resolution recommending deferrment for such persons was introduced at the last meeting of the Society by Mr. K. P. Kammer, it was decided to notify the membership of this resolution and bring it up for vote at the next regular meeting.

The recommendation of the Awards Committee that Mark E. Carrigan, Senior engineering student at Louisiana State University, be given the Junior Membership Award was approved.

A letter from Chairman L. J. Cucullu of the Professional Advancement Committee regarding a change in wording of that section of the minutes of the February Board meeting on February 13th concerning the above Committee was read and tabled.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Special Meeting of the Board, June 8, 1942

The meeting was called to order by President Cappel with the following members present: Kammer, Kerr, Kuhn, Steinmayer, Stewart and Mayer.

The following resolution proposed by Colonel V. J. Bedell was approved.

"Whereas—The State Legislature of 1940 passed a bill to provide for a system of State Civil Service and

Whereas—The people of the State of Louisiana by a large majority approved an amendment to the Constitution of the State to establish said State Civil Service and

Whereas—This System of State Civil Service is deemed by this Society to be for the best interests of the engineering profession of the State as well as to the people of the State in general

Therefore be it resolved that the Louisiana Engineering Society make known its approval to the State Legislature and respectfully recommend that the body appropriate the necessary funds for the inauguration and maintenance of said Civil Service system."

The special meeting was then adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Society, June 8, 1942

The meeting was called to order by President Cappel with approximately sixty members and guests present.

The minutes of the last meeting were read and accepted.

Chairmen of the Standing Committees presented reports on the activities of their Committees. The reports are briefly summarized as follows:

B. W. Pegues—The Awards Committee has recommended a senior student from Louisiana State University and one from Tulane University to receive the Junior Membership Awards given annually by the Society. Nomination for the Scholarship Awards for the coming year are requested.

Ole K. Olsen—The Finance Committee will endeavor to collect dues from those members in arrears. All members were requested to assist in securing applications for reinstatements from members previously dropped for delinquency in dues.

E. C. Coburn—The State Sections Committee is actively promoting the establishment of a Section in the northern part of the state. Details will be reported at a later date.

A. M. Fromherz—The city authorities have been advised that the Society is ready and willing to serve wherever possible in matters of Defense. The Defense Committee has been relatively inactive since no requests for service have been received.

E. A. McLellan—The Committee on Student and Junior Activity plans to contact the students at Louisiana State University and at Tulane University this fall in order to encourage student participation in Society activities.

L. L. Newman (by letter)—The Committee on Civic and Industrial Affairs will welcome notice of any undertaking where there is a lack of proper engineering recognition.

N. H. Ross—Committee on Entertainment and Outings is arranging to hold the Annual Golf Tournament sometime in July. Details will be announced later.

G. E. May—The Technical Papers Committee has endeavored to sponsor joint meetings with the local sections of the Founder Societies and to secure papers relating to engineering phases of the war effort.

R. P. Bassich (by letter)—The Employment Committee placed eighteen men out of twenty-four applications received during the first four months of 1942.

L. J. Cucullu—The Committee on Professional Advancement has recommended the publication and distribution of an article by Dean Freund entitled "Unionism—An Issue in Engineering."

A. M. Hill—Publications Committee "A" will welcome any suggestions regarding the publication of the Proceedings.

G. H. Hammett—Publications Committee "B" is making progress.

The resolution tabled from the last meeting expressing the Society's attitude toward deferrment of engineering students and faculties from active military service was passed by unanimous vote.

Colonel V. J. Bedell submitted the following resolution in written form:

"Whereas—The Legislature of 1940 passed a bill to provide for a system of State Civil Service and

Whereas—The people of the State of Louisiana by a large majority approved an amendment to the Constitution of the State to establish said State Civil Service and

Whereas—This system of State Civil Service is deemed by this Society to be for the best interests of the engineering profession of the State as well as to the people of the State in general

Therefore be it Resolved that the Louisiana Engineering Society make known its approval to the State Legislature and respectfully recommend that that body appropriate the necessary funds for the inauguration and maintenance of said Civil Service system."

In view of the fact that such an expression must reach the State Legislature immediately to be of any value. Colonel Bedell moved the suspension to the regular rules regarding tabling of such resolutions until the next meeting. The motion was seconded and passed by unanimous vote. Colonel Bedell then moved that the resolution be adopted. This motion was seconded and the resolution adopted by unanimous vote.

A letter from Mr. B. H. Grehan was read regarding certain sections of the Architects Bill concerning engineers. President Cappel appointed a Committee consisting of K. P. Kammer, Chairman, Bernard Graff and

A. J. Naquin to review this bill and discuss said sections with the architectural group.

Mr. Ivan Purinton spoke briefly on the Plant Protection School to be held on June 12th and 13th.

Mr. Harold Salaun presented a series of film slides entitled "Lets Get to Work, New Orleans." The slides dealt with the increased traffic loads now being thrown on the street railway and bus system and suggested means by which the public could assist in speeding up this form of transportation.

Mr. T. E. Alexander, Engineer, Equitable Equipment Company, presented an interesting sound motion picture in technicolor entitled "The Design of a Riley Steam Generator."

The meeting adjourned with a rising vote of thanks to the speakers.

J. K. MAYER,
Secretary-Treasurer.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

AUGUST, 1942

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXVIII. OCTOBER, 1942 NO. 5

CONTENTS

EDITORIAL NOTES AND COMMENT

Dynamite Storage? What supposedly considerate and intelligent person would be guilty of storing two or three hundred pounds of dynamite in his garage? Yet as gasoline rationing approaches, there are those who would store this substance which, pound for pound, releases more energy than dynamite.

Insurance companies are concerned and cancellation or nullifying will result where illegal storage exists.

Do your part as an engineer; appreciate the hazard of explosion resulting in property damage and loss of life, and try through your own contacts to prevent your friends and neighbors from creating such a danger. Remember, gasoline fumes sink to the ground and can "flashback" considerable distances from burning rubbish, etc.

Off to the Right Start: At this time of the year millions of young people are returning to school and college. The whole

pattern of life may be influenced by the first few days in new surroundings.

Those in teaching work in particular should appreciate the opportunity and responsibility in these first few contacts. First impressions should be good impresisons, and good impressions should continue.

Time spent with new employees to assist them in getting acquainted with the rules of the organization and with their fellow workers is worthwhile. This time and effort makes for a satisfied and loyal personnel.

A few simple suggestions: (1) Be sure that the new employee understands what the duties are, whether the employee be a stenographer or an engineer. (2) Introduce the new person not growlingly but cordially to his or her immediate associates. (3) Acquaint the new worker with rules and regulations of your office or plant.

"Off to the right start" has enormous possibilities in every walk of life. Are you making the most of this opportunity to help others and yourself?

In this Issue. Mr. Arthur J. Naquin presented a paper on industrial safety engineering at the September meeting. If you have not had much contact with the subject you will probably be surprised at many points brought out. Whether you know it or not, four cents out of every dollar goes to pay for costs of accidents.

New Members. Each reader can not fail to be impressed by the large numbers of new members listed this month. This is a splendid achievement. There are forty-four men; count 'em. Read over the list. It will help you remember their names when you meet them at the Society's functions.

Member

Angier, Philip P., Age 51. Endorsed by H. B. Henderlite, N. E. Lant, H. L. Lehman. 3 yrs. in C. E., Univ. of Michigan. 1915-22 Rodman, Draftsman, Engr.-Inspector, Resident Engr. with Ralph Modjeski, Consulting Engr. 1928-31 Resident Engr., Melville Bridge, T. & P. RR. 1931 to date Resident Engr.,

Bridge Construction, La. Dept. of Highways. Box 346 Franklin, La.

Ball, J. Nelson, Jr., Age 38. Endorsed by N. E. Lant, H. L. Lehmann, S. C. Smith. 3 yrs. Engr. School, La. State Univ. Structural Engr. Course, Wilson Engr. Corp. (25% completed). La. Highway Comm. as follows: 1924-25 Instrumentman; 1925-30 Resident Engr.; 1930-33 District Const. Engr.; 1933-35 Resident Engr. 1935-36 Sales Engr., Flynn Mfg. Corp., Alexandria, La. 1936-40 District Maintenance Engr. & 1940 to date District Engr. (Construction & Maintenance), La. Dept. of Highways. P. O. Box 595, Lafayette, La.

Barnes, **Robert Leland,** Age, 46. Endorsed by N. E. Lant, H. L. Lehmann, S. C. Smith. 1916-20 Rodman & Instm., Santa Fe RR. 1920-22 Field Engr., La. Oil Refining Co. 1922 to date with La. Dept. of Highways as follows: Resident Engr., Br. Loc. Engr., Asst. Br. Const. Engr., District Maintenance Supt. Fordoche, La. Member A. S. C. E.

Brooks, Robert Teryl, Age, 34. Endorsed by N. E. Lant, H. L. Lehmann, S. C. Smith. 2 yrs. in Engr., La. Tech. Engaged in Engr. work for La.Dept. of Highways for 11 yrs.—5 yrs. as Instmn., last 6 years to date as Resident Engr., in charge of actual construction of Roads & Bridges. 812 Bank St., New Iberia, La.

Clarke, F. Tackett, Age, 45. Endorsed by H. S. Allen, A. J. Landry, H. L. Lehman. 1928 B. C. E., La. State Univ. 1928-31 Resident Engr. — 1st Asst, with L. J. Voorhies (sewers, waterworks, etc.) 1 yr. as Engr., McWilliams Dredging Co. 1 yr. with Coast & Geodetic Survey. 6 yrs. with La. Dept. of Highways as Res. Engr., Instmn., Draftsman. Audit Engr. & Project Eng. At present with Union Sulphur Co., Sulphur, La. c/o Union Sulphur Co., Sulphur, La.

Colbert, Tom F., Age, 49. Endorsed by H. B. Henderlite H. L. Lehmann, H. Waugh. Service with La. Hwy Comm. & La. Dept. of Highways as follows: 1921-29 Insptr., Instrmn. & Resident Engr. on grading & drainage grading & surfacing projects; 1929-31 Party Chief on location; 1931-41 Instrmn.

& Res. Engr. as above. 1941-42 District Maintenance Supt. 1205 Holly St., Alexandria, La.

Coltharp, James Blankenship, Age 38. Endorsed by A. J. Dubus, P. J. Guelfi, F. E. Johnson, Jr. 1925 B. S. in E. E., Texas Univ. 1½ yrs. Training Course, Gen. Electric Co. 1 yr. Const. Engr., Phoenix Const. Co., Dallas, Tex. 1 yr. Illumination Eng.; 7½ yrs. Gen. Elect. Trans. & Distr., Texas Div.; 4 yrs. Asst. Supt. Distr.; 1 yr. and to date Supt. Trans. & Distr.,—all with Gulf States Utilities Co., Baton Rouge. 2875 Zeeland Ave., Baton Rouge, La.

Corley, William Lester, Age 40. Endorsed by H. B. Henderlite, H. L. Lehmann, R. B. Richardson. High School Education & I. C. S. Course in Engr. 1920-22 Rodman for R. R. G. R. R. 1922-to date with La. Hwy. Comm. & La. Dept. of Highways as follows: 1922-23 Inspector; 1923-29 Instmn; 1929-35 Resident Engr.; 1935-40 Dist. Const. Engr.; 1940 to date Dist. Engr. 3122 Cadiz St., New Orleans, La.

