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PRESIDENT OF THE LOUISIANA ENGINEERING SOCIETY.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. III FEBRUARY, 1917 NO. 1

CONTENTS

EDITORIAL NOTES AND COMMENT

Annual Reports. Do you read the annual reports of officers and of the Board of Direction, which are published in the first issue of the year under the head of Business of the Society? They make interesting reading, and a perusal of them for this year will show that the Louisiana Engineering Society under the efficient leadership of President Young has upheld the high standard of activity which was established during the year of 1915.

An active campaign for new members had been carried on with the result that during the year forty-six new names were added to the roll. The total loss of members by resignation and from other causes was twenty, thus leaving a net gain of twenty-six. The rolls of the society now show a total of two hundred sixty-six members. This is a gratifying showing, but there are still a number of engineers in the city and in the state who should be members of the society, and the committee is not going to stop its campaign until a majority of these are brought within the fold. Those of us who had the pleasure of listening to the inspiring words of the President of the American Society of Mechanical Engineers at our anual meeting will recall that he said he considered it the bounden duty of every engineer to contribute to the general welfare and upbuilding of the profession by joining the local society and taking part in its activities.

Reports of the Secretary and of the Treasurer show that the finances are in excellent condition. The General Reserve Fund shows a balance of $732.20, while the balance in the Reserve Fund of the *Proceedings* is $658.33. The Treasurer's balance is $937.18.

The Library Fund comes up with the interesting balance of $0.01, which is evidence to the effect that the Library Committee has been up and doing, more striking evidence of which is furnished by the statement that they have expended the sum of $1,262.73 during the year 1916. Some eight hundred dollars of this was paid out for the improvements to the library room, while the balance was expended for new books, binding of journals and subscriptions to publications.

The well known enthusiasm and efficiency of our new President is a guarantee that the year 1917 will show equally fine results.

The Smoker. Again the activities of the year were brought to a close with a social function in the form of a smoker. We had the honor and pleasure of having with us as guests of the Society two distinguished representatives of the profession, in the persons of Dr. Ira N. Hollis, President of the American Society of Mechanical Engineers and President of the Worcester Polytechnic Institute, and Mr. Spencer Miller, one of the Managers of the American Society. At the annual meeting, held just preliminary to the smoker, Dr. Hollis made a brief address in which he set forth in a most interesting and inspiring way the ideal that the engineer should always keep before him both in regard to the technical side of his profession and to his duties and obligations as a citizen.

The smoker was held in the main dining room of the Cosmopolitan Hotel and was under the direction of a committee consisting of James M. Robert, R. S. Manley, Ole K. Olsen and A. M. Lockett. Fully a hundred members and their guests responded to the invitation, thus making the function a record breaker for attendance. Mr. A. M. Shaw was master of ceremonies and he pulled off a number of stunts that were very unique and made up a large part of the fun and pleasure of the evening. One of the most amusing was that in which a number of reports of various and sundry municipal schemes which had suffered the fate of being pigeon-holed were made to come forth from their seclusion and give an account of themselves. President Young delivered the annual address, his subject being "Why the Engineer? Who Is He? What Is He?" The address is published in this issue and forms an interesting commentary on the subject of the position and influence of the engineer as a factor in the progress of civilization. The professional part of the entertainment was taken care of by a "coon band", and by three young ladies, recruited from one of the high class cabaret shows, who danced and sang sentimental ditties with a fervor and spirit quite befitting the occasion. It is reported that some of the younger and more sporty members of the Society were rather angry and jealous because these same young ladies insisted in directing their songs almost exclusively towards a certain dignified professor of engineering, towards a municipal engineer of great repute, and towards a handsome and prominent young contracting engineer. It might not be out of place the next time to suggest to the committee that they take steps to see that such favors are more evenly distributed. But everybody had a good time, and congratulations are hereby tendered the committee and the master of ceremonies on the success of the function, and they have the sincere thanks of all for the hard work they did in getting up the smoker and pulling it off so smoothly.

The Petroleum Industry in Louisiana. A very interesting paper with the above title was read before the Society at its November meeting. Unfortunately the author, Mr. H. A. Pallfelt of the Standard Oil Company, was unable to be present and the paper had to be read by proxy. The absence of Mr. Pallfelt naturally limited the discussion very materially, but attention was directed to one particular point brought out by the statement in the paper to the effect that the oil industry in Louisiana was in its infancy. The industry is in its infancy, not only from the stand-point of the discovery and production of crude oil, but also, and much more important, from the stand-point of the processes of refining the crude oil and the extraction therefrom of its many useful and valuable components. It was noted that very little of the Louisiana crude petroleum is used for fuel here, the fuel oil used in New Orleans and upon the sugar plantations coming very largely from the Mexican fields. A suggestion was made by Mr. A. M. Shaw, which it would be well for the Committee on Technical Program to take up actively. That was that some person competent to handle the subject in the proper way be requested to prepare for the Society a paper upon the *applications* of the various kinds and grades of oil. The point was made that practically every operation with which the mechanical engineer has to deal is vitally dependent upon *oil,* and yet very many engineers are more or less ignorant as to the proper methods of using it, and there are no very readily available data upon the subject.

The Outing. The Louisiana Engineering Soceity used to have as one of its social activities a function known as "The Annual Outing." It consisted of an all day excursion and picnic to some point of engineering interest in the state, and members were expected to bring their families and their friends with them. Several years ago the outing was given up, partly for the reason that we had pretty well exhausted the possibilities in the way of places to which to go, and partly from the fact that the function each year was costing the Society more than it should. One of the attractive features of this excursion to many members was that they could bring their families along and in this way there was greater opportunity of promoting sociability among themselves.

A number of members have at different times expressed their regret that this function should have been abandoned, therefore this word of comment. The suggestion has been made that the plan might be tried of dropping the educational feature of the outing and just make it a purely social affair. Now that dancing forms such an important part of all our social activities, it has been further suggested that we should charter for a day one of the river or lake excursion steamers and go off for a picnic. Probably the incoming administration may find it feasible to take up this suggestion. It is presented here for what it is worth.

BOOK REVIEWS.

Bridge Engineering. By J. A. L. Waddell, C. E., D. Sc., Am. Soc. C. E. In two volumes. John Wiley & Sons, New York, 1916. Price $10.00.

Dr. Waddell has presented in this monumental book of two volumes and approximately two thousand pages, all the information acquired by him during an active practice of forty years. The illustrations are exceptionally well reproduced, and the many tables and diagrams are clear and concise. Although *Bridge Engineering* will undoubtedly take the place of the author's well known *De Pontibus* as the practicing bridge engineer's familiar book of reference, the work will also appeal to the student as a source of encyclopaedic knowledge in this branch of engineering.

Bridge Engineering covers the entire field of bridge engineering, with the exception—as is stated in the preface—of the theory of stresses and similar matter which may be found in all standard text books. Certain portions of *De Pontibus* have been revised, brought up to date, and incorporated in the new work. The author's easy, personal, almost conversational style presents to the reader the toughest of problems in a palatable and interesting manner.

The first chapter deals with the evolution of bridge engineering from prehistoric times down to the present day, and the possibilities of the future development of the science are thoroughly discussed. This is followed by a chapter demonstrating the need for the bridge specialist and treats of the services and qualifications necessary. Chapter III deals with the ordinary materials of bridge construction. Chapter IV discusses the properties of the various alloy steels suitable for bridgework, and curves are presented from which the weights of metal may readily be found for various spans. A comparison is made of the costs of spans for uniformly varying excess unit costs of nickel steel as compared to carbon steel. The possibilities of long span construction with alloy steels are thoroughly discussed. In connection with the subject matter of this chapter it will be remembered that the American Society of Civil Engineers awarded Dr. Waddell the Norman Medal for 1909 for his paper "Nickel Steel for Bridges." The subjects of dead and live loads, impact loads, the effect of centrifugal and other forces due to track curvature, wind loads, vibration and traction loads are discussed in detail in Chapters V to IX inclusive, diagrams and curves being given to facilitate the computation of these loads. The following chapter deals with methods of stress computations, and a knowledge of the standard text book presentation of stress computation is assumed. The short cuts as used by the practicing bridge engineer are discussed and an explanation of the use of the equivalent uniform live load in lieu of wheel concentrations is given, so that, aided by the tables and curves, the necessary computations are clearly explained. Chapters XI, XII, XIII and XIV are devoted to the subjects of secondary, temperature and indeterminate stresses, deflections, the combination of stresses and working stress intensities; following the practice of the author, diagrams and curves are given, with practical examples of their application. The subject discussed in Chapter XV is of the most fundamental importance, viz "First Principles of Designing," and merits the careful study of practising bridge engineers as well as students. There are fifty generalizations, or first principles, presented by the author, which are the results of long experience and observation in his special field. The importance of the work of detailing is emphasized in Chapter XVI, instructions, tables and diagrams being given for facilitating this work. Present day shop practice as affecting bridge design is treated at length and in detail in the next chapter. Chapter XVIII first classifies the various kinds of traffic and then discusses the most suitable type of bridge for any class or combination of traffic. This subject is divided under the three headings of "railway," "highway" and "combined" bridges. There follows a discussion of floors and floor systems, dealing with the various types, and the advantages and disadvantages of each as applied to various cases are dealt with. A detailed consideration of lateral and swaybracing systems for every type of bridge is given in Chapter XX. Plate girders; I beams;

simple truss spans; trestles; viaducts and bridge approaches, and elevated railroads are the subjects respectively of Chapters XXI to XXIV inclusive. The chapter devoted to cantilever bridges is most complete: the economic relations and functions of cantilevers being discussed at length. Numerous existing cantilever bridges are cited as examples and their various features commented upon. In this chapter much information new to the profession is presented. The following chapter deals with the four types (depending on the number of hinges) of steel arches. The comparative merits are canvassed and formulae are presented for ascertaining approximate weights of metal for use in design assumptions. The chapter on suspension bridges presents a novel and useful method of rapidly computing approximate quantities of metal for ordinary types of suspension bridges. Although the author states his intention of leaving the subject of movable bridges to be dealt with more fully by another, this matter is discussed probably more exhaustively in Chapters XXIX, XXX and XXXI than in any other work yet published. Reinforced-concrete bridges is the subject matter of Chapter XXXVII, in which many original formulae and diagrams for designing beams, columns; and methods of stress calculations in various members; the detailing of slabs, cantilever beams, arches, piers, etc., are fully treated. This portion of the work devoted to reinforced-concrete bridges in itself would make a most valuable addition to engineering literature. The matter of foundations in general and detail with a full discussion of various methods, is treated of in a comprehensive manner in Chapters XXXVIII to XLII inclusive. Field and construction engineers will gather much useful information from the chapter on expedients in design and construction. The work preliminary to actual bridge design is given thorough attention in Chapters XLVI to LI inclusive and also in chapter LIV. Aesthetics and economics of design are discussed in Chapters LII and LIII. The next two chapters are devoted to quantities of materials of the various kinds used in bridge construction; and the preparation of estimates, specifications, contracts and reports are treated at length subsequently. Field engineering and the inspection of all kinds of materials of construction form the subject matter of Chapter LIX. Business matters relating to engineering and questions of an ethical nature are exhaustively dealt with in the five following chapters. Specifications for the design of superstructures, substructures and reinforced-concrete bridges are given in complete detail; and a chapter is devoted to complete specifications governing the construction of superstructure, substructure, approaches, etc, By the aid of these design and construction specifications the work of preparing plans and specifications preparatory to calling for bids on any class of bridgework is greatly facilitated. The Glossary of Terms relating to bridge engineering given in Chapter LXXX is probably the most complete ever published, and will no doubt prove of great value in aiding the student to an understanding of many technical terms which otherwise would be slowly acquired by many years of actual experience.

As a general work of reference for engineering students and practicing bridge engineers, and as supplementary to the standard text books, "*Bridge Engineering*" will be found invaluable.

F. H. FRANKLAND.

PAPERS AND DISCUSSIONS

WHY THE ENGINEER? WHO IS HE? WHAT IS HE?

By

SAMUEL YOUNG,

Presidential Address, Delivered Before the Society, January 13, 1917.

To speak of the engineer and his relation to the rest of mankind is but to thresh over old straw, from which has already been gleaned almost the last grain of new ideas.

Still, in spite of all that has been said and written on the subject, the world at large seems no nearer to enlightenment as to the identity of the engineer than it was a century ago.

Does even the street gamin have to be told what relation the doctor bears to the social organism, what the lawyer or the minister? Certainly not—these relationships are well understood by all.

On the other hand, I wonder if there is an engineer who has not been asked the question, over and over, and usually by intelligent people, "what does an engineer do—what is his work?" To the average person, an engineer is an animal who stands up straight on his hind legs, using his fore paws to help him sight through a telescope. The writer well remembers an occasion when he was traveling in a remote section of the country in search of a party of engineers who were making surveys for a railroad. He met a "native" on the road and asked him if he had seen any engineers or surveyors in that vicinity. "Yes, I saw three men stobbing across the prairie this morning"—"one who stobs," (not even "one who stakes"), being his definition of an engineer. The same definition would no doubt be entirely satisfactory to about 98 persons out of every 100, though the average man might go so far as to make the distinction betwen military engineers and civil engineers, that military engineers wear brass buttons and civil engineers do not, or he might designate a mechanical engineer as one who operates the engine in an ordinary power plant.

The question which naturally arises in this connection is, why is this true—why does the world fail to understand the engineer, why fail to place him in his proper relationship to the rest of mankind? As the engineer is so intimately associated with almost every step of material progress which the world has made and is making, one answer to the question might be said to be illustrated by the man who, after spending about half an hour diligently searching for his spectacles, at last finds them still securely hooked behind his ears but otherwise resting safely on his forehead, just above his eyebrows. The application is obvious. One doesn't spend much time thinking about or appreciating his nose—unless he happens to be subject to hay fever—but he uses it to smell with just the same.

That is one way of explaining the submergence, so to speak, of the Engineering Profession. But, let an engineer make a serious mistake in his work,—then you will see him, with his professional identity, come to the surface of the great social sea, like a dead fish after an explosion of dynamite in the waters where he swam.

As the individual wishes to enjoy a certain personal identity in the community where fate has placed him, so does the Engineering Profession wish to have a standing commensurate with the importance and the dignity of its achievements. However, it is not within the scope of this paper to deal with the ways and means which might be employed to accomplish that worthy aim. Let us be content with referring to a few of the engineer's activities.

To what might we liken this stupendous and terrible European war with the engineer eliminated? As well try to imagine that wonderful play, "Hamlet", with the Prince of Denmark left out; or a monster ship adrift on the high seas without machinery to direct her course; or an eagle standing aloft on his rocky perch, strong of wing and vigorous in body but suddenly deprived of that keen vision which so accurately directed his flight. Further comparisons are unnecessary.

The engineer does not boast of his genius because it has been able to bring forth those terrible implements of destruction with which, for more than two years, some of the most civilized nations of the world have wreaked their vengeance and poured out their awful wrath upon one another. But justly may his bosom swell with pride over the contemplation that, whether in peace or in war, his masterful ability, infinite pains and untiring effort have overcome tremendous difficulties, and that he has, at least in large measure, been able to accomplish the results that have been demanded of him.

One of the most difficult of the large problems which confront every great city of the world is the safe and expeditious handling of the vast multitudes of people who daily throng the streets in pursuit of their vocations and pleasures. The captains of industry have called upon the engineer to provide ways and means of transportation. With energy and resourcefulness, the engineer has responded to the call, and, as a result, we have the great steel tubes affording safe pasage underneath the channel of the broad Hudson river, the labyrinth of subways of New York, Chicago, London and Paris, and the thousands of electric lines which traverse the streets of every city.

The fabulous values of real estate in the congested centers of the large cities created a demand for a maximum of floor space for a minimum of ground area, and here again the engineer has risen to the occasion and has constructed the modern skyscraper with its fifty-two stories of height piercing the region of the clouds.

So, we might enumerate achievement upon achievement—the building of the Panama Canal, the great bridges of the world, the tunnels of almost unlimited length, the perfection of wireless telegraphy, and of the flying machine, the under-seas boat, etc., etc., until it would seem that, with time and financial backing available, the scope of the genius of the engineer recognizes no other obstacles.

Samson slew a thousand men with the jaw bone of an ass. To-day, a ten-year-old boy with a small rifle could put a Samson out of business in two minutes. Yet the jaw bone of an ass would be about as effective against the modern implements of warfare as would be the small rifle.

An eminent authority has said that "war is the most highly specialized and scientific profession in the world to-day." The European war which is raging at this time certainly bears eloquent testimony to the above statement. When we stop to think that large opposing armies, facing each other within hailing distance for months and months, are unable to advance even a few yards, it seems remarkable, but such is the case. The men on both sides are brave, well trained, seasoned soldiers and they are led by officers who have proven their ability. Then why does not one side or the other advance? The answer is obvious —the game is being played strictly and absolutely according to scientific principles and both sides have developed these scientific methods to such a degree that human bravery and skillful maneuvers are of secondary importance. It is a far cry from Samson's jaw bone of an ass to the most modern machinery of warfare, and to the engineer belongs the greater part of the credit for the development. Even within the period since this terrible war began, the improvement in methods and in war machinery has been remarkable.

As the play at the theater could not go on without the stage manager, so it is in this great war drama now being acted on a stage of grand proportions and magnificent settings. The engineer is the stage manager—he arranges the settings and provides the paraphernalia. If it were possible to eliminate the engineer from the one side but not from the other, no doubt the play would soon come to an end.

When a commanding officer decides to attack, he first calls on his engineers to investigate and report on the physical aspects of the country—the topography must be known and maps made, he must know the nature of the soil, the condition of highways and of railroads, all of which are important elements in the success or failure of a charge. In many instances, temporary bridges must be constructed in order to cross armies over rivers. Sanitary systems must be provided if an army is to remain long in one position. Much depends on the judgment and the clear vision of the engineer in all of these matters and he is absolutely indispensable as a part of an army organization.

Modern battle cruisers plow through the surface of the sea with the speed of express trains and they are able to give battle, with telling effect, at a distance of almost 12 miles. The latest and most improved guns and other war machinery for use on land are equally as efficient, and trenches, barricades, etc., are all being constructed scientifically and according to carefully developed plans.

Railroads and highways, well layed out and substantially constructed, affording safe and rapid transportation for armies and supplies, are perhaps equally as important in war as are guns, air machines and other war equipment.

All of these things, whether battle cruisers, dreadnaughts, U-boats, air machines, death-dispensing guns, or railroads and highways, all are children of the engineer's brain.

But, as I have already remarked, the engineer experiences a certain feeling of pride and satisfaction, not because he has been able to make war so terrible, though this may in the end go a long way toward preserving peace, but rather because he has accomplished the things that were demanded of him by the rest of mankind and because of the consciousness that he has done his work well.

But, after all, perhaps the most important role the engineer will be called on to play, in connection with this terrible European war, will be his part in the readjustment after the conflict of arms is over. Industrial plants have been destroyed, railroads, bridges, and magnificent highways have all felt the scourge of war, yawning craters and gaping trenches, like ugly wounds, now mar the once beautiful landscapes, and splendid buildings now bear the scars of shot and shell.

These things must be restored and again the engineer will be called on to do his part. He will set about the task, gigantic though it be, with the same zeal, the same energy and the same honesty of purpose which have ever characterized the Profession and he will do his work well.

THE PETROLEUM INDUSTRY IN LOUISIANA.

By

H. A. Pallfelt,

Read Before the Society, November 13, 1916.

Gas escapement in low, marshy places has attracted attention since the State was first settled. Active search for oil and gas, however, was not undertaken until about 1890, and again resumed in 1901. The Spindletop Field near Beaumont, Texas, was discovered at that time, and this discovery lead to active development of Louisiana Coastal Fields. The Jennings Fields were discovered in 1901, the Caddo Oil Field in Northwestern Louisiana in 1904, the Crichton and Naborton Field in 1914 and the Elm Grove Gas Field in 1915.

General Conceptions: Louisiana is located entirely within what is known as the Mississippi Embayment Area. At the beginning of the Eocene Period, the Gulf extended inland to Cairo, Ill., as an apex, the shores being formed by the older cretaceous rocks. Since that time the embayment area has gradually filled in towards the Gulf with sands, clays, silts, etc., so that a traveler starting at the cretaceous—tertiary contact, and going Southward, encounters the successive younger formations.

Stratigraphy: The formations exposed in Louisiana range from recent quaternary to and including the Eocene Wilcox. A few isolated cretaceous out-crops are known to exist; these, however, are found in connection with Saline Domes.

Oil and Gas Horizons: The principal gas horizon in Louisiana is the Nacatoch Gas Sand, which is of cretaceous age. This sand has an average thickness of about one hundred and thirty feet, and produces large quantities of gas in the Caddo, Shreveport, Elm Grove and Naborton Field, and produces a heavy grade of oil in the Vivian Field. The Nacatoch Sand is reached in the above described fields at depths of seven hundred to eleven hundred feet below surface; in the Pelican Field, where same has produced a little oil, it was reached at about thirteen hundred feet.

The Woodbine sand is the prolific oil-producing formation in Northern Louisiana, however; gas is also produced from this sand. In the Caddo Field the Woodbine is reached at twenty-two to twenty-four hundred feet, in the Crichton Field at twenty-six hundred feet, in the Naborton Field at twenty-four hundred feet, and in the Pelican Field at about three thousand feet.

Structure: The general structure in Louisiana is very simple. As before mentioned, the disposition of the formations took place in a Southeasterly direction towards the Gulf; accordingly the prevalent dips are toward the Southeast.

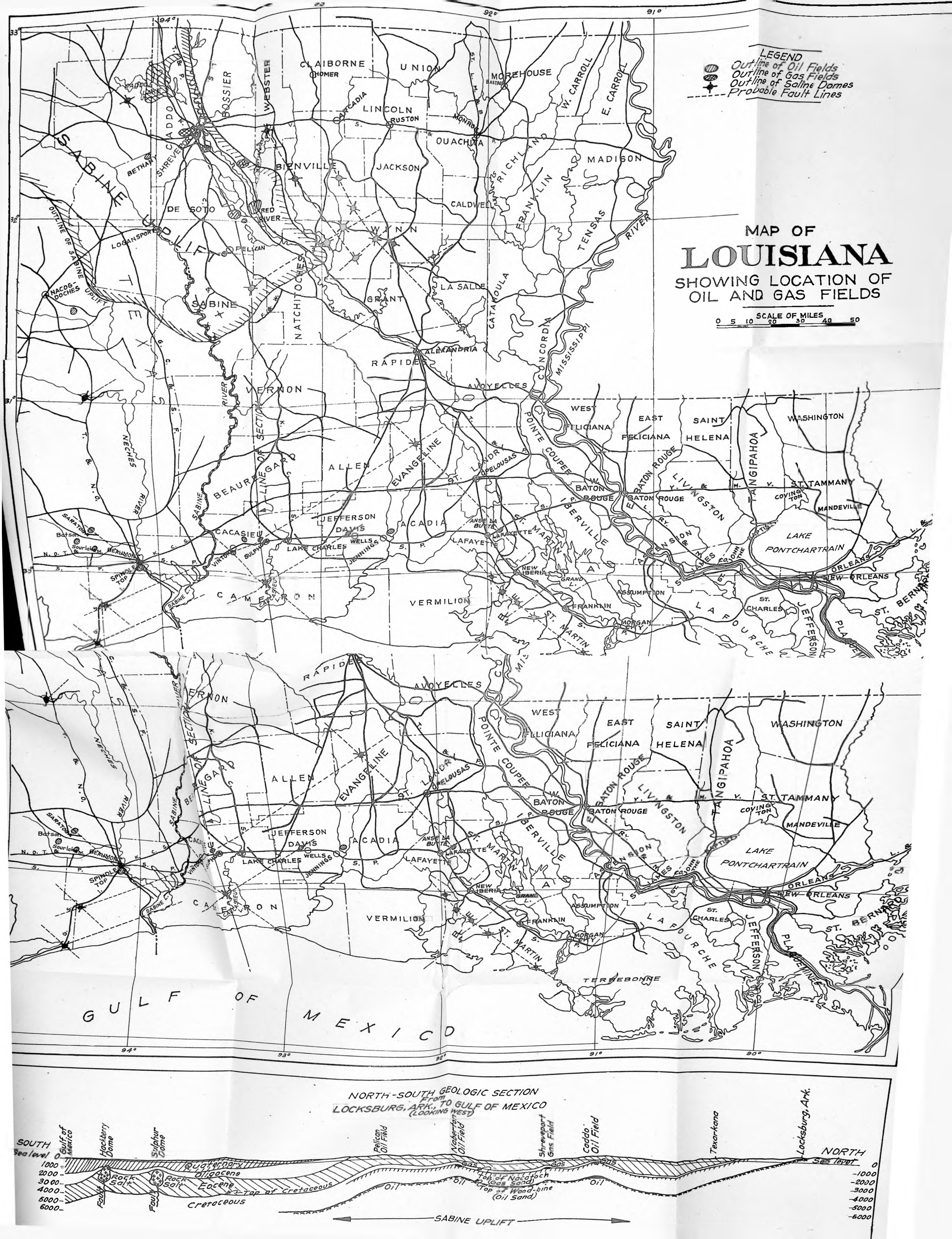
Sabine Uplift: This area is outlined in plan map, and Structure is shown on section. The Sabine Uplift is a large area which is structurally higher than the surrounding areas. Accordingly the Nacatoch Sands and the Woodbine Sands are reached at less depth on the Sabine Uplift than outside of this area.

Saline Domes: The distribution of these domes is shown on plan map. At present these domes are thought to be located at the junction of deep seated faults; these fault lines are also shown on plan map. The areas of the earth's crust were evidently weakened at these places and so offered opportunity for the salt water to circulate vertically, in so doing these waters cooled and deposited the salt in the form of a large salt plug which bulged the adjacent formation upward. Several Saline Domes in Northern Louisiana show cretaceous out-crops, so that the deformation caused by the crystallization of the salt at these places was between a thousand and sixteen hundred feet.

Alignment of Domes: The plan map shows probable fault lines along which the Saline Domes seem to be located. The alignment is about parallel to the older faults of the cretaceous rocks, and also parallel to the cretaceous—tertiary contact. Search for Saline Domes should be carried on with the above clearly in mind.

Accumulation of Oil and Gas.

Anticlinical Theory: Study of the known oil and gas fields has clearly shown that a certain relation exists between the accumulation of oil and gas and structure.


MAP OF
LOUISIANA
SHOWING LOCATION OF
OIL AND GAS FIELDS
SCALE OF MILES
0 5 10 20 30 40 50
LEGEND
Outline of Oil Fields
Outline of Gas Fields
Outline of Saline Domes
Probable Fault Lines
GULF OF MEXICO
SABINE UPLIFT
NORTH-SOUTH GEOLOGIC SECTION
From
LOCKSBURG, ARK., TO GULF OF MEXICO
(LOOKING WEST)
SOUTH
NORTH
Gulf of Mexico
Hackberry Dome
Sulphur Dome
Pelican Oil Field
Naborton Oil Field
Shreveport Gas Field
Caddo Oil Field
Texarkana
Locksburg, Ark.
Sea level
Quaternary
Oligocene
Eocene
Rock Salt
Fault
Top of Cretaceous
Cretaceous
Gas
Oil
Top of Nacatoch (Gas Sand)
Top of Wood-bine (Oil Sand)
SABINE UPLIFT

Given a pervious layer as sand or sand rock charged with oil, gas and salt water, sealed above and below by impervious layers as clay and shale, the oil, gas and salt water will separate according to their specific gravities. This separation will more easily take place if the beds, instead of being horizontal are folded into domes or anticlines. The oil and gas fields in Louisiana are all located in connection with structural features, such as domes and anticlines, or in connection with Saline Domes. The first accumulation may be termed as Stratum Oil and Gas, the other as Saline Dome Oil and Gas.

Stratum Oil and Gas: Here the oil and gas occur in one certain layer or stratum accumulating in the structurally high areas of such stratum. The Caddo, Shreveport, Elm Grove, Crichton, Naborton and Pelican Fields are examples of this kind of oil and gas accumulation. The oil and gas in all of these fields are indigenous, that is, occur within the formation therefrom they are produced, the accumulation being due to structure.

Saline Dome Oil and Gas. Here the structural deformation is caused by the growth of a Saline Plug which bulges the overlying formations upward. This results in structure which is favorable for oil and gas accumulation, such accumulation occurring about the periphery of the salt nucleus. The oil and gas in this case are endigenous, that is, come from other layers, generally from below, into a layer in which finally trapped and produced. The oil fields at Jennings, Edgerly, Welsh and Vinton are fields of this nature. In general, however, it may be said that the Saline Dome Oil Fields are erratic and uncertain in production, whereas the Stratum Oil Fields are regular and steady.

II.

The natural oil fields of Louisiana are growing year by year, and according to the latest comparative figures issued by the United States Government it ranks fifth in production, having passed West Virginia since the Conservation Commission of Louisiana made its last report.

For the year 1914 the standing of the leading oil producing States of the Union was, in barrels:

California	99,775,327	Increase 2.03 per cent.
Oklahoma	73,631,724	Increase 15.81 per cent.
Illinois	21,919,747	Decrease 8.26 per cent.
Texas	20,068,184	Increase 33,70 per cent.
Louisiana	14,309,435	Increase 14.49 per cent.

III.

Accredited by the United States Government with having one of the greatest natural gas fields in the country, Louisiana was among the states that exceeded in 1914, the output of the previous year. Standing sixth in the production of gas in 1914, being exceeded only by the states of West Virginia, Pennsylvania, Ohio, Oklahoma and Kansas, in the order named, Louisiana is forging rapidly ahead.

IV.

The bulk of oil production is now in the northern part of the state, covering the parishes of Caddo, DeSoto and Red River, with some little oil in Sabine Parish, and several recently completed gas wells in Bossier Parish.

TOTAL SHOWING OIL PRODUCTION IN BARRELS BY YEARS OF THE LOUISIANA OIL FIELDS FROM 1901 TO 1915 INCLUSIVE.

Year	Jennings	Welsh	Anse la Butte	Edgerly	Vinton	Caddo	De Soto	Red River	Total
1901...............	Oil Disc.	....	Oil Disc.	....	....	....	....	....	....
1902...............	548,617	Oil Disc.	....	....	Oil Disc.	....	....	....	548,617
1903...............	892,609	25,162	....	....	....	....	....	....	917,171
1904...............	6,683,066	35,892	....	....	....	Oil Disc.	....	....	6,718,958
1905...............	8,891,416	10,000	9,000	....	....	....	....	....	8,910,416
1906...............	9,025,174	23,936	25,000	....	....	3,358	....	....	9,077,538
1907...............	4,842,520	47,316	60,385	....	....	50,000	....	....	5,000,000
1908...............	5,111,577	31,555	145,805	....	....	499,937	....	....	5,788,874
1909...............	1,966,614	26,169	37,930	....	....	1,028,818	....	....	3,059,531
1910...............	1,626,159	54,724	44,018	....	26,701	5,090,793	....	....	6,841,395
1911...............	1,180,177	27,901	62,411	....	2,454,103	6,995,828	....	....	10,720,420
1912...............	1,105,711	22,140	25,000	....	932,639	7,177,949	....	....	9,263,439
1913...............	790,648	31,144	6,612	Oil Disc.	1,888,864	9,781,560	Oil Disc.	Oil Disc.	12,498,828
1914...............	412,036	18,629	18,623	586,376	1,465,302	7,572,254	3,834,593	401,622	14,309,435
1915...............	Total from all fields...............								18,414,802

VI.

Caddo Parish has been the center of development in North Louisiana. The discovery of oil in this parish has run in sections or pools in the northern part of the Parish, extending practically from the Arkansas line south for a distance of some twenty miles, and extending east from the Texas line from twelve to fifteen miles, the oil being found in pools at irregular intervals through this territory, principally along the western side of the parish, and from the town of Vivian south to the Mooringsport Pool. From Vivian production has followed a northeasterly course into what is called the Houston District where the shallow heavy oil is found. What is termed heavy, or fuel oil, is that which is graded by the pipe line companies as of a gravity below thirty-eight degrees Baume, while the light oil is of a gravity above thirty-eight degrees Baume and brings a higher price.

Gas is found throughout this territory and produced in commercial quantities. It is also found in and around Shreveport; and recently there have been completed in the territory south and west of Shreveport, within a radius of about ten miles a number of gas wells, but no oil has been found, as yet, in this section.

In De Soto Parish the production is at present confined to practically two townships, namely township twelve north of twelve west, and township thirteen north of twelve west, being mainly in the northeastern part of township twelve north of twelve west, and in the southeastern part of township thirteen north of twelve west. The development extends in a northeasterly direction into the Parish of Red River, where oil was first produced in 1914, and the production greatly increased during the year 1915. Owing to no new development, the production is now practically at a standstill. A number of gas wells have been completed in De Soto Parish, and are being used for commercial purposes, but only two or three gas wells of any consequence have so far been developed in Red River parish.

Development through North Louisiana is very scattered extending from the north end of Caddo Parish to the southwestern part of De Soto, then into the northern part of Sabine parish, and back through Red River and Bossier parishes, with an occasional wild cat well in other parishes, making it very difficult to cover the entire district, because of the distance between points of development and the inconvenience in getting from one point to another.

During the past year there have been drilled in the north Louisiana district something like 519 wells, which are distributed as follows:

	De Soto-Red River, including Sabine Parish.			Caddo Parish.		
Month (1915)	Oil	Gas	Dry	Oil	Gas	Dry
January	6	0	5	9	0	1
February	12	3	7	6	0	2
March	16	2	3	7	0	2
April	28	2	7	10	0	4
May	32	1	2	5	1	2
June	27	0	5	7	1	6
July	37	1	16	4	0	3
August	33	1	5	8	3	3
September	33	2	4	3	1	7
October	26	0	5	3	2	9
November	19	3	1	12	1	7
December	22	6	11	1	3	3
Totals	291	21	71	75	12	49

The oil found in the different parishes is of a somewhat different quality or grade, according to locality. The Caddo light oil being the highest grade, with the De Soto oil next. The oil found in Red River parish has been found to be not as good for refining purposes as the De Soto and Caddo oil, and consequently does not bring the same price—while the Caddo heavy or fuel oil is the lowest grade. The difference in the oils according to their specific gravities is as follows:

Caddo Light Oil	45.5 Degrees to 38 degrees Baume
Caddo Heavy	38 degrees to 19 degrees Baume
De Soto	38 degrees to 41.5 degrees Barme
Red River	40.5 degrees to 42.5 degrees Baume

The prices of oil have varied considerably according to market conditions during the past year. The lowest price for Caddo heavy oil, that is, oil below 38 degrees, being reached about March 26th when the market went to 35c per barrel, while the highest price of the year was reached about December 28th when the market went to 80c per barrel. The lowest price for Caddo Light Oil was about March 24th when the market dropped to 60c per barrel, and the maximum price was reached December 28th at $1.20 per barrel. Up to about July 16th De Soto and Red River oil were classified together at the same price, but at that date, with De Soto Oil at 50c, a change in grade was made and the price of Red River Oil reduced to 35c. The minimum price of De Soto Oil was reached about March 24th at 50c per barrel, and for Red River Oil about July 16th at 35c, and the maximum price for De Soto Oil was reached December 28th at $1.10, and for Red River Oil the same date, at 85c per bbl.

The total production of oil for the year 1915, taking pipe line runs as a basis, is as follows:

Caddo	6,047,260 Bbls.
De Soto and Red River	8,519,167 Bbls.
Edgerly	1,318,926 Bbls.
Vinton	1,181,035 Bbls.
Jennings	308,297 Bbls.
Welsh	24,267 Bbls.
Anse la Butte	30,000 Bbls.
Estimated runs to Shreveport refineries (not included in above figures)	985,750 Bbls.
Total	18,414,802 Bbls.

or at an approximate average price of 80c per barrel, $14,731,-841.60. This was in increase over the production for 1914, in round figures of 4,100,000 barrels.

The gas production in Louisiana has kept pace with the oil production, and the north Louisiana fields are furnishing natural gas for Shreveport, La.; Little Rock and Pine Bluff, Ark., and Marshall, Texas, but it has proven somewhat difficult to estimate the actual amount of gas produced, but it is roughly estimated at 27,261,260,000 cubic feet during the year 1915 produced in these fields at an average value of 2c per thousand cubic feet, or $545,225.20.

It is probable that no other industry in the state has developed with such rapidity from the insignificant amount of oil produced in 1902 (548,617 barrels) with only small capital invested, to the vast production of 18,414,802 barrels in 1915, with many millions of dollars invested by small and large companies, and while showing such enormous growth in the above mentioned period, it is probable that the Petroleum Industry is as yet in its infancy.

It can therefore readily be seen that the Petroleum Industry has become one of the chief factors in the industrial and commercial life of the State of Louisiana.

DISCUSSION.

THE CHAIRMAN: Is there anybody here who will volunteer to take Mr. Pallfelt's place, and answer questions?

MR. ANDERSON: There is a gentleman here this evening, who, though I do not wish to impose upon him, I believe is probably very capable—I am sure is capable—of answering some of the questions asked him, and no doubt a great many. I see here the professor of Industrial Chemistry at Tulane University, Professor Williamson.

THE CHAIRMAN: Have you anything to say, Professor, on the oil industry in Louisiana?

PROFESSOR WILLIAMSON: Mr. Chairman, I know less about this than Professor Anderson does.

THE CHAIRMAN: It is too bad, with such an opportunity to enlighten us, that Mr. Pallfelt could not be here to-night. There are a great many interesting questions that could have been asked him, I am sure. But there must be somebody here that has some acquaintance with the oil industry.

Is there no one who has anything to say on the subject?

MR. GREGORY: Mr. Chairman, in the closing of the paper, Mr. Pallfelt tells us that he believes the petroleum industry is probably in its infancy. That is interesting news, right now, with the increasing cost of coal, and there is quite a movement, I find, in the City of New Orleans, in the power-plants, to use fuel oil. I think the fuel oil that is being used here is mostly Mexican crude, but the fact that Louisiana and Texas are so rich in fuel oil will be a great factor in the development of this section, both as a manufacturing section, and in the way of supplying fuel to power plants, for drainage and for irrigation, and such purposes as will require power; and I think that is particularly true right now, when the price of coal has soared up as it has.

THE CHAIRMAN: I had hoped Mr. Pallfelt would say something about fields nearer home—for instance, Terrebonne Parish. In that parish a gentleman named Knapp—I don't know whether he represented himself or some big oil interests—drilled six or seven wells. Those wells varied in depth from 1800 to 3300 feet. In some of the wells he struck tremendous gas pressures; I don't recall at what depths they were, but they were estimated at close to one thousand pounds. In none of the wells, Mr. Knapp tells me, did he strike rock, and there was no means of anchoring his wells. The pressure was so great, even in the case of the deepest wells, that in a very short time it caused the alluvial soil to go through the screen, and come up through it into the well in a form which he characterized as "spaghetti" —in long strings of silt. Pretty soon that clogged up the well completely, and he knew—or he told me he knew—of no means by which they were ever going to hold those wells. But he is satisfied, in his own mind, that somebody will come along, after a while, with much more money than he has, and will strike a field there. He says he spent something over half a million dollars in his various adventures in Terrebonne and the eastern part of St. Mary Parish. With this tremendous gas pressure he found, it is certain that there is a great supply of gas there, which could be easily piped to New Orleans and to all this territory.

Prof. Williamson: Mr. Chairman, I said that I would not say anything, but there are one or two questions I did want to ask the author of the paper, to-night. In the first place, I am much interested in his statement that the oil industry is in its infancy. That has quite a significance, to me, from two standpoints. One is, it is in its infancy from the standpoint of the development of the oil industry, reckoned from the discoverer's point of view, of oil deposits; the other is, it is in its infancy as to the number of possible products that we might get from crude oil. The industry has been practiced in a conservative way, and yet in a wasteful way. The number of compounds and the quantity of such compounds we have gotten from crude oil in the past has been limited, but is now on the increase as a result of the study and application of physical chemistry. I do not mean to bring in chemistry as the all-important cause of develoment with reference to the products to be derived, but I do mean to say that the application of some of the principles of physical chemistry has brought out new products, as well as greater quantities of the products already being produced. Now, we might cite, as an example of this, the work of Rittman, which has increased the production of gasoline—or light oils, as we are disposed to call them—from the oil, in reference to the old process. We may refer to the work of Schnelling, which is just as important as Rittman's but which has not received as much notoriety, because it did not go through the public press first, but which is, if anything, as potent a process for the cracking of oil as Rittman's process. Now, the signifiicance is this, it does not apply merely to gasoline, because there are many other products that can be gotten, but to the number or varied number of products which we may finally realize from crude petroleum, which may be of importance industrially.

Now, on the second hand, the development of the oil industry is especially interesting because we rarely find oil alone; we generally find gas somewhere close about. We have not developed the gas-fields of Louisiana to any great extent, except the Caddo field, and it has not been brought to the City of New Orleans,—for reasons not given. But if we could develop the gas-fields of Louisiana, which, if the report of the United States Geological Survey be true—or the surmise of that geological survey be true—promises to be among the largest fields, we may expect, accompanying that, (and that is the significant portion of it to my mind), a vast or immense development of industrial enterprises, as a result of cheap fuel in the form of natural gas. I might cite, for example, that if we had natural gas in New Orleans the sand that is dredged by the Jahnckes would not go to Shreveport—or all of it would not go to Shreveport—for the making of glass. I might cite silicate of soda as an important product which could be made if we had cheap fuel. I might venture a surmise on the production of cheap electrical power, if we had natural gas at hand. It is a question in my mind whether we cannot yet produce electrical power by the gas engine almost, if not quite, as cheaply as we can by means of water power. I have no data to support that, but that, coupled with the nature of our resources here, namely, sulphur, salt, some limestone—(quite a bit, if we take into consideration our shells), which are good limestone for certain purposes,—would open an immense field.

So I think the statement there, which I wished to ask about, that the oil industry is in its infancy, has a greater application than simply the discovery of new wells—or new deposits. I think it has a greater significance when looked at from the standpoint of industrial development, not only of Louisiana, but of the adjoining states.

THE CHAIRMAN: Professor Williamson, I do not like to expose my ignorance, but with reference to the cracking process in use, with regard to gasoline, I know that such a process exists, but have never acquainted myself with the process. Is it too long a subject to state briefly how that is done?

PROF. WILLIAMSON: To be perfectly plain about it, I do not know in detail how it is done. I know in a general way, but there is an element of secrecy with regard to oil work, so that even those of us who are supposed to know something about it know very little.

MR. HUTSON: Mr. Chairman, to get up and display my ignorance concerning your statement with reference to drilling for oil and finding gas, in gumbo, and not being able to hold it, I got the impression, from talking with a man from the Caddo field, that within recent years they had learned, in that field, how to put down a successful oil well where there was no rock at all. The way they did it, after they had learned the location of the gas deposit, was to drill down almost to it with a large casing, and then pump down the cement until they had made quite a lump of artificial rock there. They then drilled down through that artificial rock, and set their gas-pipe as if they were discovering the gas in a rock formation. Now, whether that system would be practicable in Terrebonne, and enable them to put down successfully a gas well or not, I do not know. It may be they found gas in a porous stratum, overlaid by gumbo, and they could put this lump of concrete there and hold their well anchored, and keep it from blowing out, as some of the early gas-wells in the Caddo field did. It may be they could not do that in Terrebonne.

I know there has been a great advance, in recent years, in the practice of the drillers in the Caddo field. It is a good deal different from what it used to be when they drilled around Beaumont, where if they struck gas they had a blow-out. They have learned to hold down a pipe in spite of very heavy gas pressure.

The Chairman: Has any other member anything to say on the subject?

Mr. Malochee: I wanted to say, Mr. Chairman, that I was very glad to hear Professor Williamson speak about the development of the gas industry. It struck me, while Professor Gregory was speaking about the use of oil under boiler plants, that if we are going to have a true conservation of our valuable assets in Louisiana we ought not to burn the oils that we are getting out of Louisiana soil, and, as a matter of fact, there is very little of it that is burned. I understand practically all of the oil burned to-day in New Orleans and in the sugar district is Mexican petroleum; I do not believe it is any of our Louisiana product; and it seems to me that there is so much more value to oil when it is broken up into its constituent oils—light oils, asphaltum, etc., as demonstrated by these different processes where they are trying to get more gasoline out of oil,—that it is almost criminal to be burning oil under boilers, unless it be such oil as cannot be broken up. On the same basis, we have been sending our cotton to the New England mills at from six to fifteen cents, and paying from twenty-five to thirty cents, or one dollar and a half a pound for the same cotton when manufactured. It seems to me that material we have here in Louisiana ought to be, if possible, conserved by being,—well, so to speak, manufactured into what is really valuable material, as compared to the raw stuff.