Cromer, Sylvan, Age, 35. Endorsed by H. L. Lehmann, B W. Pegues, H. W. Waterfall. M. S. Oklahoma Univ. 1930-38 Instructor, Asst. Prof., Oklahoma Univ. 1938 to date Asst. Prof., College of Engr., La. State Univ. Summer work as Engr. with following companies—Oklahoma Natural Gas Co., Tulsa; Southwest Natural Gas Co., Ada, Okla., Arkansas Fuel Oil Co., Shreveport; Gulf States Utilities Co., Baton Rouge. Member—A. I. M. E., Tau Beta Pi, 2164 Ferndale, Baton Rouge, La.

Crossan, Thomas Edmund, Age, 48. Endorsed by A. J. Dubus, P. J. Guelfi, H. L. Lehmann. 1914 graduate of Williamson Free School of Mech. Trades in Power Plant Engr. 1914-17 Operating & Const. Depts. of plants under Mgr. of Stone & Webster Engr. Corp. 1917-19 U. S. Army, A. E. F. 1919-22 Operating Dept., Power Plant, Houghton, Mich. & same for Blackstone Valley Gas & Elect. Co. 1922-30 Chief Engr., various Stone & Webster Engr. Corp. Plants. 1930-42 Supt. of Production, La. Station, Gulf States Utilities Co. 1942 to date System Supt. of Production for G. S. U. Member—A. S. M. E. for 17 yrs. since 1925. P. O. Box, 2431 Baton Rouge, La.

Drake, James Lewis, Age 40. Endorsed by C. C. Barnard, D. W. Godatt, C. M. Kerr. 1923 Graduate of Georgia School of Tech., E. E., 1923-29 Alabama Power Co., Birmingham—1 yr. as Cadet Engr. (drafting & checking field work), balance as Field Engr. (supervising substation const., distr. const. & transformer installation Const.) 1929-35 Dixie Const. Co., Birmingham, as Elect. Const. Engr. (estimating layout, designing, supervision of all types of elect. const.) 1935-40 D. & G. Elect. Const. Co., Tifton & Fitzgerald, Ala—owner of co. which did both engr. & const. of all types & consulting for smaller companies. 1941-42, G. P. Rice, Consulting Engr., as Elect. Engr. in charge of all elect. inspection & testing Keesler Field, Biloxi, Miss. February 1942 to date, Barnard, Godat & Heft as Elect. Engr. (designing layout work, supervision, gen. specifications & gen. elect. engr.) Also Elect. Engr. on Shreveport Reconsignment & Holding Depot for same company. Member—A. I. E. E. & International Assoc. of Elect. Insptrs. 2908 Beaulieu, Metairie, New Orleans, La.

Edwards, Clarence C., Jr., Age, 39. Endorsed by H. L. Lehmann, R. B. Richardson, H. Waugh, La. State Univ., E. E., no degree. 1921-26. Draftsman, Instmn., Instmn. in Charge 1926-29. Res. Engr., State & Federal Aid Projects, 1929-33. Project Supt., U. S. Forest Service. 1933-37. Resident Engr., State & Federal Aid Projects, 1937 to date. Box 645, Winnfield, La.

Elissalde, M. H., Age, 37. Endorsed by F. R. Adams, A. J. Dubus, P. J. Guelfi. 1928 B. E. in E. E., 1934 M. S., La. State Univ., 1928-31 Sales, Edison Lamp Works, Gen. Electric. 1934-35 Stone & Webster Engr. Corps., Lake Charles, La. 1935 to date Drafting & Design, Gulf States Utilities Co., Baton Rouge, La. 2708 Adams Ave., Baton Rouge, La.

Erskine, Frank G., Age, 35. Endorsed by J. M. Fourmy, H. L. Lehmann, G. Rice. 1927 B. E., Univ. of Miss. 1930 C. E., Cornell Univ. (specialized R/C). Summers of 1924, 1925 & from 1927 to May 1928 Draftsman, Designer, Instmn., etc., Engr. Dept., Jackson, Miss. May, 1928—September 1929 Cartographic Engr., U. S. Coast & Geodetic Survey; October 1930

—March 1937 Aerial Photo Mapping for same, March 1937 to date Field Engr., particularly on pavements, Portland Cement Assoc. 1809 Milan St., New Orleans.

Favret, James E., Age, 33. Endorsed by C. M. Kerr, O. K. Olsen, G. Rice. 1930 B. S. in C. E., Univ. of Notre Dame. June 1930 to date in construction work with Lionel F. Favret, Gen. Constractor, taking care of all engineering required at that office. Member—I. E. S. 226 Brockenbraugh Court, New Orleans, La.

Goodloe, Edwin Henry, Age 39. Endorsed by H. L. Lehmann, R. B. Richardson, H. Waugh. 1919-21 Instmn. & Insptr., Parish of St. Landry. 1921-40 Instmn. & Res. Engr. in charge of Hwy. Const., La., Dept of Highways. 1940 to date Dist. Maintenance Supt., 4th Dist., Lake Charles, La. 317 East Madison St., Opelousas, La.

Hill, J. Clifton, Age, 31. Endorsed by E. C. Coburn, A. J. Dubus, M. C. Schwartz. 1932 B. S. in Ch. E., La. State Univ. Employed since graduation as Student Engr., Asst. Chemist & Chemist at La. Station, Gulf States Utilities Co., Baton Rouge in development & testing of water treating equipment, etc. Member—Alpha Chi Sigma, Pi Beta Tau, American Chemical Society. 2153 Broussard St., Baton Rouge, La.

Hudgins, Melvin C., Age, 30. Endorsed by S. G. Dupree, A. A. D. Jackson, H. L. Lehmann. 1934 B. S. in M. E., La. State Univ. 1934-35 Method Study Engr., Shell Oil Co., Norco, La. 1935-36 Jr. Draftsman, Shell Oil Co., Roxana, Ill. 1936-37 Res. Const. Engr. Shell Oil Co., Roxana. 1937-38 Tech. Asst., Cracking Plt. Operation, for same. 1938-39 Const. Engr. (Zone), for same. 1930-40 Draftsman, La. Dept. of Hwys. 1940 to date Const. & Maintenance Engr., Ethyl Corp., Baton Rouge, La. 1525 Eugene Ave., Baton Rouge, La.

James, Ernest Joseph, Age, 36. Endorsed by H. B. Henderlite, H. L. Lehmann, R. B. Richardson. 1923 finished Bolton High School, Alexandria. 1923-37 at La. State Univ., 1 yr. premed., 3 yrs. C. E., 1927—Appt. Cadet Colonel, L. S. U. Regt. & Commissioned 2nd Lt., 256 Infantry ORC on completion of

4 yr. course R. O. T. C. 1927 to date with La. Dept. of Highways as follows: 1927 Rodman: 1927-31 Instmn., Hwy. Location & Const.; 1931-41 Res. Engr. on const. of concrete, surface treatment & gravel hwys.; 1941 to date Dist. Engr., Dist. No. 3, supervision of const. & maintenance in 7 central La. parishes. 2401 Marye St., Alexandria, La.

Jarman, Joseph Edmund, Age, 43. Endorsed by N. E. Lant, H. L. Lehmann, W. L. Thompson. 1917-20 Instmn., Boundary Line & Drainage Investigation, John L. Roper Lumber Co., New Berm, La. 1923 to date with La. Dept. of Highway as follows: 1923-24 Instmn. & Insptr.; 1924-August 1941 Res. Engr., Bridge & Road Const.; August 1941 to date District Engr. in charge of Construction & Maintenance. 1025 Pujo St., Lake Charles, La.

Landry, Earle Adrian, Age, 38. Endorsed by T. T. Chenet, W. S. Guedry, H. L. Lehmann. 1931-33 Res. Engr., Road & Bridge Const., La. Hwy. Comm. 1933-35 Project Engr., Levee & Road Const., McWilliams Dredging Co. 1935 to date with La. Dept. of Highways as follows: 1935-41 Res., Engr., Road & Bridge Const.; 1941 to date District Court Const. Engr. Road & Bridge Const. 715 East Charles St., Hammond, La.

Lenoir, Leo Sims, Age, 44. Endorsed by N. E. Lant, H. L. Lehmann, R. Richardson. 1922 to date with La. Hwy Comm. & La. Dept. of Highways as follows. 1922-27 Res., Engr.; 1927-28 District Engr.; 1928-29 Asst. Engr.; 1929-30 Const. Engr.; 1930-32 District Engr.; 1932-34 Res. Engr.; 1934-40 District Maintenance Supt.; 1940 to date District Engr. 3425 Fairfield, Shreveport, La.

Lirette, Paul E., Age, 36. Endorsed by H. B. Henderlite, N. E. Lant, H. L. Lehmann. 1924-28 C. E., La. State Univ. 1929 Rodman, Southern Pacific RR. Co. & Instmn., T. B. Smith, Houma, La. 1930 to date with La. Dept. of Highways as follows: 1930-32 Clerk, Right-of-Way Dept.; 1934-40 Asst. to Right-of-Way Engr.; 1940 to date Right-of-Way Engr. 2127 Second St., Baton Rouge, La.

Mattison, Edwin Lorenzo, Age, 37. Endorsed by H. S. Allen, N. S. Catchings, H. L. Lehmann. 1926 B. A., Chem.,

Southwestern College, Winfield, Kansas. 1929 Ph.D., Chem., Univ. of Nebraska, Lincoln, Neb. 1929-34 Research Chemist, Jackson Research La., DuPont Co., Deepwater, N. J.; 1934-38 Supervisor & Consultant, Basic Color Area for same. 1938 to date Chief Chemist, Tetra-Ethyl Lead Plant, Baton Rouge for same. Member—Am. Chem. Soc., Phi Lambda Upsilon, 3430 Government St., Baton Rouge, La.

McWhorter, Arthur W., Age, 54. Endorsed by J. E. Coyne, H. L. Lehmann, R. B. Richardson. 1909 B. S., Engr.; Univ. of Alabama. 1917-19 Capt. Engr., 31 Divis., A. E. F. 1920-21 Div. Engr., Georgia Hwy. Dept. 1922-27 Contractor—Self. 1927-30 Supt. of Const., Alabama Hwy. Dept. 1930-32 Const. Engr., La. Hwy. Comm. 1933-36 Asst. State Engr., C. W. A., W. P. A. 1936 to date Const. Engr., La. Dept of Highways. 3312 Jena St., New Orleans, La.

Nixon, Leo A., Age, 42. Endorsed by N. E. Lant, H. L. Lehmann, S. C. Smith, Graduate of Bolton High School, Alexandria, La. 2 yr. correspondence course in Struct. & Elect. Engr. 1921-24 Asst. to Parish Surveyor, Alexandria, La. 1924-26 Instmn. on location, La. Hwy. Comm. 1925-31 Rodman, Instmn. (C. E.), T. P. RR., Alexandria, La. 1931-33 Instmn., Draftsman, concrete hwy. const., La. Hwy Comm., Baton Rouge. 1933-34 Surveyman, concrete revetmen work, U. S. E. D., New Orleans, 1934-36 Const. Engr., Airports, Hwys., Bridges & Natural Gas Systems, W. P. A., Alexandria, La. 1936-37 Rodman (C. E.) in charge bank widening T. P. RR., Alexandria 1938 to date Asst. Engr., Insptr., concrete test pile work, Morganza Floodway & other const. work, Texas & Pacific Ry Co., Dallas, Tex. New Roads, La.