And the question of the coal proposition, I believe, is simply a temporary one. The high price of coal, I do not think, can possibly stand very much longer, and it seems to me that many people are making a mistake, just because of a few months—or even a couple of years—of the high price of coal, to be throwing away so much of our valuable material, raw material, that we have in Louisiana, if we are burning Louisiana oil. But I am glad to say I do not believe any of the fuel oils of Louisiana are being used in that way. I was speaking, recently, to a man who was selling oil for the Standard Oil Company, and, to illustrate what he told me,—he said he had prices on fuel oil, that these prices were given him, and that if he handed a contract into the office, as he had done on one or two occasions, these contracts had to be submitted to New York. In both instances they had been rejected at the price, given to him; so that, as I understand it, when he was given prices those prices were always subject to revision by the powers that be. That appears to me to indicate a tendency which I am glad to see, a lack of—or at least a holding back of our oil supply in Louisiana for purposes of burning under boilers.

THE CHAIRMAN: Is there anybody else who has anything to say on the subject, this evening?

MR. SHAW: I would like to suggest something for the consideration of the Program Committee, the committee on technical papers. This paper to which we have just listened outlines the general subject of oil production, and the talk by Professor Williamson has given us a proper idea of the possibilities as to what may be secured from these oils. There are, however, quite a number of the members of the Society who are still in the class to which I belong, who are dealing more or less with oils and who know practically nothing of the proper application of the various grades of oil to their particular work. If we could have a paper written in more or less popular style, which would list the various classes of oil suitable for use in certain types of internal combustion engines, and classes of oils which are suitable to be used only as fuel, and the manner in which these different oils are to be used, I think it would be of a good deal of value. Such a paper might state the relation between the specific gravity of oils and their flash points, and other matters which enter into the use of these oils in internal combustion engines. It was only a short time ago I was so absolutely ignorant in this respect that I did not know that in specifying the specific gravity I had not covered all the details necessary to insure the quality of oil required for a given purpose; in fact, that there was practically no relation between the flash and burning point of light oils and their specific gravity. If a paper could be written out, in popular style, covering these practical uses of oils, as applied to our local practice, it would be of great value to the Society.

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ROBERT M. O'BRIEN, (1916), Superintendent of Equipment, N. O .Ry. & Lt. Co., 5315 Camp St., New Orleans.

FOSTER OLROYD, (1901), (1915), City Electrician, 516 Pelican Ave., New Orleans.

OLE K. OLSEN, (1905), Contracting Engineer, 822 Perdido St., New Orleans.

J. H. O'NEILL, (1916), Sanitary Engineer for the Louisiana State Board of Health, 936 Arabella St., New Orleans.

J. DEVEREUX O'REILLY, (1912), Engineer, Board of Commissioners of the Port of New Orleans, Liverpool & London & Globe Bldg., New Orleans.

H. A. PALLFELT, (1914), Civil Engineer, Standard Oil Co. of La., P. O. Box 1250, New Orleans.

ARSENE PERRILLIAT, (C. M.), Consulting Engineer and Managing Engineer Hercules Construction Co., Ltd., 821 Hibernia Bldg., New Orleans.

ALFRED RAYMOND, (1900), General Manager, Drainage Operating Department Sewerage and Water Board of New Orleans, City Hall Annex, New Orleans.

C. T. RAYNER, JR., (1909), Chief Engineer, Board of Levee Commissioners, Orleans Levee District, 2116 Canal St., New Orleans.

LYMAN C. REED, (1907), Vice-President and Manager of the United Electric Sales Co., 926 Lafayette St., City.

HAMPTON REYNOLDS, (1910), General Contractor, 1304 Carrollton Ave., New Orleans.

JOHN RIESS, (1906), Engineer and Contractor, 503 Hibernia Bldg., New Orleans.

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

J. M. ROBERT, (1908), Associate Professor of Machine Design, Tulane University, New Orleans.

E. H. ROUSSEAU, (1907), (1916), 935 N. Solomon St., New Orleans.

GEORGE H. RUGGLES, (1914), Engineer, with Ford, Bacon & Davis, care Ford, Bacon & Davis, New Orleans.

F. J. SCHWAB, (1911), (1915), Engineer, with N. O. Ry. & Lt. Co., 201 Baronne St., New Orleans.

ARTHUR M. SCOTT, (1915), Engineer, with Ole K. Olsen, Concrete Engineer, 822 Perdido St., New Orleans.

J. H. SEAMAN, (1912), Salesman, Westinghouse Elec. & Mfg. Co., 1012 Maison Blanche New Orleans.

G. ARTHUR SEAVER, (1911), Office Engineer, with George J. Glover, General Contractor, 2011 Marengo St., City.

CHAS. H. SHAPLEIGH, (1915), Ass't. Engineer to Assistant to the President, N. O. & N. E. R. R., 1002 Q. & C. Bldg., New Orleans.

JAMES S. SHARP, (1915), Resident Engineer, N. O. & N. E. R. R. 816 Burdette St., New Orleans.

A. M. SHAW, (1910), Consulting Engineer, 1001 Hibernia Bldg., New Orleans.

F. E. SMITH, (1916), Engineer, with Planter Fertilizer & Chemical Co., 3149 Chartres St., New Orleans.

CHAS. E. SNYPP, (1911), Engineer, with Southern Cotton Oil Co., Gretna, La.

W. L. STEVENS, (1917), Architect and Engineer, 312 Whitney-Central Bldg., New Orleans.

EDGAR L. STREAM, (1915), Consulting Engineer, care Vaccaro Bros. Co., New Orleans.

ALFRED F. THEARD, (C. M.), Principal Assistant Engineer in charge of Drainage, Sewerage and Water Board of New Orleans, City Hall Annex, New Orleans.

FRANK J. TRELEASE, (1916), Engineer, with Ford, Bacon & Davis, care Ford, Bacon & Davis, 921 Canal St., New Orleans.

PAUL UHLICH, (1906), 201 Baronne St., New Orleans.

WALTER P. VILLERE, (1909), 3231 Grand Route St. John, New Orleans.

GILBERT D. VON PHUL, (1916), Contracting Mechanical Engineer, 322 Hibernia Bldg., New Orleans.

FRANK H. WADDILL, (1898), 407 Tulane-Newcomb Bldg., City.

GEORGE D. WADDILL, (1911), Junior Engineer, U. S. Engineer Office, 5219 Camp St., New Orleans.

J. D. WALKER, Ass't. City Engineer, Room 21 City Hall, New Orleans.

JACKSON W. WATERS, (1915), Superintendent A. G. Thomas, 2611 Canal St., New Orleans.

ALFRED L. WEBRE, (1913), Mechanical Engineer, 643 Magazine St., New Orleans, La.

THOS. WHITE, (1912), care American Creosote Works, Station B., City.

BEN WILLARD, (1900), Local Manager, General Electric Co., care General Electric Co., Maison Blanche Bldg., City.

WM. H. WILLIAMS, (1908), Member of Firm of Doullut & Williams, Civil Engineers and Contractors, 1016 Hibernia Bldg., New Orleans.

CHAS. S. WILLIAMSON, JR., (1916), Associate Professor of Industrial Chemistry, Tulane University, New Orleans.

THOMAS L. WILLIS, (1907), Principal Assistant City Engineer, City Engineer's Office, New Orleans.

VICTOR L. WILLOZ, (1900), Superintendent of Distribution, N. O. Ry. & Lt. Co., 201 Baronne St., New Orleans.

J. NORMAN WILSON, (1911), Ass't. Engineer, Drainage Construction Dept., Sewerage and Water Board of New Orleans, 2823 Dante St., New Orleans.

R. C. WILSON, (1911), Consulting Engineer, 7911 Elm St., New Orleans.

PEYTON W. WOOD, Member of Firm B. D. Wood & Bros., Submarine Engineers and Contractors, 314 Hennen Bldg., New Orleans.

A. A. WOODS, (1911), Superintendent, N. O. & N. E. R. R., Press and Levee Sts., City.

DURALD F. WOODS, (1915), Assistant Engineer, City of Gretna, 2618 Coliseum St., New Orleans.

W. B. WRIGHT, Division Engineer, Sewerage and Water Board of New Orleans, City Hall Annex, New Orleans.

SAMUEL YOUNG, (1911) Consulting Engineer, 1002 Perrin Bldg., New Orleans.

HENRY L. ZANDER, (1898), Parish Engineer for Jefferson Parish, Engineer 1st and 2nd Good Roads Districts, Engineer 2nd and 5th unit 4th Jefferson Drainage District, 821 N. Rampart St., New Orleans.

NON-RESIDENT MEMBERS.

WM. E. ATKINSON, (1911), State Highway Engineer, Board of State Engineers, Highway Dept., Room 104, City.

CHAS. D. BABBITT, (1911), Private practice and real estate, Gueydan, La.

JOS. P. BERANGER, (1915), care Punta Alegre Sugar Co., Punta San Juan, Cuba.

MERRILL BERNARD, (1917), Parish Surveyor, Acadia Parish. Engaged in Surveying and Engineering practice. Crowley, La.

A. L. BLACK, (C. M.), Engineer, with Ford, Bacon & Davis, 921 Canal St., New Orleans.

C. W. BOCAGE, (1909), Civil Engineer, Houma, La.

EDWARD W. BRES, (1915), Inspector, U. S. Engineers, U. S. Eng. Office, Q. & C. Bldg., New Orleans.

R. W. BRINGHURST, JR., (1912), P. O. Box 192, Alexandria, La.

HENRY F. CAMERON, (1914), General Manager, Lake Charles Railway, Light & Water Works Co., care Lake Charles Ry. Lt. & W. Co., Lake Charles, La.

E. H. COLEMAN, (1911), Ass't. Engineer, with J. F. Coleman, Consulting Engineer, 920 Hibernia Bldg., New Orleans.

JNO. DE M. CRAWFORD, (1916), Engineer, with U. S. Engineers, 4th Mississippi River District, 12th Floor, Q. & C. Bldg., New Orleans.

L. C. DATZ, (1906), Engineer Southern Properties, United Gas & Electric Engineering Corporation, 21St and 1St Ave., Birmingham, Ala.

A. D'HEUR, (C. M.), Vice-President and General Manager, Kern Trading & Oil Co., 1058 Flood Bldg., San Francisco, Cal.

LEANDER P. ELBERSON, (1911), Crowley, La.

S. WALLACE ELBERSON, (1911), Engineer, with A. M. Lockett & Co., Crowley, La.

FRANK E. EVERETT, (1914), Drainage Engineer, Franklin, La.

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

FRANCIS T. FOOTE, (1909), Manager People's Lumber Co., Kaplan, La.

LOUIS J. FORTIER, (1914), Junior Civil Engineer, U .S. War Department, U. S. Engineer's Office, New Orleans.

JAMES McC. FOURMY, (1916), Manager and Engineer, C. E. Cate Estate, Hammond, La.

FRED. I. GETTY, (1915), Manufacturer of Oil Well and Water Well Supplies, Strainers, Pumps, etc., 603 Cutting Ave., Jennings, La.

C. H. GILLEAN, (1912), 1625 Second St., City.

W. A. HALLER, (1913), Engineer, with Federal Light & Traction Co., Federal Lt. & Trac. Co., 60 Broadway, New York City, N. Y.,

EDWARD J. HENRIQUES, (1915), Ass't. Engineer, with Xavier A. Kramer, Consulting Engineer, Magnolia, Miss.

CHARLES L. JACOB, (1911), Engineer, with Jarret-Chambers Co., Inc., Contractors, 357 West 119th St., New York City.

E. S. JARRETT, (1909), President, Jarrett-Chambers Co., Inc., Contractors, 30 East 42nd. St., New York City.

EUGENE W. KERR, (1911), care Cuban Cane Corp., Havana, Cuba.

XAVIER A. KRAMER, (1911), Consulting Engineer, Magnolia, Miss.

L. A. LOUSTALOT, (1913), Frnaklin, La.

THOS. WATTS MADDUX, (1914), Engineer, with Brookhaven Gravel Co., Brookhaven, Miss.

THOMAS A. MEANS, (1914), Member of Firm of Symmes, Means and Chandler, Agricultural Engineers, 58 Sutter St., San Francisco, Cal.

HENRY A. MENTZ, (1915), Engineer, with Xavier A. Kramer, Consulting Engineer, Magnolia, Miss.

ARTHUR R .MIELLY, (1915), With Eng. Dept. Missouri Pacific Railway, Monroe, La.

CHARLES W. OKEY, (1911), Engineer in charge Reclamation Project of Combahee Company, Whitehall, S. C.

WM. C. OLSEN, (1914), Resident Engineer for Gilbert C. White, Consulting Engineer, P. O. Box 56, Durham, N. C.

GUY OSBORNE, (1913), Engineer, Black River Cypress Co., Sardinia, S. C.,

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

HENRY NEWTON PHARR, (1908), Olivier, La.

H. A. PHILIPPI, (1912), Superintendent of Construction, U. S. Engineer Office, Vicksburg Engineer District, P. O. Box 421, Vicksburg, Miss.

OTTO F. REISZNER, (1916), General Engineering Practice, Lecompte, La.

W. B. ROBERT, (1911), Parish Engineer, Opelousas, La.

M. P. ROBERTSON, (1898), (1916), 906 N. Boulevard, Baton Rouge, La.

ERNEST A. ROSE, (1915), Rocky Ford, Colo.

JOHN A. SALMEN, (1911), Vice-President, Salmen Brick & Lumber Co., Ltd., Slidell, La.

T. H. SAMPSON, (1900), Manufacturer of Sampson Process Gum Lumber, Helena, Ark.

REGINALD McC. SCHMIDT, (1915), Inspector, U. S. Engineer Office, 1023 Leontine St., New Orleans.

GEORGE SELMAN, (1908), 615 N. 4th St., Monroe, La.

HOBART D. SHAW, (1917), Engineer in charge, Shore Protection, City of Gulfport and Harrison County, Miss., Gulfport, Miss.

JAS. SHERRARD, JR., (1910), Ass't Engineer, American Bridge Co., Erecting Dept. 1712 Widener Bldg., Philadelphia, Pa.

FRANK SHUTTS, (1909), Lake Charles, La.

FRED N. SHUTTS, (1913), Parish Engineer, Calcasieu Parish, La., Lake Charles, La.

JOHN A. SILSBEE, (1915), Engineer, with Tidal Oil Co., P. O. Box 1088, Tulsa, Okla.

REINIER, SWART, (1898), Baton Rouge, La.

IRA W. SYLVESTER, (1901), Consulting Engineer, City Hall Bldg., Alexandria, La.

J. A. THORNTON, (1911), Morgan City, La.

WM. F. TRIGGS, (1914), Gueydan, La.

THOS. H. TUTWILER, (1898), Engineer, Memphis Railways Co., Memphis Rys. Co., Memphis, Tenn.

W. A. VAUGHN, (1912), Reece, Kansas.

WM. VON PHUL, (1908), Vice President and General Manager, United Railroads of San Francis o. 58 Sutter St., San Francisco, Cal.

ALLEN E. WASHBURN, (1908), Port Eads, La.

W. S. WHITE, (C. M.), 918 Parkerson Ave., Crowley, La.

MAYBIN H. WILSON, (1912), Asst. Engineer, Northwestern Pacific R. R., P. O. Box 220 Sausalito, Cal.

RESIDENT ASSOCIATE MEMBERS.

R. M. BAUMBACH, (1911), Manager, Eugene Ditzgen Co., 615 Common St., City.

H. W. FLETCHER, (1914), Manager, Clyde Iron Works, 416 Carondelet St., City.

GEORGE J. GLOVER, (1916), General Contractor, 1022 Whitney Bank Bldg., New Orleans.

JULES GODCHAUX, (1899), Raceland, La.

BYRON LYONS, (1914), Engineer, with Board of State Engineers, 1503 Carrollton Ave., New Orleans.

EDWIN L. POWELL, (1914), President New Orleans Cuban Steamship Co., 1531 Exposition Blvd., New Orleans.

ROGER B. QUINCY, (1915), Manager, New Orleans District, Robert W. Hunt & Co., Engineers, 1022 Hibernia Bank Bldg., New Orleans.

JOHN J. STEADHAM, (1912), Supervisor of Bridges and Buildings, N. O. & N. E. R. R., 1228 Music St., New Orleans.

F. W. STEVENS, (1909), Manager New Orleans District Sales Office, Allis-Chalmers Mfg. Co., 719 Maison Blanche, New Orleans.

J. M. VANDERVEER, (1916), Vice-President, American Creosote Works, 1429 Jackson Ave., New Orleans.

W. E. WAKEFIELD, (1916), Engineer, with A. M. Shaw, Consulting Engineer, 1709 Baronne St., New Orleans.

STILLMAN W. WHEELOCK (1914) Manager of Sales, Carnegie Steel Co., 1030 Maison Blanche, New Orleans.

NON-RESIDENT ASSOCIATE MEMBERS.

EDWIN C. BROWN, (1915), Traveling Salesman, 1105 Linwood Blvd., Kansas City, Mo.

RESIDENT JUNIOR MEMBERS.

JOHN A. BROOKSHIRE, (1913), Engineer, with Sewerage and Water Board of New Orleans, 1217 St. Roch Ave., New Orleans.

JAMES J. BULLIUNG, (1915), Draftsman, N. O. Ry. & Lt. Co., 201 Baronne St., New Orleans.

ASHLEY CALONGNE, (1914), Engineer, with S. A. Calongne & Sons, Paving Contractors, 403 Hibernia Bldg., New Orleans.

A. HAROLD DELBERT, (1913), 4730 Prytania St., New Orleans.

RALPH EARL, (1913), 1419 Henry Clay Ave., New Orleans.

EDWIN JOSEPH FISHER, (1913), Electrical Contractor, 2316 Camp St., City.

A. M. FROMHERZ ,(1915), Engineer, with Fromherz & Drennan, Architects and Builders, 1133 Fourth St., New Orleans.

H. M. HAYNE, (1914), 3222 Prytania St., New Orleans.

FRANK L. HOLT, (1915), Draftsman, N. O. Ry. & Lt. Co., 201 Baronne St., New Orleans.

E. M. HORNOT, (1912), 1528 Harmony St., New Orleans.

SAMUEL D. JACKSON, (1916), Estimator, E. M. Lockett & Co., Ltd., 533 Baronne St., New Orleans.

WILHELM EMILE KOCH, (1913), Engineer, with Julius Koch, General Contractor, 2627 Coliseum St., City.

R. B. KOHNKE, (1911), Ass't. Engineer, Sewerage and Water Board of New Orleans, 2506 Berlin St., New Orleans.

WALTER B. MOSES, (1912), (1916); Engineer, with A. M. Lockett & Co., Ltd., 533 Baronne St., New Orleans.

SHEPARD F. PERRIN, (1915), General Contractor, 1421 Napoleon Ave., New Orleans.

ROBERT A. PIERPONT, (1915), 1036 Napoleon Ave., New Orleans.

FRANK R. SHAW, (1913), 4481 De Montluzin St., New Orleans.

CLIFFORD H. STEM, (1914), Ass't. City Engineer, 7933 Poplar St., New Orleans.

NON-RESIDENT JUNIOR MEMBERS.

GEORGE O. ALLAIN, JR., (1916), 542 63rd Ave., West Allis, Wis.

G. C. BADGER, (1913), Engineer, with General Fire Extinguisher Co., No. 1 Liberty St., New York.

M. A. BERANGER, (1915), Ass't Engineer, Borderland Sugar Co., San Benito, Tex.

F. R. DUVIC, (1916), Engineer, with U. S. Engineer Office, Q. & C. Bldg., New Orleans.

WILLIAM F. EBLEN, (1916), Engineer, with Houston Light & Power Co., Houston, Tex.

JACOB F. MULLER, JR., (1912), Engineer, and Ass't. Secretary and Treasurer United Gas & Electric Engineering Corporation, 2100 First Ave., Birmingham, Ala.

HERBERT P. NATHAN, (1913), with Curtis Aeroplane Co., 180 W. Ferry St., Buffalo, N. Y.

CARL SCHNEIDER, (1916), Engineer, with Freeport & Mexican Fuel Oil Corp., Meraux, La.

LUCIEN J. TROXLER, JR., (1915), 11 Willoughby Ave., Brooklyn, N. Y.,

HORACE M. WHITE, (1915), Ass't. Engineer, Louisiana & Arkansas Railway, P. O. Box 112, Stamps, Ark.

STUDENT MEMBERS.

H. HESTER BATE, 7901 Poplar St., New Orelans.
EARLE A. BERRY, 3721 D'Hemecourt St., New Orleans.
JOHN CALLAN, 1712 Baronne St., New Orleans.
WALTER COOKE, 1025 Alvar St., New Orleans.
JOSEPH M. GWINN, JR., 7405 Burthe St., New Orleans.
E. C. HAWKINS, Tulane University, New Orleans.
JOSEPH W. JOACHIM, 626 Second St., New Orleans.
ALBERT J. LEGETT, JR., 1439 Frenchmen St., New Orleans.
JOHN A. O'BRIEN, 1030 Nashville Ave., New Orleans.
FRANK E. SPRAGUE, 802 Peters Ave., City.
LOUIS E. STOUSE, 382 Broadway, New Orleans.
FRANK A. TURNER, 4401 Carondelet St., New Orleans.
DAVID L. WIEDMAN, McDonoghville, La.
VENNARD WILSON, 1221 Constantinople St., New Orleans.
ALLAN L. WOLFF, 1522 Aline St., New Orleans.
CHARLES J. WYLER, 530 Jackson Ave., New Orleans.

SUMMARY.

Resident Members	134
Non-resident Members	65
Associate Members	12
Non-resident Associate Member	1
Junior Members	24
Non-resident Junior Members	9
Student Members	21
Total	266

PAST OFFICERS.

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
Jas. C. Haugh	1911
D. S. Anderson	1912
A. M. Shaw	1913
W. H. Williams	1914
L. C. Datz	1915
Samuel Young	1916

Vice-Presidents.

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

Secretary and Librarian.

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

Treasurers.

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

Directors.

Thos. L. Raymond....1898
A. C. Bell....1898-1899
F. T. Llewellyn....1898
Frank M. Kerr....1899-1900
Henry J. Malochee....1899
T. H. Tutwiler....1900-1901
Ernest D. Ivy....1900-1901-1902
Alf. Raymond....1901-1902
John M. Ordway....1902-1903-1904
A. C. Duval....1903-1904-1905
W. McCorkindale....1903
C. W. Wood....1904-1905-1906
E. L. Jahncke....1905-1906-1907
John Riess....1907-1908
W. B. Gregory....1909
Marcel Garsaud....1908-1909-1910
J. W. Armstorng....1909-1910
A. M. Lockett....1910
A. M. Shaw....1911-1912-1914
L. C. Reed....1910-1911-1912
D. S. Anderson....1911-1913
W. B. Gregory....1912-1913-1914-1915-1916
L. C. Datz....1912-1913-1914-1916
A. T. Dusenbury....1913-1914
Ole K. Olsen....1915-1916
W. H. Williams....1915
R. S. Manley....1916

DECEASED.

CHARLES H. DICKINSON, C. M., December 13th, 1898.
EDGAR L. LAMBERT, R. M., March, 1901.
H. BOLIVAR THOMPSON, C. M., July 10, 1901.
THOS. L. RAYMOND, C. M., November 15, 1901.
GEO. A. LEDERLE, R. M., March 27, 1905.
JOHN T. NORTON, R. M., July, 1905.
FRANCIS V. PELLERIN, R. M., March 31, 1908.
JUDGE JOHN CLEGG, Assoc. M., October 5, 1908.
JOHN MORSE ORDWAY, Hon. M., July 4, 1909.
HENRY B. RICHARDSON, C. M., August 22, 1909.
CHARLES W. WOOD, R. M., April 3, 1911.
BENJAMIN MORGAN HARROD, C. M., September 7, 1912.
JOHN D. WHITE, N. R. M.
JAMES C. HAUGH, R. M., July 6, 1913.
J. C. HENRY, N. R. M., December, 1914.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, Dec. 11, 1916.

The meeting was called to order with President Young in the chair. and Messrs. Dusenbury, Gregory, Klorer, Olsen and Hogg present.

The minutes of the previous meting were read and approved.

Communications—A communication from Mr. F. H. Newell, Chairman of Committee on Engineering Co-operation, was read. Mr. Newell stated that it had been decided to hold the next conference in Chicago during the latter part of March or early in April, and urged our Society to send a delegate. The Secretary was instructed to reply that we will use our best efforts to send a delegate as we are very much interested in the movement.

A communication from Mr. F. H. Newell, chairman of the Committee on A National Water Law of the American Society of Civil Engineers, was read. Mr. Newell stated that he was interested in the suggestion of our Committee for a permanent engineering commission to decide questions coming under the law, and hoped that we would submit an outline how such a commission should be constituted.

Resignations—The resignations of Messrs. Louis Jacoby, Resident Member, and E. F. Emmer, Student Member, were accepted with regret. The resignation of Mr. Leo Steckler, student member, was ordered laid over.

Applications—Applications of Messrs. A. N. Goldberg for transfer from Student to Resident Member, and Merrill Bernard for admission to Non-Resident Member, approved by the Membership Committee, were ordered to ballot. Applications of Messrs. B. H. Grehan for transfer from Non-Resident Junior to Resident Member, and P. B. Jeffries for admission to Non-Resident Member, were ordered to ballot subject to approval of Membership Committee.

Applications of Messrs. H. H. Bate, J. A. O'Brien, F. A. Turner, D. W. Wiedman, A. L. Wolff, for Student Member were ordered to ballot. Applications of several Seniors in Mechanical Engineering Course at Tulane University could not be secured in time for the meeting. These applications were ordered to ballot if approved by Mr. W. B. Gregory.

Prospective Members—A list of engineers who might be eligible to membership in the Society was submitted by the Membership Committee. It was moved and carried that the list be printed and mailed to the membership.

Certificate of Membership—The question of issuing a certificate of membership to members who may desire one was taken up. It was moved and carried that a vote be taken along with the ballot for officers to ascertain the attitude of the membership towards same.

Bills—The following bills were approved for payment:

Tulane University Press, printing and postage	$ 7.35
Pobert H. Scott, tracing map for Proceedings	6.00
Army Service School, books for library	4.50
Eugene Dietzgen Co., boks for library	84.30
Smith Stencil Works, rubber stamp for library	1.58
Electrical World, subscription	3.00
Engineering News, subscription and book	8.00
Owen Gernon Co., binding five volumes	6.50
W. T. Hogg, Secretary, salary and incidentals	36.20

Statements—The financial statements of the General Fund and Cash Account were submitted by the Secretary.The statements showed a balance for eleven months of 1916 in the General Fund, $679.74, and Cash on hand after paying bills, $710.34.

New Business—It was moved and carried that the following proposed change in Section 2 of Article VII of the Constitution of the Society be submitted to the Society for formal action:

Present section reads: Honorary members shall be proposed by at least ten members and shall be elected ONLY BY UNANIMOUS VOTE OF THE SOCIETY.

Amended Section to read: Honorary members shall be proposed by at least ten members and shall be elected BY THE BOARD OF DIRECTION.

There being no further business the meeting adjourned.

W. T. HOGG, Secretary.

Regular Meeting of the Society, December 11, 1916.

The meeting was called to order with President Young in the chair and 29 members and guests present.

Minutes of the previous meeting were read and opproved.

Report of Committees—Mr. Shaw, chairman of the Library Committee, rendered a report. Mr. Shaw stated that 58 volumes had been added to the library, including four donated, making a total cost of $185.50, which will leave at the end of the year an unexpended balance of $20.37.

President Young rendered thanks to the Library Committee on behalf of the Society for the work they have done.

Mr. Olsen, chairman of the Membership Committee, Div. A., reported that the Membership Committee had been working hard. They have worked up a list of engineers who might be eligible to membership in the Society. The list, after a good "boiling down," contains from 60 to 70 names. President Young stated that he had attended several meetings of the membership committee, that they had worked very hard, and hoped that the members would co-operate with the committee in the work to increase the membership.

Mr. Gregory, chairman of the Technical Papers Committee reported that the committee had nothing definite ahead, only prospects. The committee felt that the material furnished during the year had been excellent.

Mr. Coleman urged upon the younger members of the society to prepare papers, and assured them that the papers would be welcomed by the older members ,and if any criticism is offered, it will only be of a friendly nature. Mr. Young suggested that Mr. Coleman write up a short article on the subject for the journal. President Young stated that he was very much gratified over the work of the technical papers committee.

Mr. Kokosky, chairman of the Employment committee reported that 181 positions had been secured for clients during the year of which 39 were permanent positions, and the balance temporary, and recommended that a formal application for position be gotten up charging a fee of 50c, which would be credited to the Library Fund. Mr. Shaw moved that the recommendation be referred to the Board of Direction with full power to act. Mr. Garsaud offered an amendment to the motion requesting the board to report back to the Society their conclusions. The motion was carried as amended.

Technical Exercises—Mr. Charles Payne Fenner was on the program to give a talk on "The Due Process Clause of the 14th Amendment to the Constitution of the United States," but owing to suddenn illness was unable to be present.

Nomination of Officers—The nomination of officers was then taken up. The following ballots were cast:

For President—	1st Ballot
A. T. Dusenbury	15
John Klorer	2
John Riess	1
	18

For Vice-President—	1st Ballot
John Klorer	14
Ole K. Olsen	3
John Riess	2
	19

For Secretary—	1st Ballot
W. T. Hogg	16
Ole K. Olsen	2
Jas. M. Robert	1
	19

For Treasurer—	1st Ballot	2nd Ballot
Ole K. Olsen	7	10
John Riess	8	9
A. M. Scott	3	....
J. H. O'Neill	1	....
	19	19

For Director (to serve 3 years)—	1st Ballot	2nd Ballot
John Riess	7	10
Jas. M. Robert	5	9
M. Garsaud	3	....
W. H. Williams	2	....
J. F. Coleman	1	....
	18	19

Unfinished Business—Mr. Gregory stated that he had just returned from the Annual Meeting of the American Society of Mechanical Engineers in New York, and that Mr. Ira N. Hollis had been elected President. Mr. Hollis intends to visit each local chapter during the year. Mr. Gregory stated that Mr. Burwell and himself suggested to Mr. Hollis that he visit New Orleans on January 13th, and he replied that he could. Mr. Gregory suggested that we invite Mr. Hollis to our Smoker. Mr. Coleman stated that no discussion was necessary and moved that Mr. Hollis be invited to attend the Smoker. Mr. Shaw suggested that in case a few members of the local chapter A. S. M. E., who may not be members of our Society, would wish to attend the Smoker, that they be given an opportunity to be present. Mr. Riess moved that the members of the local chapter A. S. M. E. not members of our Society be invited to participate in our Smoker. The motion was seconded and carried.

Mr. Shaw submitted the following resolution:

Resolved—That the thanks of the Society be extended to each of those who have presented books to the Library and that the Secretary be instructed to write a personal letter to each donor, advising him of this action of the Society, and assuring him of our appreciation of his kindness. The motion was seconded and carried.

There being no further business, the meeting adjourned to the collation.

W. T. HOGG, Secretary.

Regular Meeting of the Board of Direction, Jan. 13, 1917.

The meeting was called to order with President Young in the chair and Messrs. Dusenbury, Klorer, Manley, Olsen and Hogg present.

Minutes—The minutes of the previous meeting were read and approved.

Ballot—Ballots for the election of new members and transfers of old members were opened. There were 46 formal and 3 informal ballots. The following were elected:

Resident Member—Chas. O. Babin, New Orleans; Allen W. Haskell, New Orleans; Charles Kirschner, New Orleans; Robert W. Nolte, New Orleans; William Louis Stevens, New Orleans.

Non-Resident Member—Merrill Bernard, Crowley, La.; Hobart Doane Shaw, Gulfport, Miss.

Transfer Junior to Resident Member—Bernard H. Grehan, New Orleans; James Norman Wilson, New Orleans.

Transfer Non-resident Junior to Non-resident Member—Charles Louis Jacob, New York.

Transfer Student to Resident Member—Abraham Norman Goldberg, New Orleans; Norman A. Hotard, New Orleans.

Transfer Student to Resident Junior—Shepard F. Perrin, New Orleans.

Student Member—Henry Hester Bate, Earle A. Berry, Walter Cooke, Joseph Marr Gwinn, Joseph W. Joachim, Albert John Legett, Jr., John A. O'Brien, Louis Emile Stouse, Frank A. Turner, David Walter Wiedman, McDonoghville, La.; Vennard Wilson, Allan L. Wolff, Charles Jacob Wyler.

A communication from Mr. L. C. Datz was read in which Mr. Datz called attention to Section 1 of Article VII of the Constitution of the Society, which requires that an application for membership shall be endorsed by at least three members in good standing. Mr. Datz stated that two applicants on the above ballot apparently were not endorsed by members of the Society. It was moved and carried that the two applicants in question be considered elected to membership, and that proper steps be taken to secure the necessary number of endorsers who are members of the Society.

The application blank the the Society contains the clause—"He shall give at least three references who shall preferably be members of the Society, and who shall know him personally. The Secretary was instructed to remove the word *preferably* from the clause.

Applications—The following applications were ordered to ballot subject to the approval of the Membership Committee:

For Transfer from Student to Resident Member—James P. Ewin, New Orleans.

For Transfer from Junior to Resident Member—George E. Durr, New Orleans.

For Transfer from Student to Resident Junior Member—Robert A. Pierpont, New Orleans.

The Secretary was instructed to remove the name of one of the endorsers from the application of Mr. Paul Jeffries as three other endorsers had been secured.

Resignation—The following resignations were accepted with regret: L. H. Guerin, New Orleans, Resident Member; A. W. Jackman, New Orleans, Resident Member; A. J. Nelson, New Orleans, Resident Member; H. P. Porter, Beaumont, Tex., Non-Resident Member; J. E. Poche, New Orleans, Junior Member; P. E. Lehde, New Orleans, Student Member; W. B. Monroe, New Orleans, Student Member; Leo Steckler, New Orleans, Student Member; H. F. McDermott, Chicago, Non-Resident Member.

The resignations of several other members were ordered laid over as their dues for 1916 had not been paid in full.

Dropped Members—Several Junior Members were ordered dropped from the membership of the Society as they had not applied for transfer to higher grade after holding Junior membership for over three years.

Certain Student Members were ordered dropped from the roll of the Society as they had not applied for transfer to a higher grade before the end of the year in which they graduated.

The following bills were approved for payment:

M. C. LeJeune, stenographer at meetings	$ 31.00
Tulane University Press, printing December issue	172.35
Tulane University Press, printing and postage	87.10
Am. Railway Engineering Assn., Proceedings	17.50
Am. Society for Testing Materials	8.80
Professional Memoirs, Vol. V to VIII inclusive	19.00
Fabacher's Rathskeller, refreshments	13.70
W. T. Hogg, Secretary, salary and incidentals	38.50
Douglas Anderson, Editor of Proc. Salary ½ year	150.00

Reports—The Annual Reports of the Secretary and Treasurer were submitted and accepted.

There being no further business, the meeting adjourned.

W. T. HOGG, Secretary.

Annual Meeting of the Society, January 13, 1917.

The meeting was called to order with President Young in the chair, and 52 members and guests present.

The minutes of the previous meeting were read and approved.

The Annual Report of the Board of Direction was submitted and accepted.

The Library Committee reported a balance of one cent in the Library Fund after paying all bills on hand.

Ballots for the election of Officers to serve during the year 1917 were opened, and the following vote was cast:

For President:

A. T. Dusenbury 57

W. B. Gregory 1

For Vice-President, John Klorer 58

For Secretary, W. T. Hogg 58

For Director, John Riess 58

The following proposed change in Section 2 of Article VII of the Constitution of the Society was approved:

Present section reads—Honorary Members shall be proposed by at least ten members and shall be elected ONLY BY UNANIMOUS VOTE OF THE SOCIETY.

Amended Section to read—Honorary Members shall be proposed by at least ten members and shall be elected BY THE BOARD OF DIRECTION.

Dr. Ira N. Hollis, President of the Worcester Polytechnic Institute and recently elected President of the American Society of Mechanical Engineers addressed the Society, and spoke of the position and duties of an engineer as a citizen.

There being no further business, the meeting adjourned to the Smoker.

W. T. HOGG, Secretary.

ANNUAL REPORT OF THE BOARD OF DIRECTION.

Year 1916.

To the Louisiana Engineering Society:

Gentlemen—Your Board of Direction begs to report that during the past year it has held 11 regular meetings and one special meeting for the transaction of the Society's business.

The reports of the Treasurer and Secretary are attached to this report.

Attention is called to the number and grade of technical papers presented during this year, and the excellent work of the committee in charge.

During the early part of the year the Library Room was opened to the membership and the Library Committee has done excellent work in purchasing additions to the collection of books in the library.

The membership committee has done a great deal of work and the committee and members who co-operated with them deserve the thanks of the Society for the excellent showing they have made. In spite of the well worked field in 1915, forty-two new members and four former members were added to roll of the Society. The committee also deserves praise for the work in publishing the new form of application.

The publication committees deserve the highest praise for their work in securing advertisements for the **Proceedings** and the class of work turned out by the editor and his associates which has won for the **Proceedings** several exchanges of the highest class.

The employment committee reports that it has secured employment for 181 clients during the year, which is an excellent showing.

Attention is called to the excellent financial condition of the Society. The statements show a balance in the General Reserve Fund of $732.20, and in the Proceedings Reserve Fund $658.33. The treasurer's report shows a balance January 1, 1917, of $937.18.

In conclusion, the Board wishes to thank the Committees and Members of the Society for their co-operation and assistance in carrying on the work of the Society.

Respectfully submitted,

SAM'L. YOUNG, President.
A. T. DUSENBURY, Vice-President.
W. T. HOGG, Secretary.
JOHN KLORER, Treasurer.
A. T. DUSENBURY,
R. S. MANLEY,
OLE K. OLSEN, Board of Direction.

ANNUAL REPORT OF THE SECRETARY.

Year 1916.

To the Board of Direction, Louisiana Engineering Society:

Gentlemen—As Secretary of the Society, I beg to submit the following report for the year 1916:

During the year the Board of Direction held 11 regular meetings and one special meeting, with an average attendance of 6.4. The Society held 10 regular meetings and one special meeting with an average attendance of 51, maximum 70, minimum 29.

During the year the membership changed as follows:

GRADE—	On Roll Jan. 8, 1916.	Elected.	Reinstated.	Transferred To.	Transferred From.	Dropped.	Resigned.	Failed to Qualify.	Died.	On Present Roll.
Resident	121	18	2	8	7	3	5	0	0	134
Non-Resident	56	4	1	9	3	1	1	0	0	65
Associate	10	3	0	0	1	0	0	0	0	12
Non-Res. Asso.	1	0	0	1	1	0	0	0	0	1
Junior	21	2	1	8	6	0	2	0	0	24
Non-Res. Junior	8	2	0	4	5	0	0	0	0	9
Student	23	13	0	0	7	1	7	0	0	21
Totals	240	42	4	30	30	5	15	0	0	266

The table shows a total increase in membership of 46, deducting a total loss of 20, leaves a net increase of 26, which is an excellent showing.

Submitted separately is the Treasurer's report, which shows a balance Jan. 1, 1917, of $938.18. Add to this collections received since Jan. 1, and not yet transferred by Secretary to Treasurer, $245.00, and the total cash on hand equals $1,182.18.

Attached hereto are statements showing the Operating Results of the General Fund, Proceedings Fund and Library Fund, a Cash Statement showing receipts and expenditures, and a statement of the Financial Condition of the Society.

The following technical exercises were held:

February 14, 1916. "Some Structural Features of the Cotton Warehouse and Terminal of the Board of Commissioners of the Port of New Orleans," by Frank J. Trelease.

March 13, 1916. "Tropical Storms," by Dr. I. M. Cline.

April 10, 1916. "Industrial Resources of Louisiana," by Prof. Chas. S. Williamson, Jr.

May 8, 1916. "The Density Rule for the Grading of Select Structural Yellow Pine Timbers," by J. E. Rhodes. "Creosoted Wood Block Pavements," by F. P. Hamilton.

June 12, 1916. "Personal Experiences of a Canadian Soldier in Belgium," by J. W. Fairlie.

September 11, 1916. "Recent Storm Tides on the Gulf Coast," by Chas. W. Okey.

October 9, 1916. "Improvements of the Passes of the Mississippi," by Lt. Col. E. H. Schulz.

November 13, 1916. "The Petroleum Industry in Louisiana," by H. A. Pallfelt.

As librarian of the Society, your Secretary desires to express his appreciation of the efforts of the Library Committee during the past year.

Your Secretary desires to thank the officers and members of the Society for their kind co-operation during the past year. It has been an honor and a privilege to serve you and I thank you.

Respectfully submitted,

W. T. HOGG, Secretary.

FINANCIAL CONDITION OF THE SOCIETY, JANUARY 1, 1917.

Assets.

Cash on hand	$ 937.18	
Membership Accounts Receivable	536.64	
Advertisers' Accounts Receivable	237.88	
Total assets	$1,711.70	$1,711.70

Liabilities.

Credit Balances in Advertisers' Accounts	$ 21.76	
Credit Balances in Membership Accounts	12.50	
Balance in Library Fund	.01	
Balance in Proceedings Reserve Fund	658.33	
Miscellaneous Accounts Payable	286.90	
Total liabilities	$ 979.50	$ 979.50
Balance in General Reserve Fund		$ 732.20

General Reserve Fund.

Balance from year 1914	$ 165.60
Balance from year 1915	189.15
Balance from year 1916	377.45
	$ 732.20

Proceedings Reserve Fund.

Balance from year 1915	$ 112.20
Balance from year 1916	546.13
	$ 658.33

GENERAL FUND.

January 1, 1917.

Results for Year 1916.

Revenues—		
Dues, membership	$ 2,189.00	
Entrance fees, membership	381.00	
Banquet assessment, membership	208.00	
Back dues (members reinstated)	12.00	
1915 Balances (members reinstated)	19.00	
Total revenues	$ 2,809.00	$2,809.00
Expenses—		
Subscription to Proceedings	$ 497.83	
Library Fund appropriation	480.00	
Salary of Secretary	270.00	
Printing and postage	269.92	
1916 Smoker expenses	283.65	
Miscellaneous Expenses	143.10	
Refreshments	69.65	
Losses on Members Dropped	42.00	
Credit to Membership acct. on charge for badge paid direct to jeweler	2.25	
Credits to Membership acct. for differences in Res. and Non. Res. dues	5.25	
Exchange on checks $8.05, less 10c paid by member	7.95	
Total expenses	$ 2,071.60	$2,071.60
Net balance		$ 737.40
Add account payable from 1915 (charged off)		17.50
Balance for 1916		$ 754.90
One-half appropriated to Library Fund	$ 377.45	
One-half credited to General Reserve Fund	377.45	
Total	$ 754.90	

PROCEEDINGS FUND.

Results for Year 1916.

Revenues—		
Advertisements	$ 1,572.43	
Subscriptions, membership	497.83	
Subscriptions, outsiders	2.00	
Sales of Proceedings	47.70	
Total revenues	$ 2,119.96	$2,119.96
Expenses—		
Salary of Editor and of Secretary	$ 330.00	
Printing and mailing Proceedings	1,040.58	
Printing and engravings (incidentals)	62.75	
Stenographer, society meetings	124.00	
Miscellaneous Expenses	16.50	
Total expenses	$ 1,573.83	$1,573.83
Net revenue for 1916		$ 546.13
Add balance from 1915		112.20
Balance in Proceedings Reserve Fund		$ 658.33

and disbursements for the period from January 9, 1916, to January 8, 1917, inclusive dates.

The duties of Treasurer were filled by Mr. E. H. Coleman from January 9, 1916, to June 24th, and by the undersigned from that date until the end of the above period.