Odom, Leo A., Age, 37. Endorsed by H. L. Lehmann, N. E. Lant, F. F. Pillet. 1927 B. E. in C. E., La. State Univ. Draftsman, part time, La. Hwy. Comm. from July 1924 until graduation & as Bridge Detailer from June 1927 to March 1929. 1929-Feb., 1941 U. S. Corps of Engrs., Rivers & Harbors & Flood Control work as Chief of Survey Party, Designer of Lock Structures, Resident Engr., on Lock Const. (Harvey Lock), Chief of Structural Design Section, Chief of Engr.

Div. of Dist. Office in Kingston, Jamaica. Feb. 1941 to date Chief Engr., State Dept. of Public Wks. Have C. E. State License; member (assoc) A. S. E. C. 10th Floor, Capitol Bldg., Baton Rouge, La.

Roberts, Harry T., Age, 43. Endorsed by S. G. Dupree, A. J. Landry, H. L. Lehmann. B. S., Engr., Rose Polytechnic, Terre Haute, Ind. Employed in various engr. capacities by Mengel Co. 1917 to date. At present, Plant Engr. for Mengel Co. 426 Beverly Drive, Baton Rouge, La.

Scott, C. M., Age, 39. Endorsed by A. J. Dubus, P. J. Guelfi, H. L. Lehmann. 1926 B. S. in E. E., New Mexico College of Agri. & Mech. Arts. 1926 to date with Gulf States Utilities Co. as follows: 1926-Jan. 1927 Meter Dept.; 1927-Sept. 1928 Asst. to Div. Supt., Power Pl. Const.; 1928-June 1932 Design & Layout, Elect. Engr. Dept.; 1932-June 1934 Substation Const.; 1934-July 1935 District Engr.; 1935-June 1940 Supervisor E. T. & D. Laf. Div.; 1940-June 1941 Asst. to Gen. Supt., Western Public Service Co.; June-Oct. 1941 Asst. Gen. Supt. for same.; Oct. 1941 to date Asst. Supt., E. T. & D., Baton Rouge, La. 2025 Lawndale, Baton Rouge, La.

Senn, Robert Ira, Age, 37. Endorsed by N. E. Lant, H. L. Lehmann, W. L. Thompson. 1925-26 Engr. Course, State Normal, Troy, Ala. 1941 Graduate Lafayette Inst., Los Angeles Bus. Adm. 1926-Aug. 1927 Rodman, Instmn. & Field Office Draftsman, Atlantic Coast Line Ry., Wilmington, N. C. 1927-July 1928 Instmn, Chief of Party, Office Engr., Frisco Ry. System, St. Louis, also Engr. in chg. of ry. depot sites & sub-div. 1928-Aug. 1930 Asst. Res. Engr., heavy bridge const., Shop Insptr. on fabricated str., Field Engr. on Str. Steel Erections & Office Engr. in chg., of partial & final estimates, Alabama Bridge Corp. 1930 to date with La. Dept, of Highwas as follows: 1930-31 Instmn., Acting Res. Engr., Road Dept.; 1931-41 Bridge Dept., Instmn., Shop Insptr. on Fabricated Str. Steel, Asst. Engr., Miss River Bridge 3½ yrs., Res. Engr., Bridge Const., Engr. in chg. Baton Rouge Bridge Steel Erection; Engr., Coast & Maintenance Dept.; Res. Engr., grading, drainage, concrete road const. Rt. No. 3, Box 68, Monroe, La.

Spengler, Joseph Cooper, Age, 33. Endorsed by A. J. Dubus, P. J. Guelfi, H. L. Lehmann. 1934 B. S. in Chem., La. State Univ. 1935 to date gen. engr. const. work in Gas Dept. of Gulf States Utilities Co., Baton Rouge. 2903 Hollywood Drive, Baton Rouge, La.

Stevenson, George Franklin, Age, 36. Endorsed by W. S. Guedry, N. E. Lant, H. L. Lehmann. 1927-28 Instmn., Gulf States Utilities Co., Lage Charles, La. 1928-31 Draftsman, Chief of Party, Stone & Webster Engr. Corp. 1931 to date Res. Engr., La. Dept. of Highways. P. O. Box 235 Amite, La.

Vaughan, Robert H., Age, 43. Endorsed by H. L. Lehmann, R. B. Richardson, H. Waugh. 1925-27 Parish Engr., Claiborne Parish; 1929-33 Instmn. & Res. Engr.; La. Hwy Comm. 1935-36 Engr. Insptr., P. W. A. 1936 to date Res. Engr. & District Const. Engr., La. Dept. of Highways. 1508 East Kings Highway, Shreveport, La.

Wade, Battaille Harrison, Age, 39. Endorsed by O. G. Kirby, N. E. Lant, W. L. Thompson. 1925 B. S. in C. E., Miss. A. & M. 1925-27 Taught class in C. E. 1927-28 Office Engr., Ford, Bacon & Davis, Sterlington Pl. 1928-31 Field Engr., Stevens & Wood, on Const., Steam Pl. & Hydro-Elect. Pl. 1931-37 Instmn.; 1937 to date Res. Engr. for La. Dept. of Highways. Licensed Engr., State of Miss. Box 307 Jennings, La.

Watson, Thomas Alton, Age, 35. Endorsed by E. C. Corburn, A. J. Dubus, P. J. Guelfi. 1927 B. E. in C. E., Duke Univ. 1927-June 1928 Chem. Lab. McMillan Oil Ref., Long Beach, Calif. July-Dec. 1928. Chem. Lab., Texaco Natural Gas Pl., Long Beach Calif. Jan-May 1929 Math. Teacher, Mineral Springs, Winston-Salem, N. C. June-Sept. 1929 Rodman & Levelman, Survey Party, City of Long Beach. 1929-31 Gas. Engr. Dept., L. A. G. & E., Los Angeles. 1931 to date Gas & Industrial Sales Dept., Gulf States Utilities Co., Baton Rouge. 3340 Hollywood Dr., Baton Rouge, La.

Affiliate Member

Douglas, August Hoffman, Age, 49. Endorsed by B. H. Grehan, H. L. Lehmann, B. B. Pierce. Attended La. State Univ. 1909-12. 5 yrs. with U. S. Engr. Corps as civilian—Rodman, Chainman, Instmn., Draftsman, Topographer, Surveyor, Observer of Tides, Winds, Currents & Sediments. Captain, U. S. Army Corps in U. S. & France 1918-19. 1920 to date—Industrial Sales Engr. 4711 Baronne St., New Orleans, La.

Shankle, Warren C., Age, 45. Endorsed by H. B. Henderlite, H. L. Lehmann, R. B. Richardson. 1916 B. A., Math major. Tulane Univ. 1917-18 Army Air Service as Pursuit Pilot & Engine Instructor. 1918-40 Sales Engr.—Contractors Equip. & Heavy Const. Machy, specializing in Construction Plant Layout & Design & Plant Operation &Maintenance. 1940 to date Equip. Engr. & Equip. Supt., La., Dept. of Highways. 2550 Fairfield Ave., Baton Rouge, La.

Junior Member

Landry, Henry Louis, Age, 31. Endorsed by A. J. Dubus, P. J. Guelfi, H. L. Lehmann. 1938 B. S. in E. E., Southwestern La. Inst. while Foreman Clearing Crew, McWilliams Dredging Co. Atchafalaya Spillway. 1 yr. Rodman, U. S. Geological Survey. Balance with Gulf States Utilities Co. as follows: 1½ yr. Relief Operator & Utility Man 2½ yrs. Elect. Trans. Hi-Line Dispatcher & Substation Operator; at present Industrial Sales Engr.—consultant on Elect. & Gas Equipment and application of Elect. & Gas & Gen. Service rendered to industrial users. 2222 Cedardale Ave., Baton Rouge, La.

Mack, Wallace Ray, Age, 39. Endosed by R. I. Allen, J. E. Coyne, H. L. Lehmann. April-Oct. 1929 Instmn.; 1929-May 1930 Instmn, in-charge; 1930-June 1933 Instmn.—La. Hwy. Comm. Nov. 1933-Aug. 1934 Surveyman & Party Chief, War Dept. & Private Engr. Co. making Hydrographic & Topographic Surveys. March 1935 to date Instrmn., La. Dept. of Highways. While with Dept. of Hwys, employed on all types of road const. & location. Cameron, La.

Martin, William Otho, Age, 39. Endorsed by J. E. Coyne, R. B. Richardson, H. Waugh. 3 yrs. in Math-Science Course, La. State Normal. 1930-32 Topographer; 1935-37 Junior Instmn.; 1937-40 Senior Instmn.; 1940 to date Chief of Party—La. Dept. of Highways, RFD. 2, Box 227, Natchitoches, La.

McCorquodale, Luther Duncan, Age, 36. Endorsed by R. I. Allen, J. E. Coyne, H. H. Shutts. 1925-27 Rodman to Jr. Instmn., Calcasieu Parish Engr. Dept. 1927-32 Jr. Instmn., La. Hwy. Comm. 1932-34 Instmn., F. Shutts & Sons, Engr. Firm, Lake Charles. 1934-35 Chief of Party (Engr.), G. M. Oil Co., Houston, Texas. 1935-40 Instmn.; 1940 to date Res. Engr., La. Dept. of Highways. 1007 So. Division St., Lake Charles.

Melancon, Alfred Marion, Age, 30. Endorsed by A. J. Dubus, P. J. Guelfi, H. L. Lehman. 1936 B. S., La. State Univ. July 1936-Feb. 1937 Field Supervisor, Triple S. Mapping Program. 1937-June 1938, Lab. Instructor, La. State Univ. 1938 Junior Operator & R/W man, Geophysical Crew. Jan. 1939 to date Engr. Draftsman, Gulf States Utilities Co. Baton Rouge. 762 Stevens St., Baton Rouge, La.

Nevils, Albert B., Age, 36. Endorsed by H. L. Lehmann, R. R. Richardson, I. L. Thomas. 1925-28 Rodman. Calcasieu Parish, Calcasieu Navigation Channel Project; during which time worked for F. Shutts & Sons running Land Lines stating Oil Well locations, etc., 1934-35 Instmn., G. & M. Oil Co., Houston, Texas, doing Geophysical work. 1935-42 Instmn; at present, Jr. Traffic Engr., Dist. 4, Traffic & Planning Section, La. Dept. of Highways, 605 Alamo St., Lake Charles, La.

Sharp, George Parish, Age, 47. Endorsed by R. I. Allen, J. E. Coyne, R. B. Richardson. 1922-24 Rodman; 1924-31 Instrumentman; 1931 to date Chief of Party—La. Dept. of Highways. Route 2, Baton Rouge, La.

PAPERS AND DISCUSSIONS

INDUSTRIAL SAFETY ENGINEERING

By Arthur J. Naquin(*)

When James Watt and Matthew Boulton changed the Newcomen steam engine from a "lumbering monstrosity"(1) into a practical prime mover, they accelerated tremendously the Industrial Revolution of England. Let me quickly picture for you the industrial change that took place in Britain as the American Colonies were winning their independence.

Prior to 1750, all spinning and weaving was done in the home. It was a slow and laborious operation. Only one thread could be spun at a time. Weavers were forever waiting for a supply of thread. Then, an Englishman by the name of James Hargreaves invented in 1764, a spinning wheel that would spin eight threads simultaneously. He named it the "Spinning Jenny" after his industrious wife. Within several years, the spinning jenny was improved so that sixteen threads could be spun at one time. In 1775, Richard Arkwright using waterpower, speeded up the spinning process still more, and in 1779 Samuel Crompton invented the spining mule which produceed two hundred threads at one time The weavers, now, had too much thread. Since the spinning mule produced a stronger, more uniform and cheaper product than could be made in the home, the weavers naturally purchased the material that best suited their needs. Thus came into being an important dislocation in the home-industrial life of Great Britain. The domestic system of manufacturing was beginning to totter.

The over abundant supply of thread naturally turned attention to the deficiencies of the hand powered loom. In 1785

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(1)Phrased by Ed. R. Granniss of the National Conservation Bureau in Appendix II of "Industrial Accident Prevention".

Edmund Cartwright invented the power loom which was quickly adapted to steam power drive in that same year. Again, another economic dislocation took place. Cloth made on hand looms at home could not compete with the superior and cheaper product of the rapidly growing factories and mills. Thus began a migration from the farms and villages of England to those centers of steam or water power. Manchester, for example, quickly grew from a village of some 8,000 persons to over 200,000. Let me now tell you of some of the consequences of this rapid change in the pattern of daily life of England's industrial workers.

Men, women and children long used to working quietly and unhurriedly at their homes suddenly found themselves confined in congested, poorly lighted, poorly heated and otherwise unsanitary factories and homes in mushrooming English cities. Two thirds of the workers were women and children who were compelled to work from 12 to 16 hours per day, six days per week. No laws existed to compel a shorter work day or work week, the provision of sanitary facilities, the guarding of factory machines. Experience had not yet indicated the need for such protection. The Industrial Revolution took a bitter toll in human life and misery. And England, now capable of underselling all foreign competitors in world markets, created an empire.

DEVELOPMENT OF LEGAL PROTECTIVE MEASURES

Let us now trace briefly the evolution of legal measures enacted to protect an individual worker. Prior to 1880, an injured industrial employee in England—or this country—had scant chance of receiving any recompense for his injury. Employers had three "common-law" defenses: (1) Contributory negligence; (2) Fellow-servant rules; (3) Assumption of risk. In general, injured employees, or their dependents could not break this defense. In 1880, the Employers' Liability Act was enacted in England—and was followed in this country by similar enactments; Alabama in 1885 and Massachusetts in 1887. These laws modified the three common-law defenses by requiring employers to do certain things to protect the lives and limbs of their employees. Thus, manage-

ment found it necessary and profitable to engage in a certain amount of accident prevention work. For example, in 1892, the Safety Department of the Joliet Works of the Illinois Steel Company was formed. The first safety order covered the inspection of all engine flywheels.

The real impetus to safety work was not forthcoming, however, in this country until the State of New Jersey enacted the first Workmen's Compensation Law in 1911. Previously, it had been first enacted in Germany (1885), England and Austria-Hungary (1897), France and Italy (1898), Russia (1903), and for certain U. S. Government employees—at the instigation of President Theodore Roosevelt—in 1908. In effect, Workmen's Compensation laws remove all question as to who is legally responsible for an accident. The employer—if he elects to come under the laws—must compensate all injured employees or their dependents no matter who is to blame for the accident which led to the injury. In this country, only the State of Mississippi has not enacted such a law.

With the enactment of Workmen's Compensation Laws, industrial accident prevention work passed from a moral—"I am my brother's keeper"—phase to an economic one. Industry found it necessary to protect its financial existence by generally purchasing Workmen's Compensation Insurance, the premiums of which varied more or less in direct proportion to the accident frequency and severity experience of the insured factory, plant, mine or mill. The management of large companies began to find it profitable to delegate to a certain official of the company the responsibility of preventing industrial accidents. Thus was created the job of Safety Director. Often, technical men were so designated because it would be incumbent upon them to design guards or enclosures, and so the title of Safety Engineer came into being. Unfortunately, only one industrial plant in eight has today any organized industrial accident prevention program.

WHAT IS INDUSTRIAL SAFETY ENGINEERING

Industrial Accident Prevention work rests today on the firm bedrock of trial and error, research and experimentation. In large industries such as the automobile (extant), cement, pe-

troleum, public ultities, railroad and steel, accidents have gradually been reduced and held quite near the vanishing point. For example, the Lone Star Cement Corporation of this city has operated well over five years without a lost-time accident. Such results can be duplicated when ever and where ever there is a will on the part of management to do so, plus an understanding of how it can be done. This understanding may be gained best by designating someone in authority to learn the broad principles of industrial accident prevention work. They can be learned from the National Safety Council, a non-profit organization set up in 1913 by industry for clearing-house purposes. They can be learned from text books like "Industrial Accident Prevention" written by H. W. Heinrich of the Travelers Insurance Company. Best of all, they can now be learned in the classroom in company with other key employees of industry. Today, under the auspices of the National Committee for the Conservation of Manpower in War Industries, some 25,000 key men from industry are engaged in studying a 96-hour evening school course in "Industrial Safety Engineering" at some seventy Engineering Colleges and Universities in this country. Probably 25,000 more have already completed such a course. At this very moment, up at Tulane University, a class of fifty foremen, superintendents, safety engineers and others are listening to a lecture on "Safety Training" by my colleague and associate, Mr. George Miller, who is handling my class for me tonight. Thanks to the understanding by Dean James M. Robert and Professor Arthur M. Hill of the need for such instruction in this city, some104 key employees have already received this four months course of instruction. Eighty-five more are presently enrolled. They come from nearly every large industry in this city including our many shipyards, and from local Army, Navy and other National, State and Municipal Groups. Here are some of the subjects covered in the course:

1. The Industrial Accident Problem
2. History of the Development of the Industrial Safety Movement
3. Economic Advantages of Accident Prevention Work
4. Injury Sources and Causes

5. Safety a Responsibility of Management
6. Appraising Safety Performance
7. Accident Reports and Records
8. Investigation of Accidents
9. Organizing a Complete Industrial Safety Program
10. The Three General Types of Safety Organizations
11. Qualifications of a Safety Man
12. Creating and Maintaining Interest in Safety
13. Psychology as Applied to Safety Training
14. Job Analysis and its Relationship to Accident Prevention Work
15. Safety Training
16. Plant Layout and Arrangement
17. Purchasing with Safety in Mind
18. Safeguarding Machinery
19. Handling Material Safely
20. Industrial Plant Maintenance
21. Industrial Plant Housekeeping
22. Industrial Plant Illumination
23. Industrial Plant Inspections
24. Hand Tool Hazards
25. Low Voltage Electrical Hazards
26. Prevention of Falls
27. The Prevention of Eye Injuries
28. Industrial Health Hazards
29. Organizing an Industrial First Aid Program
30. Fire Prevention, Fire Protection, Fire Extinguishment
31. Street and Highway Traffic Safety
32. Safety on the Home Front

Nearly all of these subjects require a three hour session in order to cover them. Industrial Safety Engineering consists of the application of the principles involved in the subjects outlined above.

INJURY SOURCES AND CAUSES

Time does not permit a discussion of all the subjects previously outlined. A brief examination of the sources and causes of accidents will not take too long, however, and is very pertinent.

THE FOUNDATION OF A MAJOR INJURY

00.3% OF ALL ACCIDENTS PRODUCE MAJOR INJURIES------
08.8% OF ALL ACCIDENTS PRODUCE MINOR INJURIES-------
90.9% OF ALL ACCIDENTS PRODUCE NO INJURIES----------

THE RATIOS GRAPHICALLY PORTRAYED ABOVE---1--29--300 SHOW THAT IN A UNIT GROUP OF 330 SIMILAR ACCIDENTS, 300 WILL PRODUCE NO INJURY WHATEVER, 29 WILL RESULT ONLY IN MINOR INJURIES AND 1 WILL RESULT SERIOUSLY.

THE MAJOR INJURY MAY RESULT FROM THE VERY FIRST ACCIDENT OR FROM ANY OTHER ACCIDENT IN THE GROUP.

MORAL—PREVENT THE ACCIDENTS AND THE INJURIES WILL TAKE CARE OF THEMSELVES.

ANALYSIS OF 50,000 INJURIES

CAUSES OF ACCIDENTS	50,000 INJURIES		500,000 ACCIDENTS NO INJURY	%
	MAJOR	MINOR		
DISREGARDED INSTRUCTION	491	14509	150000	30
INATTENTIVE	375	10625	110000	22
NOT INSTRUCTED	230	6770	70000	14
HASTE, FOOLING, ETC.	202	5798	60000	12
UNSKILLED	134	3866	40000	8
PHYSICALLY UNFIT	49	1451	15000	3
MENTALLY UNFIT	17	483	5000	1
MECHANICAL HAZARDS	168	4832	50000	10
	1666	48334	500000	100

NOTE—ACCORDING TO THIS ANALYSIS ANY INDIVIDUAL CAUSE PRODUCES THE SAME PERCENT OF MAJOR INJURIES AS MINOR AND NO-INJURY CASES.

THE TRAVELERS INSURANCE CO.

FIGURE 1

Injuries are caused by accidents. However, only one accident in ten[2] will generally result in an injury. Only one accident out of three hundred and thirty will generally result in a "Lost-Time"[3] injury. Therefore, management has many opportunities to observe and correct faulty conditions before they result in serious injury. See Fig. 1 entitled "The Foundation of a Major Injury."

Behind every accident is a cause. The cause may be either mechanical or personal or a combination of both.

Mechanical causes—while most numerous—account for only ten (10%) per cent of all accidents. Personal causes account for eighty-eight (88%) per cent. What are these mechanical and personal causes?

There are only six direct mechanical causes of accidents. They are:

1. Improper guarding
2. Defective substance or equipment
3. Hazardous arrangement
4. Improper illuminatoin
5. Improper ventilation
6. Unsafe dress or apparel (including lack of proper personal protective equipment)

Personal causes of accidents are:

1. Bodily defects (physical or mental)
2. Lack of knowledge or skill
3. Improper attitude

These latter personal causes usually result in a number of unsafe acts such as:

1. Operating without authority
2. Working at unsafe speeds
3. Making safety devices inoperative
4. Using unsafe equipment, or using equipment unsafely
5. Taking unsafe position or posture
6. Working or moving on dangerous equipment
7. Failing to use proper personal protective equipment
8. Distracting, teasing, startling and abusing

---

(2) (3) These ratios first worked out by H. W. Heinrich, Assistant Supt., Engineering and Inspection Division, The Travelers Insurance Company in 1929.

Unsafe acts find their origin in a person's ancestry or social environment. See Figures 2, 3, 4 and 5 for the relationship between the five factors which, in sequence, lead to an accidental injury.