Received from the Secretary—	Deposited in Bank of Orleans	Deposited in Citizens Bank	Less Exchange cost
Jan. 11th	$ 207.75	....	....
Jan. 11th	31.50	....	$ 0.50
Jan. 21st	204.80	....	....
Jan. 21st	67.75	....	0.40
Jan. 26th	114.25	....	....
Jan. 26th	5.50	....	0.20
Feb. 8th	60.00	....	....
Feb. 8th	3.00	....	0.10
Feb. 14th	71.75	....	....
Feb. 14th	32.10	....	0.10
Feb. 19th	78.00	....	....
Feb. 19th	5.50	....	0.10
Feb. 21st	9.00	....	....
Mar. 1st	25.75	....	....
Mar. 1st	3.00	....	0.20
Mar. 3rd	49.99	....	....
Mar. 23rd	99.41	....	....
Mar. 23rd	64.25	....	....
Mar. 24th	24.08	....	0.30
Mar. 24th	36.16	....	0.20
Apr. 5th	34,82	....	....
Apr. 5th	3.50	....	0.10
Apr. 10th	67.82	....	....
Apr. 10th	9.00	....	0.40
Apr. 22nd	68.75	....	....
Apr. 22nd	3.00	....	0.10
Apr. 24th	88.00	....	....
Apr. 24th	62.00	....	0.40
May 4th	27.00	....	....
May 9th	170.09	....	....
May 9th	4.50	....	0.20
May 15th	89.74	....	....
June 2nd	27.23	....	....
June 24th	7.16	....	....
Total received by E. H. Coleman	$1,856.15	....	$ 3.30

June 27th	90.82	....	0.20
June 27th	8.10	....	....
July 5th	41.34	....	....
July 5th	23.66	....	0.20
July 20th	....	$ 67.25	....
July 20th	....	55.07	....
July 20th	....	79.59	....
July 20th	....	14.75	0.80
Aug. 1st	96.35	....	....
Aug. 1st	38.09	....	0.40
Aug. 1st	....	53.93	....
Aug. 1st	....	2.50	0.10
Aug. 16th	....	134.93	....
Aug. 16th	....	16.83	....
Aug. 16th	....	23.33	0.10
Aug. 24th	....	72.73	....
Aug. 24th	....	14.01	....
Sept. 5th	....	45.82	....
Sept. 14th	52.24	....	0.30
Oct. 5th	63.68	....	....
Oct. 18th	....	66.25	....
Oct. 18th	....	50.50	....
Oct. 18th	....	35.33	....
Oct. 18th	....	18.42	0.60
Oct. 24th	55.50	....	....
Oct. 24th	18.50	....	....
Oct. 24th	19.00	....	0.30
Nov. 8th	....	55.73	....
Nov. 8th	....	28.15	....
Nov. 8th	....	26.16	0.40
Nov. 11th	155.29	....	....
Nov. 28th	....	89.75	....
Nov. 28th	....	50.46	0.50
Dec. 7th	68.91	....	....
Dec. 7th	44.16	....	0.40
Dec. 23rd	62.23	....	....
Dec. 23rd	20.83	....	0.10
Dec. 26th	....	49.02	....
Dec. 26th	....	19.66	0.15
1917.			
Jan. 4th	50.25	....	....
Jan. 4th	18.10	....	0.20
Jan. 4th	65.52	....	....
Jan. 4th	3.33	....	....
Total received by John Klorer	$ 996.00	$1,070.17	$4.75

Combined total of receipts	2,852.15	1,070.17	8.05
Less cost of exchange, $8.05, as distributed above	5.40	2.65	
	$2,846.75	$1,067.52	
Plus balance on hand Jan. 9, 1916, as per previous Treasurer's report—$703.11	584.62	118.49	
Total receipts accountable for	$3,431.37	$1,186.01	$4,617.38

Disbursements.

Disbursements by E. H. Coleman, Treasurer, viz:

No.		Checks drawn on Bank of Orleans	Checks drawn on Citizens Bank
1.	D. Daubert	$ 21.00	....
2.	F. M. Norman	22.70	....
3.	Tulane University Press	77.65	....
4.	Lake Brothers	10.00	....
5.	L. C. Datz	5.00	....
6.	Engineering & Contracting	2.00	....
7.	Engineering Record	2.50	....
8.	Electrical World	3.00	....
9.	Electric Journal	3.00	....
10.	Engineering Publishing Co	2.00	....
11.	Concrete	1.50	....
12.	Jas. Buckley & Co	5.00	....
13.	M. Clay Lejeune	25.00	....
14.	Ole K. Olsen	73.30	....
15.	Cosmopolitan Hotel Co	155.85	....
16.	Crescent Cigar & Tobacco Co	28.10	....
17.	Louisiana Printing Co., Ltd	12.50	....
18.	W. T. Hogg	23.55	....
19.	Schumert & Warfield	4.00	....
20.	N. O. News Co	4.75	....
21.	L. & C. Co	28.00	....
22.	E. Francke	7.00	....
23.	Tulane University Press	179.20	....
24.	Tulane University Press	60.25	....
25.	W. T. Hogg, Secretary	46.91	....
26.	A. Doubert	10.50	....
27.	American Architect	8.25	....
28.	Engineering Record	9.00	....
29.	Frank G. Churchill	25.00	....

30.	Owen Gernon Co.	15.00	
31.	Dameron-Pierson Co.	1.68	
32.	Farish Art Store	12.45	
33.	Frank N. Norman	11.13	
34.	Tulane University Press	15.40	
35.	W. T. Hogg, Secretary	23.25	
36.	A. Daubert	10.50	
37.	John Riess	866.62	
38.	Tulane University Press	197.20	
39.	Tulane University Press	70.90	
40.	H. J. Harvey	3.50	
41.	L. C. Datz	2.75	
42.	W. E. Evans	2.50	
43.	Douglas Anderson	150.00	
44.	Kokosky & Co	1.50	
45.	W. T. Hogg	28.97	
46.	Fabacher's New Rathskeller	7.00	
	Disbursements by John Klorer, Treasurer, viz:		
47.	Railway Age Gazette	5.00	
48.	C. C. Hartwell Co	41.00	
49.	M. Clay Lejenne	27.50	
50.	Fabacher's New Rathskeller	7.40	
51.	Miss Jeanne Jarreau	8.25	
52.	Rowland and McRedmond	20.00	
53.	Tulane University Press	18.15	
54.	W. T. Hogg	24.77	
55.	Tulane University Press		160.00
56.	Tulane University Press		23.00
57.	Dameron-Pierson Co		.89
58.	Engineering Magazine		1.50
59.	Fabacher's New Rathskeller		7.00
60.	W. T. Hogg		65.50
61.	Electric Railway Journal		3.00
61.	Owen Gernon Co		19.00
63.	Tulane University Press		24.25
64.	Tulane University Press		142.60
65.	T. Fitzwilliam & Co., Ltd		3.75
66.	W. T. Hogg		34.40
67.	Tulane University Press		12.25
68.	Concrete Cement Age		2.50
69.	Owen Gernon Co		9.00
70.	C. P. Eilerson		25.00
71.	W. T. Hogg		32.50
72.	M. Clay Lejenne		56.00
73.	Engineering Magazine		3.00

74.	Stauffer, Eshleman Co., Ltd.	....	1.50
75.	Fabacher's New Rathskeller	....	14.00
76.	Farish Art Store	....	.50
77.	Tulane University Press	....	193.45
78.	Tulane University Press	....	23.45
79.	W. T. Hogg	....	37.55
80.	Eugene Dietzgen Co.	78.95	....
81.	*American Society for Testing Materials	36.80	....
82.	*The Army Service Schools	22.80	....
83.	*Owen Gernon Co.	6.50	....
84.	*Engineering News	8.00	....
85.	*Electrical World	3.00	....
86.	Ed. Smith's Stencil Works	1.58	....
87.	Robert H. Scott	6.00	....
88.	Tulane University Press	7.35	....
89.	Douglas Anderson	150.00	....
90.	W. T. Hogg	35.20	....
	Total disbursements, January 9, 1916, to January 8, 1917		$3,680.20
	Balance in each depository	$646.76	$290.42
	Total balance on hand January 8, 1916, inclusive of disbursements indicated (*), checks for which are still outstanding		$ 937.18

Respectfully submitted,

JNO. KLORER, Treasurer.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

FEBRUARY, 1917

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

Index to Advertisements—Continued.

The Proceedings of the Louisiana Engineering Society

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

DOUGLAS ANDERSON, Editor.

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

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LOUISIANA ENGINEERING SOCIETY

OFFICERS FOR 1917

President, A. T. DUSENBURY, 236 Baronne Street.
Vice-President, JOHN KLORER, 213 New Court House Bldg.
Secretary, W. T. HOGG, Tulane University.
Treasurer, OLE K. OLSEN, 822 Perdido Street

DIRECTORS.

SAMUEL YOUNG, 1002 Perrin Building.
R. S. MANLEY, 301 Q. & C. Building.
JOHN RIESS, 803 Hibernia Building.
JAMES M. ROBERT, Tulane University.

STANDING COMMITTEES

On Technical Papers
James M. Robert
Henry L. Hutson
C. S. Williamson, Jr.

On Library
Arthur M. Shaw
E. Hunter Coleman
Bernard S. Nelson

On Publications—Division "A"
Douglas Anderson
W. T. Hogg

On Publications—Division "B"
W. H. Williams
John Riess
R. T. Burwell
Ole K. Olsen
Samuel Young

On Membership—Division "A"
Ole K. Olsen
Rufus S. Manley
Clifford H. Stem
Bernard H. Grehan
Marcel Garsaud
John Klorer
G. A. Seaver

On Membership—Divison "B"
Alfred Raymond
T. L. Willis

On Employment
H. Kokosky
Chas. J. Hardy

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

All business communications should be addressed to W. T. Hogg, Secretary P. O. Station 20, New Orleans, La.

Sidney F. Lewis

Recently Elected Honorary Member
of the
Louisiana Engineering Society

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. III APRIL, 1917 NO. 2

CONTENTS.

EDITORIAL NOTES AND COMMENT

Civilization and The Engineer. Ask men of different professions to outline for you the important epochs or periods in the progress of civilization, and you will receive various answers Published elsewhere in this issue of the *Proceedings* is a very inspiring statement of the relation of the engineer to the progress of civilization, as given by a man, who in his long connection with the profession of engineering, has proven himself to be, not only of exceptional technical ability, but also of a broad philosophy which carries with it both inspiration and conviction. For the major portion of his professional life Dr. Hollis has been a teacher of engineering, and furthermore a teacher of engineering in one of the greatest universities of the country, where some of his most intimate friends were eminent teachers of literary or philosophical subjects. Dr. Hollis takes almost as the text of his address a quotation from the writings of Mr. H. G. Wells, in which he says: "The history of mankind is the history of the attainment to external power." Another way of stating this sentence would be to say that the history of mankind is the history of engineering, for it may be said that every forward step in the attainment of external power has been accomplished through the invention of some form of engineering device, however simple and crude these devices may have been in the early beginnig of civilization. And each such forward step along material lines has carried with it the possibility, in fact, the necessity, of a further advance in a spiritual way. From this point of view the work of the engineer is the very foundation of the whole progress of the civilization of man.

It too often happens, however, that the engineer contents himself with the development of inventions for the betterment of mankind while failing utterly to appreciate the capacity that lies within his work of inspiring the higher and more spiritual emotions. Dr. Hollis has developed within himself this capacity to a pre-eminent degree, and it is this very quality which renders so inspiring any words of advice or encouragement which he may offer to his fellow engineers. In order to place his profession and its ideals properly before the people it is necessary for the engineer to acquire the power of expression. And there can be no better means to this end than for each and every man to become a member of one of the great engineering societies of this country. Further than this he should join the local engineering society, if such exists, in his own community and should take an active part in its business and technical proceedings.

It is to be regretted that every member of the Louisiana Engineering Society could not have been present to have *heard* these inspiring words of Dr. Hollis and to have felt something of the personality of the man; of those who were not present no man should fail to read the address as reproduced in the pages of this journal.

Men and Materials. The two great factors in the working out of any engineering plan are labor and materials. Labor means men, and men mean human beings who are entitled to a fair share of the profits of their labor, not only from the financial standpoint, but from the social and spiritual side as well. Financiers, contractors, managers and superintendents are more and more turning their attention to this phase of the problem and are beginning to realize that if the worker is to attain to his proper place in the forward progress of civilization he must have a larger self-expression. This is something of the same problem with reference to the working-man that Dr. Hollis has discussed for the engineer. It is, in fact, the universal problem of mankind. Each class, or group or profession, or however we may attempt to classify mankind, can never acquire its just share of the benefits of civilization, material, social or spiritual, until such time as it shall have attained to an adequate and safe degree of self-expression. There is reprinted in this issue an article by Mr. Fred. H. Rindge, Jr., which appeared originally in The Electric Journal for January, 1917, entitled "Industry's Changing Emphasis." It gives a succinct and clear exposition of this important matter and should be of interest to many of our members, who have to deal with large groups of men.

Honorary Members. The rule for election to honorary membership in the Society has been recently amended. According to the original rule a name for honorary membership must have been proposed by at least ten members and be elected by the unanimous vote of the Society. The new rule provides that at least ten members must propose the name for honorary membership, but that the election shall be by the Board of Direction. The first honorary member to be elected under this new rule is Colonel Sidney F. Lewis. We take great pleasure in extending our congratulations to Colonel Lewis and are gratified at being able to publish in this issue a portrait of him and a short sketch of his professional life.

Map of the Recent Gulf Coast Storms. There is being sent out with this issue of The Proceedings a map showing the paths of the recent Gulf Coast Storms, the heights of the water at different localities, and other data contained in Mr. Okey's paper.

It was his intention to have had this map published with the original paper, but there was some necessary delay in getting it out. Through the courtesy of the United States Department of Agriculture we were permitted to use the tracing for the map from which to make a cut. This map comes then as a supplement to the issue of October, 1916, which contains Mr. Okey's article entitled "Storm Tides Along the Central Gulf Coast."

To Our Advertisers. The Louisiana Engineering Society publishes this journal because its members feel that they should have some means of keeping a permanent record of the technical activities and business transactions of the Society. It serves further as a means of keeping the members in closer touch with each other and with the affairs of the Society. We could not afford to publish the journal if it were not for the financial assistance we secure from the advertisements. We do not propose to offer you an advertising medium with the enormous circulation of the Saturday Evening Post or the Ladies' Home Journal; you would not advertise in these papers because they would not reach the people whom you wish to reach with your advertisement. We do offer you, however, an advertising medium which will carry your Ad to the very class of people in this community whom you desire to reach especially. While we cannot guarantee that the individual engineers, members of the Society, will always patronize exclusively the firms who advertise in our journal, yet we can state that there is a very strong feeling throughout our membership that this is the proper policy, and the majority of our members will, whenever possible, give preference to the advertisers who patronize us. We are all working in a common cause, and the aid which you thus extend to us will bear fruit in the additional profit which will come to you.

Changes of Address. We have been requested to publish the following as being the present addresses of the members named below:

J. A. Brookshire, with Bucyrus Co., 808 Marquette Ave., South Milwaukee, Wis.

Gail H. Brown, c/o. Ford, Bacon & Davis, 115 Broadway, New York City.

H. H. Gibson, 244 Olivier St., New Orleans, La.

Arthur R. Mielly, P. O. Box 201, Monroe, La.

Hebert P. Nathan, 117 Highland Ave., Buffalo, N. Y.

J. Norman Wilson, 8237 Apricot St., New Orleans, La.

COLONEL SIDNEY F. LEWIS.

[Upon the recommendation and endorsement of a large number of its members Col. Lewis has recently been elected an Honorary Member of the Louisiana Engineering Society. In view of his long and active connection with the affairs of our organization, as well as his distinguished engineering services to the State, this brief sketch of his professional life is herewith presented.—Editor.]

Sidney Francis Lewis, son of Dr. John Hampden Lewis, and grandson of Judge Joshua Lewis, was born in New Orleans, January 28th, 1854. His father was one of the most prominent physicians of the city, a Master of Arts of Yale College, Bachelor of Arts of the Sorbonne, and a graduate of the Medical School of Paris. Sidney Lewis' early education was obtained in the private and public schools of New Orleans. He attended the old Grammar School in St. Philip Street and graduated in 1869 from the Central Boys' High School in Burgundy Street. This was at the time when the Rev. John Percival was principal of the High School. Under the tutorship of Prof. Ulric Bettison he was coached for entrance to the University of Virginia, where he matriculated in 1870. He took up a combined Literary and Scientific Course, pursuing his studies until the summer of 1874. As a result of the strain from overwork he was taken seriously ill and was obliged to return to New Orleans in the Fall of that year. His illness prevented his return to Virginia until May, 1875, at which time he took the necessary final examinations and received his degree of Civil Engineer as of the Class of 1874.

Mr. Lewis returned to New Orleans during the closing days of the troubles over reconstruction and carpet-bag rule, and as he says, his start in the practice of his profession was made under the difficulties incident to that period in the history of the city and state. In 1877, during the administration of Governor Francis T. Nicholls, he received an appointment as draftsman and assistant engineer in the State Engineering Department.

In 1880, he was appointed a member of the Board of Engineers to fill a vacancy caused by the resignation of Major B. M. Harrod, chief state engineer, who resigned to become a member of the Mississippi River Commission which was created by act of Congress in the Fall of 1879. From 1880 to 1908 he was a member of the Board of State Engineers, and during the latter period, he was engineer in charge of seven of the constituted levee districts of the state. He located, designed and had charge of the construction of the rear protection levee in Plaquemine Parish, East Bank, and which led to future erection of levees in the reclamation of wet lands throughout the state. He assisted and gave his advice in the closure of many crevasses in the levee districts under his immediate charge.

In the fall of 1908, upon the recommendation of Governor Jared Y. Sanders, he was elected by the Board of Levee Commissioners of the Orleans Levee District as their chief engineer. From September 17, 1908, to September 1, 1916, he served the city and state in this responsible position, locating, designing and superintending the construction of the largest continuous embankments for protection that exist in the world to-day. These were built with the aid of the most up-to-date mechanical devices, and at a greatly reduced cost, as compared with the methods of former years.

Mr. Lewis, on account of factional politics, resigned his position with the Orleans Levee Board on September 1, 1916. He is now practicing his profession as a "Consulting Engineer," with an office in the Strand Building, recently erected on Baronne and Gravier Streets.

In 1877, he joined the State Militia as a private in Battery C, Louisiana Field Artillery, and from a private he rose through all grades to Lieutenant, and served for a short period as Captain of Battery A of the same regiment, when he was commissioned as Colonel of Engineers by Governor S. D. McEnery, and served on his staff to 1888.

He became a member of the American Society of Civil Engineers in May, 1881, his number being 653, and his certificate of membership is signed by James B. Francis, the eleventh president from the date of organization in 1852. He is one of the oldest members in the South. He is a charter member, and was the first President of the Louisiana Engineering Society in 1898.

Colonel Lewis has been twice married and has nine children. His first marriage was in 1880 to Miss Clara Davis, who died in 1889. In 1892 he was married to Miss Eveline Nicaud. One of Colonel Lewis' son, Mr. J. H. Lewis, has adopted his father's profession and is an assistant engineer with the United States Government.

PAPERS AND DISCUSSIONS

ENGINEERS AND ORGANIZATION.

By

DR. IRA N. HOLLIS,

President of the American Society of Mechanical Engineers.

Delivered Before the Society, January 13, 1917.

It was suggested by members of the Society that I might say something to-night to you as engineers on the subject of engineering societies and in general of those organizations that tend to give the profession more adequate representation before the public. There are some sides of engineering that rarely have a hearing. You know as well as I that for a long time we have been classified as among the utilities, as contrasted with the higher things of life, the utilities that enable men to live on this planet, but nevertheless utilities.

Some writer has said that no inspiring emotions are ever derived from a machine and that no inspiring thought can come from a utility. That forms a fair text for engineers, particularly as there is no truth whatever in it. It is a one-sided statement from literary men who have no conception of the ideals and thoughts of those who are educated for applied science. For twenty years I was associated very intimately with the great faculty in the oldest university of this country, and I listened from time to time to the doctrine that applied science should not be taught in a university for general education. It seems to me then that the engineer will never come to his own until he is in a position to speak for himself, until he has learned that power of expression which will enable him to state clearly and adequately his own ideals. The truth of the matter is that there is much inspiring emotion from a machine and from every invention, no matter what the reason for its development may have been.

The modern writers have written more or less satisfactorily regarding engineering. One, Rudyard Kipling, has appealed to the profession through some of his poems. McAndrews' hymn alone will refute the claim that there is no inspiring emotion from a machine. Another writer, Mr. H. G. Wells, has approached the subject of engineering in his book, "The World Set Free," and he has made a sound statement in his first sentence, when he says, "The history of mankind is the history of the attainment to external power." I want to call your attention to the significance of this statement in relation to your profession. The book itself is a piece of fiction, representing the world set free by mechanical and chemical invention; nevertheless, the prologue expresses the plain truth. The word "history" here is used in the sense of the evolution or the growth of man on this planet. It is far more than the record of wars and political changes, as it means man's development from the time the first creature who took a club in his hands began that long process by which human reason has grown to its present state. What does he mean by external power? He explains it somewhat in the prologue, yet in such a way as to prove that he does not understand the full force of his finding. External power may mean energy wholly external to man, or it may mean the appliances that enable man to use his own energy more effectively.

Invention may be classified into three types. The first type reaches far back into the history of man. It involves the use of his energy without any external advantage whatever. It enables him to put into a moving body, such as a hammer or club, the kinetic energy derived from his muscular strength and to deliver that energy at some point where it may have a maximum effect. The sword is an example, and all kinds of hand tools which are constantly being invented to-day belong to the same power. The club which has been mentioned afforded man a tool or a weapon for offense and defense and thus enabled him to replace his claws and teeth in defense and attack. When he took a club in his hand, he had crossed that shadowy zone separating the creature of instinct from the being with the potential power of reasoning.

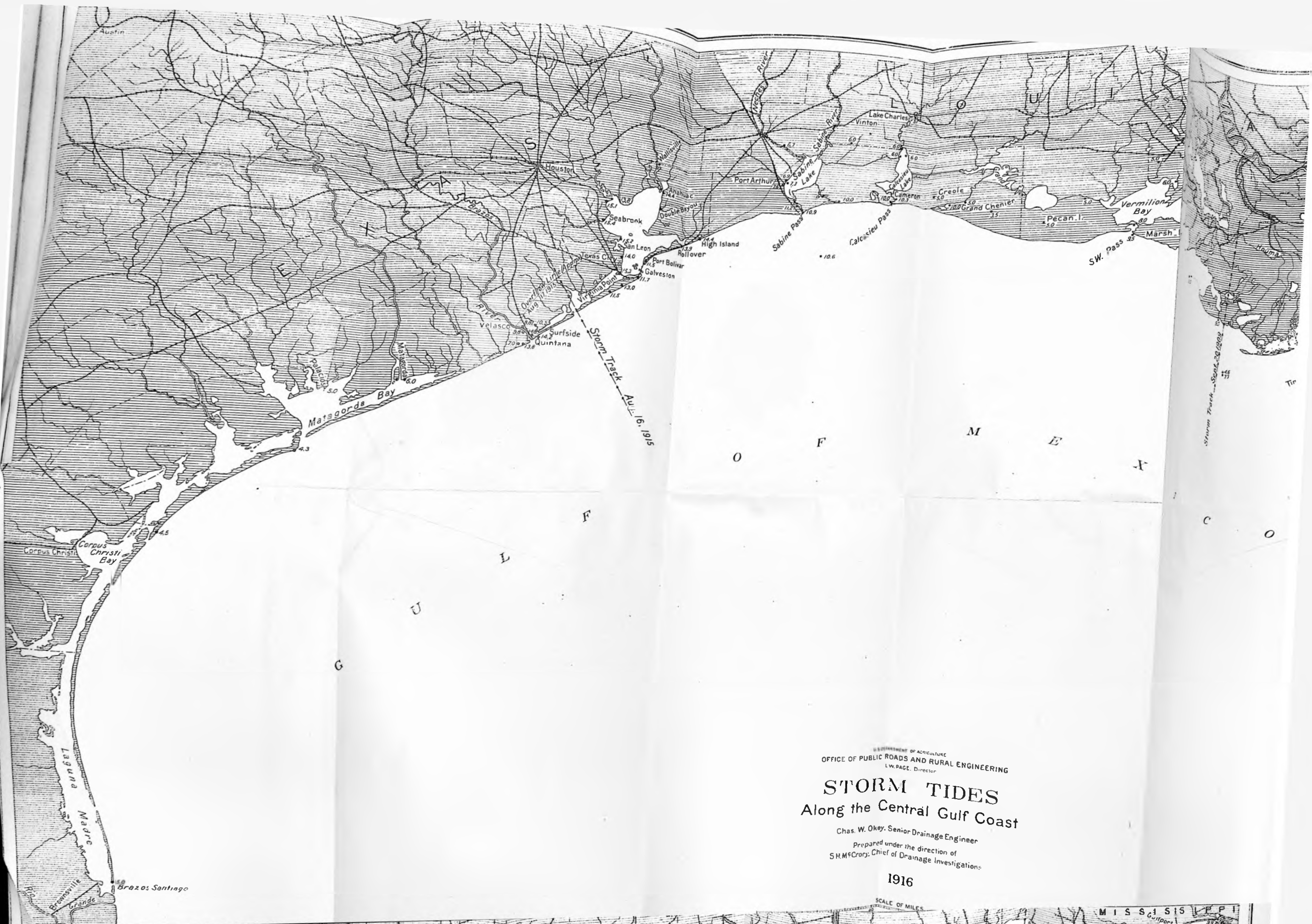
The second type of invention is that which does not offer a man power outside of himself, but gives him an advantage by the reduction of external resistance. A man has a certain amount of energy within his own body, and the effect may be increased by reducing friction, as for example with the roller carrying a weight. The wheelbarrow, for instance, is a very good example of reduction in external resistace. Before its invention, two men were required to carry a burden. Whoever replaced the man in front by a wheel enabled, by that invention, one man to do as much work as two previously had been able to do; not by supplying external energy, but by reducing external friction. The wheelbarrow, therefore, was a great labor-saving invention. If any of you have read Laird's book on "The Monuments of Ninevah," you will recall therein some pictures of bas-reliefs found beneath the sand that buried the ancient city. One of them represents the transportation of a stone lion, which was to be placed at the side of an entrance to the library. It is a bas-relief, very lively in character, indicating how heavy weights were transported from place to place. The stone is placed on a sled with two runners beneath which are rollers similar to those used for moving modern houses. There are the rollers coming out at the rear, and men hurrying forward to place them under the incline at the front of the sled. Two men are at the rear of the sled with levers to jolt it for the reduction of initial friction; wrapped around the stone are great ropes which lead forward, divided into many Y's, so that a thousand men could be placed on the drag. A boatswain standing on the front end of the sled to direct the work completes a very good picture of the whole process. The work was wholly manual; no external power being supplied by any means. Someone has credited DaVinci with the invention of the wheelbarrow, but I believe this to be an error, inasmuch as the wheel and the roller were common many centuries before DaVinci was born.

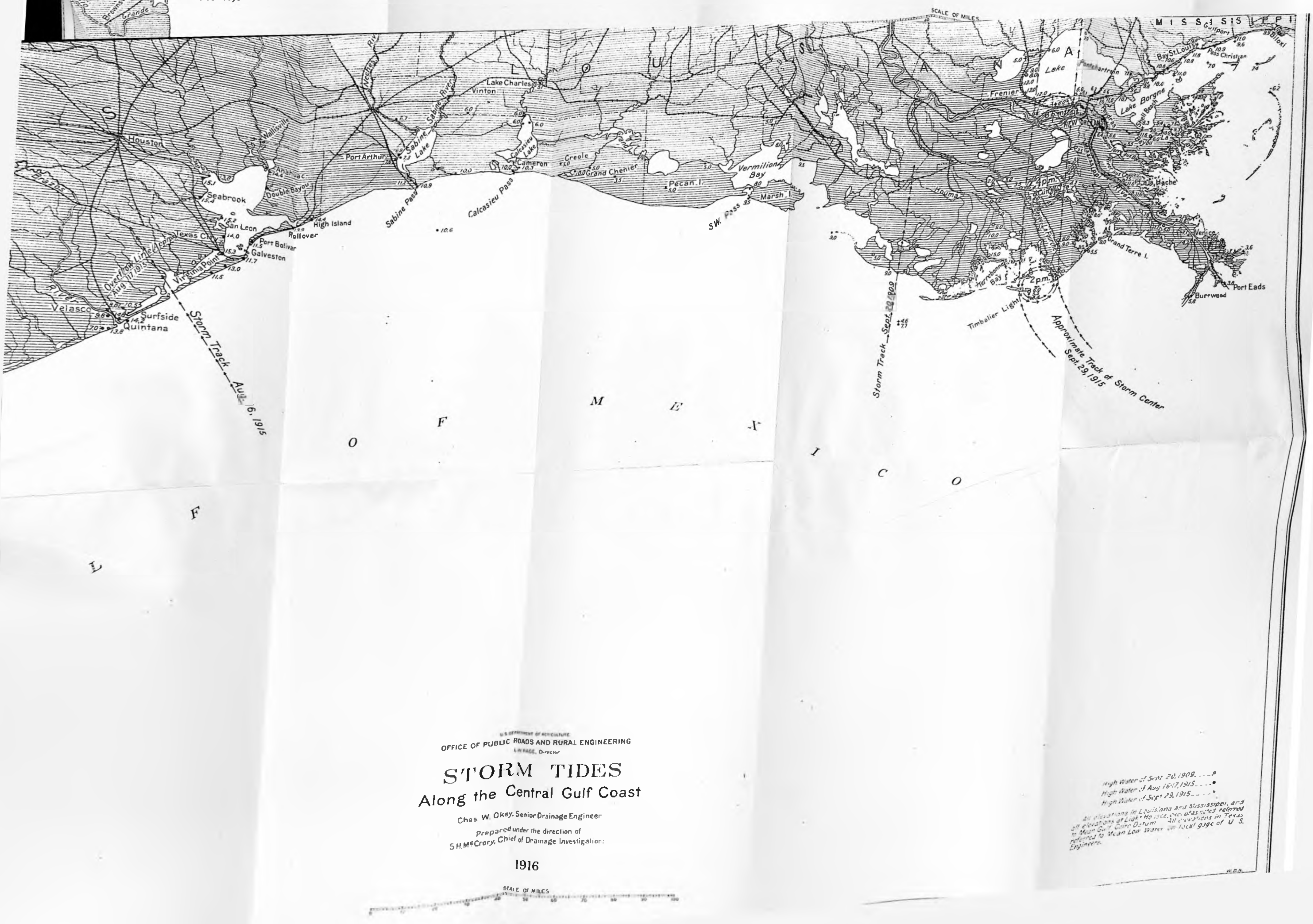
The third type of energy is perhaps what Mr. Wells had in his mind when he referred to external power. It represents what in modern engineering is called the prime mover and supplies energy wholly external to man's body. The first example is to be found in the use of a sail, although undoubtedly previous to the sail domesticated animals had been employed in transportation. The kinetic energy of moving air was applied to the propulsion of boats and subsequently to wind-mills. It is not necessary here to go into detail, for every engineer knows the progress of invention to the modern steam-engine. Between the sail and the steam engines would come the water wheels of all types and the explosive engine, now represented by the gasoline and oil engine for all kinds of purposes. The steam-engine, however, is the culmination of a period during which comparatively little advance was made. In 1760, transportation on land was nearly as crude as it had been in the time of Christ. Transportation at sea had been advanced by the improvement in ships and sail-carrying capacity. Watt's improvement of the steam-engine thus made a complete change in the outlook towards the emancipation of mankind and the possibility of freeing him from hard toil.

That sentence of Mr. Wells' may be stated in a different way by saying that the history of mankind is the history of engineering. In this sense, engineering is the application of science to the uses of mankind for the purpose of enabling him to live under the hard conditions imposed by nature on our planet. It was the first of the sciences, although the name itself did not come into use until the nineteenth century. As a matter of fact, every effort of man towards his physical welfare may be classified under engineering until we come to the science of preventive medicine, and even that involves a large amount of engineering. Every instrument, every utensil, every weapon however simple or complicated that we have to-day was invented at some time in the history of man; and external power which has been of very slow growth from the beginning of man on the planet to the dawn of history and again from the dawn of history to James Watt has been enormously accelerated by the use of energy stored in the ground or found in the sun's rays and in water. Consequently, with a proper understanding of the word "history" and of the word "engineering," Mr. Wells would have been right in saying that the history of mankind on this planet is a history of engineering.

I might go further by saying that the use of external power as we now understand it means an accelerated growth. Is it fanciful for an engineer to believe that if reasoning power began to develop with the invention of the first weapon that man took into his hands, the spiritual power may have a like development in the future of steam and water power? The instrument of defense or offense used by man in the primitive state separated him entirely from the animal that had only its teeth and claws to maintain its place in nature. It did not, however, relieve him from the hard daily toil necessary to maintain life. The proper understanding of external power and energy may be the means through coal and the sun's rays of relieving man from many of the hard conditions of life, and thus open out a development of which we have no conception. The human family will have ideals and successes that are entirely beyond our imagination.

Is it true that no emotion is to be found in a machine? Emotion is more or less based on an appeal to the imagination and in that sense every invention is a fruitful appeal to the emotions. One of our Massachusetts writers, Gerald Lee, has called attention to this side of engineering. One can not look at a locomotive hauling a train of cars at high speed without emotion. It carries the hopes and fears of many; and beyond it, if one has the power to see, lies the whole history of mechanical invention. The average writer would see only a heterogeneous mass of metal composed of what the engineer would call the cylinders, the boiler, the furnace, the drivers and the frame, but he would be blind to the elements that go to make the machine. The truth of the matter is that writers are in most cases very one-sided in their education and experience, just as many engineers are one-sided. The only difference between the two classes of men is that the engineer's attention is often called to literature, while the writer's attention is rarely or never called to invention and its products. In the locomotive lies the thought and the toil of many thousands who have brought the machine to its perfection and it is, therefore, a picture of man's struggle on this planet. Mr. Lee has called attention to Millet' "Angelus," where we see two people standing on a plowed field with their heads bowed reverently at the sound of the bells from the shadowy towers beyond the fields. Any man who looks at


U.S. DEPARTMENT OF AGRICULTURE
OFFICE OF PUBLIC ROADS AND RURAL ENGINEERING
L.W. PAGE, Director
STORM TIDES
Along the Central Gulf Coast
Chas. W. Okey, Senior Drainage Engineer
Prepared under the direction of
S.H. McCrory, Chief of Drainage Investigations
1916
SCALE OF MILES
T E X A S
L O U I
G U L F O F M E X I C O
Austin
Houston
Seabrook
San Leon
Texas City
Virginia Point
Galveston
Port Bolivar
Rollover
High Island
Double Bayou
Anahuac
Port Arthur
Sabine Lake
Sabine Pass
Calcasieu Pass
Calcasieu Lake
Cameron
Creole
Grand Chenier
Pecan I.
Vermilion Bay
Marsh I.
SW. Pass
Lake Charles
Vinton
Velasco
Surfside
Quintana
Matagorda Bay
Corpus Christi
Corpus Christi Bay
Laguna Madre
Brownsville
Brazos Santiago
Storm Track Aug. 16, 1915
Overflow Line from Storm Aug. 17, 1915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Surfside
Quintana
Houma
Timbalier Light
Terrebonne Bay
Grand Terre I.
Burrwood
Port Eads
Lake Borgne
Gulfport
Biloxi
Bay St. Louis
Pass Christian
Storm Track Sept. 20, 1909
Storm Track Aug. 16, 1915
Approximate Track of Storm Center Sept. 29, 1915
Overflow Line from Storm Aug. 17, 1915
High Water of Sept. 20, 1909
High Water of Aug. 16-17, 1915
High Water of Sept. 29, 1915

that painting and sees nothing but a splash of color representing this man and woman upon a plowed field is blind, because there is in the picture the whole struggle of humanity. After all, we derive our lives from the soil and we go back to the soil, and these two people represent, as one looks on the picture, the hard struggle of life that has been going on for centuries and that must go on if we are to maintain our place. It also represents the futility of life. These people have come and will go, like the leaves in the spring and in the fall. A plow lying in a field represents, to one who has the capacity to see, the same futility of life and the same sadness that comes over one in looking at Millet's "Angelus." How can any human being, whether he be non-literary or literary, look at any great invention, whether it be a painting or a plow, without an inspiring emotion?

Our trouble as engineers springs out of the fact that we never have been quite willing to learn to express ourselves. We have been so busy in developing all kinds of invention towards the well-being of mankind, and, as this war proves, towards the destruction of mankind, that we have forgotten some of those things that make this world better to live in. Comfort is not always best for men, especially if it tends to promote a worship of material success. Our own profession, if approached from the point of view of service and unselfish devotion to mankind, has in it all the capacity for inspiring emotion that is desired. But when careless and reckless of the finer things, it has also the capacity to enslave. The engineer has been used in the great war for the construction of a Frankenstein trampling the life out of Europe. It may be that the cessation of all wars will depend on him.

Was the invention of the steam-engine the opening of a new day to mankind; was it the sun rising over a world set free, or was it the beginning of a new slavery? Are we following it as poor lame humanity to that land promised to the children of Hamelin when they followed the pied piper to the hill, or are we the cripple left behind? I often think of the lame boy's mournful complaint, after his companions had gone, and I am tempted to quote this little poem because it carries with it the suggestion that men who have the capacity to see beyond the picture on the canvas or the locomotive on the track see visions of something better for mankind. You will all remember that in this poem Mr. Browning has painted the revenge of the pied piper who summoned the children away to follow his reed pipe, after the city fathers had refused to pay him for getting rid of the rats. That flute must have sounded thin and reedy and yet to the children it carried a different story. The little boy who was lame told what he heard and what was promised him in this poor music. Here it is:

> "One was lame,
> And could not dance the whole of the way;
> And in the after years if you would blame
> His sadness, he was used to say,—
> 'It's dull in our town since my playmates left!
> I can't forget that I'm bereft
> Of all the pleasant sights they see,
> Which the Piper also promised me.
> For he led us, he said, to a joyous land,
> Joining the town and just at hand,
> Where waters gushed and fruit trees grew,
> And flowers put forth a fairer hue,
> And everything was strange and new;
> The sparrows were brighter than peacocks here,
> And their dogs outran our fallow deer,
> And honey bees had lost their stings,
> And horses were born with eagles' wings:
> And just as I became assured
> My lame foot would be speedily cured,
> The music stopped and I stood still,
> And found myself outside the hill,
> Left alone against my will,
> To go now limping as before,
> And never hear of that country more!' "

I think of James Watt as the pied piper, the music of whose wheels is summoning all mankind to the world set free, if only humanity does not limp too much, if only the engineer can learn the power to make the way possible for all who follow.

A writer has often the wrong impression of the engineer. While his profession is that under which our manufacturing is carried on and under which an enormous amount of money is made from the sale of manufactured articles, nevertheless most invention has something of an unselfish purpose. Even the man who is counting the dollars he is going to gain from some patent he has taken out really has in his heart a desire to benefit mankind. Behind the dollar is an element of unselfishness; exactly the same as in the case of the Jesuits who explored the Great Lakes and the Mississippi River. They had a hope of saving mankind and many of them thus went to obscure and miserable deaths from a high motive. Our own country is one of ideals wherein most individuals will sink private interest for the public good. I remember many years ago in Cambridge a professor who had been sent over as exchange lecturer. He had been the leader of the imperial orchestra in Berlin and he was giving a course of lectures in Harvard. He had previously visited the United States. I asked him one evening what struck him most forcibly about the United States. He answered, "I can answer that very quickly, because it is a thing that has surprised me. I had always heard that America was dollar-mad, or as we call it in Europe, the country of the dollar; but I have found that the American people are fundamentally a people of great ideals and I have had some examples of that. Some years ago I was in Madison, Wisconsin, during the celebration of a football victory and the streets were full of men. I think some of them had been drinking. It was along towards midnight, and the town was in a wild uproar over the success of the local university. Suddenly a door opened in a building and fifty or sixty girls who had been attending a lecture came walking down the street. At once the drinking men were pushed to the rear, the noise ceased, until these ladies had been permitted to pass. After they had gone, the uproar began again." "No country," he said, "but one of ideals could have shown such respect for women."

To come back now to what we have been talking about in relation to the engineer and his ideals, what is the best method by which the engineer may acquire the power of expression which will place his profession adequately before our people? I know of only one way and that is by organization, in which men will help one another, not only to commercial success, but to that interchange of views that will enable them to express themselves. That organization can take two or three directions. Every engineer who is eligible ought to belong to a national engineering society. He owes it to his country and to his profession. He ought also to belong to a local society of engineers as a means of promoting that good fellowship and helpfulness without which the profession can not succeed in doing for a community what is within its power to do. Every man who is eligible to membership in the society which I am representing here should belong to it, not because he will get fifteen dollars' worth of benefit for the fifteen dollars dues, but because he is thereby giving the whole profession the power of serving the country, and of representing to the country not only that the profession has power to serve, but that it is willing to serve. I am not asking you gentlemen to join the National Society of Mechanical Engineers, but to join one of the engineering societies; the Electrical, the Mining, or the Civil Engineering. They all have the same motive; that is the promotion of what is to the good of the country and to the good of the engineering profession. Hence the message that I bring to-night, if I bring any at all, is that every man here owes it to his community to pay his tax towards the possibility of better service. The future of democracy depends upon us as it does upon all other individuals of our country. Perhaps it depends more upon us than upon the law-makers, because, after all, it is our profession that, along with preventive medicine, constitutes the constructive forces of modern life.

Sections of the national societies do not interfere in the slightest with the growth of a local engineering society. An excellent illustration of that is afforded by the Boston Society of Civil Engineers, where the sections of the Electrical Engineers and the Mechanical Engineers have flourished for years. The Boston Society has continued to grow and, if I am not incorrect in my figures, it has gone from 600 members to 1,000 members since the section of the Mechanical Engineers was established in Boston. There is absolutely no conflict between the local section of a national society and a local engineering society. They can all work together under reasonable conditions. It is not at all necessary that an organization should be exactly the same in every locality. I can well imagine that the conditions would influence the organization and the sections, and there is no reason why New Orleans should have exactly the same system as Chicago or Detroit.

There is one thing about all this, however. We must remember that no local section can speak for an entire society any more than it can speak with authority for the individuals in its own section. We are prevented by our own constitution from taking part in partisan politics, and that seems wise, because a scientific society would lose its character if it went too much into politics. We are permitted, however, to go into public activities which the engineering profession can assist. If I were called upon to give an exact definition of the line which should be drawn, I should encourage local societies to construe their privilege liberally, with the understanding that no body of men can speak for the entire society, nor use the name of the society unless a referendum has been sent out throughout the country for the purpose of getting the views of every member. The boundary that seems on the whole the best is that which includes all subjects in which a conclusion can be reached by scientific investigation as the province of national societies and their sections. Any subject that can not be developed by investigation and that can not be determined by scientific methods is questionable. For instance, no section of our society should step in between the employers and the employees in any industry, inasmuch as the labor question involves many things that can not be worked out by investigation, such as would be proper to a scientific society. In the matter of standards, however, which involve conventional methods necessary to enable us to carry on business, our society can perform a real public service. The boiler code is one instance of that. Every variety of organization is possible, under a very free construction of our constitution and by-laws, if we only use ordinary good sense. I would advise any section that has some discussion that my involve political questions to write to the Council for information and advice. Let us all remember, however, that we are working together for the continuance of democracy and towards the greatness of our country.

INDUSTRY'S CHANGING EMPHASIS

From Materials to Men.

By

Fred H. Rindge, Jr.,

Secretary, Industrial Service Movement.

(Reprinted from The Electric Journal, January, 1917.)

At the head of many of our great industries are those who, because of American birth and training, were made custodians of American ideals and should have made those ideals pervasive. We are confronted with the fact that in some instances they have failed to do so. In the pursuit of economic advantage—the dollar—too many have neglected the social responsibility—the men. If the emphasis in the past has been upon the economic, it is not to be wondered at that the problems of the present are emphatically social.

The practical is never safe unless it is woven through with the ideal. If thousands of workers are gathered by the forces of industry, corresponding socializing forces must be set in motion. Safety, if nothing else, demands this. Many clear-visioned industrial leaders see and act upon this, while others fail; and their failure penalizes all. The two types are illustrated by two officers of a western plant employing many foreigners. The president, who had some knowledge of a plan of welfare work, said to the manager:—"We ought to do some betterment work in our plants. This plan looks good to me. What do you say to trying it out?" The manager answered: —"Oh, the first thing they will do will be to teach the foreigners English, and then they will get together and make trouble."

Experience proves that such work will not cause trouble. As a matter of fact, this kind of betterment brings only happiness, ideals and efficiency, output and earnings. More than that, it lessens some things, including drinking, vice and the cost of production. This has been demonstrated again and again by different companies.

Man Efficiency.

The genius in industry which has given to the world the wonders of machine efficiency is beginning to address itself to the more important and more difficult subject of man efficiency. This marks the dawning of industry's brightest day. But just as formerly it was difficult to induce conservative management to see the wisdom of discarding old machines for new, so with the methods of dealing with the human factor. Progress has been made, however; witness the new standards of factory construction, the sanitation, the safety devices, etc., and the new types of industrial towns, housing, education, etc.

It is still very easy for factory management to give the major regard to material and machinery and to scan with special care proposed expenditures for the welfare of the workers. A manufacturer who was interviewed recently regarding some welfare work which he favored, but which would involve a cost of $8000 for permanent equipment and $1500 a year for maintenance, said:—"That would require special consideration by the directors and certain of our stockholders, and I know they will not approve it." On his desk lay an order to discard $18,000 worth of machinery and install $40,000 worth of new. He had no trouble getting approval and quick action on scrapping old machinery, but when the question of scrapping old methods of dealing with men arose the case was different.

Signs of Promise.

Observation leads to the convention that the hearts of employers and employees beat more nearly in unison than the strikes, lockouts, dynamitings and court actions would indicate. The pressure of rapid industrial development and the desire for personal gain have obscured some of the finer things. The economic has been emphasized at the expense of the social. But the emphasis upon the human factor is fast becoming more general and more sincere, more intelligent and more unselfish. The new appreciation of character as an economic asset and the spirit of good will welcoming reasonable self-expression along mutually helpful lines—these are among the signs that appear upon the horizon at this the dawn of a new day in industry.

The avoidance of waste is of increasing importance in industry, and this ought to be so, for we are guilty of awful waste—of timber, of coal, of water power, etc. We do well to be concerned about these things, but it is noticeable that the growing theme is human conservation and the changing emphasis is from materials to men. There are few meetings of manufacturers or of workmen where this subject is not to the fore. The avoidance of waste, of life and limb and of human capacity is regarded as of more importance than the waste of timber and coal and water power.

Self-Expression of the Worker.

Closer attention to the human factor will show not only the value of socializing and character-making influences, but it will reveal what some employers are loath to see, but what an increasing number of others are glad to recognize, that the workers must have larger self-expression.

The instinct of self-expression is the human attribute that accompanies human progress; indeed, it makes human progress. The ground swell of industrial unrest that is on throughout the world, notably in the Christianized world, makes progress. It is a movement from within outward and upward; one which cannot be confined without peril of explosion, but may be released and directed so that what might be destructive and a calamity will become productive and a blessing. There is no need to fear this demand for self-expression if there is the right kind of guidance. Hence the wisdom of first looking well to character-forming influences, and then opening the channels for safe and satisfying self-expression.

No increase of wages or decrease of hours will alone satisfy a worker. Every man wants to run something. If he hasn't anything of his own he will want to run something that belongs to somebody else and to run it his own way. The genius of industry is discovering this and is giving the more intelligent workers a proprietorship in more of the things that concern them. A worker who may not own his tools or his handiwork, his home or his job, ought to be helped to find something that he can own and run. Too often modern industry gives men nothing but wages, and men will not be content with wages only.

The Big Problem—Handling Men.

After all, it is largely a matter of handling men in the right way. In spite of seeming exceptions, in spite of the influence of "outside agitators," the men, as a rule, respond quickly to right treatment. The big leaders of industry never lose faith in this fundamental idea. For example, Mr. E. M. Herr, president of the Westinghouse Electric & Mfg. Company, in a paper before the American Institute of Electrical Engineers some time ago said these very significant things:

"In the management of men, the engineer as usually trained, has his severest test. Many engineers, remarkable for their judgment, skill and intelligence, fail dismally in handling men. The very nature of the training of the engineer tends to unfit him in directing and controlling the rank and file of the workmen. The exact and uncompromising methods so necessary in engineering training cannot be applied in dealing with men. Fairness and justice are the cardinal principles to be used always, but in addition, in dealing with people one must know how to bring the human element into all such relations. When this is properly done, the workman is inspired, stimulated and led into obedience and loyalty to which no severity or rigid rules could drive him."

And again:—

"There is a great difference in the effect upon an employee of the way an order or decision is given. You all have probably at some time dealt with those in authority from whom you would rather receive a refusal than an acquiescence from another. An adverse decision would be received from the former superior and carried out with a feeling of loyalty and willingness, but with an unavoidable feeling of grudging obedience and almost revolt from the latter. The different effect upon the employee was caused by the employer's knowledge of and due regard for one phase of the human element in dealing with the employee."

This problem of handling men raises the vital question of "Where can industry secure the right type of men to handle other men?" Some industrial concerns are giving time, study and money to training up such men from the ranks. Other concerns look largely to the graduates of our engineering schools. These engineering graduates are often skilled in technical knowledge, but weak in experience in dealing with men. In final analysis then, it is a problem of training the undergraduate, of giving him instruction in the human as well as the technical side of his profession, and of affording him contact with industrial workers. If this can be done he will graduate much better equipped for his chosen profession. The engineer in reality stands between capital and labor and must appreciate the viewpoint of both. How can he be helped (as an undergraduate if possible) to be equal to his task?

Solving the Problem.

For the last eight years the Industrial Service Movement has been answering this question by a practical program which commands the admiration and enthusiasm of all who have heard of it. In coöperation with both employer and employee this movement has enlisted thousands of engineering students and others in meeting industrial workers—foreigners, working boys, skilled mechanics, trades unionists and others—in some practical service, and this has given these young engineers new visions of the workers and of their needs. It has inspired them with a desire to promote better industrial conditions, and already where such students have become engineers the effect of their training is seen in better treatment of men and a better understanding between the workers and employers. The man who handles men intelligently is at the focus of the whole industrial situation. The Industrial Service Movement develops this type of man. The far-reaching effect of this work appears already in many quarters, and the years just ahead should yield far greater results. The national engineering societies are joining heartily in the effort. Papers on this subject have been read before the annual meetings of these influential organizations, and sent to their members—over 25,000 business men and engineers. Human engineering* is finding a place in the required course of colleges and upon convention programs.

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*Copy of the proposed course for engineering schools on "The Human Side of Engineering" can be secured on request from the author, 124 East Twenty-eighth Street, New York.

Special lecturers on these topics are secured for the colleges. Among these men are some of the real leaders of industry, who are willing to take time from their busy life to help promote the human engineering idea and ideal. Observation trips are planned to give college men a knowledge of existing conditions, how these conditions are being improved by the various agencies, and the industrial betterment work of various companies. Special libraries and social problems are promoted in the engineering schools.

Most important of all, during the past year 4500 students from 250 colleges were engaged regularly in industrial service, thereby reaching 100,000 working men and boys. They taught English to foreigners, mechanics to American men, right living to boys and a score of other worth-while things. Three thousand graduates are already active in industrial betterment largely as a result of interest acquired at college. These volunteer workers do not go down to help others, nor ask others to come up and be helped, but rather go with them in a spirit of common-sense brotherhood. The task, in a word, is to get workingmen educated and educated men to work. The movement yields most desirable and lasting results to those who are being served by the students, to the students themselves, to the whole of industry (as employer, employee and stockholder profit from the increased good will) and to society, because it begets better understanding and makes society safer. In the words of J. Parke Channing, famous mining engineer:—

> "The whole plan seems sane, practical and convincing. It helps the coming engineer to get a broader perspective while an undergraduate. It enlarges the worth of the workers through the service of the students. It affords an instrument for all-round welfare work, wherever the engineer may go. * * Think of what it will mean to industry to have a thousand or more men each year entering upon their work with this splendid spirit, and with the ability to inspire confidence, good will and loyalty. What will this mean to the industrial leadership of the future?"

This whole movement has been initiated and promoted on the broadest kind of a basis by the international, state and local branches of the Young Men's Christian Association, in coöperation with other agencies, and especially with the two great forces in industry. It has been backed by industrial leaders, who have realized the strategic importance of just this sort of thing.

Beside this special drive at this special problem, a most comprehensive plan of welfare has been developed in connection with manufacturing interests, electrical and otherwise, and with the cotton, coal, lumber and other industries. Mr. Herman H. Westinghouse has on several occasions declared his approval of the masterly way in which the welfare program has been handled. A splendid illustration of this work exists at Wilmerding, Pa. Mr. John F. Miller, president of the Westinghouse Air Brake Company, says:

"The part of our welfare work which is administered through the agency of the Y. M. C. A. has been an unqualified success due, we believe, to the altruistic spirit underlying all association work, able local management and the helpful co-operation of the larger organization in state and nation."

Mutuality Rather Than Neutrality.

All such work is helping industry to shift its emphasis from materials to men, where it belongs. Many mistakes have been made in so-called "welfare work;" often the men resent the company doing anything for them. That is one reason why some employers of labor and influential engineers invite the Y. M. C. A. to run the welfare work. It is a neutral, or rather a mutual agency, and is therefore not under suspicion. Furthermore, it develops that self-expression of the worker, the need of which has already been noted, for it enlists him in committee service, shows him how to serve others, and in reality makes him feel that he and his fellows are "running the thing themselves."

The greatest forces in industry are like the electric current—unseen. Integrity, stability, intelligence, good will, loyalty, these are unseen, but the effects of such qualities in workingmen are seen on every hand and, in the last analysis, determine success. Industry is realizing this more and more every day, and that is why its emphasis is shifting from materials to men.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, February 12, 1917.

The meeting was called to order with Vice-President Klorer in the chair and Messrs. Riess, Young and Hogg present.

Minutes—The minutes of the previous meeting were read and approved.

Delinquent Members—The Secretary reported certain members delinquent in their dues for 1916.

The Secretary was requested to write these members in regard to their delinquency before final action would be taken.

Dropped Members—The Secretary reported that Mr. ———— had failed to apply for transfer from Junior Member to Full Member as required by Sec. 4 of Art. II of the Constitution of the Society. It was moved and carried that Mr. ———— be dropped from the membership.

Applications—The following applications were ordered to ballot, subject to the approval of the Membership Committee:

For Resident Member—L. O. Piersol of New Orleans.

For Resident Junior Member—H. L. Gilbert of New Orleans.

For Transfer from Resident Junior to Resident Member—Hyman Rabinovitz.

Membership Card—The issuing of new membership cards was taken up and after considerable discussien it was moved and carried that the Secretary be instructed to have two hundred new cards engraved, omitting the year, as previously engraved, and leaving a blank space for insertion by the Secretary the year in which the card is issued.

Vacancy on Board—The election of Mr. Ole K. Olsen as Treasurer of the Society left a vacancy in his unexpired term as a Director. It was moved and carried that Mr. James M. Robert be elected to fill the vacancy, the term to expire December 31, 1917.

Bills—*The following bills were approved for payment:*

Robert H. Scott (tracing maps for Proceedings)	$ 8.50
Tulane University Press (printing and postage)	31.75
M. C. Le Jeune (stenographer at meetings)	29.00
Cosmopolitan Hotel Co. (Smoker bill)	156.30
Engineering and Contracting (subscription)	3.00
Engineering Publishing Co. (sub. to Munc. Engineering)	2.00
American Architect (subscription)	8.00
Railway Age Gazette (subscription)	5.00
The Engineering Magazine (Index Annual, 1916)	3.00
W. T. Hogg, Secretary (salary and incidentals)	32.50

Reports—*The financial statements of the General Fund and Cash Account were submitted by the Secretary and accepted. The statements showed a balance in the General Fund for January of $30.84, and cash on hand after paying all bills $898.71.*

There being no further business the meeting adjourned.

W. T. HOGG, Secretary.

Regular Meeting of the Society, February 12, 1917.

The meeting was called to order with Vice-President Klorer in the chair and 52 members and guests present.

The minutes of the previous meeting were read and approved.

There were no reports from committees. The technical exercises of the evening were then held. Mr. L. P. Breckenridge, Professor of Mechanical Engineering at Yale University, spoke on "THE ENGINEER," HIS OPPORTUNITY AND HIS OBLIGATION." Professor Breckinridge was tendered a rising vote of thanks for his interesting talk.

Mr. Chas. S. Williamson, Jr., stated that the third exposition of Chemical Industries would be held in Grand Central Palace, New York City, the week of September 24, 1917.

This exposition will feature the industrial possibilities of the South. It is highly important that every Southern State be properly represented by an exhibit of its manufacturing possibilities.

Louisiana has natural resources that no other Southern State possesses.

In view of this opportunity to display before the Captains of Industry our industrial, chemical and engineering potentialities, which should be thoroughly and adequately exploited, Mr. Williamson submitted the following resolution:

Be It Resolved, That the Louisiaan Engineering Society unanimously endorses a movement to obtain this result, and will lend its services and council to further this cause.

The resolution was unanimously adopted.

The following proposed change in Section 2 of Article VII of the Constitution of the Society was submitted for a second vote and approved:

Present section reads: Honorary Members shall be proposed by at least ten members and shall be elected ONLY BY UNANIMOUS VOTE OF THE SOCIETY * * * Amended section to read: Honorary Members shall be proposed by at least ten members, and shall be elected BY THE BOARD OF DIRECTION * * *

There being no further business the meeting adjourned to the collation.

W. T. HOGG, Secretary.

Regular Meeting of the Board of Direction, March 12, 1917.

The meeting was called to order with President Dusenbury in the chair and the entire board present.

The minutes of the previous meeting were read and approved.

Applications—The following applications were ordered to ballot:

For Member—Paul B. Jeffries, L. O. Piersol.

For Junior Member—H. L. Gilbert.

For Transfer from Junior to Full Member—Hyman Rabinovitz.

The following applications were ordered to ballot subject to approval of membership committee:

For Member—J. F. Fonville of Magnolia, Miss.; A. H. Guillot, Jos. M. Bing, and Lee A. Christy, of New Orleans.

For Transfer from Student to Full Member—Frank Sprague.

For Junior Member—John Appleby, Jr.

Delinquent Members—The Secretary reported certain members delinquent in their dues for 1916. The Secretary was instructed to communicate with the non-resident members, and to place the local accounts in the hands of a collector in the hope that the indebtedness would be paid before the next meeting.

Resignation—The resignations of Messrs. Chas. H. Shapleigh and Jas. Sherrard, Jr., effective December 31, 1916, were accepted with regret.

Communications—A letter from the Committee on Engineering Cooperation requesting that a delegate be appointed to represent the Society at the meeting to be held in Chicago, March, 1917, was taken up. It was moved and carried that the President make an effort to appoint a delegate to represent the Society.

A letter from the Manufacturers' Record stating that it could not exchange with our Proceedings was read. It was moved and carried that the subscription to the Manufacturers Record be cancelled.

The question of exchanging publications with the Michigan Technic, published at the University of Michigan, was discussed. It was moved and carried that we exchange publications.

Honorary Member—A proposal recommending the election of Sidney Francis Lewis to Honorary Membership in the Society, signed by twenty mmebers of the Society, was submitted by the Secretary. The proposal recommended his election for the following reasons:

"Col. Lewis was one of the founders of the Society, a charter member and our first President.

"He has taken part in the activities of the Society throughout its entire history.

"He is one of the older members of the American Society of Civil Engineers and the oldest, in point of membership, in the State of Louisiana.

"He has been in the active practice of his profession in this State continuously since his graduation from the University of Virginia, being identified for practically all of that time with the development of the levee system of the Lower Mississippi river, one of the most vital problems of engineering of this section."

It was moved and carried that Sidney Francis Lewis be elected to Honorary Membership in the Society.

Bills—The following bills were approved for payment:

Tulane University Press (February Proceedings)	$211.35
Tulane University Press (printing and postage)	50.40
Ole K. Olsen (advanced for Smoker expenses)	94.76
Fabacher's Rathskeller (refreshments for February Meeting)	6.25
W. T. Hogg, Secretary (salary and incidentals)	33.20

Reports—The report of the Smoker Committee was read and accepted. The report stated that the expenses of the Smoker amounted to $281.91, and the membership assessment $212.00, leaving a deficit of $69.91.

The financial statements of the General and Proceedings Fund and cash account were submitted by the Secretary and accepted. They showed a balance in the General Fund for January and February of $68.77, in the Proceedings Fund from February issue, $24.38, and cash on hand after paying all bills, $992.51.

There being no further business the meeting adjourned.

W. T. HOGG, Secretary.

Regular Meeting of the Society, March 12, 1917.

The meeting was called to order with President Dusenbury in the chair and 41 members and guests present.

The minutes of the previous meeting were read and approved.

Mr. Olsen, Chairman of the Membership Committee, stated that the committee was working hard, but that every member should do his part in the work to increase the membership. Almost every member knows several men who are eligible to membership, and should try to bring them in. Application blanks will be sent out with the bills next month and more will be furnished if the members can make use of them.

The technical exercises of the evening were then held. Mr. Edgar L. Stream was on the program to read a paper entitled, "MANUFACTURE OF CANE SUGAR," but received an unexpected call to Central America. Mr. W. B. Gregory read Mr. Stream's paper, which was followed by considerable discussion.

As there was no further business the meeting adjourned to the collation.

W. T. HOGG, Secretary.

Special Meeting of the Board of Direction, March 16, 1917.

The meeting was called to order with President Dusenbury in the chair, and Messrs. Klorer, Olsen, Riess, Robert, Young and Hogg present.

Mr. Dusenbury stated that the object of the meeting was to consider what disposition should be made of the surplus cash in the treasury of the Society. After discussion, it was moved to deposit $250 in each of the four banks that advertise in the Proceedings of the Society.

There being no further business the meeting adjourned.

W. T. HOGG, Secretary.

A TRUE COPY.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of The Proceedings of the Louisiana Engineering Society, published every two months at New Orleans, Louisiana, for April 1, 1917.
State of Louisiana, Parish of Orleans; ss.

Before me, a Notary Public in and for the State and parish aforesaid, personally appeared Douglas S. Anderson, who, having been duly sworn according to law, deposes and says that he is the editor of the Proceedings of the Louisiana Engineering Society, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Louisiana Engineering Society, New Orleans, La.; Editor, Douglas S. Anderson, New Orleans, La.; Managing Editor, none; Business Managers, none.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock). The Louisiana Engineering Society. There are no stockholders. President, A. T. Dusenbury, 236 Baronne St., New Orleans, La.; Secretary, W. T. Hogg, Tulane University, New Orleans, La.; Treasurer, Ole K. Olsen, 822 Perdido St., New Orleans, La.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent of total amount of bonds, mortgages, or other securities are: (If there are nono, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the names of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

DOUGLAS S. ANDERSON.

Sworn to and subscribed before me this 31st day of March, 1917.

H. W. KAISER, Not. Pub.

[SEAL] (My commission is for life.)

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

APRIL, 1917

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISEMENTS

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PROFESSIONAL CARDS

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Louisiana Engineering Society

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DOUGLAS ANDERSON, Editor.

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LOUISIANA ENGINEERING SOCIETY

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Vice-President, JOHN KLORER, 213 New Court House Bldg.
Secretary, W. T. HOGG, Tulane University.
Treasurer, OLE K. OLSEN, 822 Perdido Street

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

All business communications should be addressed to W. T. Hogg, Secretary
P. O. Station 20, New Orleans, La.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

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EDITORIAL NOTES AND COMMENT

Prominent Visitors.—The Louisiana Engineering Society has been fortunate during the past season in having had visits from several very distinguished engineers, who have delivered addresses before the Society and its guests. The Committee on Technical Exercises is to be congratulated on having secured the services of these gentlemen, for it is always an inspiration to listen to men of distinction in the profession who are able and willing to bring us a message from the outside. The first of these lecturers was Dr. Ira N. Hollis, President of the Worcester Polytechnic Institute and President of the American Society of Mechanical Engineers. We shall not soon forget the inspiring words he spoke to us on the occasion of our Annual Meeting in January. For the February meeting we were fortunate in having Dr. Lester P. Breckenridge, Professor of Mechanical

Engineering at Yale University, and a former Vice-President of the American Society of Mechanical Engineers. Dr. Breckenridge spoke upon the subject, "The Engineer; His Opportunity and His Obligation." The address is printed in this issue of the Proceedings, and will prove of great interest to the engineer who thinks of and takes the broader view of his profession and the obligations resting upon him as an individual member of the profession.

At the May meeting Professor Albert Van Hecke of Belgium gave an illustrated lecture entitled "Life in the Belgian Refugee Camps in Holland." Professor Van Hecke was professor of civil engineering in the University of Louvain and was present when that city was sacked and burned by the Germans. Upon the occupation of the greater portion of Belgian territory by the German army large numbers of refugees, made up of people of the poorer and working classes, went over into Holland. The problem of caring for these people was a serious one, and Professor Van Hecke was one of the men called upon to help find the proper solution. At is was desirable to attempt to maintain as far as possible the national character of these refugees, it was decided that they should all be kept together in some form of camp or community. Land of sufficient extent was set aside for this purpose by the Dutch government, roads and systems of drainage were constructed, barracks and houses were built, schools and industries were established, and several hundred thousand of these refugees are living there to-day under conditions which are surprisingly good when one considers the terrific strain upon resources to which all European nations, even neutrals, are subjected at the present time. Professor Van Hecke has been in charge of certain of the industrial features of the camp life, and he has come to this country in order to interest and obtain financial co-operation of Americans in carrying on this very necessary and important work. The lecturer illustrated his remarks by means of moving pictures, showing the more important phases of the every-day life and work of the camp, and he and his co-workers are to be congratulated upon the very excellent results they have obtained with the meager resources at their command.

Individual Preparedness.—What is each one of us prepared to do in the war with Germany to which this country proposes to devote all of its great energy and vast resources in order that the nations of the world may continue their existence in a peaceful prosperity, which does not bear the label, "Made in Germany?" This is the subject which Mr. A. M. Shaw has treated in his usual efficient and capable way in a paper read before the Society at the meeting of April ninth. This was a joint meeting of the Engineering Society and the local section of the American Chemical Society, and brought out one of the largest audiences of the season. Among the invited guests were a number of the Army and Navy officers stationed in or about New Orleans, and several of them contributed to the discussion of the paper. This is a subject which appeals particularly to the engineer for the reason that this is peculiarly a war of engineering skill and ingenuity. The engineering profession almost more than any one other profession will be called upon to contribute both men and ideas for the successful completion of the task which our country has undertaken. There is as yet a good deal of uncertainty as to what each individual can do to help out, and it is probably a question of waiting until the Government has been able to get its own plans into more detailed and practical shape. The engineers of the country, through their major organizations, have already done a great service in the Industrial Survey undertaken a short while ago. Practically all of the engineers have through different organizations already placed themselves upon record as to willingness and ability to serve the country in such positions as their services may be most efficiently utilized. A perusal of the paper as well as of the discussion, participated in by many of the members and guests, may well serve to suggest to us ways and means that might be adopted to further aid the Government in its stupendous task.

The U-Boat Problem.—Beat the U-boats and you have the Germans beaten. This is the great problem of the war. Many of the greatest scientific minds and the most ingenious inventors of the world are turning their whole attention to this problem. But, quoting from the letter printed below, "It must be remembered that many of our greatest inventions and discoveries have been made by men not specialists in the particular field in which the discovery has been made.'' Many men are thinking about this submarine problem, and perhaps some person may have the nucleus of a very excellent idea. The Government wants these ideas. In order to bring the matter to the attention of engineers and scientific men throughout the country the National Research Council is sending out the letter and memoranda printed below, a copy of which has just been received by Prof. W. B. Gregory. In order to give it a wider circulation it has been decided to print it in this issue of the *Proceedings*:

NATIONAL RESEARCH COUNCIL
ENGINEERING COMMITTEE
GANO DUNN, Chairman.
W. F. DURAND, Vice-Chairman
Washington Office: Munsey Building
New York Office: The Engineering Foundation,
33 West Thirty-ninth Street

WASHINGTON, 21 May, 1917.

MY DEAR MR. GREGORY:

The problem of the submarine is the most important individual problem of the war.

Its solution is the most important question confronting the Allies at the present time.

As one of the co-ordinate branches of the Research Council there has recently been organized an Engineering Committee with offices in Washington and New York; it is in contact with the work of the other committees of the Council and with the various problems which are brought to its notice by the several branches of the Government.

The primary purpose of this Committee is to act as an intermediary between the needs of the Government on the one hand and the vast field of potential human energy and genius represented by the engineers of the United States.

Under these circumstances and having in view the supreme importance of the submarine problem, the Engineering Committee appeals to you to devote your best thought and study to this problem and to transmit to the undersigned, at the earliest moment, any suggestions which, in your opinion, may give promise of effective service in dealing with any or all of the various phases of the problem.

It must be remembered that many of our greatest inventions and discoveries have been made by men not specialists in the particular field in which the discovery has been made. It may thus well remain for some one not a specialist in these matters to contribute most valuable factors in dealing with the problems.

It must also be remembered that presumably the solution is manifold and may represent a joint application of many different elements under the general heads of:

Detection of the presence or location of a submarine.

Protection against torpedo attack by the submarine.

Offense against the submarine.

For these reasons the Committee bespeaks your earnest efforts and asks that you will not withhold from its consideration any carefully thought out scheme or suggestion which may seem to hold the germ of a helpful idea.

As an aid in your consideration of the problem, certain facts are given on the accompanying sheet regarding approaching a study of the problem.

In conclusion I beg to say that you cannot overestimate the importance of this problem at the present time and while other agencies and individuals are now and have been for some period engaged in its study, there is still room—nay, more, urgent need, of the very best efforts which the engineers of the country can contribute.

We are sending this letter to selected members of the Engineering Societies distributed over the United States. May we ask you to act as a secondary center of distribution and by word of mouth or otherwise, bring the matter to the attention of others who, in your judgment, might be able to contribute helpfully to the solution of the problem?

Faithfully yours,

(Signed) W. F. DURAND,

Vice-Chairman in Charge

Work of the Engineering Committee.

Address:

W. F. DURAND,

327 Munsey Building,

Washington, D. C.

MEMORANDA ON SUBMARINES

Submarines operate singly or in groups as may seem best suited to local or special conditions.

They are suppsoed, where circumstances favor, to lie on the bottom at rest and with listening devices attempt to detect the approach of vessels. On receipt of evidence that a vessel is approaching, they rise to a level permitting observation with periscope, and then manœuver accordingly. When in water too deep to permit lying on bottom, the submarine must maintain steerage way in order to hold its level of submergence. The minimum speed at wihch this can be done will range with circumstances from 2 to 4 knots. The maximum depth of submergence is about 200 feet. The usual depth of running is from 50 to 100 feet.

They have been supposed to return to the home base at intervals of 30 to 35 days. The total radius of action will presumably range from 5,000 to 8,000 miles at a moderate cruising speed of 10 or 11 knots. The high speed emerged will range from 14 to 18 knots, or possibly more in latest designs. The maximum submerged speed is about 10 knots.

Hidden bases have been presumably used off the Irish and other coasts. There have also been suspicions of bases on the coasts of Greenland and Iceland. Submerged bases for oil and supplies have also been employed.

The time required from emergence to submergence will range from 1 to 3 or 4 minutes, according to circumstances.

When submerged near the surface, the time required to raise the periscope, take a quick observation and lower it again, may range from 15 to 30 seconds. If desired, the submarine can follow an undulating path, rising and submerging alternately, at frequent intervals, at will. Or otherwise it may run fully submerged but near the surface and take frequent observation through the periscope. Modern submarines are provided with two or three periscopes. The loss or destruction of one, therefore, will not necessarily disable the boat.

Torpedoes fired from submarines are presumably aimed by changing the direction of the boat. This, however, is not assured in all cases. The torpedo, in order to run true, must travel at an immersion of about 10 feet. In smooth water it may be run at a shallower depth than in rough water.

Submarines may operate at night with less liability of detection, but with, of course, greater difficulty in picking up their target.

Submarines use the gyroscopic compass.

Sounds produced by the movement of a submarine through the water, including those traceable to the propeller, to movements of the rudder, etc., should permit of detection by the use of modern refined sound-detecting devices.

The distance at which a protecting net, plate, or shield or other means of exploding the torpedo before reaching the side of the ship must be located in order that such distance will render the effect of the torpedo harmless, will depend primarily upon (1) Weight of explosive charge, (2) Depth of torpedo when exploded, (3) Strength of the ship's structure. With modern torpedoes and a depth of 10 or 12 feet and with the structure of modern merchant ships, distances of 20 or 30 feet would perhaps be required in order to give good assurance against injury. With rough water and possibly much less submergence at the time of explosion, reduced distances of 15 or 20 feet might prove sufficient. Experimental investigations on this subject show a very wide divergence among the results and no precise rule can be given. It may be added, however, that naval constructors generally are satisfied that the distance at which protecting plates or shields would have to be placed in order to secure immunity is so great as to render their use of very doubtful practicability.

Additional information on specific points will be furnished on request, if practicable to do so.

ENGINEERING COMMITTEE,
W. F. DURAND,
Vice-Chairman.

21 May, 1917.

New Members.—Since the publication of the last issue the following new members have been received into the Society and the following transfers made:

Jos. M. Bing, New Orleans, Resident Member.
Albert H. Guillot, New Orleans, Resident Member.
Paul B. Jeffries, Vicksburg, Miss., Non-Resident Member.
Luther P. Piersol, New Orleans, Resident Member.
Jesse F. Fonville, Magnolia, Miss., Non-Resident Member.
Horatio L. Gilbert, New Orleans, Junior Member.

TRANSFERS.

George E. Durr, New Orleans, Junior to Resident Member.
Hyman Rabinovitz, New Orleans, Junior to Resident Member.
James P. Ewin, New Orleans, Student to Resident Member.
Frank E. Sprague, New Orleans, Student to Resident Member.
Robert A. Pierpont, New Orleans, Student to Resident Junior.

The Membership Committee has been doing good work this past few months and they have plans for carrying their campaign still further.

BOOK REVIEWS

Grandes Voûtes. By PAUL SÉJOURNÉ, Ingénieur Conseil, Paris, France.

That all activity in France, outside of military affairs, is not utterly paralyzed, as many people in this country seem to believe, is shown by the completion about the end of last year of Monsieur Séjourné's monumental treatise on "Great Arches." He has been working on the preparation of the manscripts for a long time, but he did not publish the first volume of the book until 1913. There are six volumes in all, quarto size, and they contain 1,732 pages, 334 photographic views, 896 other illustrations, and tables too numerous to count—in fact, the first four volumes consist mainly of tabulations of data concerning important masonry and reinforced concrete arch bridges, together with their numerous illustrations. It is only the last two volumes which contain any of the ordinary style of text.

The book is entirely different from any technical work ever published in America, and it is far too elaborate in style and price to suit the pocketbooks of most American engineers. While it is bound merely in paper covers with the leaves uncut, the cost of the six volumes is 250 francs, or about $50. The reader will ask "Where does this expense come in, and is it justified?" The answer is that the cuts are most elaborate, that the paper is heavy and expensive, and that the typography and the finish are superb. Yes, the book is well worth the price, but it should be purchased mainly by public libraries, universities, and technical schools—also by those engineers who specialize in reinforced-concrete-arch construction.

It is an education in aesthetics to study the handsome illustrations; and if he even could not read a word of French, the treatise would be most valuable to any progressive bridge specialist.

The author is a man well on in his sixties, who has had a broad and voluminous practice, and who stands at the very top of the engineering profession in France. He is of a genial and friendly nature, and the writer is proud to be able to include him on his list of personal friends. There is a peculiar geniality about French engineers of high standing which does not exist at all generally among the scientific and professional men of other nations; for in addition to the politeness and suavity which are inherent in the French people as a whole, the engineers are highly-and-broadly-educated gentlemen; and to meet them is always a true pleasure and a privilege. As the writer in times past associated with many of the leading engineers of France, on intimate and friendly terms, he can speak authoritatively on this subject.

But to return to the book under consideration—the minimum span length considered is forty meters (about 131 feet): and the author aimed to include all the important structures of the world, although his geographical lists cover only Austria, England, France, Germany, Luxembourg, Italy, Norway, Switzerland, and the United States. The completeness of the statistics furnished concerning arch bridges is extraordinary, covering about all the information of value which the reader could desire. At the end of the sixth volume are given tables that serve as a compendium of the information furnished; but, unfortunately, there is no topical index such as is provided in most American technical works. This is about the only real blemish in the entire treatise; and it is not as important as it would have been had the volumes contained a large proportion of text matter. Volumes V and VI, however, deal with the theory of arch designing and with the detailing; hence a good index would have proved serviceable to the reader, and especially to one who desires to make use of the work in order to improve the general character of his practice.

With most of Monsieur Séjourné's statements the writer will agree; but when he remarks that "*On fait une voûte d' après les voûtes faites; c'est affaire d' expérience,*" he surely must refer to European practice and not to American; because in this country bridge designers are constantly endeavoring to evolve new types and to effect improvements in old ones. It is only in Europe that the worship of precedent is noticeable in designing. Something is to be said, though, in favor of the practice of studying existing structures and old types, for progress in design can best be effected by innovations which are improvements on established practice. In the making of such improvements Monsieur Séjourné's great work will take a leading part in all that pertains to arch-bridge design and construction.

J. A. L. WADDELL.

PAPERS AND DISCUSSIONS

THE ENGINEER—HIS OPPORTUNITY AND HIS OBLIGATION.

By

DR. LESTER P. BRECKENRIDGE,

Professor of Mechanical Engineering, Yale University, Delivered Before the Society February 12, 1917.

Mr. President and Members of the Louisiana Engineering Society:

I assure you it is a great pleasure to stop in New Orleans for a week and meet some of the engineers of this interesting city.

I met your member, Professor Gregory, in New York, the other day, and when I said to him that I was going to visit New Orleans on my trip to the Coast, he said to me: "Well, you will have to talk to our Engineering Society." I did not start out with the idea of talking, but here I am, and I am glad to say some things to the members of your Society.

In the first place, I bring to you the greetings of the engineers of the American Society of Mechanical Engineers up in New York, who are always glad to send words of greeting to engineering groups situated in different parts of our United States. I bring a word of greeting from the engineering men and boys of Yale, the Sheffield Scientific School of Yale, being the institution with which I am now connected. I have taught at four different institutions—Lehigh University, Michigan Agricultural College, the University of Illinois, for sixteen years, and now I am back at Yale, where I graduated in 1881; as I came in here tonight, I found my Illinois and my Lehigh boys and my Yale associates among the audience, and it is a great pleasure to see them.

One thing that occurs to a man from New Haven when he reaches this part of the country, where cotton is such an important part of your industries is the fact that our one-time citizen, Eli Whitney, did some thinking about cotton in his early years, and the invention of the cotton gin was the result. What a blessing that invention was to the South in particular and to the world in general.

At present Mr. Eli Whitney, the grandson of the inventor of the cotton gin, is one of our esteemed and influential citizens.

In the Mason Mechanical Laboratory of the Sheffield Scientific School recently constructed at Yale at a cost of about $250,-000, we have, not a cotton gin, but a Whitney milling machine. Those of you who are mechanical engineers will know what a milling machine is. It is a machine that cuts metal; not a machine that has anything to do with the making of flour—and this milling machine was made by Eli Whitney, and it was the first milling machine made in the world; it is mounted on a wooden base, and it is an interesting relic of the early days of machinery which has developed so wonderfully.

The grandson of Eli Whitney is now a member of our Yale Corporation, a distinguished citizen of New Haven, president of one of our banks and of the New Haven Water Company, and one of the most helpful men in all the civic affairs of New Haven.

I have had most delightful impressions of New Orleans. I have never been in New Orleans until this week, and you can imagine my impressions as a stranger coming into this city. I have had the pleasure of meeting here many delightful people. I have been taken in tow by friends, and have been shown much of your city, not only the social side, but the industrial side, the engineering side, the commercial side, the shipping side, and I am wonderfully impressed with this magnificent city at the mouth of the Mississippi River—or at least, I thought it was near the mouth until I learned, after getting here, that it is 110 miles from the mouth of the river.

I have had the pleasure of meeting your Commissioner of Conservation, Mr. Alexander, and he has told me something of the wonderful resources of the State of Louisiana, you know them well,—about your sulphur, your salt, your gas and oil wells, and your crops of lumber and cotton, and those things which we think of perhaps not as frequently as we do of your cotton industry. It is the cotton industry, of course, that we always associate with these Southern States. We think of cotton going down the Mississippi River, and off across the ocean or up into New England, I am surprised to find that many of those twelve million bales, more or less, of cotton, do not go up to New England, do not go away, but almost one-half of what you do not export is manufactured into some kind of cotton cloth right here in your Southern States. I congratulate you upon your rapid industrial growth.

The topic which I understand I am to talk about is: "The Engineer; His Opportunity and His Obligation." Well, I think I did select that subject, because, with such a subject, you can easily see that one could talk about a great variety of subjects, and you will discover, as the minutes go by, that I have not prepared a story about some wonderful design of a new machine or engine or motor, or even some great record of pumping water, building a dam or a great power station, but have simply a few thoughts to present which perhaps would seem to fit better a title of Old and New Engineering conditions. You might think that, coming from an educational institution, and having taught mechanical engineering for thirty-five years, I should discuss the problems of education, but I fear I don't know much about the problems of education. I have been learning all these years, and I shall not say much about the problems of education.

They say there are two signs that tell when a man is growing old: One of them is that he insists on being comfortable—well, I rather suspect that I am guilty; the second, that he begins to talk about the things that were, rather than about the things of the future.

I feel that the conditions surrounding the engineer of today are so changed, and that the future has so much new work for the engineer and so much important work, that before bringing up the things that have to do with the obligations of the engineer, I might be permitted to say a few words about the engineer working under the old conditions.

My ancestors were all New Englanders, and I never went outside of New England until I was twenty-five years old. My father and mother were "brought up" on New England farms. My father left the farm when he was twenty-one—(there were eleven on the farm, boys and girls, and somebody had to get out)—and went down to Connecticut to work in a factory. He was soon married. Connecticut is my native State. Many were the summers I spent on a farm, so let me give you just a sketch of a New England farm of a few years ago. It was an independent unit, it needed almost nothing from outside. On a New England farm, my grandparents raised all their own food; they raised their grain, their cattle, their chickens, their hogs, their vegetables, their fruit; nearly all of their articles of food. They did have to buy a few things. Sailing vessels came across the ocean, from time to time, and brought tea, coffee and sugar, but for the most part, they were independent, as far as their food was concerned. There was a goodly bunch of boys and girls, and they all worked and all contributed hard labor with long hours to the production of the necessary supplies. They made their own clothing, their hats, their shoes and socks. Often have I held the sheep they sheared, and I knew that the wool would be my mittens and socks the next winter. They made their own blankets, their rag rugs; they made their own linen—they had to have a little calico now and then, and this they also had to buy. I remember very well seeing all of these things going on. They went into the woods and cut their own wood, and supplied themselves with material for shelter and fuel. Sometimes they took the logs down to the mill two miles away, where there was a little water power, and had them cut. I went to the mill many times to help. I would go down while the logs were being sawed up. They took their grain to the same mill to be ground. They made their tallow candles for light. They drove horses to the village, five miles. It was twelve miles to a railway station. They went to church on Sunday. They got a letter occasionally. The children had some "Schooling" in the winter. Oxen with sleds "broke out" the roads when the snow was deep. Were they not almost an independent unit? Think of the crude tools they possessed.

From this condition of living, of fifty years ago, where an individual unit of eight or ten people were almost absolutely independent of the outside world for their food, clothing and shelter, into what have we grown? We have grown from a condition of independence where we hardly needed the help of our neighbor, into the condition of extreme dependence, which we call a modern city. Take the New England cities—or any cities—to-day; they are absolutely dependent upon somebody else. New England would starve if it didn't have someone making food for it and sending it there all the time. All this change has been brought about because tools have changed in the hands of man. This first independent unit on the farm had very simple tools. They had hand tools for their grain and hay, also a hand-loom, an axe, a saw, a draw-shave, a few edged tools, a heavy grindstone. I can feel the kink in my back now, when I begin to talk about it. It seems to me that those uncles of mine just loved to bear on hard when I was turning, because I was strong in those days and hated to give up and lay down on the job, and they kept on bearing down harder. They sharpened their own tools, all simple tools, but they used them with surprising skill and effectiveness. Suddenly we began to put new tools of a different kind in the hands of man. James Watt, inventor of the steam engine, gave to the engineer the most useful tool that was ever invented. What a remarkable procession of tools have followed the invention of the steam engine. The steam engine made the factory possible. How wonderful is the story of the steam engine and what it has done. It has brought the people from the farms to the city; it has furnished centers of power; it has relieved man of heavy labor; it has enabled man to direct tools and machines so that one man may do the work of many. It has made possible by using power to do what was impossible without it. Thus the steam engine has brought about the most wonderful changes in our social conditions—some of the changes are good, and some are bad. People have used good tools with which to do bad things. People have used the same tools to kill animal food and to kill their enemy; but that condition has been brought about by the fault of man hismelf, and it is not the tools' fault. If you use a tool for a bad purpose it is your fault; it is not the fault of the tool, because the tool was not designed, perhaps, for that thing; although, of course, in some cases they are.

What the steam engine has accomplished would be a theme for many lectures. It has provided for transportation on land, and transportation by water. It drives our industries; it operates other tools, large and small machine tools, the tools that make so many other things, and it furnishes power for many thousands of industries—two hundred and sixty thousand industries in the United States, these industries filled up with tools driven by some power, largely the steam engine, and these tools are making things for men and women all over the world.

More recently has come the internal combustion engine. Found in many places where the steam engine cannot be used, or where it is not as economical to use it. Slowly at first, more rapidly later, we have a marvelous and economical engine, which we now call the internal combustion engine. What has it done? Look on your streets, and on your country roads. The automobile—transportation on land, but not on rails; transportation on the water, transportation under the water, transportation in the air—all due to the internal combustion engine, a wonderful engine of high economy. A new tool in the hand of man.

But still more wonderful has been the development of that great adjunct of the steam engine and the water wheel, the electrical generator and the electrical motor. The steam engine could not reach far enough. It ran a shaft that ran the mill and belts ran to the machines, but it could reach only four or five hundred feet, or at most a thousand feet. Sometimes we put up a cable or a rope drive, but still it could not reach far enough; and then the electric generator, the three small wires and the motor, and they found that this could reach to very great distances. That made it possible to develop a large amount of power in one central place, and reach out one hundred, two hunderd, and three hundred miles and carry that power in any direction with economy, to the place it was needed. What a wonderful development that has meant! What possibilities of economy in the development of power, due to the fact that we could develop our power in one great central station and use it as we wish, and use it not only for power, but use it for light, for heat—not so much for the heating of homes or houses as for industrial heating devices. There is much of our industrial heating, electrical heating ovens, japanning, that is now done with electrical current. The heating of our homes is of course still very expensive, but that electrical arm reaches into the various corners wherever we wish it, and it is destined to reach still further and still further, until every country, city, and town, every factory, building and home has available its electrical current. I noticed, stretched across the country all along through the Southern States, not an unusual but a rather larger amount of high tension wiring than I had expected to see. It begins to look like Switzerland, which is covered with a network of high tension wires. I didn't realize the large development and distribution of electrical power, which I see in this surrounding country, and in this city.

How important also has been the electrical transmission of intelligence. We used to burn fires on a mountain as a signal, or perhaps we hung lights in the belfry tower, "One if by land, two if by sea." We put up lighthouses on the coast to prevent vessels getting into trouble. How helpless the vessels were when they went out to sea. If we wanted to transmit a message we sent a man on horse-back with a letter—a courier. Now we have the telegraph, the telephone, the wireless—how completely they cover the world. A man in New York can communicate with the world, he can do business anywhere in the world to-day, and he does it. It is the bringing together of those little individual farm units that I spoke about that has revolutionized the habits of thought, and the methods of living of the world. It has created the opportunity and the obligation of the engineer. It has completely revolutionized methods of doing business. It has made it possible for large corporations to do business all over the world, and it will be well for us in the immediate future if we recognize these changed conditions. Other countries have excelled us in this respect.

How much better are the facilities for getting a scientific or technical education. The growth of universities all through this country has been most wonderful and indeed most fortunate. The demand for trained men for technical and business positions is at present very large.

I remember when I was a student at Yale one time the professor of physics had all the lights out, and the room dark for an experiment going on at the desk, and the fellows put up a job on him, they all took off their shoes and sneaked out, and when the lights were turned on the room was vacant. I think that might be a good scheme, so if any of you people have an engagement and I talk too long, just get right up and go out.

I must not say more about other new tools. But in all directions about us we see innumerable changes brought about by the introduction and use of new tools.

The character of the engineers' work, as I have thought of it recently, has progressed in the last forty years something like this: First, the engineer studied materials: iron, steel, wood, stone and brick, he knew how strong they were, he knew their physical qualities. That was the engineer's first job, and he didn't know very much except about materials. Second, engineers began to study machines. There were not very many machines. I worked three years in a machine shop and learned a trade before I went to college. There were only five types of machines, very simple ones—a drill press, a lathe, a planer, a milling machine and a shaper—what a wonderful development in new, in heavy, in complicated automatic machines in the last twenty years. Just think of the vast amount of study there has been and there must be about this machinery. So next the engineer had many materials and very much machinery to learn about; learn to design, construct and operate. It is only a little while ago since engineers began studying on a third side of the "M" square. This side is men.

When Fred Taylor began to tell us the story about moving pig iron, picking it up, carrying it and putting it in a car, increasing the amount of labor a man could do by forty per cent, and still decreasing the fatigue, we began to wonder what he was talking about. Since that time, about 1900, we have learned marvelous things about reductions of costs, due not only to machinery, not only to materials, but to the way men work. Perhaps some day the world will better understand and appreciate the great work of Fred Taylor. Motion study scientifically applied in the industries means a reduction in cost, and a reduction in fatigue to the individual. There are industries where the same cycle of motions has to be made by thousands of operatives, and the question of standardizing these motions, finding just the best cycle, is the science of motion study. Mr. Frank Gilbreth has doubtless used and developed this science more than any other engineer. I am glad to know that he has recently addressed you. How little do we study, how little do we understand men. Some great industries are beginning to make a careful study of men. It will be to their own interest to do so. We are beginning to think of men as really worth something. Machines, we used to think, were a good deal better than men. The locomotive engineer used to think that his locomotive was a most precious machine, and no one but he could run it. We are beginning to find out that the laboring man is worth thinking about, and that it is our duty, not only to teach him, but to protect him, to look after his welfare, to provide for his old age, to do many things that have been left to the community to do without any particular plan. A very proper study for the engineer is man. Let us give to the wage-earner, the man, the woman, the child, not simply what is right and just, but opportunity to rise, to advance, to learn as well as earn.

There is another side needed to close up this square. This is a study of money, still another "M." More and more the engineer will tell how much money shall rightly be put into an industry, into a mine, into a railway property. We are not justified in expending twice the money it should cost to produce an industry any more than we are justified in putting in twice the material needed when building a bridge.