FIGURE 2

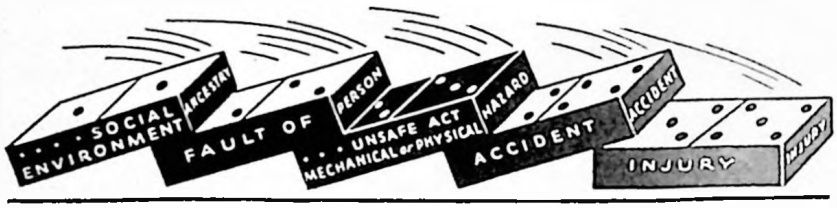

FIGURE 3

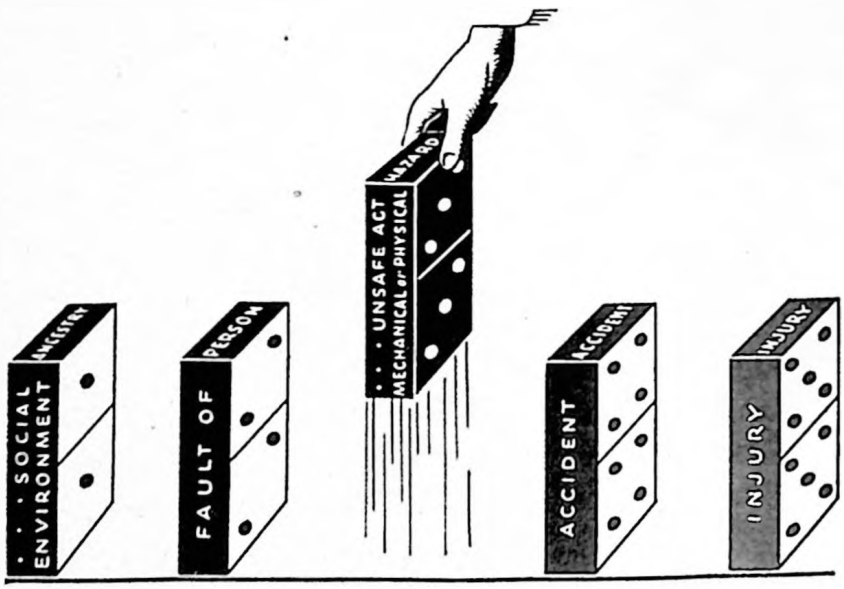

FIGURE 4

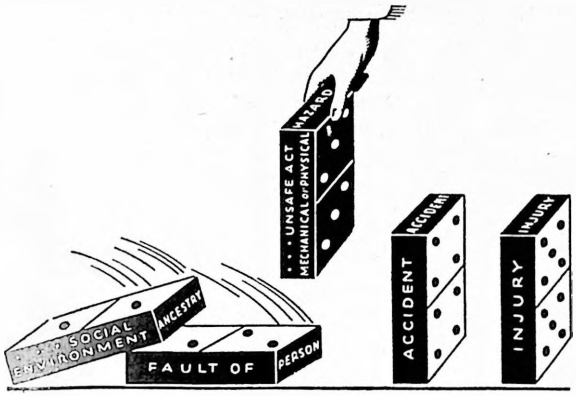

FIGURE 5

THE INDUSTRIAL ACCIDENT PROBLEM TODAY

In this year 1942 A. D. our country is faced with a problem not unlike that of the Industrial Revolution in England. Once again women are being engaged to work in ever increasing numbers in our munitions-of-war factories. Men from the mines and farms and forests are migrating to the great shipbuilding centers. Work continues around the clock with its swing-shifts and overtime. And physical deficiencies, lack of knowledge or skill, or improper attitudes like "deliberate chance taking", are taking an ever increasing toll of human lives and limbs of American workmen. What is equally important is that the war effort is being seriously hampered. If this were not true, President Roosevelt would not have made it the principal point in his address at the Dedication of the new Naval Hospital at Bethesda, Maryland on September 1st. If this were not true, General William S. Knudsen would not have made it the sole basis of his talk this past Friday night. President Roosevelt stated that the toll of industrial accidents in 1941 was 19,200 deaths, 100,000 permanent injuries, over 2,000,000 total injuries and a time loss of over 42,000,000 man days. General Knudsen, describing industrial conditions in this present year, stated that there has been an average of 11,500 American workmen killed or injured every day since Pearl Harbor.

Unless this trend is halted, America faces an ever increasing prolongation of the present armed conflict. No longer can the ranks of skilled workmen be quickly replaced. We will not meet the production schedules we are capable of meeting.

There is no quick and easy means of preventing industrial accidents. Men must be trained in the art of preventing them just as they are trained to operate a welding torch or fly an airplane. Industrial Safety Engineering as a profession beckons to men preferably with technical training and a background of practical operating experience. Right now, to speed war production, the U. S. Office of Education together with the Department of Labor is offering the Safety Course in approximately 250 centers. Industrial Safety Engineering as a course of instruction can do much to acquaint you key men with the proven principles which, if applied, will prevent accidents.

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Meeting of the Board, June 30, 1942

The meeting was called to order by President Cappel with the following present: Kerr, Kohnke, Steinmayer, Fithian and Mayer.

The minutes of the meetings of May 29th and of June 8th were read and approved.

The question of increasing the service rendered the membership by the Society was again discussed and several letters read concerning this matter. It was decided to secure for consideration as much information as possible from several engineering societies which have recently expanded their services.

A report from Mr. K. P. Kammer was read stating that his special committee had met with representatives of the Louisiana Architect Association, the New Orleans Chapter of the American Institute of Architects and the Louisiana Section of the American Society of Civil Engineers and that certain revisions were agreed upon in Section 18, Paragraph One of the Senate Bill, No. 147. It is believed that these revisions give the engineers full protection in the performance of their profession.

President Cappel announced that by recent action of the Senate Judiciary Committee the State Board of Engineering Examiners had been divorced from the Department of Occupational Standards and returned to its former status.

President Cappel announced that the resolution expressing the Society's attitude on draft deferment for qualified engineering students and faculty had been sent to General Raymond Fleming and Major J. Lester White. A reply from Major White was read stating that the interest of the Society in this matter is appreciated.

It was announced that the resolution expressing the Society's approval of the State Civil Service system had been sent to all members of the House and Senate by Mr. Charles E. Dunbar. Several replies received to date indicate that the resolution seems to be having some effect.

It was announced by the Secretary that 94 letter ballots opened on June 30th elected the following:

Members:

Francis A. Boyle, Louis W. Harrell, Leo W. Hough, James J. Saurage.

Transfer from Student to Junior Members:

Martin S. Baer, Hal C. Becker, Ralph E. Blake, Walter E. Douglas, Jr., Stanley G. Dinkel, Holmes Earl, Faurie E. Ferchaud, Irwin Frankel, W. Scott Goldman, Bernard A. Grehan, S. Kenan Manson, Jr., John M. Miazza, Irwin A. Rabenovitz, R. M. Sanderford, Jr., Raymond Sherrard, Jr., Santos V. Shields, Spencer G. Smith, Harold H. Stream, Jr., John R. Tusson, Walter J. Verlander.

The Secretary was directed to have 500 reprints made of the article "Unionism—An Issue in Engineering" which was published in the June Proceedings. The reprints are to be distributed to senior engineering students in the various Louisiana colleges this fall.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

OBITUARY OF
HAL MAGNUS BOURG

It is with deep regret that the Society recognizes the untimely passing of one of its most likeable members, Hal Magnus Bourg.

Born November 13, 1902 at Houma, Terrebonne Parish, Louisiana, he was educated in the local public elementary, parochial and high schools. Later he took a Surveying and Mapping course with the International Correspondence School, and was awarded a certificate of graduation in this course.

As a child, Mr. Bourg showed unusual talent in the art of lettering, making his spending money by printing bulletins and signs for local merchants and theaters. He was able to sublimate this hobby later in life in his application of his store of knowledge dealing with all forms of decorative lettering.

His father, the late H. M. Bourg, Sr. was Mayor of Houma, and his uncle, the late F. X. Bourg was Assessor of Terrebonne Parish. Another uncle, J. Charles Bourg was for many years City Judge of Houma.

In 1926 Mr. Bourg was appointed deputy assessor for the Parish of Terrebonne, and carried on the work required of this office with fairness and exactness.

In 1927 he accepted a position as assistant draftsman in the City Engineer's office in the City of New Orleans, and his work there consisted of general drafting, dealing particularly with city streets, water mains, sewers, etc. As a draftsman he had the qualities of neatness, originality and artistic balance, and was an expert letterer and penman.

During the large highway construction program in Louisiana in 1929, he accepted a position with the Louisiana Highway Commission in the road department, and for several years drew plans for road construction projects. Later a separate organization was set up in the Highway Commisison designated as the Map Department, and he became the engineer in charge. It was in this department and under his supervision that the highway map of Louisiana was developed from an ordinary map to an artistic informative document. By research and correspondence with other mapping agencies each succeeding issue of the Louisiana may was a decided improvement over previous issues, and he developed a corps of cartographers skilled in this particular line of work.

Mr. Bourg had a very pleasing personality and was an accomplished musician, often performing for the entertainmeent of his friends.

His passing is a great loss to the Society and to his profession. On June 2, 1929, he was married to Miss Velma Brien. He is survived by his wife, Mrs. Hal M. Bourg, his mother, Mrs. Hal M. Bourg, Sr., and a brother, Robert.

BE IT RESOLVED, That the Louisiana Engineering Society extends its profound and heartfelt sympathy to his wife and family, and that this tribute be recorded in the minutes of the Society and be published in its prodings.

H. L. LEHMANN, Chairman
N. E. LANT,
C. A. MYERS.

Minutes of the Meeting of the Society, July 13, 1942

The meeting was called to order by President Cappel with approximately 60 members and guests present.

The minutes of the last meeting were read and approved.

President Cappel announced that several letters received from members of the State Legislature expressed appreciation of the Society's motion commending the State Civil Service bill. It was also announced that one section of the Architects Bill had been revised by joint committee action and is now acceptable to both architects and engineers. President Cappel requested the membership to be seriously considering the effects of unionism on the engineering profession as some action must be taken on the question in the near future.

Chairman Ross urged the members and guests to attend the Golf Tournament on July 15th.

President Cappel appointed a committee consisting of D. W. Stewart, Chairman, F. N. Billingsley and C. W. Ricker to prepare an obituary on the death of Mr. Frank G. Frost.

Mr. Robert E. Chesnut, Designer with V. M. Friede, Inc., presented an interesting illustrated paper on "Modern Cargo Passenger Liners Designed for the Mississippi Shipping Company". A model of one of these ships was exhibited along with numerous blueprints.

The meeting adjourned with a rising vote of thanks to the speaker.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Board, August 3, 1942

The meeting was called to order by President Cappel with the following members present: Kerr, Kohnke, Stewart and Mayer.

The minutes of the last meeting were read and accepted.

A letter from Mr. Charles E. Dunbar, Jr. was read expressing the appreciation of the State Civil Service Commission for the active support of the Society during the recent legislative session. It was decided to read this letter at the next meeting of the Society.

A letter from Mr. Raymond Bassich concerning listing of engineers by the War Production Board was read. The Secretary was directed to secure further information from Mr. Bassich on this matter.

President Cappel presented a detailed financial report for the years 1940 and 1941 which had been prepared under Mr. Ole K. Olsen's direction. This report showed the records of A. M. Hill to be correct upon leaving office and those of J. K. Mayer to be correct at the end of 1941. The Board instructed the Secretary to express its appreciation to Mr. Olsen for presenting such an excellent paper.

Since no further information had been received from Mr. Peckworth of the American Society of Civil Engineers concerning expansion of certain state engineering society activities, the Secretary was directed to write Secretary Seabury of the American Society of Civil Engineers.

The following resignations were accepted with regret: Robert W. Adamson, M. J. deLerno and Arthur F. Landry. Due to Mr. Landry's statement that he had originally tendered his resignation in 1941 it was decided that the $10.00 recently sent for 1942 dues to be refunded.

Mr. Charles E. Cassagne was made Chairman of Membership Committee "A" to replace Col. H. P. Newton, who is now on active military duty.