In the early days when building bridges and boilers and machinery, we put in material enough—we wanted to be sure they were strong enough, and we often put in more than enough. Many machines were loaded with material, many industries were loaded with machinery, and many engineering projects, promoted without the aid of engineers, have been loaded with money. There will soon come a time when the engineer's methods of study, as applied to the use of materials, metals, machinery and men, will also be applied to the use of money. Engineers are being asked to sit with financial boards all over the country. Some of the great engineering companies that are now doing work all over the world are furnishing men to sit as experts with men that control money, to advise whether or not the financiers are justified in putting a certain amount of money into a certain kind of industry, I do not expect the engineers to run the finances of the country, but I do expect that engineers will lend a hand, and that they will apply much the same methods of reasoning in the use of money they have applied in the use of materials and machinery.

I must stop. I think I have indicated some of the obligations of the engineer. Of course, it is the engineer's job to conserve the materials and forces of nature for the benefit of mankind. That has always been the obligation of the engineer, but we hardly knew what that word "force" meant, and we didn't know what "conservation" meant, when that definition was new. We are learning more and more the necessity of conservation; and we know now that the forces of nature may be human forces. The government taking the lead has called our attention to the fact that we have not been conserving our lumber, or fuel in this country, and that many useful products have been allowed to go to waste. Neither have we been conserving our soil very well. If you start at Plymouth Rock and go across those New England farms, New York State and on to Ohio and Illinois, you will see what has happened to most of the land. They have simply skimmed off the best part of it, and moved on further West. This process of skimming was stopped in Illinois, and that State has contributed much to the science of soil fertility. They know how to raise corn up in Illinois, and take off more and more corn to the acre every year, and still leave the land better every year. It is just as possible to do that as it is to do what we have been doing, if you use known scientific methods, and those of you who have studied this problem realize the necessity of doing it.

Another obligation of the engineer is the extension of co-operation. The engineer is under obligation, first to the nation, and for the first time in the history of the nation the President of the United States has recently asked the members of the National Engineering and Chemical Societies—thirty thousand of them—to co-operate in obtaining a census of the industries. This work was promptly done. As far as I know, that is the first time that the President of the United States has called on all the engineers to help do something, but I suspect that more and more, as time goes on, the nation will ask the help of the engineers, and the engineers will gladly give it. The engineers will be ready with their co-operation and with their aid to do those helpful things which, because of his training, the engineer knows how to do, and which he is under obligation to do as best he can.

The engineer is under obligation to help the State, and that he is doing in a great many instances, sometimes serving on commissions, often co-operating with engineering experiment stations in their research work. Again officers of the State, located at many of our important educational centers, are doing extremely important work in engineering research, publishing the results, and distributing them widely, and these States are contributing much through the engineer, to the advancement of knowledge or the profession of engineering.

The engineer is under obligations to the city. Of course, the city employs its engineers, nevertheless there must be more and more, groups of engineers brought together in an advisory capacity, counseling and acting with the mayor, or whatever the organization of the city may be, in order that the city's affairs may be well done. The modern city is largely an engineering job; streets, waterworks, sewage disposal, all sorts of drainage projects, railroads, belong to the city; gas works, electric lighting plants, fire protection, so many of the things that a city is spending money for are the things that an engineer must do; it seems to me that more and more the cities will ask the engineer for counsel and help. Already the cities under the City Management Plan are calling distinguished engineers to their boards of city management, putting them in charge of the cities. It seems to me that one hundred and thirty-six cities, I am not sure of these figures, have within the last five or six years established what are called City Management Plans, and almost invariably some distinguished engineer has been put in charge of the work, or made a prominent member of a group, having that work in charge. If there is any city that has needed the help of the engineer, it has been the City of New Orleans. The problems have been peculiar to it, and the solution of those problems, it seems to me, have been wisely foreseen and efficiently executed. I had hardly realized your great problems of handling the water, of both your drainage areas and sewage disposal works, that were involved on account of the peculiar location of this city, but working hand in hand with the sanitary engineer, the knowledge which has come to us from a study of pure science and its application by the engineer, has changed the entire character of the City of New Orleans, making it safe, sanitary and beautiful.

The engineer is under obligation to conserve the labor and materials of industries. I am told there are two hundred and sixty thousand industries in this country, and that only ten per cent of this number know how much it costs to make their product. Is not that strange? But that is the way we have been doing things, it is time to do better. Isn't it too bad that ninety per cent of our industries do not know how much it costs to make their products. Many of them think they do, but they do not. Often the same thing happens in agriculture. Up in Illinois they used to tell me that often farmers with one hundred cows would make more money if they would kill twenty-five of them. Those twenty-five were not helping him make any money, just helping him lose money he was making on the other seventy-five. Don't get the mistaken idea that a system of cost accounting is all that industries require. It will require real engineering skill and experience to determine how to improve methods, and above all what things should not be done at all. The work being done by such men as Mr. H. L. Gantt is of great importance to our industries, and you will be instructed and benefited by reading his contributions to the Transactions of the A. S. M. E. The engineer will find some of his most important duties in the industries, and he must apply the same methods, the same analysis, to his problems there that he has found to be sound and successful when solving his problems, using metals, materials, machinery or forces.

In general the obligation of the engineer is to give service. It is possible that many of us have felt, that the successful man in the last fifty years was the man that made money. Sometimes he inherits money, and we don't think so much of that, as success. There are, however, a great many men in this great country that have acquired by their own effort and by their keen sense of values a lot of money, and we have said they were very successful men. I think we have come to the time when there is going to be a new type of successful man, and the type of man that simply makes money is not going to be the highest type of man, nor is he going to be looked upon as the man who is the most successful. I think the time is coming when many more of the men, who have acquired vast fortunes, will wish to use them more wisely. Once in a while, a very rich man sees the uselessness of accumulated fortunes, and he begins to enjoy giving away some of his money. But the type of man that is going to be considered successful in the future, is that type of man who is able and willing to render a distinct service to the community in which he lives, to the city in which he lives, to the State in which he lives, and to the nation in which he lives, and we, as engineers, are bound to contribute all that is within us to any of these noble objects.

PREPAREDNESS OF THE INDIVIDUAL.

By

A. M. Shaw,

Read Before the Society April 9, 1917.

On last Monday night, the most of us had the pleasure of listening to a paper on the subject of preparedness by one of our members, Mr. A. M. Lockett. In this paper, the author modestly refrained from making any considerable mention of the part which he has played in the industrial survey of the State, an accomplished fact which, if utilized as it may be, should contribute to a large extent in the mobilization of our resources in the present emergency. It was noticeable in Mr. Lockett's paper that he made no attempt to tell the army how they should mobilize nor the navy how they should man their ships, but the discussion was full of suggestions applying to the part that the technically trained man might play and the meeting was especiallly fortunate in having present a number of men of the army and navy who could and did give us suggestions and advice from their point of view.

If we should need anything to convince us that this is a democratic country, the spirit of that meeting should furnish the necessary material. One can not imagine such a meeting being held by a combination of army men and civilians under an autocracy, and even in a republic, it is supposed to be difficult to get the army and navy in sufficiently close touch with civilians to permit the easy interchange of ideas which took place at the last joint meeting of the members of the A. S. C. E. and the A. S. M. E. While no attempt will be made in the present paper to enter into a discussion of military or naval matters, it is the hope of the writer that there may be present some members of both branches of the service who will give us the benefit of their ideas in the matters suggested or along other lines relating to preparedness.

It is difficult and would avail little for the non-military man to discuss or to offer suggestions as to military operations, but there are many fields in which the technically trained man may co-operate with the military that will contribute in a large measure to the support of an army in the field. An example of what may be done has already been referred to, the industrial survey which was made by the Naval Consulting Board. The steps which the Society has taken looking toward the cataloging of all men in the State who may render service in some special capacity is another move in the same direction. Our loyalty and patriotism should prompt every man to do his most and those of us who have had the special advantage of special training are, even more than others, obligated to serve as best we can. If extreme measures of defense and offense are found necessary, as quite likely they may, the Federal Government will doubtless dictate as to what class of men will be the most useful on the firing line and what men should remain to keep up the supplies, but for the present, it is the duty of the individual to make a careful study of the situation and decide as best he may, how he can be of the most service.

The special knowledge, training and experience gained by engineers should generally fit them for some special work which will be required in the outfitting, care or assistance of an army, but at the present it will be difficult for the most of us to make a wise selection as to the field to be entered. For many who are really ready to serve, there will of necessity be a more or less protracted period of waiting, but during that period, we should not be idle. A little introspection might well be done even at this late date. This applies even more to the men of wide experience, who may reasonably be expected to take charge of important activities than to the younger man who will, in all probabilities, serve under the direct observation of older men.

In the American Society of Civil Engineers, we have two grades of corporate members, members and associate members. The present requirements for full membership contain the clause "He shall have had responsible charge of work for at least five years, *and shall be qualified to design* as well as to direct engineering works."

This idea of being able to "design as well as direct" will play an especially important part in any work which engineers may be called on to undertake in the present crisis; and the designing called for will be far different from anything that the most of us have undertaken in the past. By "designing" might be considered the individual ability to furnish new (and always practicable) ideas or to combine existing data in a special way to meet special conditions. Is it not possible for the average engineer of established standing to better equip himself for the part which he may be called on to take? Assume for instance, a man of wide experience in railroad construction and maintenance. Either in his own office or that of his superior, have been worked out certain standards for meeting certain conditions. These standards have doubtless been the subject of careful study and attention to detail and have resulted in economies of design, purchases of materials and in construction, but even under the conditions which have prevailed during the past year have led to unjustifiable extravagancies. By a careful study of the cost of construction and maintenance, it might have been clear that under the conditions existing in 1914, a steel girder span or a truss would be the most economical structure for crossing a certain waterway, but at present, it might be found that a reinforced concrete, a mass concrete or even a timber structure would be better engineering. Standards, properly used, make for economy, but the engineer should be ever on the alert to see that he is not following standards blindly. Numerous other examples might be cited along the same lines, but a glance at the following tabulation of a few representative materials used by engineers with their prices in 1914 and at present might be more illuminating. The figures given as Pennsylvania prices are taken from an article published in the Engineering News of March 29th, and are those submitted by the officials of the Pennsylvania Railroad in their hearing before the Interstate Commerce Commission. The prices shown for local supplies are secured from local dealers and are for New Orleans delivery, even though the actual materials may be secured from other parts of the country.

Comparison of Prices for a Few Materials of Engineering for the Years 1914 and 1917:

PENNSYLVANIA RAILROAD.

	1914.	1917.	Percent Increase
L. 1 S. Locomotives	$28,500.00	$39,500.00	38.6
St'd Steel Passenger Cars	15,000.00	20,000.00	33.0
St'd Steel Gondola Cars	1,184.00	2,569.00	117.0
	1915.		
Axles, per pound	1.5c	4.1c	173.4
Bridge Steel	1.83	4.71	157.5
Mill Plates and Shapes	1.055	4.45	295.0
Steel Castings	2.60 to 6.10	5.50 to 11.0	89.5

NEW ORLEANS DELIVERIES.

Contractor's Hoisting Engine, 7x10, D. D., D. Cyl. w. boiler	$1,150.00	$1,550.00	35.0
Hayward O. P. Bucket, 1½ yd	1,040.00	1,500.00	52.0
Best Hoisting Cable, 1 inch	.20	.42½	112.5
Shafting, 1 15-16 inch	.02½	.05¾	146.2
Smooth Galvanized Wire, 16 gauge	2.40	5.00	108.0
Wire Nails	3.00	6.00	100.0
Track Spikes	2.00	4.00	100.00
Corrugated Galvanized Iron Roofing	2.25	7.00	211.0
Cypress—			
12x12—16 sound timbers	38.00	45.00	18.4
2x 4—16—sound timbers	33.00	38.00	15.1
6x12—36 Select barge mtl	48.00	60.00	25.00
Best Grade of Shingles	3.50	4.50	28.7
Pine—			
12x12—16 sq. edge and sound	18.00	21.00	16.7
2x 4—16 sq. edge and sound	13.50	16.00	18.5
6x12—32 Select Str. mtl	30.00	35.00	16.7
B Grade Flooring—¾x5¼	21.00	26.00	23.8

CONCRETE MATERIALS.

	1915.	1917.	Percent Increase.
Cement	$1.70	$2.10	23.5
Sand	.95	1.00	5.27
Washed Gravel	1.45	1.45	00
Ingredients for a 1:3:5 mixture for one cubic yard mass concrete	3.21	3.61	12.4

It is interesting to note what appears to be a great inconsistency in the foregoing tabulation. In the materials quoted in Pennsylvania, those which require a large amount of labor in their preparation have increased the least, while the maximum increase has been in the simple mill plates. This may be taken as indicating a greater demand for the simpler materials, or it may mean that labor has not increased in anything like the proportion of raw materials. A combination of the two is doubtless more logical.

The lesser per cent advance in steel products on the New Orleans market is due partly to the more stable freight charges which make up a part of the cost to the dealer and also to a steadying effect of large local stocks which were purchased before the latest advances in Pittsburg prices. As a matter of fact, many steel products may be purchased in New Orleans today at a lower figure than prevails in the steel centers.

The comparatively small advance in the cost of timber and concrete materials is especially interesting, and this should be given careful consideration in the design of so-called permanent structures as well as for temporary ones. It is not alone the first cost and cost of maintenance that should be considered, but also the availability of material. Even during the past year, many projects have been delayed, or even abandoned, on account of the difficulty in getting deliveries, and this condition will become more pressing if the war continues many months. It may look to some like a step backward to consider the use of wood in structures which we have been building of steel, but such a step might be taken to advantage in many instances. The principles of good engineering have not changed and will not change, but the engineer who is worthy of the name will always be ready to go back to these principles rather than to blindly follow standards and precedent which have been established either by himself or others. These principles of engineering require the consideration of many things other than the cost of construction and maintenance, such, for instance, as fire hazard, delays to traffic or manufacturing processes, necessitated by renewals, etc., on the one hand, and possible obsolescence on the other. This question of plants becoming obsolete has not been given the attention in the past which its importance might justify, and it is probable that the changed conditions that will follow the establishment of peace may require a radical departure from past practices in many lines of the country's activities.

It is not the writer's intention to advocate careless or unsafe construction, in fact, the matter of safety should be given special thought in the use of the less dependable materials, but it would appear from a study of present and past prices that real economy could be effected in many instances by reverting to the earlier types of construction.

Another illustration might be drawn from machine shop practice. Many a well organized shop has, with great advantage to its owners, studied out the matter of the utilization of old materials and established a point at which they may economically be discarded and new materials substituted. Such a standard is of value only under reasonably stable conditions. The principle may still stand, but will require frequent revision of its application. Here again we have not only the question of the cost of the material but also of its availablity. There is also to be considered the increasing efficiency of shop tools which alone might justify considerable shop work to utilize a piece of material which formerly would have been thrown into the scrap pile. On a recent visit to a well-equipped machine shop, located in the sugar section, a machinist was noticed in the act of placing a disreptuable looking piece of second-hand shafting in the lathe. Curiosity got the best of the visitor, and on inquiry, he was told that this shop had not purchased any new shafting for several months, but that they had gone around a number of dismantled sugar houses and picked up a large supply of second-hand material, which they found could be straightened out and turned down (to take out the defects and small crooks) to good advantage. High speed tools and moderate labor cost assist in making this saving possible. Even confessing the lack of any definite knowledge on the subject. the statement is hazarded that there is enough unused shafting in Southern Louisiana (excepting only the larger sizes) to supply the machine shops of the section for several months.

Economies have been effected in the past by discarding equipment. such as engines and boilers still in good condition, for others of more modern and efficient design, and it is possible that this may be done even under the present conditions in certain cases. but the engineer should keep in mind the possible utilization of such equipment, either in its present location or for other duties.

While perhaps not coming directly within the province of the engineer, other means of saving of waste might well be mentioned, such as the disposal of the miscellaneous bric-a-brac found around the abandoned sugar houses. These places have been an eye-sore on the landscape for years and have been a real contributing factor in influencing prospective purchasers against this section. In many instances, the plants have been abandoned for commercial reasons other than that of the financial failure of the owner, but this is hard to explain to a visitor. An abandoned and partially dismantled manufacturing plant conveys to the ordinary observer only one thing, the failure of the enterprise, when it may only mean that the owner has found that he can sell his raw product to a large central mill and derive more profit than by operating his own factory. Most of the material still left in the older houses can be disposed of only as junk, and under normal conditions the price received would hardly pay for the labor necessary to load it onto cars for shipment, but this has all changed. There is a good market for second-hand tanks of almost any description, and scrap metals may be sold for much more than formerly and probably for a better price than will be possible after conditions become normal. The clearing up of these old ruins would yield a profit to the owners, would improve the general appearance of one of the most attractive sections of our country and would make available a considerable area of land that is now worse than useless. The same idea might be applied to other classes of equipment, such as discarded farming tools, unused bridges (we have in this city some good steel spans over canals which have been filled), and "many other articles too numerous to mention," as the auction notices so frequently put it.

"If we are to improve the opportunity we now have to serve our country, we must cut waste to the bone wherever we can find it. We must train down and cast off useless tissues, like athletes. We must take a fresh view of our affairs, break with hampering tradition and apply ourselves with energy to every means of increasing our strength. Then, whether there be peace or war, a short war or a long one, we shall be so much the more effective in it." ("Lefax" Magazine for March, 1917.)

Blindly following precedent, antiquated rules and obsolete custom is much the same as the little boy said of a lie: "It is an abomination unto the Lord but a very present help in time of trouble." The engineer should be conservative to a certain degree, but in assuming that attitude, it should not be used as a cloak to cover ignorance, lack of initiative or downright laziness that would prompt him to follow an old standard when a departure from that standard would be better engineering.

The adaptability of many non-technical men, laborers and artisans, to meet emergency conditions, is frequently commented on by others who have been more fortunate in their early training. The " 'Cajun" trapper will mend his pirogue with a handful of mud, the Mexican Peon will mend a broken cart-wheel with a piece of home-made twine, and the negro laborer will mend almost anything, from a shovel handle to his own gallusses with a piece of wire or a ten-penny nail. On a recent trip into New Orleans on a bumpy train ambitiously styled "The Cannon Ball," we were stopped at a point not indicated on the time card. An inquiry as to the cause brought out the laconic reply: "Engine trouble." Many of the passengers got out to investigate and to give their advice, but got no farther than the mail car, when the colored porter came rushing back and asked the mail clerk for "a chunk of mail twine 'cause the eagle eye wants it to fix his engine." The twine was forthcoming from Uncle Samuel's supply and in less than ten minutes, the repair was made and we proceeded without further delay. The question naturally came to all of us, "What did they do with that twine?"

The profession or art of engineering has made tremendous strides, even during the memory of many of our society, and those who would remain in the lead have been compelled to work and study incessantly in order that they might not be left behind, but the change which now confronts us, or with which we will soon be confronted, is different from anything that this generation has yet encountered. The new plans made necessary by the new conditions will not come as an evolution but will be a revolution, or in many instances, a reversion. A study of methods adopted at times during the Civil War will indicate some of the problems that may arise, though the means of overcoming difficulties at that time will serve only to set us to thinking, seldom as a solution of the problems now to be solved. The Pioneer troops constructed viaducts of round timber cut from adjacent forests to carry railroad traffic over dizzy heights, people wore homespun who never before seen such goods and substitutes were found for almost every conceivable so-called necessity. Since 1865, our civilization has become more complex and with this change has come greater complexity in the problems that will meet us when the materials which we have accustomed ourselves to consider as always ready to spring to hand when needed are found unavailable. It is in the coping with such emergencies that the engineer, if he be of the right stuff, will be able to prove his right to recognition.

The title of this paper might indicate that it was intended as a sermon, and in some respects, it might be so considered, for it has been written with the purpose of inciting our members, the engineers of Louisiana, to a wholesome self-study, which should make them more valuable, especially during the present crisis, to themselves, to their community and to their country. We will have need of men who can take orders and who can execute these orders is as nearly literal a manner as circumstances may permit, but above all, we need men who are able to meet new conditions with new ideas; men who are on the alert at every turn; men who "shall be qualified to design as well as to direct engineering works."

DISCUSSION.

THE PRESIDENT—We will now have a general discussion of Mr. Shaw's paper, but before the discussion is general, I would like to just call on a few to make some remarks. Mr. Coleman, will you say a few words to us?

MR. COLEMAN—Mr. President, I hardly feel equipped to intelligently discuss Mr. Shaw's very interesting paper. I was invited during the day by the chairman of your Entertainment Committee, and was advised that I might see a copy of Mr. Shaw's paper, but I have been so busy with other matters as not to have been able to avail myself of that opportunity.

I think the question of preparedness of the individual is one to which practically every member of the profession has been giving some thought and some attention, in his individual capacity. I take for granted that each of us is anxious to render every service which it may be in his power to render to the Government in this time of emergency, and doubtless each of us has thought to study out for himself those avenues in which he might be able to render most efficient service to the country.

Speaking for my own self, the principal difficulty I have encountered in any such thoughts or studies is due to a complete lack of information as to what character of service the Government needs and requires at the hands of engineers. I have a very general idea, in view of the amount of engineering service which will be needed by the United States Government at this time, that it is probably much greater than most of us realize, and will probably afford an opportunity for a greater number of engineers to serve than any of us realize. But just in what branches of engineering service the Government will need service, or will need the most service, I am not well informed. I had hoped that I might have been called on a little bit further down on the list, so that I might gather new ideas from other speakers, but I feel sure that the result of our evening's discussion of this subject should make known to us the branches of engineering service which will be required by the

Government, which will equip each of us with a better idea of how he may render that individual service which he desires to render to his country.

Lieutonant Hamner—I am the manager of the Naval Station, if I may preface this in this way.

Mr. Coleman has just said that we don't know what we have got to do. From my point of view, we have declared war against Germany; we are practically at war with all of her allies. We have to wait until we know what our objective is, and if you don't know what your objective is, you are at a loss as to what you are trying to do. So I should like to tell you, if you don't mind, about the Naval Station, and what we are trying to do there, as one of the small points of organization for the general development of ultimate efficiency of the Government.

We at the Naval Station have certain officers assigned there as assistants, the majority of them are assistants under me there, who are subject to war duty. Several of them have already been detached. The rest of them will unquestionably be detached. It leaves me alone to run that station and make it efficient, with all my assistants taken away.

Now, most of you who have run a big business can probably realize what that means. How you can help me is that I want four people. Two of them I have already asked about this. One is Commodore Jahneke, and the other is Mr. Lucien Lyons, Jr. I want Commodore Jahneke to be sort of general manager of this thing. I will look after the paper work, and I want to use his energy. The other one is Mr. Lyons, in the electrical and motor boat work. Of the other two people that I would like to have, one is some person with civil engineering education who has had experience in handling men, who is able to take charge under Mr. Copeland, my civil engineer, of what, I trust, will be vast improvements in the civil engineering line in that station. The other one is a man who has handled enough work to be able to take charge of foundry and machine shop and general shop superintendence work, from an office point of view. The second man I mention is a particularly hard man to find. I want to go into this a little bit as to what the station over there is. I have been here for a year in New Orleans, and it has been my great disappointment, since I have been here, to find how little the people in New Orleans know about the Naval Station, or, when you get right down to it, care about it. They talk about it, and they write a little about it, but I have been here over a year, and I give you my word there have not been half a dozen men who amount to a row of pins who have ever been to that Naval Station to see what we have there. Now, we have a naval station there with a shop equipment which can take charge of and do two or three times as much work as any shop you have in New Orleans.

Now, we have over there what I think is in embryo one of the distinctive stations of this country. We have a station that can handle any work that the Mississippi River can handle. Now, the Mississippi River cannot handle battleships, and everybody in this city who is not conversant with this fact has always insisted on a battleship station. The station is all right, but the Mississippi River cannot handle them. There has never been a battleship in New Orleans that did not go aground getting in. We have never had a big battleship here, and it is impossible for them to get in this river. The sooner people realize that a ship drawing 29 feet cannot come over a 30-foot bar and a ship drawing 35 feet cannot touch a 30-foot bar unless she is stuck forever, the sooner they will appreciate the facilities of the Navy Yard. We should do and ought to do the work of boats handled in the Gulf, boats going around Hayti and Santo Domingo, and the rest of the Gulf ports. As far as I know, we have never made a plea for that class of boats. We have always made a plea for battleships. The Mississippi River, at the present date, and under the best recommendations that the army engineers give us, cannot handle battleships. That is a fact. There is no argument about it. It is a fact, and they have got to go to some other means than the Mississippi River to get battleships up here. There are other means which have been suggested, but it involves money and time.

Now, at the New Orleans Naval Station a year ago, we employed 150 men. We employ today between 500 and 600. We employed before this war broke out 500 men. Our payroll there is between $10,000 and $12,000 a week. It is all spent in New Orleans. It is a big enough payroll for the people who are interested in manufactures in New Orleans to pay attention to.

Since the war has broken out, and before that, there are many of the prominent firms who have been to me personally, their presidents and the rest of them have come over, and I have always been glad to see them, and want to show them what we have there.

The majority of the firms in this town, under this present emergency, have been most generous. They have come to me and said: "Any material that we have you can have at our price, providing we were bidding. We will give it to you in preference to other people, and we won't hang you up because we are the only people that have got it." There are firms in town that have held me up—at least, I think so—on the price. They have quoted me a price, and when they found out they were the only people I could get things from, have jumped the price 50 per cent before delivery. I don't think they ought to do it. Of course, I don't know anything about business; a man has naturally got a right to make as much money as he can make legitimately, but simply because a man is the only man who happens to have material in stock and you need it, I don't think he ought to jump his price the way some few have done—and I wish to say that this is true of only a few firms. The rest of them have given us goods when we needed them, at their regular prices. There are two or three firms here who have held us up, and I, on my part, have preferred to delay work rather than buy from them.

Now, I wish to extend to everybody here a cordial invitation to come over and visit the Naval Station. It will be a privilege and pleasure to me to welcome you, who are engineers and technical men, and I am anxious to show you an equipment and the work we are doing.

Lieutenant Moses—The principal thing I want to do tonight is to get somebody interested in the matter of recruiting.

The Navy is just 30,000 men short. You engineers know where to reach men, and we need them now. We want coal passers, and men behind the guns, and I want all of you here to get the names of men who can elist. You all employ lots of men and know who can be spared, and we must have men to shovel coal and shoot guns.

We started some months ago anticipating this trouble by giving the enlisted men sheets such as I have here. They call for the name and address, to be filled in by the person who makes out the list of those who are eligible for enlistment, and I will appreciate it very much—I will pass these slips around—if you will fill in the names of any workmen or any people who you think will want to enlist in the Navy. We have a small recruiting force here. It will not be possible to go and see these people, but recruiting literature will be mailed them.

I think each of you can probably spare three or four men to enlist. The word of the employer will probably help. I think each American here ought to be willing to take that personal interest in getting the recruits that are absolutely necessary.

The Navy, as I said, is 30,000 men short. When I left Philadelphia, there were six battleships placed in reserve to put new battleships in commission. Those ships placed in reserve have to be placed in commission, and we have to get the men to do it. We have to get coal passers and machinists, mechanics and electricians and men to man the guns.

The recruiting station cannot go out, as I said before, and see these men personally, but I believe that every man here tonight is in touch with at least four or five men who would make good material for enlistment, and can be spared. You are the ones who know what men can be spared from these industries here without crippling the local supply.

The President—If any of you can fill in these blanks referred to by Lieutenant Moses and send them to the recruiting station, I know it will be appreciated by him and it is quite your duty to do so.

The President—A number of our members have been applying for commissions in the engineering section of the Officers' Reserve Corps. We have one of our members to-night who has received his commission, Professor Gregory, and we will be glad to hear from him.

Mr. Gregory—Mr. President and members. I know very little about the Engineer Officers' Reserve Corps. I have been unable to find out very much. I might say, briefly, though, for those who know nothing about it, that back in August of 1916, a letter was received from the American Society of Mechanical Engineers—I think letters were sent out from the four great engineering societies, the Civil Engineers, the Mechanical Engineers, the Mining Engineers and the Electrical Engineers. There had been a bill passed by Congress which permitted engineers to enlist for service with the Government in time of war, or when war is imminent. The men enlisting have a term of five years, and if there is no war, or danger of war, the amount of service that is given to the country is only 15 days per year, two weeks. Men enlisting in this work receive grades according to their experience, their age and their training. Now, since the first letters were received, the age limits have been changed a great deal. Of course, the question of supply and demand will come in finally assigning commissions to the various applicants. Personally, it seemed to me that this was an opportunity to be of service to the country, and it appealed to me particularly because I was named by the American Society of Mechanical Engineers as the representative of that national society on an examining board that was to be organized in New Orleans to serve this section and the section around Vicksburg. Now, since that time, however, the plans have changed to such an extent that the examining board consists only of the engineer officers of the United States Army, and so far as I know, to date, the examinations have not been very strenuous. There is a physical examination, and the applicants are examined largely on their record, their experience, and their training, both as engineers and in the military line, and the commissions are given on that basis.

Mr. President, that is about all I know about the Officers' Reserve Corps. I received my commission about a week ago, and I suppose when things have been worked out in Washington, that I shall hear further from them. I want, with your permission, to discuss very briefly the paper of Mr. Shaw.

I enjoyed the paper very much, and I noticed there that the cheapest material that Mr. Shaw has given us, as compared with

1914 prices, is wood. The advances in price of wood vary somewhere between 16 and 25 per cent, roughly. This afternoon, I took the trouble to get some prices from the office of Mr. George Glover, a well known contractor of this city and a member of this Society. Mr. Seaver kindly looked up prices in 1914, and again in 1917, and from the averages he gave me, the increase in price of cement in that time has been 67 per cent. So that cement has increased two or three times as much as wood. Of course, as pointed out by the speaker, both cement and wood have increased relatively very little, as compared to steel. I don't know why Mr. Shaw did not give us some information on cement, but I thought that possibly this would be of interest in the discussion.

Mr. Shaw—I would just like to call Professor Gregory's attention to the fact that the cement prices are placed on the tabulation, although they are down at the bottom, where perhaps you could not see them. While the prices which I got on cement were dated 1915, instead of 1914, and showed an increase of only 23½ per cent, on the other ingredients of concrete, they increased practically none—sand 5½ per cent, and washed gravel not at all, and combining those various ingredients in the proportions commonly used in mass concrete, gives an increase of only 12.4 per cent in the materials going to make a yard of concrete. Of course, going back to 1914, there would be a considerable increase in the material for the final concrete, on account of the material increase in the cost of cement, but on the bulkier materials, the advance in those would still hold down the advance in the actual net cost in the structure of the combined materials.

Mr. Gregory—Mr. President, I stand corrected. If that information was on the paper furnished me today, I read it so hastily that I failed to see it.

Mr. Shaw—It was not received until after your copy was printed, Professor.

The President—Last summer, a committee was appointed, one member from the American Society of Civil Engineers, one from the American Society of Mechanical Engineers, one from the American Institute of Electrical Engineers, and one from the American Chemical Society, to tabulate the industries in Louisiana for the Government. Mr. W. L. Howell, of the American Chemical Society, was appointed on that committee, and he is here to-night, and we would be very glad to hear from Mr. Howell.

MR. HOWELL—Mr. President, I would like to subscribe very heartily to the sentiments that Mr. Shaw has expressed along the lines of personal preparedness. It was my privilege to serve with Mr. Lockett, a member of your Engineering Society, as an associate member of the Naval Consulting Board, and I had a great deal of pleasure in serving with him, and I appreciated the methodical and efficient way in which he managed that committee work.

You, as engineers, look at things from an engineering standpoint, while, of course, we, as chemists, look at things from a chemist's standpoint. The Louisiana section of the American Chemical Society for the last three or four years has been fostering and featuring the chemical industrial development of the State of Louisiana, and we have, through committee work and papers presented on our programs, tried to bring home the many resources along chemical lines which the State of Louisiana possesses.

One phase of Mr. Shaw's paper met very heartily with my approval, and that is to meet new conditions with new ideas. You are all familiar with the ingenuity of the German chemists in utilizing various new materials when their supply of old materials was cut off, and it is probably along those lines that the chemists will be of greatest service to this Government.

The only thing that I can say is that, as a chemist, in addition to filling out the blanks that the National Chemical Society is distributing throughout the country now, not only to its own members, but to all the chemists of the country,—in addition to filling out those blanks, giving your personal qualifications as to work along various lines, it might be well for all of us, as chemists, to study the conditions that we have here in the State, so as to meet any new conditions with new ideas. At this time, when we are at war, the question of your nitrate supply is a very vital one, and I recommend to all of our members, who have not already done so, to read an article in the March copy of the Journal of Industrial and Engineering Chemistry on some experiments which were made by Professor Booker, of Brown University, Rhode Island, on the fixation of nitrogen, not by ordinary temperature, but by means of a Bunsen burner. It seems to me, at the present time, any experiments for the fixation of nitrogen are very important.

I can only say, in conclusion, that I heartily approve of any plans for personal preparedness, and I am sure that the local section of the American Chemical Society stands ready to give to our local committee any help, in any way that they are able to do.

THE PRESIDENT—Is Major Schley present?

MAJOR SCHLEY—There are one or two matters I want to speak about.

I think the attitude of most men at the present time is that they are willing and want to do something, and the question is what can they do.

The work to which the individual is to be assigned depends largely on the organization. Of course, in this country, as we know, the organization for war is not in the condition it should be. If you should be assigned to a large job to be done, and I should meet you on the street immediately after you had been assigned that job, and had no organization, and I should ask you what I might do to assist you, you would be at a loss; and that is the position of the War Department at this time.

The regular army, before war was declared, was between 80,000 and 100,000 men. The army now contemplated is about 1,200,000 men, so you can see what that means, for the small group of men in Washington who form the general staff and operate this organization. It will be necessary for things to develop. Congress must act; each department must act, so that it will take time before the individual can be reached. If you go into a large plant, industry of any kind, you are naturally impressed with the fact that a single man, who is an expert on a single piece of work, is working at that particular class of work; he is working on a piece of plant which has been ordered from some remote part of the country. Now, the question is, how did that expert receive the material and the order and get to work on that piece of plant? Naturally, it was due to organization, first of the industry which needed that piece of work, second, we will say, the mail department, or whatever department of the organization transmitted this order to the manufacturing concern, and then the organization of this industry distributed this work to the expert to work on. Of course, all of that is the result of organization.

So, I think if you will look about you, you will find opportunities from time to time to do something to assist in this tremendous task, and further than that, in time, there will be a means of applying the proper man to the proper job.

Professor Gregory has outlined to you something about the Reserve Corps of the army. I would like to enlarge on that, just taking a few minutes more of your time. There were three battalions of engineers in the army before the Hay Bill passed. That is one regiment and a half. The new regular army, as it will be when it is completed, 250,000 men, will contain seven regiments of engineers. The National Guard, when it is brought up to full strength of 450,000 men, will contain twenty regiments of engineers. The 500,000 young men who are to brought into service on the principle, we hope, of national service, universal service, will have about fifteen regiments, making forty regiments of engineers to be organized, where we had, a year ago, one and a half. You can see the tremendous task in organizing the engineering part of this tremendous force.

The engineer department at Washington has attempted to start this, and in doing so has started a Reserve Corps for officers and a reserve organization for enlisted men. That for officers is divided into two classes, class "A" and class "B," class "A" being serviceable troops, and class "B" special service, and services of a civil engineering character. The enlisted men, the organization has not proceeded yet to any appreciable extent, but those who have received commissions in the reserve corps of officers have received letters asking them to obtain the names of such men as they can, who will be ready to serve as enlisted force. The problem there, as Mr. Hamner has outlined to you, is that it will be difficult to get the men; the class of men we want for that service is tradesmen of almost all kinds, carpenters, men to handle ropes, spars, timbers, any class of work of that kind.

Mr. Hamner touched also on a matter which comes close to me, and that is the mouth of the Mississippi River. That comes under my office, and I might state briefly that the present project —as you know, of course—is the improvement of Southwest Pass, and the approximate depth is 35 feet, which has not yet been approached, but the work which is now to be undertaken will bring that depth to 35 feet. There is no project to go beyond that, so there is not, as I can see now, any hope for a battleship channel. If that 35 feet is attained, then there may be hopes for something more.

I am sorry I did not hear all of the paper, but what I did hear of it I enjoyed very much, but I think the loyalty of us all, and the willingness to do, is certainly here, and it is just a question of finding what we can do and looking about for an opportunity.

The President—I would just like to ask Major Schley if the pay for enlisted men in the Engineer Corps is the same as in the other branches of the service?

Major Schley—Yes, except that in all staff branches, there are first class and second class privates, the first class being a little higher; and also, the non-commissioned officers run into higher grades, because they are more technical men.

Mr. Hutson—I would like to ask Major Schley a question or two. To what extent were civilian employees used in the Panama Canal work, and to what extent are they likely to be used in this organization work—that is, the work which is civilian work rather than military work, the work of getting you to do the things which are to be done in this country, rather than the things to be done at the front?

Major Schley—Well, the professional side of it, that is, the engineer, himself, will come from this class "B" organization of the Reserve Corps Officers. This will be of all grades, from lieutenant to major, inclusive, and they will be at work on construction in the rear of the lines of troops. For instance, there is the maintenance of railroads, the rebuilding of all bridges and trestles that have been destroyed, construction of railroads, storehouses, hospitals, and everything of that kind, and the men who will be in charge, engineers, will be from this class "B." As to the obtaining of material and getting it to the job, that, I should say, would probably be most efficiently handled through the local Government Engineer Offices. The purchasing done for the Panama Canal, as you know, was done through the Purchasing Office in Washington, via the local Engineer Office.

With the Engineer Officers all over the country as purchasers of material, it is fairly simple. The organization now exists.

The President—Has anyone else any suggestions, or any discussion?

Professor Creighton—Mr. President, we have heard a good deal of discussion concerning the first line of defense and the second line of defense and the third line of defense, but I want to call attention to the first line of *offense*, and that is the navy.

Your attention has been called to the need, to the fact that the navy needs 30,000 men. It needs machinists, it needs gunners, it needs firemen, it needs coaling men, and I sincerely hope that the Engineering Society to-night will not disband without having done something. We have talked a good deal. I went the other night to the meeting of the University Club. We talked for two hours and a half, and what did we do? Nothing—absolutely nothing. Now, I hope the Society will not disband to-night without doing something, without giving some good suggestion that will enable the navy officers to gather in more recruits for the firemen and for the coal heavers and for the machinists and for the gunners.

Now, we, the engineers, come in contact more or less with the class of people who can afford to enlist. So it is up to us, each man, each one of us, to guarantee that we will do our utmost to help the navy in this emergency. What the army is going to do in this case is somewhat problematical, but there is absolutely nothing to think of that does not show that the navy is right now on the firing line. They are patrolling the seas from New Foundland to the Gulf, and at any moment we are liable to hear that an engagement has taken place and that some vessel has been lost.

Now, the history of the American navy is a thing we can all of us be proud of. We met the Englishman twice and defeated him. We had a war with France and came out victorious, and we all know what happened in the war with Spain. The history of the navy is one of great glory for this American continent, so that any man who wants to do anything and that can respond to his country's call should join the navy. Any one and every one of us should do his level best to help to get those 30,000 men so urgently needed for the navy, not next week, nor next month, but now.

MR. KENT—Mr. Chairman, the remarks we have just heard, and Mr. Shaw's call to individual service, prompts an inquiry that these joint societies might like, possibly, a suggestion.

Some of us who are fathers and have boys ready to serve their country have a lurking suspicion that the Government is not being quite square with our boys, and I would like to inquire of Mr. Moses as to the truth of it. I have two boys, both ready to enlist. One did his bit of service down on the border the past year, and had his honorable discharge. The other, a university man, with rather valuable interests at stake, is ready to enlist in the navy. But neither of those boys is able to ascertain whether the Government is willing to enlist them for the war. During the period of the emergency, it looks to them that the Government is taking an advantage, rather, of the patriotism of our young fellows, their willingness to serve, to secure them for the four or six years of service that, of course, the army and navy in general may need. And they, as I, have failed to learn that the Government is willing to accept the service of young men for the war, as long as the necessity endures. I would like to inquire of Mr. Moses whether that be true, and if it be true, it seems to me it is a contribution that these societies could make to suggest that the Government make a square deal with the boys who are willing to serve. It may be my boys are at fault. I know they are willing to enlist for the war, but they are not willing to sacrifice the interests, that are just as dear to them in their youth as ours are to us in our maturity, they are not willing to enlist for a period of four or five years' service, when the real exigency may not require them for more than one or two.

LIEUTENANT MOSES—The term of enlistment is four years. The country is at war. There is no guarantee at all that they will be discharged at the end of the war.

MR. LOCKETT—I think the point that Mr. Kent has made is a very good one, and while, as Lieutenant Moses says, the law is the other way, I see nothin improper about this Society passing a resolution calling upon the Government to change the law, and I would be glad to offer any such resolution that may be framed by Mr. Kent along those lines, in other words, calling upon the Government to call for enlistments in the navy for a period of the war. I would like to ask him to frame such a resolution.

MR. KENT—Mr. Chairman, such, I believe, is the suggestion. It was what Abraham Lincoln did in the Civil War. His first call was for three months' service, later, for the service of the war, and even under conscription, such might very justly be the call of the Government.

I believe the navy never has conscripted in America. I am most grateful for the offer just made to word that resolution. I would word it that these societies, in joint assembly, petition the administration to extend a call to service in the army and navy for the period of the present war, or as long as the emergency shall last. I believe these would be the very words of the President's suggestion. I think, for my own part, Congress will act upon it very speedily, because enlistments are delayed just because of that. But I do believe that such a resolution, passed by these societies, whose men have expressed so loyally and fervently, one man after another, their readiness to serve in any capacity that they may find, I believe such a resolution from these joint societies might be of help. It would clear the atmosphere at least; it would place the issue fairly before the people.

MR. LOCKETT—Mr. Chairman, I offer that resolution.

MR. COLEMAN—Mr. Chairman, before the resolution has a second, it occurs to me that the Constitution under which the Louisiana Engineering Society has to labor makes provision that no matter may be put forward as having the endorsement of the Society, excepting by a certain prescribed method, which takes too long a time to be of much service on an occasion like the one by which we are confronted, so I am going to ask that the mover of the resolution merely amend it to the extent that it be declared the sense of this meeting that such a result might be desired, such an end might be sought. If that be done, I would be pleased to second the motion, and we can declare the sense of this meeting to be whatever we please, without in any way transgressing the laws under which we operate.

Mr. Lockett—I will accept that amendment.

Mr. Coleman—With that amendment, then, I desire to second the motion, and I merely wish to say this, in speaking to the motion, that I have listened with a great deal of interest to the remarks of Mr. Kent, and I have an inner feeling which makes me in very deep sympathy with some of the views which he has expressed, notwithstanding which I think it is hardly fair to the Government to charge, or to put in language which seems to charge, any lack of good faith on the part of the Government, in the matter of calling for enlistments for a specific period of time. I feel this way, that there are many young men whose patriotism makes them strain at the leash in a desire to serve their country, and yet, whose existing business and family obligations are such that they feel a hesitancy about rendering that service for any longer period of time than the period of real necessity. If that period of real necessity be six years or ten years, I take for granted that all, or nearly all of them, would be anxious to serve for those six years, or for those ten years, although the enlistment period is only four. On the other hand, if the period of real emergency is only for one year, their own necessities, their own obligations, their family obligations, their obligations to their own future, from their point of view makes it highly necessary that they should be released, if possible, from service that yields from \$20.00 to \$30.00 a month, perhaps, or \$15.00 a month, perhaps, in the service which they render to their Government, in order that they may go back to their usual avocations. They have no desire to be permanent members of the navy or army, as these gentlemen do who have been through West Point or Annapolis. That is not their occupation for all time to come, either by inclination or by desire or by any other thing than just a patriotic intention or wish to serve the country during the time of the country's need, and I think if, by such an instrumentality as this resolution which has now been offered and which I am seconding, we can start a movement whereby we may arrive at that result. which will enable every young man to serve the country for the time that the country actually needs his service, and be released from that service when the country no longer needs it, we will have done a good thing.

The President—Mr. Lockett, I take it your resolution is that it will be the sense of this joint meeting of the Louisiana Engineering Society and the American Chemical Society?

Mr. Lockett—That is my motion.

The President—Gentlemen, you have heard that motion. Is there any further discussion?

Lieutenant Moses—I don't want to speak against the resolution, but if the only point of objection is the four-year enlistment, it is perfectly feasible for these young men to join the naval militia. There are certain regulations which enable young men to get out of the navy, if they are not contented, at the end of a year. There was recently passed a regulation that, at the end of one year's service, a man could obtain three years' furlough without pay, which means that at the end of a year, if he is not contented, or if the war is over and he wishes to go home, he can obtain a three-year furlough without pay. Then, he automatically is discharged at the end of four years. For example, if he enlisted in time of war, at the end of the war it would be a very reasonable basis for being released from the navy that there is no longer a war. Just the same as if a man enlists, and has his father or mother to support, and has not sufficient pay, in that case they usually discharge the man. If he enlisted for war service, of course, change to a peace status would give him release.