The Board voted that dues for Student Members shall be $1.00 for 12 months and that the Proceedings of the Society be mailed to said members.

The question of inviting to the Society meetings engineer officers stationed in this locality was discussed. It was decided to request the Publicity Committee to inform the various local military bases of our wish to have the officers attend our meetings.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Society, August 10, 1942

The meeting was called to order by President Cappel with approximately 40 members and guests present.

The minutes of the last meeting were read and accepted.

Mr. D. W. Stewart presented a resolution on the death of Mr. F. G. Frost. The resolution was adopted by a rising vote of the members present.

President Cappel appointed a committee consisting of A. T. Dusenbury, Chairman, H. J. Malochee and B. S. Nelson to prepare an obituary on the death of Col. A. M. Shaw.

A letter from Mr. Charles E. Dunbar, Jr. was read expressing the appreciation of the State Civil Service Commission for the active support of the Society during the recent legislative session.

President Cappel announced that the Society is collecting information on the activities of engineering societies in other states toward combating the encroachment of unionism on the engineering profession. When sufficient information is available, a plan is to be drawn up by the Board of Direction and presented to the membership for vote. Mr. W. H. Scales suggested that the Secretary write the American Association of Engineers for information which they have collected on this subject.

Mr. W. Pat Richardson, District Insulation Engineer for Johns-Manville Corporation presented an interesting sound motion picture entitled "Heat and Its Control". Several questions were answered by Mr. Richardson at the conclusion of the film.

The meeting was adjourned with a rising vote of thanks to the speaker.

J. K. MAYER,
Secretary-Treasurer.

OBITUARY OF
FRANK G. FROST

Died July 1st, 1942

BE IT RESOLVED, That in behalf of the entire membership of the Louisiana Engineering Society resolutions be adopted in tribute to the memory of our late fellow member and distinguished colleague Frank G. Frost.

The Louisiana Engineering Society has lost by death many distinguished and beloved members. None has been more genuinely mourned by its rank and file in the sense of personal loss than is Mr. Frost.

By his death we have lost a beloved associate whose outstanding character as an engineeer reflected high honor upon our profession and whose memory is a worthy inspiration for all time.

It is fitting that we should record Mr. Frost's personal qualities as they were revealed to the members of the Society by regular contact. He was of sterling character, the genuineness of which was reflected in his gentlemanly demeanor at all times, his high-minded sense of duty to his profession, his unselfishness, his kindness, his understanding and in his wholesome good fellowship.

BE IT FURTHER RESOLVED, That these resolutions be spread upon the minutes of the Society and published in its Proceedings, and that a copy be sent to Mrs. Frost together with an expression of our sincere sympathy and heartfelt condolence.

F. N. Billingsley,
C. W. Ricker,
D. W. Stewart, Chairman.

OBITUARY OF
COLONEL ARTHUR M. SHAW

The sudden death of Colonel Arthur M. Shaw was a great shock to his many friends in the engineering fraternity.

Colonel Shaw was killed in an accident that occurred August 2nd, 1942 in Dutch Guiana near Paramaribo, where he was engaged in the construction of a Bauxite plant for producing aluminum ore.

Although 71 years old, Colonel Shaw retained the mental and physical vigor of a much younger man and after a long and interesting engineering career may be said to have "died in the saddle" as he would have wished.

Born in Lee Center, Illinois, December 12th, 1870, he attended Cornell College at Mount Vernon, Iowa. His engineering career started in 1891 and from then until 1907 he was engaged in railway work for the Illinois Central, for various interurban lines and the Mexico International Railway. As a specialist in railway engineering, he spent the period 1929 to 1933 in China as consulting engineer to the Chinese National Government during the construction

of about 350 kilometers of National Railways of China; while there he formed many friendships among Chinese engineers.

Colonel Shaw became interested in drainage and irrigation work about 1903. He was connected with a large drainage project in Lee County, Illinois and in 1909 while connected with the Drainage Department of the U. S. Department of Agriculture, he was sent to Louisiana where he became interested in the possibilities of draining our swamp lands.

During the period 1910-1917 he was chief engineer and general manager of several large reclamation projects including the Phillips Land Co., New Orleans Lake Shore Land Co., Frederick Scully Tract, Jefferson Parish Drainage District, and others. During this period he also became interested in irrigation work in Mexico, South Louisiana and Honduras. In the latter place he was a pioneer in the irrigation of banana land for the Cuyamel Fruit Co. which involved many difficult problems.

At different times during his career in the South, he was engineer for numerous other important projects including the design of two shipyards, a steel fabrication plant, a seawall project for the Mississippi Gulf Coast and a seawall project in China.

During the era of the Public Works Administration, Colonel Shaw was quite active, first as an engineer examiner and acting State Director of the Louisiana P. W. A., later as resident engineer of a large sewage project in Jefferson Parish.

His military career dates from the Spanish-American War as a volunteer engineer. During the first World War he was a major in the Corps of Engineers and connected with the construction of military camps at Camp Beauregard, Jessup, Georgia and Normayle, Texas.

During the current War he was chief engineer in charge of construction at Camp Claiborne and Polk for W. Horace Williams Co., Contractors, with whom he was associated at the time of his death.

He was the author of a number of articles on engineering subjects and was a member and past president of the Louisiana Engineering Society, member and past president of the Louisiana Section of the A. S. C. E. and member and past vice-president of the Association of Chinese and American Enigneers.

Very few engineers can point back to such a long and useful engineering career and his many friends and engineering associates feel a deep loss at his untimely death.

Be it resolved that the Louisiana Engineering Society extend its profound and heartfelt sympathy to his family in their great loss and that this tribute be recorded in the Minutes of the Society.

Respectfully submitted,

HENRY J. MALOCHEE,
B. STANLEY NELSON,
ALLEN T. DUSENBERRY, Chairman.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

OCTOBER, 1942

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXVIII. DECEMBER, 1942 NO. 6

CONTENTS

EDITORIAL NOTES AND COMMENT

In this Issue. Mr. R. E Judd of the War Production Board gives a vivid and interesting word picture of how substitutes are found and used in war production. Civilians are apt to feel that the "hard-to-get" materials in civilian life are plentiful for war production. Mr. Judd presented his paper before a joint meeting of our Society and the New Orleans Section, American Institute of Electrical Engineers. If you were unable to attend his discussion, his paper will hold your interest. Read it and find just how American ingenuity is licking this vital problem of materials.

Our Annual Meeting. Plans are again under way for the annual three-day meeting in January. The days are Thursday, Friday and Saturday, January 14, 15 and 16. On Thursday there is planned a panel discussion or clinic under the sponsor-

ship of the War Production Board. Mr. L. J. Cucullu will be chairman of this conference. He is also Chairman of the American Society of Mechanical Engineers, New Orleans Section. Representatives of the National Societies will participate. Plans for such a meeting have been under way for some time; it should prove a high-light of our sessions.

A public meeting of general interest will be held on Friday night. Saturday night marks the installation of new officers and the dinner dance.

Friday and Saturday will be devoted to inspection trips and technical sessions.

A detailed folder will be sent to each member. Plan to attend all sessions.

The Association of Commerce and the L. E. S. The minutes of the Board Meeting of November 2 outline the plan for representation of our Society in the New Orleans Association of Commerce. Engineers have little opportunity to offer their services in civic affairs. This contact with the Association should be most valuable.

Professor Derickson Honored. At a testimonial dinner on Wednesday, November 18 Professor Donald Derickson, Head of the School of Civil Engineering at Tulane, was honored by a large gathering of acquaintances and associates. Professor Derickson is a past president of the Society. The following is quoted from the speech by President Harris of Tulane University:

> "The University is very appreciative of the splendid work of Professor Derickson, both as an engineer and as a teacher. It is fitting that the graduates in Civil Engineering should honor him as they seek to do on this occasion. Such men as Professor Derickson have helped to make a great Tulane by the large measure of their activities and by their great devotion of energies in her service—for, measuring worth by devotion and service, as worth must ever be measured, his place is among those having given most. Professor Derickson has been outstanding as an engineer and a

teacher. His contributions to engineering have broght him and the University wide recognization.

Characterizing all of Professor Derickson's work has been a deep and unwaivering devotion to the College of Engineering and to the engineering profession. He has been an unselfish and untiring worker. There have always been in the hearts of his colleagues a sincere devotion to him personally for his lovable characteristics and a fond pride in his great work and achievements.

While Professor Derickson reaches the retirement age this session and will be retired, it will be necessary for the University immediately to call him back into service. The work of the College of Engineering must go on and we cannot spare Professor Derickson. We are indeed fortunate to have a man of his abilities on the faculty in that college, and I feel sure that in these times his loyalty and interest in the University and in engineering education will cause him to continue on active duty at the University.

It is difficult for an institution to show a person what an individual can express more easily. The administrators and the faculty are happy to join the Civil Engineering students, graduates of Tulane and members of the profession in New Orleans on this occasion to indicate to Professor Derickson the devotion, admiration and esteem we have for one who has been such a friend and who has meant so much to Tulane as well as to the engineering world. We hope he may always know that the fine work he is doing will be continued."

The November Meeting. On the ninth of the month a joint meeting was held with the Delta Chapter, American Society of Heating and Ventilating Engineers. Professor E. O. Eastwood, National President of A. S. H. & V. E. and Director of the Guggenheim Aeronautical Laboratories, presented an interesting illustrated paper on "The Development of the Air-

plane for its Function in the War." Unfortunately a copy of the paper is not available for publication.

Do you Know the Addresses of These Members? The Secretary does not have a correct mailing address for the following:

Clem B. Binnings	Fred H. Fenn
A. W. Brodtman	Patrick E. Garner
John F. Cassidy	Mayer Godchaux
W. A. Castille	Joseph A. Holland
H. M. Clanton	Volney F. Landry
Linton C. Cooper	Charles S. McCowan
Raymond J. Daigle	George H. Thompson
Howard F. Davis	Gerald C. Williams
William D. de Laureal	W. A. Wood, Jr.

If you can help, please use the mailing card in the back cover.

Tulane A. S. C. E. Student Chapter Wins High Honor. For the eighth consecutive year, the Tulane University Chapter of the American Society of Civil Engineers has been selected as the outstanding student chapter in the country, according to word received here from E. B. Black, National President of the Society.

In a message sent to Professor Donald Derickson, faculty advisor of the Tulane group, President Black praised the chapter for excelling above all other universities and for "conducting its affairs in a most effective and meritorious manner for the academic year, 1941-42."

The Tulane chapter's rating was decided by a special committee on student chapters of the Society. The group's record for the year was made under William O. Hudson, student president, and Santos Shields, student secretary, both of whom are now in the engineering forces of the United States Navy.

PAPERS AND DISCUSSIONS

CONSERVATION OF CRITICAL MATERIALS

R. E. JUDD*

Members of the American Institute of Electrical Engineers and the Louisiana Engineering Society, friends, ladies and gentlemen;

May I express to you first my appreciation of the honor you have bestowed upon me in asking me to be your first speaker.

Since Pearl Harbor, we of the War Production Board have spent little time in speech-making. This is no time for fancy speeches, and I am glad it isn't, for I couldn't make one. My objective shall be to secure your even more aggressive support of certain phases of the war program. I shall speak frankly. We are fighting a war which threatens every man, woman and child in America. If we lose, you and I will lose every single thing we live for . . . we don't intend to lose.