Mr. Kent—Mr. Chairman, might I just say a word to withdraw any faintest suggestion that I hold the officials who are doing their faithful service here as misleading our boys? They are not. They are absolutely frank with them. The defect really is with our Congress, and I think we are all ready to admit that our Congress is somewhat backward. The fact is that it is just the young men with force of character, with fine intelligence, men who, like yourselves, have valuable interests at stake, who are most worth while to get into the service, and those are the men that we can get under an enlistment for the period of the war.

THE PRESIDENT—Gentlemen, does anyone want to have that resolution read before taking a vote?

THE PRESIDENT—All in favor of the resolution say "Aye;" opposed, "No." It is unanimously carried.

THE PRESIDENT—Is there any further discussion? Does anyone wish to say anything further?

MR. CRUMP—Mr. Chairman, I think that resolution ought to be telegraphed to the representatives in Congress. I make that motion.

LIEUTENANT HAMNER—Mr. President, I would like to speak about the enrollment for the industrial end, what they call the Coast Guard Defense. As I say, while I am in the navy, I am in the industrial end. We have an enrollment of people only during the war, or when the President declares an emergency exists, who are strictly mechanics, to work in either the Navy Yard or for such firms in the locality of their homes where their service can be used to advantage. That enrollment requires a man to serve only during time of war or in times that the President declares an emergency. He is at liberty at any time that we are not at war, or an emergency does not exist. He is only liable to duty in the shops in the vicinity in which he enrolls, or else, if he is a seafaring man, to protection on his coast. He may be put on one of these little boats, the harbor defense or something, but it is not the regular navy.

THE PRESIDENT—Gentlemen, there is a motion before the house, that the resolution just adopted be wired to the proper authorities at Washington. Is there any second?

THE PRESIDENT—You have all heard the motion that the resolution adopted be wired to Washington to-night by the joint societies. All in favor of that motion say "Aye;" opposed, "No." The motion is carried.

The President—The President of the local section of the American Chemical Society is with us, Professor Williamson. We will be glad to hear from you.

Professor Williamson—Mr. President and members of the Society: I have enjoyed Mr. Shaw's paper, and am in hearty sympathy with the expressions that he gives there, but after listening to one or two of the discussions, I am more of the opinion than I was before that nothing has really crystallized in the minds of any of us that we can actually put into effect, more than, as he suggests, to use common sense.

As was stated here by one or two, we don't know exactly which way to turn. Yet, in the face of this, there are a good many things that we can turn to, and I think, without saying more than just a few words, some of those things to which we can turn, and one of the things which will benefit us, both as engineers and as chemists, will be a study of the industrial situation, both from the standpoint of manufacturing chemicals and from the standpoint of manufacturing machinery, from the standpoint of employing machinery, from the standpoint of rebuilding machinery, from the standpoint of agriculture; in fact, from the standpoint of anything that tends toward the production of materials. It may or may not be repeated information to state one or two actual figures in regard to the situation in this State, but I think they will serve to show the stupendous tax on our resources to which we will be subjected before we are through with this proposition that we have gotten into.

I mention particularly the nitrate situation, which has been mentioned here to-night, and is often on our minds in this respect. In the beginning of 1914, Germany had on hand 800,000 tons of nitrate of soda. Bu August, 1914, she had imported 600,000 more. At Antwerp she took 200,000, which make a total of 1,600,000 tons of nitrate of soda on hand, all of which was shot up in the first few months of the war. That may sound like a stupendous statement, and I would not make it if it were not over the signature of Mr. Frank Washburn, president of the American Cyanide Company, but it goes to show us that if we go up against the real proposition of using nitrate of soda, for example—because it is a well-known fact that, with the exception of one or two minor explosives, we cannot get along without nitric acid, or ammonium nitrate or ammonium sulphate, or some other nitrogen compound—it may go to show us what we, as chemists, and what we, as engineers, may be up against, using this instance as a figure on which to base the use and need of other things necessary in the conflict.

Sulphur, we have plenty of right here at Sulphur, Louisiana. Charcoal—it is questionable whether we can obtain enough willow charcoal or straw charcoal. As to nitrate of potash, we are dependent almost entirely upon the Chili beds.

Now, we can turn to the acetone source, and we can turn to the ether source. Those are purely from the explosive standpoint. Then, we can devote our attention to the question of food supplies, machinery supplies—in fact, any supplies, and I think, from my statement that I made when I started out, that a proper use that we can put our minds to is a study of the industrial situation, and, without being the agent for any paper, the most popular avenue that I know of for the study of this situation is through the "Manufacturers' Record," of Baltimore, which compiles statistics every week that most of us would be surprised at. I think it should be a portion of our work to acquaint ourselves with the conditions, assuming that a great many of us are more or less unacquainted with these industrial facts. Thank you.

THE PRESIDENT—Without being called on specifically, we would be glad to hear from anyone.

MR. CRUMP—Mr. President, Professor Williamson said something about the need of charcoal. I have noticed recently that the question of distilling pine stumps has been taken up quite a good deal in this section of the country; that is, just in the concern I am with, we have had a good demand recently for retorts for distilling the oils of turpentine and tar from pine stumps, and then, of course, recovering the charcoal. Is that pine charcoal to be used in connection with ammunition, or can it be used?

PROFESSOR WILLIAMSON—Pine charcoal, or most of the charcoal, with the exception of willow charcoal and charcoal from straw, charcoal from hemp, from flax, and possibly one or two woods which I do not recall now, is undesirable, for the reason that usually a high quantity of ash is contained in it. Of course, that does not mean to say that in an emergency we would not use it, but what we want is an ash-free charcoal if we can get it, since the smoke from black powder is due to the fact that 50 per cent of black powder is mineral residue. Hence, since the ash or solid residue must be as low as possible for smokeless powder, a charcoal which is low in ash is desired.

MR. HUTSON (by letter)—Mr. Shaw points out the advisability of varying from standard practice in order to obtain the best results for money expended. There is also a question of whether you can get certain materials at all within the time available to complete the required work.

It would be well for engineers to draw their specifications so as to allow great latitude in the manner of carrying out work and be prepared if necessary to change clauses in the contract to permit the use of machinery or material which is obtainable.

With a very unsettled market, it is almost impossible for a contractor to bid a lump sum with both safety and fairness. On a contract calling for large main machines, the factory may promise one year's shipment. The contractor will not be in position to purchase all the pipe, valves and small material at the time he contracts, and if he waits, he may be badly stung by a raise in the market. Under these conditions, contracting on cost plus a percentage or cost plus a fixed sum would seem the fairest to all concerned; then should there be a drop, the purchaser would get the benefit.

There are certain industries which seem inclined to stick to their own standard practice regardless of changed conditions. These are mostly where the main process requires special knowledge and special processes and the management is intent on keeping that part of his plant up-to-date and does not give the time or thought to other details to keep his plant as a whole in line with modern practice. It would seem wise for him to subdivide his plant and give his personal attention to that part where he has special knowledge and turn over to some outside engineer the purchasing of the material which should conform to standard practice in other plants. In many cases they could save many times the fee of the engineer.

As an illustration, take the sawmill industry. When sawmills were small, the cheapest equipment which could be purchased and the best for the purpose were simple non-condensing engines and return tubular boilers. But that is no reason why a man who requires 1500-horsepower should stick to return tubular boilers. It is true that under normal conditions the first cost of the bare boilers will be less for ten 150-horsepower return tubular boilers than for say three 500-horsepower water tube boilers, but the cost of the boiler room equipment, including pipe work, valves, fittings and boiler brickwork will be less for the water tube installation than for the fire tube.

Due to the fact Mr. Shaw has pointed out of material having advanced more than labor, it is probable that return tubular boilers have increased more than water tube.

Another point in favor of the water tube is that the boiler room need be less than half the size of that required for the horizontal return tubular, and if as is probable the insurance rates make a brick boiler room a good investment, this becomes quite a factor.

Another insurance feature is brought in by the workmen's compensation law, which makes it profitable to install non-return valves on each boiler branch and automatic safety stops on each engine.

The sawmill industry has clung to the simple non-condensing engine even for large powers, and it is practically impossible to get a hearing at the time they are busy purchasing if you say you want to quote on compound engines, steam turbines or condensing equipment. Under normal conditions, the cost of a compound condensing plant becomes less than that of a simple non-condensing as soon as the horsepower gets over 400-horsepower to 600-horsepower.

Now that boilers have increased over 100 per cent and engines and condensers only about 50 per cent, this difference will become the more marked.

There are several such industries in this section in which the management must have very special knowledge, and if we start new processes to supply the war needs of the country, there will be need to increase the power plants of such plants and build new power plants. I would like to see greater co-operation between the engineers of the Society so that each might do only the work in which he had special skill and turn over to someone else the work in which he had only general knowledge. This will require tact on the part of all. It would seem to me that when an engineer is called in to look after special construction work that he should consider himself as the consultant of the engineer who is permanently on the work. There should be a definite understanding between the two as to where the work of one started and that of the other stopped, and any difference of engineering opinion should be thrashed out before being submitted to the executive or before instructions are issued to the contractor.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, April 9, 1917.

The meeting was called to order with President Dusenbury in the chair and Messrs. Manley, Robert, Young and Hogg present.

The minutes of the previous meeting were read and approved.

Ballot—Ballots for the election of new members were opened and the following elected:

Jos. M. Bing, New Orleans, Resident Member.

Albert H. Guillot, New Orleans, Resident Member.

Paul B. Jeffries, Vicksburg, Miss., Non-Resident Member.

Luther P. Piersol, New Orleans, Resident Member.

Jesse F. Fonville, Magnolia, Miss., Non-Resident Member.

Horatio L. Gilbert, New Orleans, Junior Member.

Transfers.

George E. Durr, New Orleans, Junior to Resident Member.

Hyman Rabinovitz, New Orleans, Junior to Resident Member.

James P. Ewin, New Orleans, Student to Resident Member.

Frank E. Sprague, New Orleans, Student to Resident Member.

Robert A. Pierpont, New Orleans, Student to Resident Junior.

Applications—The following applications, approved by the Membership Committee, were ordered to ballot:

For Resident Member—Theo Hotard, New Orleans.

For Resident Junior—John Appleby, Jr., New Orleans.

Delinquent Members—Four members were ordered dropped from the membership on account of failure to pay delinquent dues.

Communications—A letter from Sidney F. Lewis, accepting his election to Honorary Membership in the Society, was read and accepted.

A letter from the Engineers Club of Philadelphia was read. The Philadelphia Club asked our Society to inform them as to what we considered the exchange of House and Library Privileges covered. The Secretary was directed to reply that we have nothing in the nature of a club, and to forward a copy of our Library Rules.

Bills—The following bills were ordered paid:

Electric Railway Journal (subscription)	$ 3.00
Frank Norman (collections)	1.20
Tulane University Press (printing)	29.80
W. T. Hogg, Secretary (salary and incidentals)	32.50

Reports—The statements of the General Fund and Cash Account for the first quarter were submitted by the Secretary and accepted. The statements showed a balance in the general fund of $171.19, and cash on hand after paying all bills, $1,330.65.

There being no further business, the meeting adjourned.

W. T. HOGG, Secretary.

Regular Meeting of the Society, April 9, 1917.

The meeting was called to order with President Dusenbury in the chair and 96 members and guests present.

(The members of the local chapter of the American Chemical Society were invited to the meeting.)

The minutes of the previous meeting were read and approved.

The special Preparedness Committee appointed by the President to make a survey of the professional resources of the membership reported that they had prepared a blank form to be mailed to every member of the Society together with a circular letter explaining the purpose of the inquiry. The committee asked for authority to have the form and circular letter printed and sent out by the Secretary. On motion of J. F. Coleman, duly seconded and carried, the request of the committee was approved and granted. The committee consisted of A. M. Lockett, chairman, Sidney F. Lewis and C. S. Williamson, Jr.

Mr. Shaw, chairman of the Library Committee, reported that through the efforts of Samuel Young, the Library had secured a copy of the Muscle Shoals report, which contained a large amount of very valuable information.

The technical exercises of the evening were then held. Mr. A. M. Shaw read a paper entitled, "PREPAREDNESS OF THE INDIVIDUAL." The paper was followed by considerable discussion, during which the following resolution was adopted:

Resolved, That it is the sense of this meeting that the societies in joint assembly petition the administration to extend to all service in the Army and Navy the period of the present emergency or as long as the war may last.

After the discussion Mr. Shaw was tendered a vote of thanks for his carefully prepared paper.

Outing—It was moved by J. M. Robert that the Society hold an outing in the month of May, and that a committee be appointed with power to act. Mr. J. F. Coleman objected on the grounds that under the present conditions in this country and in Europe, the Society should not hold an outing. The motion was seconded and submitted to a vote. The vote was NO, and the outing was cancelled for this year.

There being no further business, the meeting adjourned to the collation.

W. T. HOGG, Secretary.

Regular Meeting of the Board of Direction, May 14, 1917.

The meeting was called to order with President Dusenbury in the chair and Messrs. Olsen, Riess, Robert and Hogg present.

The minutes of the previous meeting were read and approved.

Delinquent Members—Eleven members were dropped from the membership rolls on account of failure to pay delinquent dues.

Communications—A letter from —————— was taken up. Mr. —————— submitted his resignation on account of removal from New Orleans. It was moved and carried that resignation could not be accepted since his dues for the current year are not fully paid as required by the Constitution.

A letter from Mr. Frank Sprague was read. Mr. Sprague stated that he had made application for transfer from Student to Junior Member, but was elected to full member. He requested that his grade be changed to Junior Member, as he had requested in his application.

It was moved and carried that Mr. Sprague's membership could not be changed to Junior grade, as he has had three years' experience since graduation.

Employment Committee—Mr. H. Kokosky, chairman of the Employment Committee, requested that the committee be provided with the stationery of the Society for its necessary correspondence. The Secretary was requested to have printed on a portion of the letter heads of the Society the title, "Employment Bureau," and send same to Mr. Kokosky.

Bills—The following bills were ordered paid:

Tulane University Press (Vol. III No. 2)	$140.10
Tulane University Press (printing and postage)	63.20
Fabacher's Rathskeller (March refreshments)	6.25
W. T. Hogg, Secretary	33.50

Reports—The statements of the General and Proceedings Funds and Cash Account for January 1 to April 30, 1917, were submitted by the Secretary and accepted. The statements showed a balance in the General Fund of $214.65, Proceedings Fund, $114.11, and cash on hand after paying all bills, $544.50.

There being no further business, the meeting adjourned.

W. T. HOGG, Secretary.

Regular Meeting of the Society, May 14, 1917.

The meeting was called to order with President Dusenbury in the chair and 46 members and guests present.

The minutes of the previous meeting were read and approved.

Mr. A. M. Shaw, chairman of the Library Committee, called attention to the number of books in the Library on Military subjects, as the Library contains most of the books of value on the subject.

Mr. A. M. Lockett, chairman of the special Committee on Preparedness Survey of the Membership, reported that the replies to the request of the committee were still coming in, and that the committee would hold a meeting shortly and tabulate the returns.

Mr. Ole K. Olsen, chairman of the Membership Committee, reported that about 18 new members had been admitted into the Society since the beginning of the year. The committee intends going after the registered engineers and surveyors in the State who are not members of the Society.

The technical exercises of the evening were then held. Mr. Albert G. Van Hecke, Professor of Civil Engineering at Louvain University, gave an illustrated talk on "LIFE IN THE BELGIAN REFUGEE CAMPS IN HOLLAND." After the discussion Mr. Van Hecke was given a rising vote of thanks.

There being no further business, the meeting adjourned to the collation.

W. T. HOGG, Secretary.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

JUNE, 1917

"PATRONIZE OUR ADVERTISERS"

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LOUISIANA ENGINEERING SOCIETY

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Vice-President, JOHN KLORER, 213 New Court House Bldg.
Secretary, W. T. HOGG, Tulane University.
Treasurer, OLE K. OLSEN, 822 Perdido Street

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

All business communications should be addressed to W. T. Hogg, Secretary P. O. Station 20, New Orleans, La.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

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EDITORIAL NOTES AND COMMENT

The Manufacture of Cane Sugar in Louisiana. The paper presented to the Society by Mr. E. L. Stream at the March meeting brought forth a very lively and interesting discussion, one of the most interesting features of which, although somewhat incidental, was the rather striking contrast in certain important details between the methods used in Cuba and those obtaining here in Louisiana. It is a well-known fact that the larger mills in Cuba and Porto Rico are paying very close attention to the question of the most economical production, particularly with reference to fuel and steam economy. Judging from the remarks of some of the gentlemen participating in the discussion it would appear that there was in certain quarters in this state a lack of attention to these two details so important to the economical handling of the crop.

In Cuba the solution of the problem comes through the use of the steam turbine and quadruple and quintuple effects, electric drive being used for the mills and the auxiliaries. Bagasse is used almost exclusively as fuel. In any question of the application of these same methods to Louisiana conditions it must be borne in mind that the season in this state is very short as compared with that in the islands, and they get there a quality of bagasse which is more mature and therefore dryer as compared with the local material.

The proper handling of a sugar house requires the services of an expert mechanical engineer, and, contrary to past practice in this state, his services should be retained in the off season, because that is the time when improvements may be made and changes effected as suggested by conditions arising during the grinding season. The planter in many cases is a non-technical man, and he is too much inclined to look askance at any new ideas or suggestions for improvement, specially if these involve the expenditure of additional capital. These remarks apply to the routine work of each individual factory. In addition there should be a provision of liberal funds and opportunity for experimentation along the lines pointed out above. This means co-operation along all lines; the organization already exists; it would appear that both the mechanical engineer and the chemical engineer should be given greater opportunities for the solution of the difficult problems inherent in the economical manufacture of cane sugar in this state.

Oil Burning. Published elsewhere in this issue is a very interesting and instructive paper on the subject of Oil Burning by Mr. B. S. Nelson, a member of this Society and associated with the firm of A. M. Lockett and Company. This paper has already appeared in the June issue of the *Journal of the American Society of Mechanical Engineers*, as it was read originally before the local section of that Society. It is republished in the *Proceedings* for the reason that it will thus reach a number of men who may not be members of the A. S. M. E. This gives incidentally opportunity for calling attention to a matter which has been the subject of some informal discussion between members of our Society. Both the A. S. C. E. and the A. S. M. E.

have local chapters in New Orleans, and papers which are presented to these local chapters, of course, become the property of those organizations respectively and may be published in their respective journals. It has been felt by certain of our members that this would tend to reduce the efficiency and usefulness of the Louisiana Engineering Society in the fact that such papers would thus be unavailable for publication in the local journal. Such will not be the case, however, for both of the above societies have expressed a willingness and a desire to meet us in a hearty spirit of co-operation in this matter to the extent that such papers will be made available for publication in our journal or in the journals of the societies either simultaneously, if this is possible, or primarily in that journal which is in position to print it first after its presentation.

A very cordial letter to this effect has been received by the Editor from Mr. L. G. French, Editor of the Journal of the A. S. M. E., in which he says in part:

> * * * * * "One of the fundamental objects of our Society is to gather and distribute engineering information. We are glad to have such information published in other journals, as well as in our own, because of the greater publicity it will receive in consequence. Whenever you have a paper, therefore, which would be adapted for your use, as well as ours, please consider that you are privileged to use it, in so far as we are concerned, at any time after it has been presented at your meeting. If we find that we desire to use it, we will make room for it as soon after the meeting as possible, but from the fact that your Proceedings does not reach a large number of our members, we are quite willing that you should have the first publication, if the matter most conveniently works out that way. At any time, however, when we can arrange for simultaneous publication that, of course, would be very agreeable to us, but we do not insist upon it."

Boiler Code Commission. Governor Pleasant has recently appointed the following gentlemen on the Commission to Examine the Uniform Boiler Code of the American Society of Mechanical Engineers:

T. W. Atkinson of Baton Rouge.
R. T. Burwell of New Orleans.
W. H. Sullivan of Bogalusa.
John H. Murphy of New Orleans.
W. B. Gregory of New Orleans.

This is in accordance with Act No. 276 of the General Assembly of the State of Louisiana for 1916, and the duties of the commission will be to examine the Uniform Boiler Code and report back to the General Assembly of 1918 whether the Code should be adopted by the State of Louisiana.

Personal Mention. Mr. A. M. Shaw has just recently received notification of his being commissioned a Major in the Engineer Corps, United States Army. Mr. Shaw's extensive experience in railway engineering as well as his experience in recent years with problems of irrigation and drainage will make him a valuable member of this corps, and in view of the extensive preparations for railway work on the part of the United States both in France and in Russia, Mr. Shaw will probably have an opportunity to see some active service abroad at an early date.

Mr. Walter B. Moses, who since his graduation from Tulane University has been in the employ of A. M. Lockett & Co., having proven himself to be one of their best and most efficient salesmen, has recently severed his connection with that firm in order to go with A. Marx & Sons of this city. He will be general manager of their machinery department and machine shop.

Prof. J. M. Robert is in charge of the School of Marine Engineering which is in operation at Tulane University during a portion of this summer. This school has been established by the United States Shipping Board and makes use of the facilities of the university for the purpose of instruction of the men. The purpose of the school is to train engineers for positions in the merchant marine, as it is recognized that there will be a great demand for such men in connection with the very extensive ship-building program of the Government.

Mr. Eugene Hawkins, a recent graduate in the Mechanical and Electrical Engineering Course at Tulane, has enlisted in the U. S. Navy and has been assigned to the local Navy Yard. Mr. Hawkins is at present engaged in instructing two classes of naval recruits in practical electricity and gas engines. The laboratories of Tulane have been placed at his disposal for this work, and the men come up every day from the Naval Station and put in a day's work on the subjects mentioned.

The Society Takes Liberty Bonds. At a recent meeting of the Board of Directors it was decided to invest a certain portion of the surplus funds of the Society in the Liberty Bond issue. This is a good move and will undoubtedly meet with the hearty approval of all members of the Society.

PAPERS AND DISCUSSIONS

THE MANUFACTURE OF CANE SUGAR.

By

E. L. Stream,

Read Before the Society, March 12, 1917.

While the industry is very old it has only been brought to its present state of perfection within the past twenty years. This is due very largely to the present commercial demand for practically only one grade of sugar which can only be produced now by what is known as a sugar refinery. This condition has eliminated all factories making anything except raw sugar of 96 purity and factories that make a white sugar for local consumption, besides it has shut out all buyers except refineries who can now control the price paid for the product to such an extent that only the best equipped factories can afford to operate. The margin of profit in this industry under normal conditions is, therefore, small. The result is that while factories were formerly designed by thumb rule engineers and managers and owners who considered themselves born with the necessary talent, to-day necessity has caused capitalists who invest in the business to make the most diligent search for the best talent they can secure. They realize that the greatest economy must prevail and greatest possible recovery be secured.

Formerly the engineer met with many difficulties in his work; there was very little he desired to know that could be found in text-books or in bulletins issued by the various experiment stations or colleges. Each engineer had his own information secured at considerable cost of time and money, and it is needless to say that his storehouse was but scantily filled. We did not have much chance to exchange ideas. The result was disastrous to planters, as each new engineer would like to rebuild the sugar house according to his own fancy. This condition led to a lack of confidence in engineers on the part of planters and they, therefore, were not held in as much esteem as they are at present.

My practice as an engineer has been very much diversified and this experience has enabled me to appreciate the comparative extent of general knowledge required by an engineer in a sugar factory. It practically reaches every branch of our profession.

As is well known, the manufacture of sugar consists in obtaining the greatest economical extraction of the cane juice, the cleaning or clarification of the juice, separating therefrom all coloring matter, gums and non-sugars, and the most economical evaporation of the water contained in juice, which means the utilization of as much as possible of the B. T. U. contained in the steam.

To secure the best possible extraction the practice is to use first a crusher consisting of two rolls with deep grooves running diagonally with the axis of same. This crusher with its deep grooves not only expresses from 40 to 60 per cent of the juice, but it receives the cane from the carrier better and prepares it for the first mill. It is, therefore, a capacity machine and one of the greatest improvements in a modern sugar house.

After passing through the crusher the cane passes through a series of three roll mills set tandem. This series consists of from two to five of these mills. It is generally conceded that the number of compressions are more effective than extreme pressures and permits of more effective dilution between mills. This conclusion is based on the theory that owing to the structure of the cane, many of the cells of same are not broken on first pressure regardless of that pressure. Besides the cane passing between rolls forms a mat which gets under pressure before the juice has time to pass out and is thereby trapped in the mass until this mass is again distributed on the carriers and passes through another mill.

There have been several shredding or disintegrating machines used in connection with the above outfits. They have been designed to mechanically break every cell in the cane before it is crushed. This is a very desirable feature and will secure far better extraction. In one case I have heard of the bagasse from last mill where this process is used analyzed 40 per cent of moisture and that moisture contained less than one per cent of sucrose. If this machine is practicable from the standpoint of durability it will become a valuable adjunct to milling .

The cleaning or clarification of .cane juice is an extensive subject and should be discussed separately. It is here that the greatest field for improvement may be found, especially when white sugars are desired.

The present method almost universally used is to treat the juice from the mill with sulphur dioxide, the effect of which is to coagulate some of the gums, bleach the juice and promote a portion of the settling. The juice is then treated with lime to bring it back to nearly neutrality and in some cases it is made alkaline and again brought back to a slight acidity, all of which is to obtain better precipitation of solids not sugar.

The juice is then heated in a closed heater to about 220° F. and run into closed settling tanks, after which it is run into the evaporators. Of course, all skimmings and settlings with wash water from tanks is again cleaned and run through filter presses. Where 96 test sugar only is desired the above process is much simplified, little or no sulphur being used.

The evaporation is conducted in multiple effects of various designs, and I would refer you to a paper written by Prof. E. W. Kerr for the meeting of the American Society of Mechanical Engineers in this city April, 1915. This, in my opinion, covers more points and can make clear almost all that one would care to know on the subject. Foster on Evaporation, Graining and Factory Control, Vol. 2, is also a good reference book. There are many points on heat economy found in the above articles that are absolutely essential to the successful engineer and which could not be covered except separately, as their application is extensive.

The multiple effect evaporates the juice to about 29 or 30 Beaume, when it is pumped to settling tanks from which it is taken to vacuum pans for graining and sometimes from pans to crystallizers, where the mass is kept in slow motion, enabling crystals to form.

An article that would cover all the many features of sugar making in detail would be too lengthy to be interesting, and to cover the subject in a general way that would enable you to form a clear idea of my notion of what a sugar house should be, I will state that if I were designing a factory capable of handling say 1,600 tons of cane per day to make 96-test sugar, I would erect same as follows:

Cane to be fed to carrier by the rake feed or car dump depending on local conditions. A 6½ foot crusher of the inclined type. Four three roll 7'x34" mills. 1600 H. P. boilers in batteries of two 200 H. P. each, all fitted with Dutch ovens in front for burning bagasse and also connected to use oil as fuel. All pumps and heaters for oil arranged to carry 100 pounds pressure on oil line and oil to be heated to 230° F. All mills and mill engines to be erected on ground floor. The driving power for mills, etc., to consist of a Corliss engine to drive crusher only and one Corliss engine for each of the two mills. Cane carrier to be driven by a separate steam engine.

Three juice heaters with eliminator and three closed settling tanks of capacity of house. Four standard multiple effects, each with 3,000 square feet of heating surface; tubes in same not over 2" diameter. 3,000 square feet of filter press surface. Two ten-foot vacuum pans and 8—40" centrifugals. All auxiliary pumps and engines, such as boiler feed, lime mixer, centrifugals, juice and water pumps to be driven by electric motors. All pumps where practicable to be triplex or centrifugal. Duplex steam pumps to be avoided; all pumps that might necessarily be steam driven to be of the crank and fly wheel type.

There should be duplicate pumps for each service except the vacuum pumps, which are not likely to cause trouble, but even these might be duplicated.

The generating sets should be in duplicate and the minimum of auxiliaries should be used. For instance, one vacuum pump for both pans and for effects with valves in suction pipe to control vacuum in each separately. One sweet water pump for all effects except first. Ample discharge openings in steam belt of each effect to pass through all condensed steam. Sweet water pump to connect to last effect only, thereby utilizing all available heat in condensed water.

I would set all effects and vacuum pans sufficiently high so that vacuum pans would have a sufficient height to discharge into crystallizers and they to discharge into mixer over centrifugals. This would also enable the condensed steam to flow from steam belt of first effect to recipient without drawing same through pump and would also prevent water from tail pipes in pans from backing up in coils. All pipes should be sufficiently large to prevent friction head. It is carelessness in details of construction that makes the difference in economy more than anything else.

The use of pressure gauges and thermometers combined with knowledge of their use will soon set right these errors.

Proper proportion of grate surface for bagasse boilers is very essential. I have seen one square foot of grate surface to ten of heating surface do good work. In this case the bagasse consumed was about one and one-half tons per hour. I am very much in favor of forced draft and minimum grate surface, as then the amount of air furnished to fire can be better controlled.

Every precaution should be taken to waste as little hot water as possible. All condensed steam should be returned to boiler and additional water required to be taken from sweet water pump, unless there is much entrainment therein, in which case the entrainment should be stopped.

All steam pipes should be minimized in number and length and every pipe or steam receptacle should be covered with some good insulating material. The most important consideration in the efficient conduct of a sugar house is steady operation; economy of fuel can not be secured without it. Besides the fouling of juice heaters and the tubes in effects is largely due to intermittent operation, in fact, there is nothing so detrimental to successful work.

I have written this article more particularly to bring before the younger engineer who is starting in this branch, my experience, with a view to have him study the basic principles involved. His education and natural intelligence will enable him to apply his knowledge and possibly make use of or improve upon some of the suggestions contained herein.

DISCUSSION.

Professor Creighton—The use of sugar goes back to the most remote periods of antiquity. The word sugar has nearly the same sound in many languages—it is "sucre" in French, "zucker" in German, "azucar" in Spanish, "saccharum" in Latin. The use of sugar may be traced to the time of the Aryan nation.

Sugar cane is a grass. It may be raised from seed, from a bud that grows on the stalk or from the roots after the cane has been cut. Practically only experimentalists obtain cane from seed. To cross one variety of cane with another is possible only through cross fertilization of the seed. In tropical climates, if cane is allowed to come to maturity it will carry a tassle which bears the seed. Most of the cane now planted in this State comes from seedling cane obtained by experimental crossing to develop an all-around cane suitable to local conditions. In Louisiana cane is planted every second year. Plant cane is cane growing from cane planted lengthwise in furrows; stubble cane is cane growing the following year or years from the roots of the stalks of the cut plant. In tropical countries, cane will grow indefinitely from the roots of the cut cane of preceding years. After so growing for seven or eight years so many stalks rise from the roots that the cane is small in size and poor in quality, so that it is better to plow up old cane and replant.

The leaves on sugar cane are alternate, that is, they do not grow opposite one another, the leaf on one side is some four to six inches higher than the leaf on the opposite side of the stalk. At the root of the leaf a bud will form. If a shallow trench is dug and the cane stalk is laid lengthwise in it, eventually from each bud may grow a new stalk of cane. Each stalk has definitely marked narrow rings or bands from four to six inches apart. These are called "nodes" and from each grows a leaf and a bud. The part of the cane between buds is called "internode."

When the new stalk grows from the bud it needs nourishment, as the roots which also form are not long nor big enough to draw the required nourishment from the soil. This nourishment, therefore, must be obtained from the cane, and glucose, found abundantly at the nodes, is this food. As the glucose near the node is used up, sucrose in the adjacent cells breaks down into glucose, the form in which it can be assimilated by the bud. Analysis shows that when the cane is growing the percentage of glucose present is high. When the cool nights of October arrive, the plant stops growing and the glucose, which is a sugar which will not crystallize, is converted in the plant into sucrose or the crystallizable sugar we use. The mother cane then contains two plant foods, glucose and sucrose, the former for immediate, the latter for future use. The chemist who discovers a method of converting glucose into sucrose will make an enormous fortune. As nature does it, the problem is seemingly possible of solution.

In its growth the sugar cane takes or converts that which it takes into many different products. Thus it absorbs silica and more or less bitter salts from the soil. It forms many nitrogeneous compounds or mucilages and gums. In the manufacture of sugar from the cane it is essential or desirable to get rid of undesirable compounds from the syrups from which the sugar is crystallized or from the molasses after the sugar has been removed. In the manufacture of sugar the value of the molasses formed is no inconsiderable asset. Molasses that can be utilized for table use is far more valuable than molasses fit for feeding cattle or from which to make alcohol. New ground, rich in salts that are bitter to the taste, may make a good sugar crop, but the resulting molasses may be so bitter from the contained salts that its use for the table is impossible. On the other hand, old land or land which has been cultivated for years may produce excellent table molasses, although the sugar content of the cane may be low.

The sugar juices in cane are contained in cells much as the juice is contained in oranges. To obtain the juice the cane is crushed in a two-roller mill with specially formed rolls. About 35% of the total normal juice is obtained from this first mill. Further this is the best juice, as it is freer of impurities. This first mill prepares a mat of crushed cane to be passed on to three roller mills. Experience shows that a larger percentage of juice can be obtained by repeated crushing and wetting with more or less hot water the crushed cane before it comes to a mill. The crushed cane coming from the last mill will contain about 50% thin juice. Evidently the more nearly this thin juice resembles water the less sugar it will contain. Hence the addition of water just before final crushing is justified.

Conditions of cane sugar manufacture vary greatly. Thus in Cuba or tropical countries the cane is allowed to mature, the sucrose or sugar content is high and the crushed cane or bagasse makes excellent fuel. The season for cane cutting and sugar making lasts six months. In Louisiana the cane is not allowed to mature. If standing cane is frozen and subsequently thawed the cane splits, thus exposing the juices to the bacteria of the air. The juice then sours, its sugar content is readily reduced and much trouble arises in boiling the juices. In boiling down to syrup the juices will foam or make bubbles similar to that seen in a kettle when it boils over. Afterward when the syrups are being boiled in the vacuum pan there will be a gummy mass to handle and crystallization will be slowed down. Hence in this State planters must start early enough to let them finish cutting all cane before the time when heavy freezes are expected. When grinding is first started there is little sucrose in the cane and the sugar produced per ton of cane is low. The molasses content is high. As the colder weather approaches the sucrose content of the cane increases, the glucose content decreases. The season lasts from two to three months. and the bagasse or fuel for the boilers comes from unripe or green cane.

The short season and the uncertainties of tariff legislation deter the planter from investing in the expensive and complicated machinery necessary for the highest economy in sugar production. Many of the local plants have gradually grown in size and so are not systematically arranged and contain much apparatus now out of date.

The conditions in Cuba allow the investment necessary to erect a first class plant. The modern Cuban house is electric driven throughout, even the mills are motor-driven. The electricity is obtained from generators driven by steam turbines of high steam economy. This results in a large economy as the evaporation is done in quadruple or quintuple effects which are operated in an economical manner. In the extraction of juice there is also a considerable economy through the use of at least five three-roller mills following a crusher. It will be noticed that these economies fit into one another.

In Louisiana only double or at the most triple effects are used. These require far more steam than the Cuban effects and hence it is useless to employ a highly economical engine or steam motor as there must be enough steam to operate the effects. In many cases live steam from the boiler is admitted to the first effect, although this is far from an economical use of the steam involved. Similarly the cane is crushed in a crusher and two three-roller mills. Cuba then has many advantages over this State, but on the other hand it has also disadvantages. In the recent revolution in Cuba many plantations lost their entire cane crop through incendiary fires, and in addition had to contribute in other ways to the rebels.

The changes experienced by the juice are quite approximately shown by the following illustration. Assume ten cubic feet of juice that has been properly clarified or freed from gums and mucilages and decolorized as much as possible. In the multiple effect these ten cubic feet would be reduced to two cubic feet by the evaporation of water. This unit of two cubic feet now contains all the solid matter in the original ten cubic feet, and is now called syrup and looks much like table syrup. In the vacuum pan by further evaporation of water a reduction in volume of 50% occurs, and we now have a mass of one cubic foot of what is called masse-cuite (cooked mass) composed of 50% sugar crystals and 50% molasses. The actual volumes handled are large, an ordinary vacuum pan is 9 feet in diameter and 12 feet or more high. From the pan the masse-cuite is dropped into a mixer, whence it is distributed to centrifugal machines. In these by the action of centrifugal force the molasses is separated from the sugar crystals. We thus obtain the first sugar and first molasses. In crystallizing all impurities are left behind, and so the molasses contains all the dirt, sulphur, lime, glucose and gums that were in the juice when sent to the multiple effect.

The first molasses still contains crystallizable sugar that may be extracted. The first molasses after treatment may be reboiled in a second vacuum pan and a second masse-cuite obtained. The sugar separated from this is second sugar and the molasses a second molasses. The operation may be repeated a third time, but crystallization is now so slow that the masse-cuite is put in wagons and kept for a year in a hot room to give the sugar time to crystallize out.

Pure sugar is perfectly white. Any color that a sugar crystal may have is due to the mother liquor caught between small particles in the process of crystallization. The darker or dirtier the mother liquor or molasses the darker the sugar. The sugar crystal is a flat rectangular parallelopipedon with neatly beveled edges. A piece of flooring board a little longer than it is wide with beveled edges might represent an enlarged crystal.

An ordinary house grinds 1,000 tons of cane per day. In Cuba there are houses grinding 7,500 tons per day. As stated a moment ago water is sprayed on the cane during crushing, and although the juice extracted is about 80% of the cane weight the weight of the juice is frequently 10 or more per cent heavier than the cane crushed.

As the volume of the juice must be reduced about 90% by evaporating water from it, it is evident that there must be some economical form of evaporating apparatus used.

In each sugar house there are two different apparatus used for evaporating the water from the juice. In one, economy of evaporation is the prime essential; in the other, after boiling, there is a viscous tenacious mass that must be discharged as rapidly as possible, and efficiency in this direction is an essential element. In the multiple effect the original juice is reduced about 80%, and in the next vessel or vacuum pan there is a reduction of 10% of the original volume or about 50% of the volume of the syrup received from the effect.

In the evaporation of cane sugar juices the temperature of those juices should not exceed 234° Fahrenheit for fear of discoloring the sugar that is to be made. An effect is simply a heater or a condenser, depending upon the point of view. Exhaust steam from the engine admitted among a lot of tubes in the effect evaporates water from juice on the other side of the tube heating surface. In a single effect the steam arising from the juice passes into a condenser carrying a vacuum. The fall of temperature is that due to the difference of the temperatures of the exhaust steam and that rising from the juice. In a double effect the pressure and the temperature on the juice side of the first effect would be higher than in a single effect, and the steam arising from the juice would be used to evaporate water from juice in a second vessel.

In modern houses the amount of heating surface in the first and second effects is far greater than in the third and fourth effects. Then the first and second effect are robbed. That is all the steam arising from any effect is not sent to the next effect, as a part is diverted to some juice heater or even to a low pressure pan. In Germany not only are effects robbed in this manner but preheaters or Paulys are used.

Mr. Murphy—In speaking of filters I understand that the author intended to filter the scum only, not the juice.

A Member—I would like to ask if the use of electricity would not apply here, as well as in Cuba.

Professor Creighton—The reason it is not used is this: In Louisiana, with the double effect, all the steam that the engines exhaust is used in the first effect and very frequently live steam from the boilers is also needed. The effects need so much steam; there is no way of economizing. The conditions in Cuba are very different. Using a crude engine a quintuple effect would not need all of its steam. You put in an economical engine to avoid blowing off steam all the time. The house is run on bagasse alone. You have to take into consideration the entire house, not a part only.

Mr. Burwell—But for a new house being designed?

Professor Creighton—Would it be economical to put in quadruple or quintuple effects in Louisiana with a sixty-day season? That is the question.

Mr. Burwell—What about practicing economy in the boilers?

Professor Creighton—There was very little experimentation on burning bagasse until Mr. Kerr took it up. In Mr. Kerr's experiments, where he simply made experiments on a house just as it was running, the amount of bagasse burned per square feet of grate surface would run from 25 to 40 pounds in Louisiana, and to 400 pounds to the square foot in Cuba. It is said that economy depends upon burning a large amount of bagasse per square foot of grate surface, but one must keep in mind that in Cuba they have more mature bagasse. However, we ought to experiment, and the planters ought to know what is the best quantity of bagasse to burn per square foot of grate surface, as there is the widest diversity in practice. And, so far as my experience goes, the planters do not handle their furnaces properly. I remember I saw once, on the Teche, a man firing four furnaces, and working like a dog. As soon as the boilers started blowing off steam he started to coal furnaces until the boilers stopped blowing off. He just simply smothered the fire. After a while, when the coal was burning well and the safety valve popped, he started to coal furnaces again, and necessarily a lot of that coal was going up the chimney as unburnt gas. There was not enough air to burn the gases, and they went up the chimney.

Mr. Murphy—I was present once at a meeting of the Louisiana Sugar Planters, when sugar planters got up and told how much oil they were burning per ton of cane. It varied greatly, being five or six times as much in one case as in another. They hoped some inspiration would come to somebody to tell what was the trouble. Mr. Dymond asked me if I had any experience. I told him the real problem was that of hiring somebody to adjust the boiler and show them what became of the heat. They insisted that they had the best fireman in the world, yet that man was burning three or four times as much fuel as another, and it seemed to me it was a simple matter to find the fault.

Professor Creighton—The trouble is something like this: I went to a plantation where a man had bought some boilers, 1500-horse power boilers, and he wouldn't pay for them, as he said they had not the power contracted for. I was there to see if they had the requisite capacity, and after a test I told him they were 1500-horsepower boilers. I went there with a student who knew the man pretty well, and the student reported the man as saying, "If Professor Creighton says they are 1500-

horsepower boilers I will pay for them, but he couldn't beat that idea into my head with an axe.'' And he said, ''I will put back those old boilers I had, because they are the very best I ever had.'' And he put back a lot of two-flue boilers. I told him what the trouble was. We had an unusually wet season and the cane grew profusely. He had a great amount of cane, and he was jamming all that green cane through his house and putting live steam into the first effect—to secure the required evaporation of the juice. He only had 6 per cent sucrose in the cane, the water content was enormous, the bagasse was green, and the boilers couldn't possibly supply enough steam, and he thought they were below the given rating of 1500-horsepower. The next year conditions changed; the cane was good, the sucrose content was high, the bagasse was good, and he never lit a fire under his two-flue boilers. Then he woke up to the fact that it was a question of seasons. Some planters have some sort of a chemist whom they can get cheap. A lot of reports are made, but never studied nor checked. The planter does not know what the conditions are. A business man does not run his business that way, or he would go broke in a short while.

Mr. Burwell—Do you think there is any economy in Cuba in driving a mill by electricity—do you think there is any real economy? You must have a certain amount of steam.

Professor Creighton—(After the meeting). Fuel cost is a big expense in running a sugar house. Where can we oconomize? A high grade turbine needs less steam than a slide valve engine. Using a high grade turbine you have less exhaust steam for evaporating purposes, therefore, a quadruple or quintuple effect is necessary. Steam pumps, simple engines and badly covered steam pipes use great quantities of steam. By using the electric drive you can use economic prime motors and avoid pipe lines and uneconomic pumps and engines.

Mr. Burwell—Do they use live steam?

Professor Creighton—They don't use live steam at all. They use steam turbines, and may have excess exhaust steam. They use bagasse without other fuel.

Mr. Murphy—The latest pump they are putting up is the compressed air compressor, running about 75 times a minute. There was one in a house where they put up a six double-effect; it was 36x36, with a turbine—not dry, however, and I think it took a great deal of power to handle it. But that pump was producing a vacuum for the whole house. They had three 12-feet pans in this double effect, and they had only one pump. Of course it is a much better arrangement than we have here in Louisiana, where they pump off everything—using three or four pumps.

Mr. Lockett—Speaking of this kind of vacuum pump Mr. Murphy just mentioned, when I came here, several years ago, one of the first things I undertook to do was to get the Louisiana sugar planters to put in a dry vacuum, and it was some job. These men had been used to a wet vacuum pump of about 30 revolutions a minute, costing at least twice as much as the pump I was trying to sell them, which was a pump which was used in all the big power plants. I succeeded in finally selling one at Poydras here. This machine, being an air compressor, could safely run 125 to 150 revolutions, but after talking with the engineer there I thought 75 revolutions was about as far as it was practical to use it. When I told him it would run that much, he went all to pieces; he said it couldn't possibly run more than a week. But they finally put it in there, and it ran very successfully. It took a good deal of argument to convince the planters that sort of thing was useful, but we have sold a good many since. That was fifteen years ago.

Mr. Becnel—At a sugar planters' meeting, one night, those gentlemen were discussing the question, and one old fellow asked another, "Well, how do you like your dry vacuum?" He said, "I don't know,"—and added, "About the only effect I could find out is it takes a —— sight more water to run a dry vacuum than it does to run a wet one."

The President—Mr. Beck, have you something you can say on this subject?

Mr. Beck—The subject has been pretty well exhausted, I think. The only thing I thought I might comment on was the quantity of oil consumed per ton of cane. Lots of houses in this State, small houses, make an open sugar for a pretty fair price, and they burn a whole lot of oil,—as I was telling the professor, anywhere from fifteen to twenty-five gallons per ton of cane. Take a house like Sterling or Reserve, and they will run from 7 or 8 or even 11. You couldn't go into a house and make them make the improvements necessary to cut down the oil consumption, unless you spent a barrel of money.

MR. MURPHY—The latest thing that we have got into now, is that the majority of the sugar planters here are putting in another mill behind the 6-roller mill. To do that they increase the double effect or make it into a triple effect by putting another vessel to it. To use steam from the first effect for heating you add in more heating surface in the first effect for heating the juices. The heating of the juice takes a great deal of steam and a great deal of horsepower. People don't figure it out very carefully, and they throw steam in there with a four-inch pipe, necessitating the consumption of a great deal of fuel. If they adopt the principle we are using now,—increasing the heating surface in the first effect, as they do in Cuba, they will get results. In Cuba, at the Violet House, we put in 3,000 feet in the last of the four effects and 5,000 in the first two, and worked that under atmospheric pressure. We robbed the second pan for four juice heaters to heat all the juices of the house, and then we had ample vapor left to continue the evaporation. That house formerly bought wood fuel. After we remodeled the house, putting in mills and all, they were working with about 20 per cent dilution, and had bagasse for sale. They had bagasse piled up to the top of the house. When they stopped, during the holidays, they had bagasse left to start with. That house worked very economically. It was electrically driven, all the pumps were driven electrically, and it worked very economically; they had ample fuel at all times. Now, this past season we put up at Salburg another three-roller mill behind the six, and put the effect in front with 50 per cent more heating surface,—and I think 100 per cent would be still better, so you can rob it and get enough vapor to heat your juices, and that will reduce your oil consumption materially.

It would be still better if they had a quadruple effect. There they run with three or four gallons of oil per ton of cane. The Pauly is on the same pressure as the exhaust lines,—the same pressure that works the effects. They only use one coil-pan—they have one coil-pan for the low-grade goods. It boils better with a coil-pan than with a calender pan. If you have 1,000 square feet in that pan, and 2,000 in the calender, it works very much better. We built two pans, one a calender and one a coil-pan, 12 feet in diameter, in one place, and we built this coil-pan to see if it could keep up with the calender, under the same pressure, and I built the coils in 8-strands, the longest strand was about 40 feet. We worked with the same steam from the same exhaust line, and the coil-pan beat the other a half-hour. They were working about 4½ hours.

They are finding out it will pay them to put in a 9-roller mill, and they are putting in other effects, and increasing the surface of the first effect, and I think that is a good move. They find out the difference in extraction will pay for the mill. And it is an economy, because they can work with less fuel and use more dilution. The object in working the 9-rollers is to get as much water between the mills as possible, to wash the juice out. There are a great many this year figuring on changing to that system of operating.

Wtih regard to the filter presses, and all that, it depends how they work the houses. In some places they want more than in others. At Reserve I think they have about twenty presses, for 2,000 tons,—500 square feet for each press. They make a white sugar at Reserve, and they are making money in melting the Cuban raws and turning that out as granulated. The difference between the raw sugars and refined sugars is so great that they have a chance to make money, under the present conditions, and I suppose they will put in more improvements in the future. They are fixing up to get more centrifugals in there, so as to keep the machinery going longer in the year.

The President—Chemistry is now playing such a large part in sugar-making, I think Professor Williamson might say something on that subject.

Professor Williamson—Mr. President, I do not think I can add anything to what has been said this evening, more than to say that the main thing we, as chemists, are interested in, in sugar production, is the clarification of the juices, and the prevention of the formation of dark products. Of course, incidentally we are interested in other things that go on in the house, but those are two of the main factors, from the standpoint of the chemist.

The study of the problem of clarification, we all admit, is still in a crude state. What we are up against, in the clarification of the juices, is a branch of chemistry—colloid chemistry—that we know very little about. Colloid chemistry has only been worked successfully, or been dipped into from the research standpoint successfully, by a half-dozen or a dozen chemists of any reputation.

When we get into the problem of juice clarification, we are in a very complicated field of organic chemistry, and one of the most complicated fields of colloid chemistry, and there is a great call for experimentation in juice clarification, and for the gathering of all the information that we can rake together on physical chemistry, organic chemistry, inorganic chemistry and on colloid chemistry. So while we use sulphur dioxide for bleaching purposes, and to furnish an acid medium in which to put more lime, and thus put in more electrolytes to throw out of the solution the colloids, the problem of clarification is still in its infancy, so far as actual experimentation or research is concerned. If we have glucose present in juices—as we have in Louisiana—and we use an alkali for clarification, there results a series of degradation products, as a result of breaking up the glucose by a lime or other alkaline medium, which will cause trouble and loss of sucrose. Hence the yield of sugar is lowered. The molasses becomes less valuable and marketable, and we may say numerous other things take place which are very discouraging. The possible number of compounds which may result from the degradation of sugar in the presence of lime or other mediums is 116, and there are about six or eight distinct branches of that 116; so one may start with a perfectly clear juice that carries glucose, and before you know it you have a molasses that is practically worthless, when considered from a standpoint of an edible or first-class molasses.

Now, making no comment on the operations in Louisiana—because I would not do that—but only from the theoretical standpoint of the possibility of improvements in clarification, the season in this State is disadvantageous towards solving the problem of clarification in this State, for the reason that we have only about sixty days of work—sometimes ninety, but as an average we will say sixty days. The result is we hardly have dipped into the matter of juice clarification before the juice is all gone. Preserving the cane and working on it has been done, and there has been some experimentation and research work, but I really charge up the fact that we do not have more publications of the general research on the composition of cane juices and the clarification of it to the short season and the lack of material available. Most of the genuine researches have to extend over a period of several years continuously, and so we find, in trying to do research work on cane juices, that just when we are about getting started the work is automatically stopped for the lack of juices. In Cuba there is a longer time for experimenting, although the juice differs from the Louisiana juice in the extent of glucose, but even there the research work has not been gone so deeply into as it might, from the chemical standpoint.

In the clarification of syrups, after you pass beyond the juice, you still step into the question of whether it is worth while to go further. As your glucose increases every time you attempt clarification, you step into something which is liable to give trouble. So we are hampered by the presence of glucose in the syrups, just as we are hampered by the shortness of the season in the matter of juices. As we continue to attempt clarification, or as we continue to boil, we may continue to increase the content of glucose, but our content of sucrose falls, and we are placed between Scylla and Charybdis. We run into the breaking down of glucose, which means the breaking down of sucrose, as well as into the products produced by the degradation of glucose which simultaneously takes place. So we are against a problem which I contend should be gone into from the purely theoretical organic chemistry standpoint, with no idea at all of manufacture, but entirely from the standpoint of finding out what we are actually dealing with in the cases of juices and of syrups,—and in the case of molasses, on which we have had practically no research.

Now, with respect to the presence of what are called ammonium compounds in the juices, of this lot of compounds we have isolated only about six or eight, and we have reason to believe there are more. When we come to study the effect of non-condensible gases in the effects especially, one of these non-condensible gases we encounter in beet sugar and cane sugar manufacture is ammonia, which is broken down from the compounds or other nitrogen compounds, such as amines, and when we break into the latter we add into the juice still another element to sucrose, and the loss jumps up.

What I have said of clarification is to show what a delicate problem the problem of clarification is. It is not at all simple. We cannot say that we can thoroughly clarify the juices, because we do not do it. The past season was one of the most remarkable seasons, in the fact that some planters ground frozen cane. Frozen cane does not mean cane, every time, that has been frozen to the point of breaking open. The freezing of cane, although it may never have been broken open, may be injurious to clarification, and to graining the sugar, for the reason that the organisms which produce gums, which we call the arabans or levulans and galactens, work admirably at a low temperature. And when we windrow cane, if it gets cold enough and the cane is not sufficiently covered, the outer surface of the stalk may become cold enough to allow the gum organisms to work. On the outside of the stalk you will find gum, which does not occur appreciably in normal cane. I came across that in a house where Mr. Gibson was present, where the sugar house was in trouble. I can't say it was due to gum being produced by those organisms, but the conditions were ripe for such a production, and the juices were so full of gum that practically all the material from the pans went into the tanks and hot-rooms for graining later. That is a condition which arose this year, and every time we have a cold season, whether the cane is badly frozen or not.

As I have said, I wanted to state this condition about clarification, so as to bring out what a complicated problem clarification is, and to show that we have not solved it, by any means. But we could have here in Louisiana systematic research the year around, if such a condition could be brought about whereby juices could be had the year round.

The President—Mr. Crump, have you anything to say on this subject.

Mr. Crump—I think I could not say very much about it, so much has already been said. I have not had much connection with sugar-making in Louisiana. I was with a firm that manufactured sugar, for about a year, but I am not very familiar with Louisiana sugar conditions.

The President—I would like to ask a question, which will expose my ignorance, and that is with reference to what we call the "effect." I would like to know what is the difference between an "effect" and a vacuum-pan, or is one the same as the other? I venture to say a good many others are as ignorant as I am on that point. I would like to have some information about that. Why is it termed an "effect?"

Professor Creighton—In the effect, if you have 10 cubic feet of juice, the first thing to do is to evaporate 8 cubic feet away, bringing that down to 2 cubic feet. The juice in the first body is very liquid, like water. By boiling you get in into a mixture of molasses and sugar, which could not be removed from the effect due to its viscosity, and hence subsequent boiling is done in a different vessel, and that second evaporation is done in the vacuum pan. The first and economic evaporation is done in the effect.

The President—Why is it called an effect?

Professor Creighton—Well, that is the term for it. It is simply a multiple effect. It called "multiple" because there are several of them—double, triple, quadruple or quintuple.

The President—I simply wanted to know why the word "effect" was applied to that instrument.

Mr. Becnel—Mr. President, before ending this discussion, I would like to say that one of the troubles, in my opinion, is that the sugar planter has never allowed himself to be influenced in the direction of the segregation of his problems. The average sugar planter, as I know him, requires a lot of valuable and well-constructed machinery, and because he has paid a certain number of thousands of dollars for the equipment, he immediately begins to think that because he has paid that amount of money he is necessarily going to do good work. So much for faith. The trouble about that, however, is that he also immediately begins to think that that machinery is of greater capacity than it really is, and I know of several instances where well-kept modern houses are doing absolutely worse work than the same houses under the same ownership did twenty-five years ago with very weak machinery. This thing was particularly brought home to me within the last two or three years. I happen to know of a cane house which, back in 1886, made $1.50 a ton with 4-cent sugar, and only extracted about 111 pounds of sugar and made about 7.42 gallons of molasses. The last season they made 111 pounds of sugar and 8.14 gallons of molasses, and they benefited from 5½ cents or more for sugar, and the sheriff closed them out. That was absolutely nothing else but the result of a badly handled house, in one way; it was the automatic cost of the raw material by reason of their field neglect. From the data I got hold of, I came to the conclusion that whilst the man bought about 70 per cent of his entire supply, his outside purchases of cane, and the remaining 30 per cent was home-grown, aggregating the two according to the approximate cost of production, I came to the conclusion that his own cane had cost him between $14.00 and $15.00 a ton to produce sugar; and there, it appeared, was the greatest trouble. Now, they should learn that the double effect will do certain things, and no more; and that a double effect, to save fuel, does not require their pumping out twice as much condensed water as they need. I have even seen a place where the over-flow pipe from a tower-tank overflowed continuously, because Mr. Planter did not want to buy a regulating valve, or because his operating engineer was so much overworked that he didn't have time to keep the half-way appliances going, and the man wouldn't put a boy there to look after it and regulate it. In a good many instances I think that a great deal of the extra consumption is due to the bad condition, or bad operation, of intrinsically good machinery. To make the planter understand that, however, is another proposition.

OIL BURNING.

By B. S. Nelson.

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The subject of oil burning should be particularly interesting to engineers in the South because Louisiana can take credit for originating the widespread commercial use of oil as fuel in the United States. While a great deal of oil was produced in Pennsylvania fields and some of it was utilized for fuel purposes before the discovery of oil here, the Pennsylvania oils were of such high grade as to make them more valuable when refined into illuminating and lubricating oils than as fuel. In fact, it has been stated that for a considerable time oil companies in Pennsylvania burned coal under their boilers.

With the discovery of Spindle Top in 1901 and the rapid development of the California fields, the supply of crude oil became greater than the demand for refined products; hence the use of oil as fuel. The recent development of the Mexican oil fields has given the South an additional supply of oil to draw on as fuel.

Fuel oil is oil which is more valuable to the producer as fuel than as a refined product. Due to the rapid increase in use of gasoline in motor vehicles and the use of distillates in stationary engines, and also to the improvements in refining crude oils, it is probable that very little crude oil will be used for fuel, and that the fuel most used will be some sort of residuum or scalped oils; that is, the oil from which the lighter constituents have been distilled off. Though the Mexican oils are, as a rule, heavier and contain less of the lighter constituents than American oils, even they are now being distilled and the residue used as fuel. The result of this will be that more attention will have to be paid to the oil-burning system than was necessary with the lighter crude oils used heretofore, because a scalped oil is heavier and more viscous than crude oil. One advantage in using a scalped oil is that there is less fire risk, because its flash point is higher than the flash point of the crude oil.

Fuel oils may be classified according to several of their characteristics, which are more or less dependent upon each other. Some of these are the flash point, or temperature at which an oil will give off inflammable vapors; the viscosity, which may be explained as the molecular friction; the specific gravity; the heat value, and the sulphur content.

The flash point of an oil is of interest particularly from the standpoint of safety. On land installations, where the oil is usually buried in a closed tank, the flash point is of less importance than on shipboard, where inflammable vapors are apt to accumulate in the hull or to be freed in a closed boiler room, due to leaky piping.

The viscosity of an oil is the principal consideration in the actual burning of that oil, because the success of the burner or atomizer depends largely on its ability to atomize the fuel into sufficiently fine particles to insure satisfactory combustion, and the more viscous the oil the more difficult this atomization. There are various methods of expressing the viscosity, one of the most used being in terms of the Engler scale. Degrees Engler means simply the ratio of the time it takes a given quantity of an oil to flow through a standard orifice as compared to the time it would take the same volume of water to flow through. Oil is usually sold, however, on the basis of its specific gravity (generally measured in degrees Baumé) and its heat value and moisture content. It is usually assumed that the heavier an oil in degrees Baumé, the more viscous is that oil, but this is not always strictly true.

Through the courtesy of E. H. Peabody, Mem. Am. Soc. M. E., in Fig. 1 is reproduced a very interesting chart giving the characteristics of some thirty different oils. This chart gives the temperature-viscosity diagram of these fuels, the specific gravity, the degrees Baumé and the flash point. Comparing two crude oils from these curves brings out the relation, or rather lack of relation, between degrees Baumé and degrees Engler:

	Deg. B.	Flash Pt.	Deg. Eng. at 230 Deg. Fahr.
Panuca Crude	13.7	140	13.75
No. 18 California	12.7	285	5.2

It is to be regretted that oil is not specified in terms of specific gravity instead of degrees Baumé, because in any calculations involving the weight of the oil per gallon or per barrel it is necessary to refer back to specific gravity. Further, the heaviest oil that can be designated on the Baumé scale for liquids lighter than water is 10 deg. B., or unit specific gravity. There are oils being used now of 10 and 12 deg. B., and no doubt still heavier oils will be used, which will call for two different Baumé scales and cause confusion.

Spindle Top oil has a specific gravity of about 0.92, corresponding to 22 deg. B., and its heat value averages about 19,700 B.t.u. California oil is somewhat heavier, the average grade of that oil having a specific gravity of about 0.95, or 18 deg. B., heat value about 18,500 B.t.u. The Mexican oils vary considerably in specific gravity and heat value, but as a rule they are much heavier than either the California or Texas oils; a typical oil now used has 0.99 sp. gr., or 12 deg. B., with a heat value of about 18,200 B.t.u.

Table 1 compares the prices of coal and oil, taking as a basis coal of the quality of Pratt, Alabama, and Pittsburgh coal, sold in the New Orleans market. While with these coals an evaporation of 10 lb. from and at 212 deg. can be realized with well-designed water-tube boilers when the boilers have ample heating surface and are in the hands of skillful firemen, it is extremely doubtful if any boilers in regular service are showing better than 8 lb., and the great majority are below this figure. Therefore, if we take 8 lb. as a basis, we are giving the coal its full value. Now, with oil giving 19,500 B.t.u. per lb., an evaporation of 14.5 lb. should be readily obtained if the apparatus for supplying the oil to the furnaces is of first-class design and if the furnaces are properly arranged. With this ratio as a basis, it is apparent that a pound of coal is equivalent to 8/14.5 or 0.541 lb. of oil. A barrel of crude oil weighs approximately 325 lb., therefore one ton (2000) lb. of coal is equivalent in practical heating value to 3.34 bbl. of oil.

TABLE 1—COMPARISON OF PRICES OF COAL AND OIL.

Coal, Dollars per Ton, 2000 lb.	Oil, Dollars, per Bbl.	
5.00	1.50[1]	1.66[2]
4.75	1.43	1.60
4.50	1.35	1.50
4.25	1.28	1.42
4.00	1.20	1.33
3.75	1.13	1.25
3.50	1.05	1.02
3.25	.98	1.01
3.00	.90	1.00
2.75	.83	.92
2.50	.75	.83
2.25	.68	.75
2.00	.60	.66

An interesting point to note with reference to the heat value of an oil is that the B.t.u. usually given is the high heat value or heat value determined in a bomb calorimeter. The actual heat value available in a boiler furnace is less because all fuel oil contains a considerable percentage of hydrogen, and the latent heat of the steam formed by the combustion of this hydrogen passes up the stack as waste heat.

In all the heavier grades of fuel, particularly the Mexican oils, water mixed with the oil is in the form of an emulsion and will not settle out in a tank as it will with the lighter American crudes. This is not so much a disadvantage as it would seem, other than causing a lowering of the heat value. With an oil light enough for the water to settle out of its own accord, this water will frequently accumulate in the tank and piping and go over into the burners in a slug, putting the burners out; but with heavy oil a very considerable amount of water can go through the burner with no bad effect. The writer is inclined to believe that a small quantity of water in heavy oil is an advantage in that these oils are usually heated above the boiling point of water to effect atomization, and the vaporizing of the moisture in the oil as it leaves the burner tip probably helps to atomize the oil more thoroughly.

Oil has numerous other advantages over coal than cost of fuel. The storage space required is much less for an equal

[1] Not allowing for labor saving.
[2] Assuming 10 per cent of cost in labor of firing and handling ashes saved by using oil, a conservative estimate for plants of over 300 hp.

number of heat units; there are no ashes to be disposed of; less boiler-room help is required for firing; the wear and tear on the furnace lining is smaller because the firedoors do not have to be opened, with the consequent chilling of the hot brickwork. Very little repairs are necessary to the grate bars; a much smaller stack can be used for the some boiler horse-power; the boiler can be forced with natural draft considerably beyond what it can with coal, an important feature where boiler capacity is scant; where feedwater is bad, it is often possible to carry a load with two oil-fired boilers which would require three boilers were coal used, thus allowing the cleaning and repairing of one dirty boiler at a time. Steam can be raised much more quickly and with no loss due to banking fires. It takes about 10 per cent of the fuel normally consumed by a boiler at rated load to keep its fire banked with coal. In case of an emergency the fire can be instantly extinguished; any one who has had to draw a hot coal fire in an emergency can appreciate this particular advantage.

THE SUCCESSFUL OIL-BURNING INSTALLATION.

There are several factors entering into the successful oil-burning installation, some of which affect the reliability of the system and others its efficient operation.

The first consideration for reliability is the oil supply to the burners, involving the storage tanks, pumping outfit, and heaters. The size of a storage tank varies, of course, with the size of the boiler plant, but it should be large enough, at least, to hold a carload of oil. A very popular size of tank is a 10,000-gal. tank, which is about 8 ft. in diameter and about 30 ft. long. These tanks are usually built of ¼-in. steel with ⅜-in. heads, though if the tank is subject to corrosion from the outside it should be made of heavier material. The tank should be equipped with a manhole and filling pipe, a suction opening, a vent opening, and openings for steam-heating-coil connections. The insurance requirements call for the tank to be below the level of the pumps and burners, which means that it is usually buried in the ground. The tank should be preferably not less than 50 ft. from the nearest building.

The oil pumps are the next consideration. The pump that has given the best results is a duplex steam pump, piston-pattern type, with brass valves, metallic packing in the oil piston and special gaskets and piston-rod packing. The size of pump should be based on a very low piston speed.

The pump should be fitted with an air chamber on the discharge side to steady its pulsations of pressure, and a governor on the steam end to maintain the pressure constant. The pressure at which the oil is delivered to the burners depends largely on the character of the oil, varying from 40 lb. for oil of 26 to 30 deg. B. to 80 lb. for oil of 12 deg. B. The pump should alyso be equipped with strainers on the suction side to keep trash from getting under the pump valves. Duplicate pumps should always be installed, so that if anything goes wrong with one pump the other may be put in service without shutting down the plant.

The pump should be set as near the level of the oil as possible to give the minimum suction lift, and the suction pipe should be as straight as possible, preferably with bends instead of elbows. Where the suction pipe is long, a foot valve at the bottom of the suction line in the tank is desirable. This should be a valve without leather seats., as fuel oil deteriorates leather. A very good valve to use is a horizontal-swing check used in a vertical position. In addition to air chamber and governor, the pump should be equipped with a relief valve set at a pressure heavier than the working pressure, so as to minimize the danger of breaking the pump. This relief valve should be of the enclosed type, so that its overflow can be piped back to the tank.

The heavier oils require heating in the suction tank in order to enable the pump to lift them. The temperature must not be high enough to cause the oil to vaporize under the suction pull of the pump. The writer has found a temperature of 110 to 130 deg. about right for Mexican oil of 12 to 18 deg. B. According to Commander John J. Hyland, U. S. N. (*Journal A. S. N. E.,* May, 1914), the viscosity of the oil had to be reduced to 375 deg. Eng. in order to obtain full capacity from a Blake pump. In order to gage this temperature accurately, a thermometer should be installed in the suction line near the pump. If this suction line is long, or has several elbows in it, it should be made one or two sizes larger than the suction opening of the pump.

The next question is that of the heater. Practically all the oil now burned as fuel requires heating in order to reduce its viscosity and facilitate atomization at the burner. There is a wide choice of heaters, but the principal considerations are, first, to have the heater of ample heating surface, and second, to be sure that this heating surface is all utilized. In heating oil with a steam coil in a vessel of oil there is a tendency to local heating, that is, the oil next to the coils may be very warm; but this heat is not readily transmitted to the adjacent oil, so that a heater in which the oil is kept in rapid motion over all the heating surface in the coil is apt to give best results. In one type of heater the oil is sent at high velocity through a long coil of brass pipe heated by steam on the outside.

There are several pumping sets on the market which combine all the requisites enumerated above in one self-contained unit. Fig. 2 shows such an outfit which, it will be noted, consists of duplicate pumps with pressure governor, air chamber, gage, suction strainers on pumps, relief valve and heater.

The temperature to which the oil must be heated naturally varies with its viscosity. For fuel oil usually burned in the South, a temperature from 180 to 220 deg. is satisfactory, the higher temperature being for oil of 12 deg. B. As far as we know, no experiments have been made to determine the degrees Engler to which oil must be heated, but judging from our experience and with the aid of the temperature-viscosity diagrams, we should say that about 8 to 9 deg. Eng. is the viscosity required for a steam-atomizer burner. It has been stated, however, that any oil which can be pumped readily can be atmized by a steam atomizer. After the oil is heated at the pump (and its temperature should be read by a thermometer permanently fixed in the discharge line from the pumps), care should be taken to keep the oil hot until it reaches the burner by proper covering of the pipes. Where the discharge line is very long or the oil pump is a considerable distance from the burners, a very helpful device is to run a small live-steam pipe

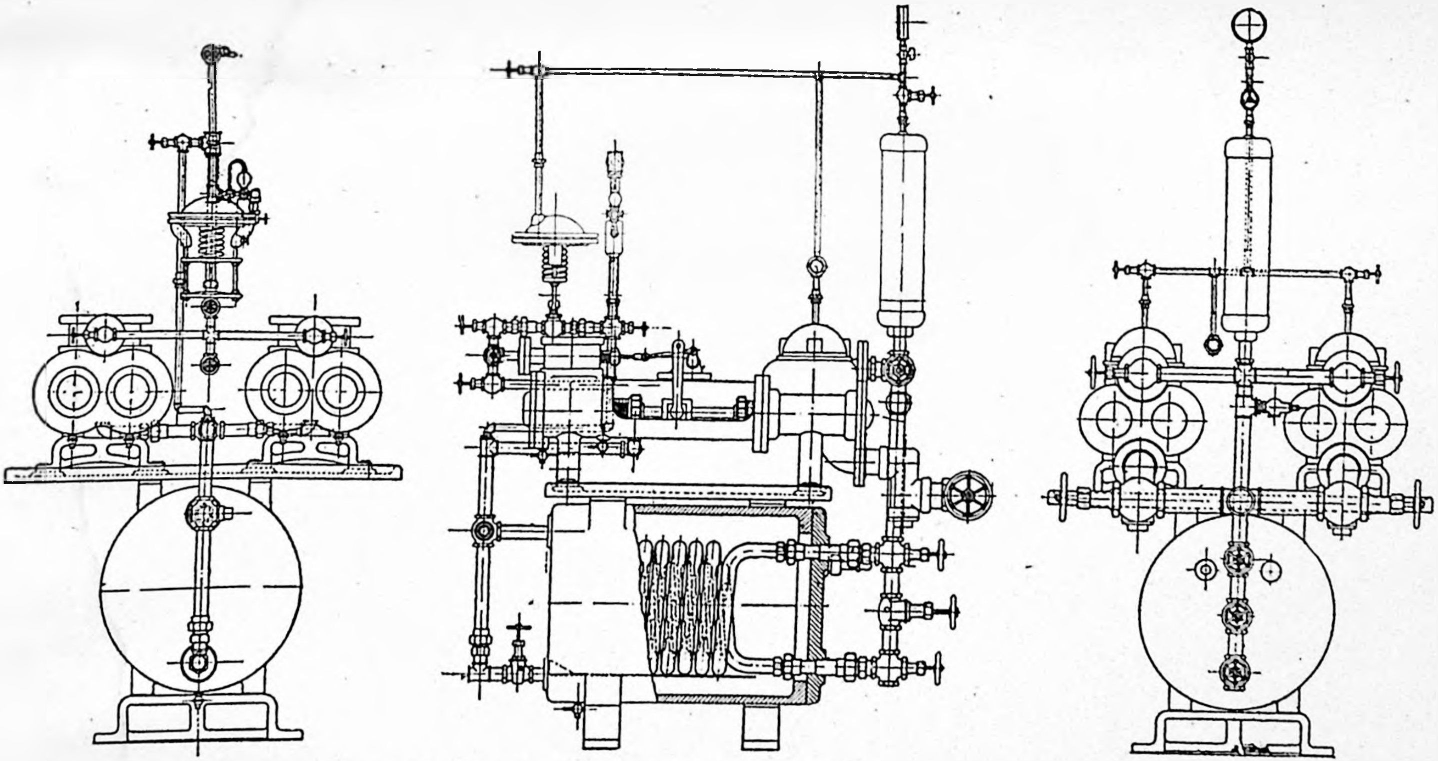

FIG. 2 OIL-PUMPING SET, SHOWING DUPLICATE PUMPS WITH PRESSURE GOVERNOR, AIR CHAMBER, GAGE, SUCTION STRAINERS, RELIEF VALVE AND HEATER

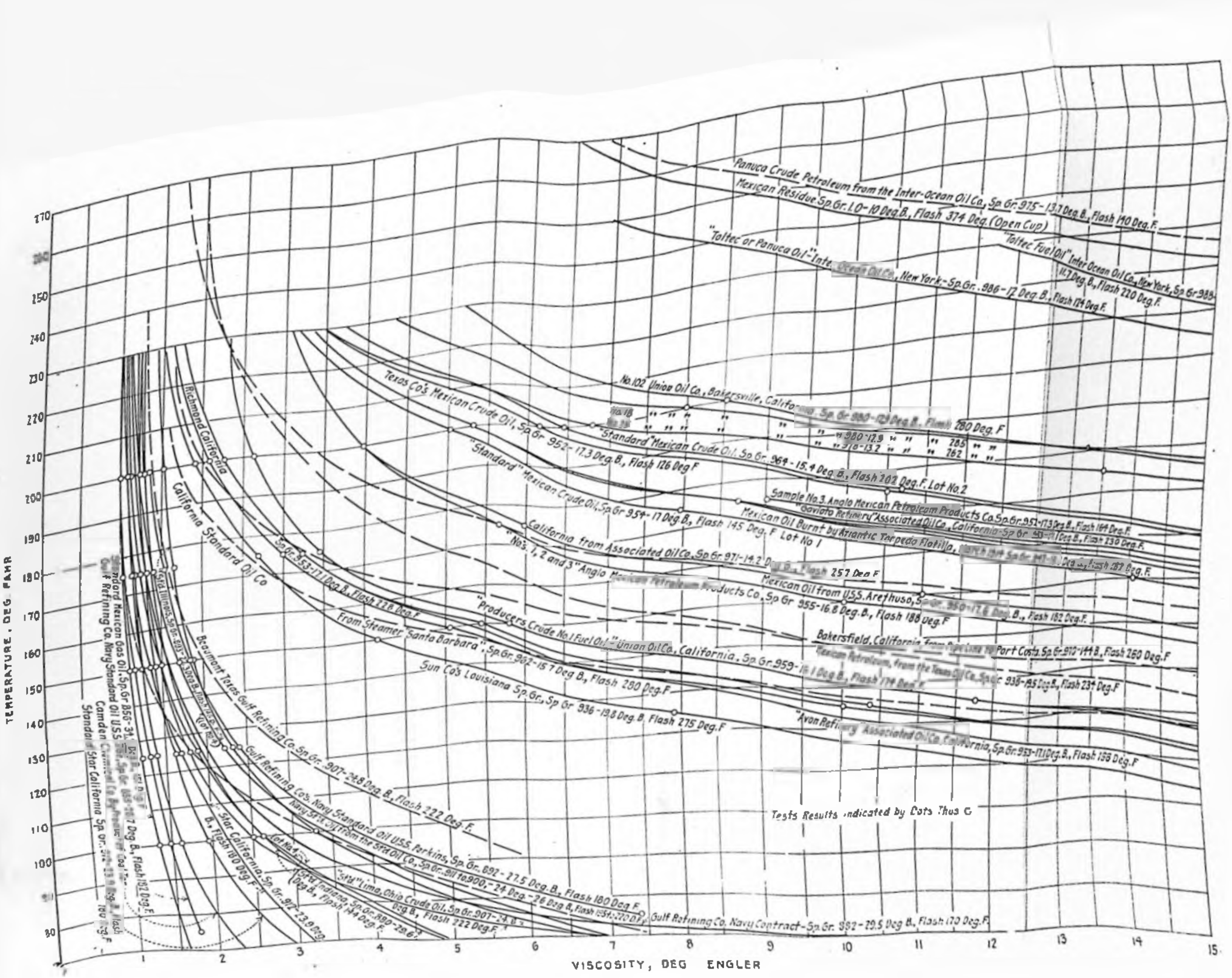

FIG. 1. TEMPERATURE-VISCOSITY DIAGRAM OF FUEL OILS

Reproduced from curves of Lient.-Comm. John J. Hyland, U. S. N., with additions (shown in dotted lines) by E. H. Peabody, Mem. Am. Soc. M. E.

inside the oil-discharge pipe. When this is done, a stuffing box should be placed at one end of the steam pipe to take care of expansion, which will be greater on the steam than on the oil pipe.

In an installation where the burners are shut down for any length of time, a bypass should always be provided from the farthest end of the oil supply to the burners back to the pump suction, or preferably to the tank. The function of this is to be able to fill the oil header with heated oil before attempting to light the burners. With much of the heavy oil now used, it will be found impossible to even light the burner until hot oil reaches the burner tip. If the above bypass is not used, there will be considerable messing up of the furnace and ashpit with unburned oil.

More stress has probably been laid on the oil burner than on any other part of the installation, which has led to the belief on the part of people unfamiliar with the burning of oil that the burner is the whole thing, whereas, as a matter of fact, the burner contributes but a very small part to the success of the installation. The term *burner* is really a misnomer, because the only function the burner performs is to atomize the fuel into sufficiently fine particles to effect complete combustion in the furnace.

For land installations, the type of burner which has proved best is the steam-atomizer burner with oil supplied to it under pressure. The essentials of such a burner are simplicity, cheaply renewable wearing parts, economy in steam for atomizing, and the production of a flame of such shape that makes good combustion and, hence, high boiler efficiency possible. The burners may be of either the round-flame or flat-flame type. The flat-flame type is preferable because it uses less steam for atomizing and produces a flame of such shape as to permit proper mixture of air to support cumbustion without excess air, which is not the case with a round-flame burner.

The use of a target wall is not necessary and may cause injury to the heating surface of the boiler by causing the flame to concentrate on a small portion of the surface, resulting in what is termed "blowpipe" action.

The general type of flat-flame burner is a tip in which are two narrow parallel and horizontal slots, the oil flowing out of the upper slot in fan shape on to the fan-shaped jet of steam issuing from the lower slot.

The position of the burner depends largely on the type of boiler. For a boiler with a long unobstructed furnace, such as a horizontal return tubular, or a boiler of the Heine or Erie City type, a burner set in the firing door is very satisfactory. For boilers where the furnace is short and the travel of the gases is upward, such as in the Babcock & Wilcox or Stirling boiler, the best arrangement is to put the burner at the back, shooting toward the front of the boiler. In either case air should be admitted to the furnace through a checkerwork of firebrick laid on the grate bars. The shape of this checkerwork should approximate the shape of the flame and thus reduce excess air, and the area of all the holes should be equal to 4 sq. in. per boiler horsepower.

Steam and oil connections to a burner should be made to allow for the expansion and contraction of the oil and the steam leaders, and should have unions above and below the burner to enable the latter to be taken out quickly for cleaning. A very essential point in installing a burner is to see that it gets dry steam. The simplest way to do this is to take the steam from the top of the auxiliary steam header. A steam connection should be provided on each burner for blowing the oil out of the burner when it is shut down, as otherwise this oil will carbonize, due to the heat radiated from the hot furnace.

The principal consideration affecting the efficiency of an oil-burner installation, other than the choice of a burner economical in the use of steam (and giving the proper shape of flame), is the proper control of the air supply. One of the advantages of burning oil, mentioned above, was the possibility of reducing the excess air to effect combustion. Conversely, one of the principal losses is the ease with which excess air can be admitted. For any particular installation (assuming the setting is tight and checkerwork properly arranged), the best draft should be determined by installing a draft gage on each boiler connected to the furnace, then gradually closing the damper until there appears just a faint trace of black smoke at the stack, and finally maintaining the draft at that point. It should be noted, however, that there can easily be smoke with excess air for two reasons, first, if the checkerwork is not properly arranged in the furnace there will be excess air, even though the combustion be incomplete, and second, poor atomization of the oil at the burner will give a grayish-white smoke, which is often mistaken for insufficient air. A more accurate method of gaging the air supply is to make periodical analyses of the stack gases and keep a record of the stack temperatures. The stack gases should not be over 100 deg. hotter than the steam, and no difficulty should be experienced in getting 13 to 14 per cent CO_2 in regular operation.

DISCUSSION.

Charles E. Snypp spoke of the difficulties experienced in handling and firing heavy Mexican crude oils. He recited an experience in which these heavy oils were substituted for the lighter crude oils, such as Spindle Top, Beaumont and Louisiana oils, in a plant especially adapted to the burning of lighter grades. Fortunately for the continuous working of the plant, the change came about gradually over a period of a couple of years, and thus the machinery was corrected and adapted from time to time to the heavy grades.

Owing to the rigid insurance requirements, the supply tank was located about 400 ft. distant from the boilers, and about 2 ft. beneath the level of the burners. This tank was buried and dirt arched over the top to supply the necessary weight to overcome its buoyancy when empty, as the ground was more or less saturated with water.

The pump which supplied the burners was located in the boiler room, and light crude of 22 deg. B. could be easily drawn through a 1½-in. pipe by pump suction without heating. For heavy crudes a 3-in. pipe was substituted and a large-capacity, slow-motion pump was used. This would handle medium grades, but in cold or wet weather the arrangement was too delicate to be relied upon. A booster pump was then located at the tank, and oil was heated to 130 deg. fahr. and forced through this 3-in. pipe. This relayed the oil to the burners. A 2-in. overflow pipe was laid from the pump, located in the fire-room, to a return pipe to the ground tanks. This slow-motion pump was speeded by allowing oil to flow freely through a ½-in. vent pipe located in the top of the pump chamber and controlled by a gate valve, and this oil circulated through the 2-in. pipe to the ground tank. This proved to be a very satisfactory arrangement for handling Mexican crudes.

Mexican crudes of 12 to 13 deg. B. should be heated to 120 to 130 deg. fahr. and delivered to the burners just under the distilling temperature, which is about 250 deg. fahr.

Superheated steam was found to be beneficial in atomizing this oil and delivering it to the fires. (The speaker had no data on the amount of preheat used, but believed that the oil should be delivered in a gaseous state to the fires.)

A 3-in. closed tube about 8 ft. long was located in the bottom of the firebox between two burners, and protected with one thickness of firebrick. Steam from the boilers was led through the front end of this tube through a ½-in. pipe, and the pipe extended to the rear end. A ¼-in. pipe was led from the steam space of this tube to the burners. The fuel oil was fed through a ¼-in. pipe into the rear end of a ¾-in. pipe which was inserted into this tube, extending the full length of the tube. Thus the oil was preheated by superheated steam and the superheated steam was used for atomizing.

The oil, flowing from the pump, located in the fireroom, was heated by the usual exhaust heater at the pump, then passed through a live-steam heater before entering the superheated tube.

The requirements for successfully firing heavy crude oils seem to be, first, large pipe lines and slow-moving large-capacity pumps; and second, proper preheating; third, superheated steam to atomize the oil.

Robert T. Burwell. Wherever any trouble with oil-burning under boilers has occurred, it has generally been of a local nature, due to the impinging of the flame on some portion of the boiler, or to the sealing of the boiler, more than to anything else, and where the oil is properly distributed, we may expect as much life from the oil-fired as from the coal-fired boiler.

We thought when the Beaumont field was discovered that, inasmuch as this oil gave such a driving-hot fire—boilers could be forced so easily—the boiler would show defects much more quickly, but we have not met with anything of that kind in our experience. The railroads now drive their boilers rather hard, and yet they do not seem to have any such trouble. They have to be careful that the oil is well distributed so that the flame will not impinge against the tubes, and for that reason most of them place the burner at the front of the firebox so that the flame passes to the rear first.

As to the type of burner, Mr. Nelson has pointed out the advantages of the flat burner. It has the additional advantage that it is not so apt to force the flame against the boiler as is a round burner; the flat burner seems to distribute the fire more equally across the chamber. I am glad to see that they are doing away with the target, which formerly caused us a good deal of uneasiness because the flame would strike the target and be deflected for a long time on one portion of the boiler, a condition that does not exist in a coal fire.

These who are using oil should bear in mind that they can force a boiler very easily, and in forcing it they should also bear in mind that the more it is forced, the more important it is that the feedwater be of good quality.

In reading over the Government Report on oil burning, one is struck with the emphasis placed on the importance of having good men in charge of the burners. This factor does seem more important than in the case of burning coal, and yet we know that there is frequently considerable difference in efficiency of men firing coal.

An efficient fireman is very important to the economical operation of a plant. One of the best illustrations of the saving by a good fireman was shown in a test made at Milwaukee burning coal, where very accurate data were taken covering a period of twenty-four hours. This test was started at 9 a. m., when fireman *A* was on duty, and his showing at the end of five hours was 9.98 lb. of water per lb. of dry coal. Fireman *B* then came on and his watch lasted 8 hours, during which time the rate was 9.23 lb. At 10 p. m. fireman *C* came on for 8 hours, and showed exactly the same amount as *B*, namely, 9.23 lb. It was thought that the discrepancy was due to the boilers being cleaner during *A's* watch, but he came on the next morning at six, and during the three hours to the end of the test made a showing of 9.87 lb. At the average price of coal this plant would save $2.40 per day by having firemen like *A* instead of *B* or *C*, and yet these three firemen were supposed to be in the same class. It is quite probable that many of our plants which have to select practically a new crew every year, such as our sugarhouses, must suffer in economy from this source.

Mr. Nelson has also pointed out the importance of a proper distribution of the air and a regulation of the air to reduce the excess air to a minimum, to which we might pay more attention with a view to developing a system by which we can determine exactly what we are doing in a plant. Mr. C. R. Weymouth, in Vol. 30 of Trans. Am. Soc. M. E., gives a table showing the boiler efficiency corresponding to varying percentages of excess air.

Referring to burners, while it appears that it does not make much difference about the type of burner, yet the Government Report gives the results of a test of the Korting mechanical burner showing an evaporation of 16.13 lb. of water from and at 212 deg. fahr. The temperature of the oil at the burners was 162 deg. fahr. and its pressure was 105 lb. per sq. in.; the temperature of the air entering the furnace was 250 deg. on one side and 290 deg. on the other, and the temperature of the gases at the fan suction was 465 deg. This result (16.13 lb. water) is unusually high, and with a burner that uses neither air nor steam to atomize the oil. The oil under pressure is forced through screw threads to the nozzle, the orifice of which somewhat resembles an injector. Most authorities place a limit of 130 deg. fahr. to which the oil shall be heated, and yet in this test the oil was heated to 162 deg., giving the best results that I have been able to find.

One point not yet touched on is the importance of having ample room in the combustion chamber. As a matter of fact, I think a small Dutch oven would give better results. I recall a power plant in this city where the boilers equipped with Murphy stokers were fitted up some years ago to burn oil—simply by lining the bed of the stoker with brick the fire had a clear sweep to the combustion chamber beneath the boilers. It was apparently the most perfect fire I have ever seen.

The form of furnace undoubtedly has considerable effect upon the temperature of the fire; in the case of a fuel in which a considerable portion burns as a gas, if these gases come in contact with a cool surface such as the boiler, before combustion is complete, there is a corresponding loss. It requires a temperature of about 1500 deg. fahr. to burn carbon monoxide.

and it would therefore seem desirable that the furnace be of such proportions as to keep the gases above this temperature until complete combustion is assured.

An interesting illustration of the effect of the temperature of the fire on the burning of a fuel is seen in the case of bagasse. Green cane contains about 76.5 per cent water, thus if 10,000 lb. of cane were dried and the water caught, we would have 7650 lb. of water. The dry matter will burn readily and produces sufficient heat to evaporate more than 7650 lb. of water per 10,000 lb. of cane. The reason green cane will not burn is because the water in contact with the combustible matter prevents the temperature from attaining a point necessary for combustion.

My observations indicate that there is a practical operating condition against the use of oil in a bagasse furnace; as a rule, the man in charge is too prone to wait until the blowing of the safety valves notifies him that it is time to shut off the burner, whereas in using coal he is not apt to add it any more frequently than the condition of the bagasse fire demands. I recall one house that burned coal with bagasse with good results, but reported unsatisfactory results with oil. Of course, this is a condition that can be improved by careful supervision; it emphasizes, however, the importance of capable men in charge of the burners.

Speaking of forcing boilers, the Government Report calls attention to the fact that a burner has a limit, and it is impossible to force a boiler with an insufficient number of burners. This suggests the idea that in many instances more burners might be used to advantage; a greater number might also permit a wider range of regulation.

Professor C. S. Williamson. I do not know much about tests on oil burning, but it stands to reason that provided you do not reduce the oil to the elemental condition, in which case carbon would be deposited, the more nearly broken the oil is, the greater the heat value obtained, for this reason: we are all perfectly familiar with the fact that if a certain product—take a chemical compound, for instance—requires so many heat units to decompose it, we have put in that many heat units before we begin to get back any heat units from its actual combustion. Oils should not be heated above their flash points nor to a temperature at which carbon is separated. This temperature depends upon the property of the particular oil undergoing use or test, and so the flash temperature will vary.

Another point is the free play of the flame. It might not be accurate to so designate it, but it often causes a loss to the boiler efficiency, for if you impinge the oil flame on the boiler, the oil will split and produce a tarry residuum which drops into the pit, thereby losing a portion of the oil, although getting the best heat value possible for the oil actually consumed. There is a certain point, which varies for different oils, at which the separation will take place, but one would have to determine this point for each oil to tell at what temperature the oil can be most economically preheated. If then the oil is preheated too highly, causing separation at this point and, further, the flame is allowed to impinge against the boiler plate, we have the formation of a residuum at two places, one (the former) of which may clog the burner, and the other produce the tarry residue in the pit below the furnace. The temperature of the flame at the point of combustion is considerably above that of the boiler plate, which possibly does not exceed 300 deg. fahr. in most cases. Hence the boiler plate will act as a condenser to the tarry residue, which has a higher boiling point than the surface upon which it is formed, and the cause of inefficient burning may be this mechanical arrangement instead of the oil being low in heat units. There is a splitting point then for different oils, which varies as mentioned.