The subject given me for discussion is "Conservation of Critical Materials." Let us review for a moment the importance of this subject as it relates to the whole program. What are the problems of a war economy? Or, we might ask, what are the tools of a war program? A simple trick of alliteration might assist us in recalling them for review. These tools are men, money, machines, and materials, and not so tangible but none the less important are method, management, and mental attitude . . . and the greatest of these is men.

As the program progresses we have seen these tools shift in position of importance. A year and a half ago our prime problem was machines. The ferreting out and utilization of idle facilities has materially relieved the distress there.

The response of millions of patriotic Americans to the call to buy war bonds has caused the problem of money to fade to lesser significance for the time being, but consideration must

*District Manager, Production Service, War Production Board, New Orleans. Presented at a joint meeting of the Society of the New Orleans Section, American Institute of Electrical Engineers.

be given to the fact that all of this must eventually be paid back.

Method and management, while of prime importance, have never been first magnitude problems as America stands foremost in its ability to produce a lot in a little time.

Our mental attitude, untrammeled by the bonds of dictatorships, remains on an extremely high plain.

As more and more of our fathers and sons and brothers take their places on far-flung battle fronts, men and manpower may become our prime problem.

Today—the pinnacle of our pyramid of problems is held by **materials**, and it is with the conservation of this element of the program that we are chiefly concerned tonight.

We speak of critical materials. What are they? "Critical" is even now a comparative term. The Fifth Provisional Report on relative scarcity of certain materials was prepared by the Conservation and Substitution Branch of the Conservation Division, and has just been published. Materials are listed in three groups, ranked on the availability of existing supplies. Group I—materials on which the supplies are inadequate for war and most essential uses. Group II—material on which there are sufficient supplies for many essential needs. Group III—materials of which the supplies are adequate for all approriate types of present demands, including use as substitutes.

In Group I, and let us remember that these are the ones most critically and vitally needed for war purposes: Alcohol and toluol for explosives; alloy steel plate for tanks, and ships and guns; aluminum for planes; burlap for packing; cobalt for cutting tools; copper for planes and instruments; cotton duck for tents and leggings; cotton linters for explosives; hemp for ship rigging; phenol for plastics; tin for containers; and silk for parachutes. These are only a few of the vital needs.

In Group II, which includes materials **essential** to war industries, are acetone, antimony, cotton seed, craft paper, diamonds, ethyl alcohol, manganese, sisal, and zinc.

Group III, which is available in significant quantities and must be used whereever possible as substitutes for those in Groups I and II, include asbestos, asphalt, cement, clay, gold, paper, sulphur—these are products of mine and forest.

We are forced to admit that shortages exist. We don't have enough for all-out war production too. There simply isn't enough to go around. We are producing five million tons of steel per month—we need nine million. So it's first things first: Actual, immediate war requirements must be met, and what is left will be distributed equitably for production of essential civilian products. It follows that we shall have to make the most of what we have, "make a little do more."

What then is the solution to these shortages? What are the approaches to **conservation** of critical materials? It would seem that there are four of them. Simply stated, they are: Save, simplify, substitute, salvage.

Save!—make things last longer. Repair instead of replace. Organize maintenance. The story has been well told on the radio, in the press, and by general advertising.

Simplify!—cut out the frills and furbelows. Fewer models and styles. Redesign along functional lines.

Substitute!—use the bountiful or less critical for the more critical. Use research to develop available materials for old uses.

Salvage!—don't hold a thing just because "you may be able to use it sometime." Get in the scrap!

A few words only on this salvage phase of the program—the work is well organized to cover its various fields of activity: **Industrial Salvage,** relating to the plants; **automobile graveyard,** to handle worn-out jallopies; **special projects,** including the recovery of unused rails, bridges, etc.; and **general salvage,** relating to the home and farm. This general salvage job has recently been in large measure turned over to the press and the school children, and they are doing a most effective work. To digress a moment on the subject, a friend of mine relates how he was recently stopped on Canal Street by a chain of boys in front of Warren Easton High School by the impetuous

demand, "Hey Mister, give us your car. We need it for scrap!" You can't beat a spirit like that. It's a good thing that silver is not in Group I. Some of us might have to place a guard over the filling in our teeth . . . So much for salvage.

So far, what has conservation of critical materials meant to us besides getting in the scrap? Oh yes, we have done without a few things; we have been satisfied (or dissatisfied) with less sugar and coffee; we have done without bananas; we may be using shoe leather or street cars to conserve that precious rubber in our tires.

But let's take a look at some of the things that the Armed Services themselves have done about conservation, especially through simplification and substitution. A willingness on their part to replace what previously appeared to be absolutely essential, coupled with American ingenuity, has been responsible for changing many well-known items of warfare. Most of you are familiar with the old 30/30 rifle shell, the cartridge of which was drawn from brass using extremely critical copper by the thousands of tons. Today these are successfully drawn from steel. The use of brass had not been previously confined to these smaller shells but was used in the big ones as well. Now the 105 mm. cartridge case drawn from steel will save 12,500 tons of brass. This is only a minute part of the total saving that will be made by cartridge case conservation. Many bits and pieces formerly produced as forgings are now stamped, pressed, and drawn from steel sheet with vast savings in steel and man hours. Known cases have reduced the quantity of material by 88%. Steel stampings integrated by the process of welding are saving daily tons of aluminum for vitally needed fighter planes. An interesting sidelight on these conversions is that idle sheet metal machinery, for which little use had been found in a war economy, has been placed in operation, thus relieving a very serious bottle neck in the forging industry. In addition, these changes and modifications have not only reduced the number of operations and needs for critical machine tools, but have materially reduced the man hours required to complete the product. Valve wheels formerly made

of bronze and aluminum are now produced by mass production methods from steel wire welded on to a steel hub at 15% of the former cost and at many times the former speed. Items formerly machined from bar stock have been re-designed using smaller bar stock in conjunction with pressed steel plates joined by copper hydrogen brazing. Primer cases formerly machined from brass bar stock are now pressed from steel in three parts, using mass production methods. This item alone will save 24 million pounds of brass in projected Ordnance requirements through 1943. Primer tubes formerly made of brass have been re-designed from steel stampings with a saving of 30 million pounds of brass. Boosters, which are small safety devices used in each explosive projectile, were formerly made on automatic screw machines. These are now pressed from steel and the automatic screw machines have been released for other vital needs. I held in my hand the other day a sample suspension lug for a demolition bomb. It had been re-designed and pressed from ¼" steel plate. Its forerunner was a forging which had to be machined after forging. The result: 17,000 pounds of steel and 8,000 machine-hours were saved on one contract.

Taken independently, these items which are only a few used in Ordnance alone, effect tremendous savings. They are only a beginning. The "Tremendous Trifle" idea is now being applied to many sub and complete assemblies with annual savings of critical material running into millions of pounds, savings of millions of machine-hours, and savings of millions of dollars.

But this is not the only way conservation has been effected. Not all of the materials required for American production are found within our borders. There are some 14 imported raw materials for which we are substantially dependent on outside sources. One random example is manganese: We produce **less than one per cent** of the world's supply but use close to a fourth of the total world production.

It is a well known fact that manganese when added to a carbon steel increases strength and hardness, decreases oxygen content and mitigates the effect of oxygen and sulphur in steel.

Manganese steel contains about 12% manganese and from .08 to 1.25% carbon. If there is only 1.5% manganese, the steel is very brittle and additional manganese increases this brittleness until the quantity has reached 4 to 5.5% when the steel can be pulverized under a hammer. With a further increase of manganese, it becomes ductile and very hard, these qualities being at their highest degree when the manganese content is 12%.

Prior to the shortage, the 105 mm. HE shell was forged from manganese steel, machined, banded, and delivered without heat treating, as the original state of the forgings was of a hardness sufficient to serve the purpose of the shell. Now because of of the shortage, the amount of manganese in the shell has been reduced to approximately one half of its original percentage. To make up for this loss of manganese, heat treating has been substituted.

The shell is now hardened above its critical steel temperature, quenched, and then allowed to draw, to permit the return of the original micro structure. The result of all this is a slightly harder shell than with the original manganese percentage but a very effective saving in the critical alloy which when multiplied by the millions of shells produced is again a tremendous saving.

As mechanical engineers, you are also interested in the steel industry. Today we have a greater capacity for chewing up steel than for producing it. Those who know agree that an increase of steel foundry capacity would relieve a bottle neck that is now hampering our production program. It is to this end that we must bend our efforts toward utilizing existing facilities rather than the construction of new ones. Time and much critical materials are needed in the manufacture and installation of electric steel furnaces. Other solutions are being sought and perfected.

The restrictions on the manufacturer of automotive cylinder blocks, stoves, plumbing goods and numerous other items consumed by the general public has made idle a large percentage of the ten million tons of gray iron casting capacity in this

country. Hence these plants are available for conversion. The **cupola converter method** is available to practically every gray iron foundry in the country that is already equipped with a modern cupola capable of high temperature melting. The conversion requires a minimum of time and critical materials and affords a maximum output in comparison with the initial effort in time and materials necessary to manufacture and install electric furnaces. The conversion consists of the addition of a side blow converter, similar to a miniature Bessemer to make steel out of cupola melted iron.

Experienced gray iron foundry men can be trained in the technique of casting steel. Sand handling and mold handling facilities require very little change for the higher temperature of steel castings. Today much progress has been made and appreciable increases in steel production are anticipated.

As electrical engineers many of you are interested in the status of copper supply and demand. The current supply is in excess of two hundred thousand tons per month and is the largest in the country's history. This is by virture of increased domestic mining, increased imports, and progressive scrap collections, 31% coming from the latter.

As has already been indicated, steel has been substituted for brass and its component, copper, in many products. However, copper is non-replaceable for many essential military purposes. The front-line battleship must have two million pounds of it. No satisfactory substitute has yet been found for producing the rotating bands on projectiles.

A word about non-military uses. Some of these are as essential as the military. Light and power for industry and housing must be provided. Communications must be maintained. Aside from these and a few other uses, you could not legally buy a pound of copper with an equal weight of gold, and steel cannot perform these functions economically. Silver, however, is being used in some electrical equipment.

The situation can be summed up with the statement that the copper supply may possibly determine the amount of munitions and major war materials that can be produced.

Substitute materials have been sought to replace materials diverted to war work. Reclaimed materials and old machinery that ordinarily would lie around the scrap heaps and junk piles have been utilized as shortages develop. Simplification of manufacturing processes and consumer goods have been intensified in the interests of efficiency and increased production. This means greater emphasis on **straight production, elimination of odd sizes and off-sizes,** and **concentration on as few models** as practicable.

Much has been said about the conservation of critical materials. Many end products are also critically needed. We have recently received a request to secure from firms in our district 1500 typewriters. These are urgently needed for use in ships and bombers. Every effort is being made to induce local owners to give up at least 20% of their typewriters for this vital need. We urge your support. If you have or know of any units that are not absolutely required by the owners, please advise our office.

A word about the efforts of the War Production Board in this conservation program would not be amiss. We have secured and maintained surveys of all production facilities in our nation. Further, a perpetual inventory is kept on the idle hours available on critical machine tools through a vast clearing house. Prime contractors in Chicago are utilizing equipment in Maine and Louisiana. Subcontracting by prime contractors has been progressively promoted, and as a result, thousands of plants otherwise unable to participate are being utilized. A perpetual inventory is now being made of all construction machinery so that needs developing in one area can be satisfied, if necessary, with equipment from another, thus reducing the amount of new equipment which would otherwise have to be manufactured to handle the need.

Groups of small plants are being organized under a qualified sponsor to handle subcontracts. This has increased the reservoir of usable facilities for prime contracting. Manufacturers of automobiles survived and developed the mass market because they gave attention to every part. Costly materials

were replaced. Re-design reduced weight. Mass production reduced cost. In the competition of business every trifle becomes tremendous. In the competition of war every trifle must now become tremendous. The competition of war now resembles the competition of business in which year after year individuals and entire industries have had to find new materials, conserve by re-design, devise new methods, in order to survive! Attention had to be given to every trifle.

There is no advantage in three times the steel production, for instance, if the Axis makes theirs go three times as far. Thousands of war items that we are now making from critical materials on critical machines must be made from less critical machines. In closing, let me say that initiative and ingenuity must and will eliminate the bottle necks. Everyone can be proud of the big things that American genius and industry have accomplished to date in war production, but we are challenged now by shortages in materials and machines that are becoming ever greater obstacles to production for victory. You are challenged as engineers operating independently or in firms and plants of this great land to do your dead-level best to substitute the less for the more critical, re-design your product so as to reduce the material, man hours, and money required to produce them, standardize your lines so as to reduce the number of items required or produced by you, clear your inventories of all salvageable materials for which you do not have an immediate need, and maintain the equipment under your responsibility with a minimum of critical materials to secure a maximum amount of production.

We are not simply fighting against something. We are fighting **for** something—something so big, so far-reaching, that it outweighs any sacrifices we can make for it.

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Meeting of the Society, September 14, 1942

The meeting was called to order by President Cappel with approximately 60 members and guests present.

The minutes of the last meeting were read and accepted.

President Cappel stated that he had received information from Mr. W. H. Scales concerning a Technological Mobilization Bill now under consideration in the United States Senate. Since this bill will be of vital interest to the Engineering Profession, President Cappel appointed a committee consisting of W. H. Scales, Chairman, D. W. Godat and L. L. Newman to study the bill and submit a report on its content as well as a resolution expressing the Society's view on this matter. Unless the committee feels that this matter is sufficiently urgent to warrant special action, the resolution will be considered by the Board of Direction and printed on the next meeting notice so that a vote may be taken at the next meeting of the Society. The Secretary was directed to write Senator Ellender for further information on this matter.

Resolutions on the deaths of Colonel Arthur M. Shaw and Mr. Hal M. Bourg were read and adopted by a rising vote of the members present.

Chairman Cucullu of the Committee on Professional Advancement reported that his Committee had recommended to the Board that the Society secure a membership in the New Orleans Association of Commerce in order to win for the Society and the profession more recognition in civic affairs. President Cappel added that this recommendation had been favorably received by the Board at its last meeting.

A report from Chairman Bassich of the Employment Committee was read and accepted.

President Cappel introduced the speaker of the evening, Mr. Arthur J. Naquin, Safety Counselor for New Orleans Public Service, Incorporated, and member of the Society, who presented a most informative and interesting paper on "Industrial Safety Engineering." A large number of safety appliances and posters were exhibited and a sound film slide shown at the conclusion of the paper.

The meeting adjourned with a rising vote of thanks to the speaker.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Meeting of the Board, September 8, 1942

The meeting was called to order by President Cappel with the following members present: Kammer, Kerr, Steinmayer, Stewart and Mayer.

The minutes of the last meeting were read and accepted.

Letters from the following concerning the encroachment of unionism upon the engineering profession were read:

G. T. Seabury, Secretary, American Society of Civil Engineers

H. F. Peckworth, Assistant to the Secretary, American Society of Civil Engineers

M. E. McIver, Secretary, American Association of Engineers.

This matter was again discussed and it was decided that each member of the Board write a memorandum of his ideas on the possible services that the Society might render its members in an effort to combat unionism in the engineering profession. These memoranda are to be referred to the Committee on Professional Advancement with a request that a definite plan of action be formulated.

A letter ballot was ordered for the following applicants who had been approved by Membership Committee "B":

For Member

Philip P. Angier, J. Nelson Ball, Jr., Robert Leland Barnes, Robert Teryl Brooks, F. Tackett Clarke, Tom F. Colbert, James Blankenship Coltharp, William Lester Corley, Sylvan Cromer, Thomas Edmund Crossan, James Lewis Drake, Clarence C. Edwards, Jr., M. H. Elissalde, Frank G. Erskine, James E. Favret, Edwin Henry Goodloe, J. Clifton Hill, Melvin C. Hudgins, Ernest Joseph James, Joseph Edmund Jarman, Earle Adrian Landry, Leo Sims Lenoir, Paul E. Lirette, Edwin Lorenzo Mattison, Arthur W. McWhorter, Leo A. Nixon, Leo A. Odom, Harry T. Roberts, C. M. Scott, Robert Ira Senn, Joseph Cooper Spengler, George Franklin Stevenson, Robert H. Vaughan, Battaille Harrison Wade, Thomas Alton Watson.

For Affiliate Member

August Hoffman Douglas, Warren C. Shankle.

For Junior Member

Henry Louis Landry, Wallace Ray Mack, William Otho Martin, Luther Duncan McCorquodale, Alfred Marion Melancon, Albert B. Nevils, George Parish Sharp.

Several applications had not been approved by the Committee because of incomplete information. The Secretary was directed to write these men for further information.

A letter from B. W. Pegues, Secretary, State Board of Engineering Examiners, was read informing the Society that the term of office of B. H. Grehan as a member of the Board had expired and requesting that a list be submitted to the Governor for appointment to fill this vacancy. The following list of Civil Engineers is to be submitted:

Bernard H. Grehan
Charles M. Kerr
N. E. Lant

A letter from John Klorer was read stating that he had been unable to obtain specific information for preparing an obituary for T. M. McCarroll. The Secretary was directed to request the Committee to prepare the obituary from personal knowledge in the absence of specific information.

Resignations of Stanley G. Dinkel and Columbus Floyd were accepted with regret.

The Board approved the deficit of $99.98 reported for the Annual Golf Tournament.

There being no further business the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Joint Meeting of the Society with the New Orleans Section, American Institute of Electrical Engineers, October 12, 1942

The meeting was called to order by President Cappel with approximately 80 members and guests present.

The minutes of the last meeting were read and accepted.

An obituary on the death of T. M. McCarroll, written by a Committee consisting of John Klorer, Chairman, C. M. Kerr and R. B. Kohnke, was read by the Secretary. A motion by Mr. Klorer that the obituary be spread upon the minutes of the Society and a copy be sent the bereaved wife was passed by a rising vote of the membership.

President Cappel announced that no report had been received from the Committee appointed at the last meeting to study the proposed Technological Mobilization Bill with its regard to the bearing on the engineering profession. No further action was taken.

President Cappel turned the meeting over to Chairman J. V. Hay of the New Orleans Section, American Institute of Electrical Engineers, who presided during a brief business meeting of the Section. Mr. Hay then called upon Mr. L. J. Cucullu to introduce the speaker of the evening, Mr. R. E. Judd, District Manager, Production Service, War Production Board, New Orleans. Mr. Judd presented an interesting and informative paper on "The Conservation of Critical Materials" and answered several questions from the floor at the conclusion of the paper.

Chairman Hay thanked the speaker and turned the meeting back to President Cappel. The meeting adjourned with a rising vote of thanks to Mr. Judd.

J. K. MAYER,
Secretary-Treasurer.

OBITUARY OF

THOMAS MICHAEL McCARROLL

The news that Thomas Michael McCarroll, a member of this Society since December, 1925, had passed away on May 14, 1942, came as a shock to his many friends and acquaintances who felt that his rugged physique ensured many more years of usefulness and good health before the final summons would come.

Mr. McCarroll was born in Gainesville, Florida, November 30, 1882, and was a graduate in the Civil Engineering course of Auburn College, Alabama. Upon leaving school in 1902 he obtained employment with the U. S. Engineer Department, Fourth Mississippi River District, and rose from the lower engineer grades successively to the position of Junior Engineer in 1920. He had acquired valuable experience in the field of levee construction, flood control and and river bank protection. When a vacancy occurred on the Board of State Engineers of Louisiana in December, 1920, he was appointed by Governor John M. Parker to membership on that Board. His services were so eminently satisfactory that he was re-appointed by each succeeding Governor. He resigned this position in April, 1941, to engage more actively in the affairs of the Louisiana Savings & Trust Company, of which bank he was a Director and one of the founders.

Of a quiet and unobtrusive disposition he studiously avoided the limelight of publicity in the discharge of his official duties and endeared himself to his fellow engineers who quickly recognized his capabilities and sterling qualities.

To his immediate family, consisting of his wife, (the former Miss Helen Mixon of Florida), his son, Eugene McCarroll, two fond grandchildren and two surviving sisters, the Louisiana Engineering Society sends its condolences for their immeasurable loss, with the prayer that Time, the great healer, may assuage their grief in their present affliction.

JOHN KLORER, Chairman
C. M. KERR
R. B. KOHNKE

Minutes of the Meeting of the Board, November 2, 1942

The meeting was called to order by Vice-President Kammer with the following present: Kerr, Stewart and Mayer.

The minutes of the September meeting were read and accepted.

A committee composed of C. M. Kerr, Chairman and Harry Shutts was appointed to draw up an obituary on the death of W. S. White, Life and Charter Member, of Sulphur, La.

A report from Chairman Cucullu of the Committee on Professional Advancement was read proposing that the Society secure a membership in the New Orleans Association of Commerce in order to win more recognition in engineering affairs. The recommendation was approved by the Board and the Committee on Professional Advancement requested to proceed with the necessary details. It was decided that the immediate past president of the Society should be made the Association of Commerce representative each year. Another report from this Committee was also read, but it was decided to defer consideration of the recommendations presented until a meeting at which President Cappel can preside.

It was reported that the term of office of E. S. Bres as a member of the State Board of Engineering Examiners expired in August. The following list of Civil Engineers was selected for submission to Governor Jones for consideration in appointment a new member: F. N. Billingsley, D. W. Godat and John Riess.

Resignations of W. T. Lundy and Ralph Blake were accepted with regret.

A letter from E. A. McLellan, Chairman and Louisiana Engineering Society Representative of the Delta Junior Engineers advising the various sponsoring societies of the decision to postpone further organization efforts for the duration—due to lack of local engineers in this age group—was read and accepted.

The question of again waiving the entrance fees for new members was discussed, but action deferred until the next meeting of the Board.

It was proposed that the Society invest at least $1,000.00 in United States War Bonds. Action on this matter was also deferred until the next meeting.

A note from Mrs. A. M. Shaw was read expressing the family's appreciation of the resolutions passed by the Society on the death of Colonel Shaw.

There being no further business the meeting adjourned.

J. K. Mayer,
Secretary-Treasurer.

Special Meeting of the Board of Direction, November 23, 1942

The meeting was called to order by President Cappel with the following members present: Kammer, Kerr, Steinmayer and Mayer.

A motion by Professor Steinmayer that a Production Clinic sponsored by the War Production Board be incorporated in the Annual Meeting of the Society was duly seconded and passed by unanimous vote. This clinic is to be scheduled for Thursday afternoon and evening, January 14, 1942. Arrangements are to be made by a committee composed of representatives of the local sections of the national engineering societies and of the Louisiana Engineering Society.

The meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.