There is a method of atomization which has not been spoken of, but which also gives good results where the installation is large enough to warrant putting it in, and that is compressed air. If you do your atomizing with compressed air, you do away with the steam you have accounted for in the absorption of heat. So where the plant is large enough, this method can be worked very successfully. It is somewhat a question of the amount of water which you introduce, in case of steam, as pitted against the nominal amount of water introduced in the case of air; also of thoroughly mixing the oxygen with the particles of oil as they are atomized.

C. D. Lebermuth. Mr. Burwell has struck the keynote in bagasse burning when he mentioned getting rid of the water. Not only is the heat value per pound of bagasse raised with a reduction of water, but also the heat value per pound of fiber. This has been worked out theoretically and experimentally by Prof. E. W. Kerr, Mem. Am. Soc. M. E. In practice it has been equally well demonstrated, where factories have reduced the moisture from 52 to 56 per cent, the limits in ordinary Louisiana six-roller mill work down to 47 per cent, now obtained by the best nine-roller mill plants.

It has been shown that under normal Louisiana conditions, 75 per cent excess air is about the minimum practicable in order to keep fires burning, this excess air being necessary in order to dry the water out of the bagasse. It can readily be seen that with this as a minimum and with the ordinary operating condition being about 100 per cent excess, bagasse furnace conditions are not at all suited for burning oil. In every case where these fuels have been tried together the results have been poor. At Meeker, built as recently as 1912, such combination furnaces could never keep up steam until they were changed and the oil and bagasse fired separately.

At the Gramercy Refinery, some years ago, they found when they were grinding cane about 1000 tons a day, the fuel rate in the refinery was practically the same as when they were not grinding. They felt that the bad influence of the bagasse on the oil-furnace conditions overbalanced all the fuel value that they got from the bagasse. Now that no grinding is done they have some well-perfected furnaces using oil which give them from 72 to 74 per cent total furnace and boiler efficiency right along, and I saw the results of a 72-hour test there, where they obtained a total furnace and boiler efficiency of 80.4 per cent with return tubular boilers. From any other source than their chief engineer, such a figure looks almost too good to accept on its face value. But as I received it I feel sure of its validity.

What is needed in the way of a combination furnace is one which will burn bagasse efficiently and permit of burning oil to run boilers full load, efficiency not counting in this case at all. For oil will only be used when the milling tandem is stopped, which occurs only at infrequent intervals. It is simply a matter of getting the same horsepower out of the bagasse boilers during these stops.

H. L. Hutson. When the Mexican oil companies first sent men up here to sell their oil, they sent an engineer to give instructions as to how the poeple should arrange to handle it, and I remember that his instructions were about as follows: Where the consumer had a large tank near the river, as most sugarhouses have, and was in the habit of gravitating the oil from the storage tank to the suction tank, he told them that they must put in a large pipe between those two, and put a pump and boiler at the storage tank, with heating coils in the storage tank, and force that oil from the storage tank to the suction tank, as it would not flow by gravity in cold weather. He said also that they should provide compressed air from some source, and when they shut down, particularly in the winter, they must blow all the oil out of the pipe line with compressed air, because if it froze on a cold day they would not get it started again. That surprised me very much, and for the first time I appreciated that they were furnishing us a semi-solid instead of a real liquid fuel.

W. B. Gregory. Professor Williamson has suggested the use of compressed air as an atomizer. In the pumping plant of the Neches Canal, near Beaumont, Texas, they first used steam as an atomizer, and then later installed a Connersville blower and thoroughly tried out burners with air as an atomizer. Whether the work was handled with great skill and intelligence I do not know, but I do know that they abandoned the use of air after some months of trial, and have ever since used steam instead. I think that in general, and for stationary plants at least, steam has been found by experiment to be far more satisfactory than air.

ALLEN T. DUSENBURY. Our plants are scattered about through the waterways of South Louisiana, and we can handle oil to much greater advantage than we can coal. For small pumping plants, if I order a carload of coal and take it to the plant, some times it will last a year or more, but the deterioration in the common line of coal is very great; whereas with a carload of oil, you put it in a tank and you may keep it indefinitely. For that reason alone, for our work, and also in getting fuel oil to the dredgeboats, it has been very convenient, and I would be willing to pay a considerable premium to get oil rather than coal for the purposes for which I have need of fuel.

B. S. NELSON. In regard to the handling of heavy fuels, it may be stated as a general rule that heavy oils have to be heated every time they are moved through a pipe. Assuming the case of an ordinary plant which gets its oil in tank cars, if the plant is so located that the tank car reaches the plant within a day after it leaves the refinery, it will usually be found warm enough to run out by gravity, as the oil is well heated when it is put into the tank car. In case the oil is too cold to run out by gravity, every tank car is fitted with heating coils, and a steam connection should be provided at the unloading switch to connect to these coils. A $\frac{1}{2}$-in. or $\frac{3}{4}$-in. steam line is usually ample to heat up the oil in the tank.

As to precautions to render storage of oil safe, most of the oil now burned is of such high flash point that there is very little danger of gas accumulating. The curves in Fig. 1 give the flash points of various oils. However, any one can find the information required on this point in a new book entitled Fire Prevention and Protection, Rules for the Safe Storage of Oil. Aside from insurance requirements, it is well to always keep the oil tank closed and have a vent pipe extending up out of danger from sparks or matches. Where oil storage is particularly dangerous, as on shipboard or barges, it is well to provide the storage tank with a large live-steam smothering connection, the function of which is to cover the oil with steam and so exclude the air. The refineries which have in the past suffered large loss from lightning setting their tanks afire now use an ingenious method of extinguishing fire by the use of foam made by pumping simultaneously to the top of the tanks two liquids which, when mixed, produce a heavy foam, which blankets the surface of the oil, thus excluding the air and extinguishing the fire.

With reference to the burner mentioned by Mr. Burwell, one reason that type is not used more is because it operates on the mechanical-atomizer principle, and the characteristic of it is high oil temperature and high pressure. I have seen cases where oil was heated as high as 240 deg. and carried 240 lb. of pressure on it. It is used a good deal in the Navy, but the oil has to be heated to such a high temperature and carry such a high pressure that it makes it dangerous. The burner used is a round-flame burner, usually, and requires forced draft, though in the naval vessels they use forced draft in any case.

The mechanical burner has been tried in stationary furnaces. Mr. Lockett and I did a little work on a mechanical flat-flame burner, but we did not get very far. A burner of that kind would be a desirable thing. Most of the mechanical burners depend on centrifugal force, and the oil comes out at the end of the burner as a diverging radial spray, and it is thrown out in a mist, which means that you get a round flame.

The average amount of steam used by the burner, to atomize the oil, depends on a good many things, for instance, whether the boiler is being run at full capacity or at part capacity. For a good burner, working under favorable conditions, you should not use over 1½ to 2 per cent of the steam generated by the boiler to atomize the fuel. With a poor burner, you may use 8 or 10 per cent. I have heard of some using as high as 15 per cent. The highest I ever got on a burner was 7 or 8 per cent.

With regard to the quantity of air required in the burning of oil, we figure on about 250 cu. ft. to a pound of oil, allowing for excess.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Society, June 11, 1917 .

The meeting was called to order with President Dusenbury in the chair and 32 members and guests present.

The minutes of the previous meeting were read and approved.

There being no new or old business to be transacted, the technical exercises of the evening were held.

Mr. John Seaman read a paper entitled "Electrification of Steam Railroads," and it was beautifully illustrated with motion pictures, lent for the occasion by the Westinghouse Co.

After the lecture, upon motion of Mr. Malochee, a vote of thanks was extended to both Mr. Seaman and the Westinghouse Co.

There being no further business, the meeting adjourned to the usual collation.

JAMES M. ROBERT,
Secretary Pro Tem.

Called Meeting of Board of Direction, June 11, 1917.

The Board of Direction was called together after the regular meeting to discuss Liberty Loan Bonds. Upon motion of Mr. Manley, seconded by Mr. Klorer, the Treasurer was instructed to purchase Liberty Loan Bonds to the extent of not less than three hundred dollars nor more than five hundred dollars, the Treasurer being empowered to use his discretion within these limits.

JAMES M. ROBERT,
Secretary Pro Tem.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

AUGUST, 1917

"PATRONIZE OUR ADVERTISERS"

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Louisiana Engineering Society

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LOUISIANA ENGINEERING SOCIETY

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All business communications should be addressed to W. T. Hogg, Secretary P. O. Station 20, New Orleans, La.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

VOL. III OCTOBER, 1917 NO. 5

CONTENTS

EDITORIAL NOTES AND COMMENT

German and American Schools.—If any apology is needed on the part of the editorial staff for filling up an issue of the Proceedings with articles on education, let it be that there was not immediately available any material of a nature more closely appertaining to the activities of this society. While not concerned directly with the problems of education, the membership is made up of men of education and technical school training, and the majority of them are interested in such problems, particularly where these problems have a bearing upon the development and progress of their profession.

Many of us have believed that there was very substantial foundation for the claim of the German people that their system of education was pre-eminent among national systems. It would certainly appear that Germany had developed to the highest degree of efficiency the relation between her technical schools and her industries. Considered from its technical side alone her conduct of the great war is an excellent illustration in support of the above statement. However, in the appraisal of the value of any system of education there are two important points of view from which to consider the matter. One of these is the effect that the system has upon the industrial welfare and progress of the country, and the other is the effect produced upon the people themselves who have been trained according to this system. This latter point of view is not always given the attention it deserves, for after all it is the more important of the two. This is the point upon which emphasis is placed by Professor Wells in the article which is reproduced here from the *New York Times Magazine*. Whether or not we agree with the author's arguments or conclusions, his comparisons of the American and German methods of training are very instructive and give us food for thought. The solution of many problems of this nature is based upon compromise, and so in this case the best results may perhaps be attained by combining the best features of the two systems respectively. Certain it is that the man whose technical or scientific education has been conducted along such lines as to blind him completely to any sense of the moral obligations and higher ideals of life, respecting and venerating only legal authority, is a man to be feared and abhorred. Ample demonstration of this has been given in the conduct of this war by the German people.

When this war is over there will begin another in which all the great nations will compete for commercial and industrial supremacy. Here is where the efficiency of the respective systems of education and their effect upon the people, both from the industrial and the spiritual point of view, will be the most potent factor. It behooves us Americans, therefore, to get into line and examine our system in comparison with those of other nations in order that we may do all in our power to develope and strengthen it.

Training Camp for Civil Engineering Students.—Elsewhere in this issue will be found a short article written by Professor

Derickson at the request of the editor. This article with the accompanying pictures gives a brief description of the camp for training civil engineering students, which has been in operation for a number of years now as a part of the prescribed course in that subject at Tulane University. Such camps have long been recognized as a most valuable feature of the engineering training at some of the larger Eastern and Northern schools, and the establishment of one for Tulane was one of the first improvements in the course effected by Professor Derickson when he took charge of the work here.

Our Military Members.—The following list of names of men who are serving their country directly in either the military or the naval branch has been compiled by the Secretary and the Editor from such information as they had available. It is probably incomplete, both as to the number of men included as well as to their respective offices and locations. We should like to have it as complete as possible and would welcome, therefore, any information from our members to make it so. Please communicate same to the Secretary or to the Editor of the Proceedings.

Bate, H. H. Second Lieutenant of Engineers, U. S. R.
Bres, E. W. First Lieutenant of Engineers, U. S. R.
Coleman, E. H. Captain of Engineers, U. S. R.
Commagere, J. A., Jr. At Second Training Camp.
Creighton, W. H. P. U. S. Navy.
Diettel, A. A.
Fortier, L. J.
Garsaud, Marcel. Major of Engineers, U. S. R., Camp Pike.
Gregory, W. B. Major of Engineers, U. S. R. Ordered to France.
Grehan, B. H. Second Lieutenant of Engineers, U. S. R., Camp Pike.
Gwinn, J. M., Jr. Aviation School at Austin, Texas.
Hawkins, E. C. Ensign U. S. Navy, N. O. Naval Station.
Hornot, E. M. First Lieutenant U. S. R., Camp Pike.
Hotard, N. A.
Joubert, C. E. Captain of Engineers, U. S. R.
Lewis, J. H. Captain of Engineers, U. S. R.
Manly, R. S. U. S. Navy.

Nolte, R. W.
O'Brien, J. A. Second Lieutenant of Engineers, U. S. R.
Shaw, A. M. Major of Engineers, U. S. R. Chief Constructing Quartermaster at Camp Beauregard, La.
Silsbee, J. A.
Sprague, F. E. Second Lieutenant, Ordnance Department.
Stem, C. H. Second Lieutenant of Engineers, U. S. R.
Wilson, V. Second Lieutenant of Engineers, U. S. R.
Wyler, C. J. Second Lieutenant, Coast Artillery, Fort Barrancas.

In addition to these are:

Allain, G. O., Jr. With U. S. Shipping Board, New Orleans.
Fairlie, J. W. Commissioned Officer in Royal Engineers Corps, Great Britain.
Johnson, Warren. Local Representative, U. S. Shipping Board, New Orleans.
Leggett, A. J., Jr. With U. S. Shipping Board.
Pierpont, R. A. With U. S. Shipping Board.
Stouse, L. E. With U. S. Shipping Board.

U. S. Waterways Commission.—At the regular September meeting of the Society Mr. Hutson was called upon to introduce a resolution which he had prepared with reference to the new Waterways Commission recently authorized by action of Congress. Mr. Hutson spoke briefly as follows in the introduction of the resolution:

> I was in Lafayette recently, when they had a convention of what is called the Southwestern Louisiana Waterways Association. The real reason for that meeting was that the men in the rice country wanted to get irrigation water from the Teche. They have effected an organization, and are going after that, but the thing that impressed me was the fact that those men were going after that thing as laymen, and it looked to me like engineers might have gone about it a little better. That is the real reason for my bringing up this resolution. The last Rivers and Harbors bill carried a clause which made provision for the appointment of a Waterways Commission by the President, and that

commission will no doubt be appointed soon, and its duties are pretty extensive. They are to investigate the uses of waterways through the whole country, with the idea of finding out the best use to which to put the water and the waterways—not confining their use to navigation, as the government has done heretofore. In other words, they will look into projects of irrigation and reclamation and water-power, as well as navigation. They have only about $100,000.00 to spend, and the greater part of that will go for salaries, so they will not have much to spend on the work. It has occurred to me that, with the great number of projects which will be put to them from different States, the ones which would be acted upon would be those which would be put up to them in the most concise form, with the briefest engineering data, so they could see that the project, on the face of it, could be put through.

Louisiana probably has more waterway problems than any other State in the Union, because we have the flood problems, the river control problem, and the navigation and irrigation problems. I thought, therefore, that the proper people to present these problems to the Waterways Commission would be the engineers of Louisiana, who have devoted their life-work to river control. So I have prepared a resolution as follows:

WHEREAS: The Rivers and Harbors Bill recently passed by Congress provided for the appointment by the President of a Waterways Commission, and as one of the duties of this commission is to make a study of flood control, reclamation of swamp lands, conservation of water for industrial and agricultural purposes, and report to Congress.

AND WHEREAS: Louisiana has many problems in flood control, conservation of water for irrigation, reclamation of swamp and marsh lands, all of which are by their nature closely connected with the use of our waterways for navigation

THEREFORE BE IT RESOLVED:

(1) That the Louisiana Engineering Society, through its President, offer its services to the new Waterways Commission to aid them in whatever way we can facilitate their work in Louisiana.

(2) That the President appoint a committee to draw up a list of the problems which now confront us and forward to the Waterways Commission a report giving an outline of the problem, its interconnection with others and the advantages to be gained by the proper solution of each problem. The object in view being to place before the Commission projects of State-wide importance which in the opinion of the members of the committee drawing up our report would be worthy of investigation by the Waterways Commission.

The motion was seconded by Mr. J. F. Coleman in the following words:

It affords me a great deal of pleasure to second the resolution which has been offered by Mr. Hutson. It seems to me that no body of men in the State could be better qualified than the Louisiana Engineering Society to formulate a schedule of the problems for conservation of water, for flood control, etc., and certainly there could be no more worthy cause to which that Society might lend itself. I therefore second the motion.

The motion was carried unanimously.

New Members.—Since the publication of our last issue the following new members have been elected to the Society and transfers of grade made as noted below:

RESIDENT MEMBERS.

Leon C. Weiss, Edwin J. H. Rodriques, Clarence H. Robinson, Robert R. Hepinstall.

NON-RESIDENT MEMBERS.

Adolph E. Hartman, Shreveport, La.
John Y. Snyder, Shreveport, La.

NON-RESIDENT JUNIOR.

Edwin A. Arpin, Florence, La.

JUNIOR MEMBER.

Andrew J. Wild, Jr., New Orleans.

TRANSFER FROM JUNIOR TO RESIDENT MEMBER.

Edward J. Fisher, New Orleans.

TRANSFER FROM STUDENT TO JUNIOR MEMBER.

David W. Wiedman, New Orleans.

Resignation of Mr. Hogg.—On account of having accepted a position away from New Orleans Mr. W. T. Hogg has resigned his position as Secretary of this Society. We regret his departure from our midst, and desire to extend to him our congratulations upon his new position and to wish him the greatest success in his new field of work.

PAPERS AND DISCUSSIONS

COMPARISON OF GERMAN AND AMERICAN SCHOOLS.

By
George R. Wells
Associate Professor of Psychology, Oberlin College, Ohio
(Reprinted from The New York Times Magazine.)

It is fair to judge an educational system (or anything else) by its results. The only condition is that those results be accurately appraised and that no large proportion of them be incapable of measurement. If this statement is to be doubted anywhere, it is certainly not to be doubted in the field of education. Their educational system has more to do with the genius and spirit of a people than any other influence. There are many forces whch tend to shape national attitudes—climate, geographic situation, and religion. But for the attitude which a nation takes toward its problems, whether of commerce, social relations, and particularly of ethics, its education is chiefly responsible.

Eloquent and insistent claims have been made for years that German education is pre-eminent among national educational systems. These claims, while chiefly made by Germans, have been so loudly and frequently stated that they have come to be generally believed in many quarters. Very much that is praiseworthy can be found in the German system, but also much that is bad. Some of their methods are poor, their equipment is not always adequate, and many absurd customs are carefully cherished. Others have pointed out the excellent features of the German system and have compared it with American education, to the great disadvantage of the latter. Admitting that many such statements are to a degree accurate, let me, in the interests of truth, point out some facts which are not so satisfactory.

Speaking generally, the German educational system comprises the Volkschulen, higher schools, and universities.

At the Volkschulen attendance is compulsory, and undoubtedly a very large proportion of the German boys pass through these schools: the figures vary from 90 to 97 per cent. They attend these schools from the ages of six to fourteen. The curriculum is difficult. From the standpoint of an American student the study hours are long and would be irksome. The course covers six years, but attendance is required for eight years, so that, as a matter of fact—almost unbelievable in this country—many normal children are simply forced to repeat the last two years! "Thus a child who is well and can attend school regularly, and possesses ability so as to merit promotion every year, will have completed the course in six years, that is, when twelve years of age. He cannot be dismissed from school without the full eight years, or nearly that. Nothing remains but for him to go over the work again." (Seeley: German School System, page 89.) The schoolrooms are not equipped up to the American standard; the children usually sit on long benches, and when one moves out all the others must move to allow him egress. The blackboard in the average German schoolroom is an affair four feet by six feet mounted on an easel. Recitations in our sense of the word do not exist; all classroom work consists of instruction. A great deal of home work is given. The two recess periods are spent in the playgrounds which are attached to every German school, but in which no child is allowed to play. The recess is spent by the children marching in a kind of dead march around the school yard. The corner stone of the course of instruction is religion. By this is meant the teaching of tenets of religious sects, always those of the sect to which the parent of the child belongs.

The higher schools are of three types: the Gymnasien, the Realgymnasien, and the Realschulen. The Gymnasien differ from the Realgymnasien in teaching more Latin and Greek, little mathematics and science, and no modern languages as a rule. The Realschulen differ from the Realgymnasien in having more mathematics and science and no Latin at all. The buildings are often sumptuous, containing laboratories and libraries, which, however, are not always available for real use. Russell, in his "German Higher Schools," an appreciative study of the German school system, tells us that the laboratories, as far as his experience goes, are seldom or never used for the students, that the methods of cataloguing and handling the libraries serve practically to prevent the students from having access to the books. The number of these higher schools is totally insufficient. "In Germany there are some 25,000 post offices, each of which represents a centre of population. The pastor, physician, and schoolmaster, not to mention wealthy peasants and Government officials, may aspire to give their sons the higher training. But in all Germany there are but 1,173 privileged higher schools, and the condition is made still clearer when one learns that the twenty-five largest cities have 208 of these schools." ((Russell, page 134.) In these higher schools there is an amount of overwork required of the student which really produces disastrous results. Nowhere in the world is the rate of suicide among children comparable with that in Germany. This overwork consists, a great deal of it, in routine performances which do not in any way compensate the student for the labor required.

A more serious criticism of the German system lies in the fact that there is complete lack of continuity. The Volkschulen do not lead up to the higher schools, but to some extent parallel them. There is no easy way whereby a student trained in the Volkschulen can enter the later years of the Gymnasien. It therefore becomes necessary for the parent to choose the child's entire career at the moment of deciding what school the child shall enter. It needs hardly to be said that the reasons which determine these choices are social.

But the most serious criticisms of German education have to do with its ultimate purposes. The German educational system exists to train citizens for the service of the State, and not for their own individual development, and the service of the State means, in Germany, pre-eminently military service. May I quote again from Russell? "It has been repeatedly pointed out in this essay that the higher schools of Germany serve purposes other than merely giving a liberal education. It is inevitable that a State system of education should be controlled in the interests of the State, but under a bureaucratic government there is danger of using the schools in the interest of the class that happens to be in power. The tendency in Germany to regulate everything that can be regulated applies to the control of public education as to everything else. Little chance is allowed anywhere to individual initiative; small credence is given to the ability of the masses to act aright. The German theory is that it is better to avoid making mistakes than to make them even for the sake of gaining experience." (page 189.)

And a still more significant quotation may be given from the translation of Professor Paulsen's "German Education" (page 257). Professor Paulsen can certainly not be accused of anti-German tendencies. "Under these circumstances the elementary schools have made steady progress during the last generation, and the confidence that this progress will continue in the future is not likely to prove deceptive. No doubt there are obstacles to be surmounted. Even in liberal circles the enthusiasm for the education of the people is perhaps no longer so warm as it was fifty years ago—not to speak of the great land-owners in the eastern provinces or of the Church of Rome. Not a few of the elected representatives of the nation view the progress of the education of the people with great misgivings. Since the rise of Social Democracy the question, whether it is not easier to govern uneducated masses, is seriously considered even by men whose indignation would have been roused, not so long ago, by the mere formulation of such a question."

Of the German universities something will be said below.

The education of girls and women in Germany does not compare with that in this country. It is assumed that courses of study for women must be different from that for boys, for in German eyes the whole purpose of woman consists in the care of the home and the rearing of children. Their education is controlled always with that end in view. In the elementary and higher schools for girls the curricula are quite different from those of schools for boys. Only in very recent years have the German universities opened their doors to women, and even today a very small minority admit women on equal terms with men.

There are really two aims of education. The fact that there are two aims and that they are seldom both achieved by any single system is not completely understood by many. The majority of the disputes concerning educational methods arises out of this fundamental confusion. In the first place, there is the necessity for the impartation of information, not only as to facts, but as to technical methods, in which skill in handling certain stereotyped situations is taught, and in the second place a successful educational system should develop what, for the sake of brevity, we may here call the problem-solving ability. Primary education to a large extent, and many forms of so-called applied or technical education, imagine their task can be completed without any consideration of the second aim. The goal is supposed to be successfully reached if the person has ready command of facts, formulæ and methods of handling a more or less large group of reactions. The products of such an educational system are valuable technical workmen and efficient and capable students or operators in the line in which they have been trained.

The Germans have developed this form of education to a high degree. Students from German schools have accurate information on many subjects. Their technical training is good, particularly in the line of applied chemistry; and in general, as far as this form of education is concerned, the German system on the whole produces first-class results. Yet there is some reason for believing that this is not true in all cases, and that products of their schools may be lacking in quite rudimentary information. E. g., Professor Ziehen of Berlin, in his book, "Prinzipien und Methoden der Intelligenzprüfung," says: "Many mentally normal Berlin workmen know almost nothing of the war of 1870-71. Many have no idea of the capital cities of other lands. Historical personages are confused in an unbelievable manner." And later: "I have myself been convinced, to my great astonishment, that certain mentally normal Berlin workmen who have lived in Berlin for years do not know on what river Berlin lies. Very many do not know into which river the Spree empties."

There is much reason for ranking American education quite high as regards technical training. Much of German supremacy in technical efficiency is simply idle rumor. That tradition has been established (and the history of its establishment is curious), but is beginning to decay. There are various forms of efficiency. German efficiency is of a certain definite kind, a kind quite different from that of other peoples. It is very apparent and is worn, as it were, on the sleeve. But there is a growing and wellfounded feeling in this country that our own educational institutions compare favorably in many respects with the best that can be said of the German.

It is probably true that linguistic training in Germany is better done than it is in the United States. There are certain specific reasons for this, chiefly geographic in nature, which may never be overcome. But it is doubtful if this is true of any other kind of training, and is most doubtful of the sciences. A prominent German pathologist who visited a certain American medical school some few years ago expressed himself as being surprised at the work done there by students, at its scientific accuracy and success. He was heard to say that, when in the future his advice was asked by prospective students of medicine, in his own country, as to the best place to study, he would be apt to name the American university in question. The value of German higher degrees is probably lessening in this country. It is perhaps fair to say that the holders of such degrees in America are not doing work which in any respect overshadows that done by American trained men. I specifically exclude men whose work is in modern languages. The reasons why their preparations should be made at least partially in Europe are obvious.

An instructor in a prominent American university told the writer a few years ago, when he was planning his graduate study, that if he, the writer, wished an "easy" degree, he should go to Germany. The remark was not entirely fair, but shows a tendency which I think is growing. A young professor in an American college, well known to the writer, after taking his Ph. D. degree in this country, went abroad and worked as an assistant in a prominent German Government research station. He found that the director of that station at the time—this happened less than a dozen years ago—preferred American to German assistants and would always make room for an American if possible, even to the extent of dismissing a German.

On the whole, German technical education, while on a high level, does not overshadow the work done in similar lines in this country. This does not mean, of course, that it is much poorer; the two systems produce on this count very similar results.

The second aim of education is to develop a certain kind of general skill which has been called problem-solving ability, the handling of comparatively new situations. Now, inasmuch as these situations cannot in the nature of the case be stated ahead of time, such training occasionally seems pointless, and for this reason is sometimes termed impracticable, and therefore useless. There is no offhand way of describing how such skill can be trained, and there is certainly no method whereby it may be assured in any particular case. It is not even possible to set forth its details with complete accuracy. But as a result of ordinary education a student should be able to analyze a novel situation, classify whatever parts of it are not novel (for no situation can be completely new), and then devote his attention and ingenuity to the new and more detailed problems which in this way are made to appear. The mental factors which make for success in this field are: (1) the ability to recognize the familiar features in a given problem and then to apply to them technical solutions already learned, and (2) a certain mental originality which is indispensable for attacking the new parts of the problem situation.

This aim of education is, as I have said, of paramount value. If it fails to be realized, progress in the solution of difficult problems must needs be slow, and the special type of problem which is particularly apt to have its solution impeded is usually not technical, but of a more intellectual nature. Because such intellectual problems are fundamental they must be persistently and intelligently attacked if civilization is to progress rapidly, or at all.

The *conditio sine qua non* of the development of the problem-solving attitude in students is wisely directed freedom, if the contradictory expression may be pardoned. The "wise direction" should be limited to the choice of technical methods used in handling the familiar parts of the situation. Students should be assisted when necessary in analyzing, but should be perfectly free in exercising their ingenuity in attacking the incomplete parts of their problems. And, on the contrary, the arch enemy of true education is the wrong sort of authority, and too copious advice as to ways and means of attacking problems. The research method is sometimes supposed to be the best means for developing this freedom of attacking problems. Of course the research method is not by any means confined to science. It is true that the research method lends itself easily to free investigation, but it is also true that it can be so regulated by precedent and by the oversight of the director of the laboratory that all real freedom on the part of the student is suppressed.

Now Germany has used research methods very much in her universities. I think that there is no reason for supposing that this method originated there. The whole German attitude toward authority has to a large extent influenced her research methods and spirit. The Herr Professor is ex officio a member of the lesser nobility and, in fact, is quite often autocratic in his methods. "Es ist leicht zu sehen" falls far too often from the lips of the prominent German teacher. His theories are often dogmatic, and for a student to discover facts which oppose or weaken those theories is a crime second only to lèse-majesté. Beyond doubt the work of the German research student, whether in science, letters, or history, must not be objectionable to the Imperial Government, and promotion to professor will be indefinitely postponed if his opinions are not relished in high quarters. It is not surprising that in not a few cases the head of a university department is a kind of petty tyrant in his relation to his junior colleagues and to his students.

If it is true that the Prussian schoolmaster was the real cause of the German victory in 1870-71, it is probably no less true that the Prussian schoolmaster is the cause of the present war and of some of its more fearful outrages, and for exactly the same reason. He has taught the German citizen to be submissively obedient to any order.

It would be untrue to say that the American university professor and head of department is never autocratic or arbitrary. Every man who has studied in a large university in this country knows department heads who are unpleasantly arrogant; but they are not in the majority in the United States. Our methods of appointment and university control to some extent, and our general theory of education in particular, not to mention the spirit of the American student, keep them from becoming numerous.

The upshot of it all is that the German educational system produces a citizen who may be well trained in a rather narrow technology, whether of science or letters. But he has a somewhat small individual initiative and a very great veneration for authority. Than this nothing could be worse so far as progress in education is concerned.

The ascendency of the German nobility over the rank and file of the German citizens is a complete and final criticism of the German educational system. What else could be expected from a system whose most honored professors could sign and support a statement entitled "An Appeal to the Nations." One of the signers of this appeal, traveling in this country in 1915, explained how the statement was handled. The article was already printed when it was presented to the professors by the military authorities, but in order to lend some degree of decency to the thing about two hundred witnesses were called in to testify to the extreme kindness of the Germans towards the Belgians and to the atrocious acts performed by the Belgians. The professors, however, to make assurance doubly sure, asked that the witnesses should be sworn, and set a certain day for them to appear and make their statements under oath. But not a single witness was willing to swear to his statement, and no one of them appeared on the day set. However, the professors, believing discretion to be the better part of valor, signed the "appeal" anyway.

Of such an educational system can much be expected but capable mechanics and workmen, few of whom will have individual directive power? And by the same token a few men will be produced who are highly trained in directing the labors and other activities of the masses of the people. But the people in general are not taught to handle their personal problems with initiative and originality.

In America it is probable that public school and technical school graduates are practically as good as those in Germany. Our educational system, with all its faults, imparts ordinary education to the large majority of its normal students, and there is a very small amount of subserviency imparted with it. The mass of Americans are not afraid to have and to act upon their own opinions. It is a significant and splendid thing that the American university to some extent is a hotbed of free thought and intense individualism, while it is a symptom of malignant disease that the German schools produce men whose mental processes and resultant activities are always at the command of constitutional authority.

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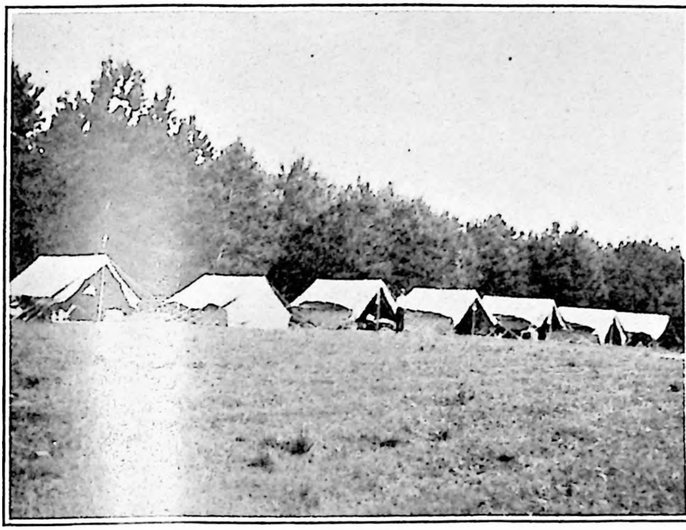
TULANE UNIVERSITY CAMP OF SURVEY PRACTICE.

By
Donald Derickson
Professor of Civil Engineering in Tulane University.

The School of Civil Engineering of Tulane University held its first camp of practice over four years ago. These survey camps last for fifteen days. They afford a more extended experience and create in the student a greater self confidence in the manipulation of instruments than is to be gained from the regular course of instruction given in the class-room and on the campus at the University. Attendance at the camp is required of the members of the Sophomore and Junior classes in civil engineering, and properly prepared students in other departments of the College of Technology may select the camp work as an elective. By requiring the student to attend the camp twice, he is enabled to continue without interruption the application of the theory which he has just studied, and, what is more important from his standpoint, he is free to seek employment for the summer vacation before all of the available positions are filled. The majority get places on engineering work during the vacation period. They are encouraged to do this as it increases their efficiency as students and makes it easier for them to secure employment after graduation.

The camp is situated near Gurley, a station on the Yazoo and Mississippi Valley Railroad, about a hundred and twenty miles above New Orleans. Here a topography is found embracing hills and streams with sufficient woods to offer good experience, but not to the extent that an undue proportion of the available time is spent in clearing lines. In fact the location is as favorable for the study of topographic and railroad surveying as could be desired. The camp equipment is very complete, consisting of sleeping tents with flys and wooden flooring; each of these tents is of ample size to comfortably accommodate four occupants; a large mess tent that at night is used for computing and mapping; a cook tent, as well as individual tents for the instructors and a tent for the instruments. Cots, tableware and other things are furnished, so that the student is required to provide only bed-clothes and towels. The instrumental equipment comprises transits and levels with different auxiliary attachments, and of different types and make, also modern up-to-date plane table, aneroid barometer, sextants, and minor instruments, as well as a varied assortment of stadia and level rods of different type.



GENERAL VIEW OF CAMP

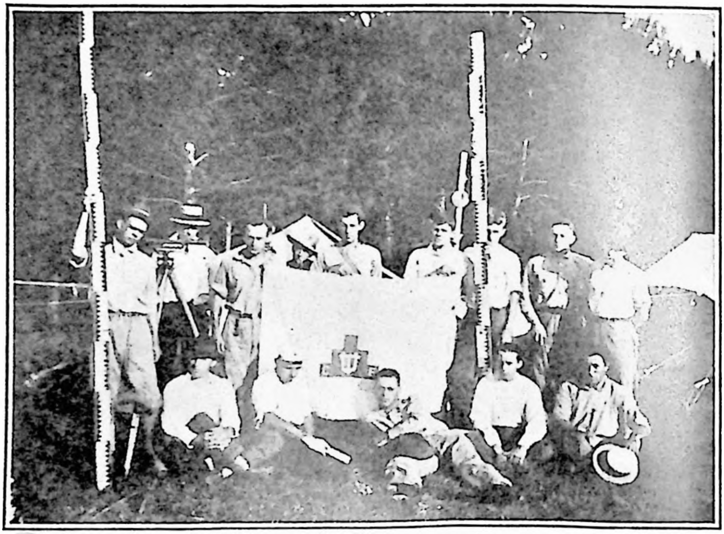
The work engaged in by the Sophomores is that of making a topographic survey of an area of from one to three square miles in extent. A base line about a thousand feet long is measured and the various corrections for temperature, pull, and sag are applied; the error being about one in a hundred thousand. Its azimuth is determined by direct observation on the sun and checked by solar attachment as well as by observation on Polaris. Stations for a triangulation system are located with regard to figure and control as far as conditions will permit. The angles are observed by repetition, and the elevations of the triangulation stations as well as other points are established by a line of levels run from a U. S. Geological Survey bench mark about a mile away. The details of the topography are taken with transit and stadia, though sufficient work is generally done with the plane table to make its use familiar. As the work progresses the notes are plotted on a map to a scale of two hundred feet to the inch. Contours for intervals of five feet are shown as well as all natural and artificial features that can be indicated on the final map. This map will be made at the University during the

MESS TENT

following term in the course in cartography to a scale of four hundred feet to an inch. In the determination of the elevations of the triangulation stations and bench marks the levels are run in circuit and are required to check with an error not greater than 0.05 ft. times the square root of the distance run in miles. In both the field work and plotting the stadia traverse must check on the triangulation system within a number of minutes equal to the square root of the number of set-ups in the traverse, while a much larger error was allowed in the elevation than in the case where the wye level was used.

The students of the Junior class make a survey for a railroad connecting two points from three to five miles apart. A reconnaissance with transit and stadia is first made of the most probable routes. This is followed by a preliminary survey of the line that the reconnaissance has indicated as being the most satisfactory. In making the preliminary survey the line is staked out in stations one hundred feet apart and stakes called plusses are placed between the station stakes to mark the points at which the line crosses a road, stream, gully or other feature that must be shown on the map and be considered in the estimates. The preliminary line consists of a series of tangents; the magnetic bearing of each tangent is observed as well as the angle of intersection. The elevation of the ground at the stations and plusses is determined and bench marks established by a line of levels. This survey forms a back bone for the topography which is next taken by means of the hand level and tape. Contours and all topographic features are plotted on previously prepared field sheets of cross-section paper, upon which the stations with their elevations are shown. The topography is sketched in on these sheets, it being taken for a distance of three hundred feet on each side of the center line. The preliminary survey is now finished, and a map and profile are plotted. Utilizing the principles of the text-books studied in class, a paper location is made from which sufficient data are obtained for the preparation of notes for the location of the line in the field as drawn on the profile and map of the preliminary survey. The notes thus prepared are for the most part adhered to, but when the line is run out, it may in places, deviate from the paper location, when as viewed on the ground, a different alignment would be more satisfactory. In making the location survey stakes are set for circular curves with spiral approaches, and special attention is given to property lines, water courses and road crossings, that they may be shown on the final map and profile which will be prepared at the university during the following term in the course in railroad mapping and earthwork. After the location survey is finished the line is cross-sectioned that the cut and fill may be determined, and the quantities estimated. Finally slope stakes are set and the Junior's work is finished.

The camp is under the direct charge of student officers. They are a Chief Engineer, an Assistant Engineer and a Quartermaster. The Chief Engineer is selected by the students attending the camp from a list of names approved by the professor in charge. It is his duty to see that the work progresses in a satisfactory manner, that each day's work is mapped out, and that the daily assignment for each student is properly arranged. The Assistant Engineer is in charge of the commissary, the cook and his assistants. He must see that the expenses are kept as low as is practicable. The Quartermaster has charge of the instruments, issuing them in the morning and receiving them when the parties return to camp. He is also held responsible for the general order of the tents and grounds.



GROUP OF STUDENTS IN CAMP

At the camp held last June there were twenty students, an instructor and a professor. One of the results of this camp is that the students become sufficiently well familiarized with surveying instruments and methods to serve acceptably as instrument men under exacting requirements and were available to carry on the work left by older men entering the army training camps.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Minutes Board of Direction Meeting, July 16th, 1917.

The meeting was called to order with President Dusenbery, Messrs. Olsen, Riess and Robert present.

Applications—The following applications were ordered through the ballot:

Leon C. Weis, New Orleans, Resident Member.
Edwin J. H. Rodriques, New Orleans, Resident Member.
Clarence H. Robinson, New Orleans, Resident Member.
Robert R. Hepinstall, New Orleans, Resident Member.
Adolph E. Hartman, Shreveport, La., Non-Resident Member.
John Y. Snyder, Shreveport, La., Non-Resident Member.
Edward J. Fisher, New Orleans, Transfer from Junior to Resident Member.
Andrew J. Wild, Jr., Junior Member.
David W. Weidman, Transfer from Student to Junior Member.
Edwin A. Arpin, Florence, La., Non-Resident Junior.

Bills—On motion of Mr. Riess, seconded by Mr. Olsen, the following bills were approved for payment:

D. S. Anderson, salary as editor for February, April and June issues of the Proceedings	$150.00
W. T. Hogg, salary and incidentals	32.50
M. Clay Lejeune, reporting the June Meeting	5.00
Owen Gernon Co., Binding 12 vols. of Magazines	16.75
Fabacher's New Rathskeller, refreshments for the April, May and June Meetings	23.45
Tulane Press, 4 bills for printing and postage	178.79
J. M. Robert, cash advanced Motion Picture Operator, June meeting	7.50
J. M. Robert, cash advanced Motion Picture Operator, May meeting	6.50

Delinquent Members—Upon motion duly seconded, it was decided to drop from the roll Messrs. ———— and ———— for non-payment of dues.

Resignation—The resignation of Mr. Hogg as Secretary of the Society was read and upon motion of Mr. Riess, seconded by Mr. Olsen, the resignation was accepted with regret. Mr. Hogg explained that the acceptance of a new position outside of New Orleans would prevent his further continuing as Secretary of the Society.

Nomination—Upon motion of Mr. Riess, seconded by Mr. Olsen, J. M. Robert was elected Acting Secretary from July 1st, at $30.00 per month, with the understanding that if this amount did not cover his expenses, that such expenses would be reimbursed to him by the society.

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

J. M. ROBERT, Secretary.

Regular Meeting of the Society, September 10, 1917.

The meeting was called to order at 8:20 with President Dusenbury in the chair and fifty-nine members and guests present.

The minutes of the June meeting were read and approved.

Mr. H. L. Hutson introduced a resolution that the Society offer its services to the New Waterways Commission. These resolutions are appended and made a part of these minutes. Mr. Coleman seconded Mr. Hutson's resolutions and upon vote of the Society, the resolutions were passed.

The technical exercises of the evening consisted of an illustrated lecture by Mr. F. J. French of the Mexican Petroleum Corporation, entitled "Notes on Ship Building". This lecture called forth several interesting discussions from various members and guests. A rising vote of thanks was tendered Mr. French.

There being no further business, the meeting adjourned.

J. M. ROBERT, Secretary.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

OCTOBER, 1917

"PATRONIZE OUR ADVERTISERS"

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PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

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CONTENTS

EDITORIAL NOTES AND COMMENT

Shipbuilding.—The opening meeting of the Society after the Summer vacation was held jointly with the New Orleans Chapter of the American Society of Mechanical Engineers, the feature of the meeting being the presentation of a paper by Mr. F. J. French, Engineer of The Mexican Petroleum Corporation, upon the subject of Shipbuilding. The paper was fully illustrated by means of lantern slides and brought forth some interesting discussion, particularly with reference to the question of constructing large ships on the banks of the Mississippi River.

The great difference in the stage of the River between high and low water appears to be the greatest obstacle to the construction of large ships in this immediate locality, or in fact, anywhere on the banks of the Mississippi. This is the controlling factor in any of the schemes which have been proposed for this purpose. Whether the ways upon which the vessel is built are arranged for stern-first or for sideways launching the difficulties in the way of providing ways of sufficient length to take care of the great variation in the stages of the river are practically prohibitive. Mr. French draws the conclusion that the only practical method of building ships on the Mississippi is to use a locked canal, which would necessitate, of course, the sideways method of launching.

A further point in connection with the building of large ships in this part of the country is that it is necessary to be able to build the heavier items of equipment, such as boilers and engines, in or near the ship-yard, thus avoiding the difficulties and expense of shipping these items from one part of the country to the other. While there are a number of shops in this vicinity which are able to undertake the manufacture of fire tube marine boilers, it is doubtful whether the larger sizes of marine engines can be economically constructed here. The labor situation also has its problems due to the fact that most of the skilled labor for ship-building is in the North and the demand for it there is so great that it would be difficult to offer inducements to have the men change their locations.

In his discussion of the paper, Mr. Warren Johnson, who has had a great deal of experience in ship building in New Orleans, reaches the conclusion "that the encouragement of large ship-building on the Mississippi River would result in commercial disaster, and prove an injury rather than a credit to this community."

Rice Irrigation.—For a number of years the rice industry in Southwest Louisiana has been facing the serious problem of securing economically a sufficient supply of fresh water for the purpose of irrigating the fields. Elsewhere in this issue of the Proceedings is published a paper by Mr. Welman Bradford of Alexandria, setting forth the advantages of a scheme proposed by him for accomplishing economically the desired end. Mr. Bradford calls his scheme the "Gravity System of Irrigation" from the fact that the water used is brought to the reservoirs, delivered to the rice fields and there distributed entirely by gravity without the assistance of any pumping operations at all. As applied to Southwest Louisiana the principal source of supply of the fresh water will be the Red River, which is to be connected with certain reservoirs, located at or near the edge of the prairie region and having sufficient elevation to permit of delivering the impounded waters to all parts of this region by main canals and laterals. The irrigation of the rice field itself is carried out by means of the "alternate system" with shallow contours or ridges to hold the water on the field. The main feature of the alternate system consists in flooding each contour for a period of ten days and then draining the water off to the next contour below, the rice being thus supplied with fresh water at intervals.

Mr. Bradford was called by the Brazilian Government in 1906 to apply his methods to the development of the rice industry of that country with the result that in a period of five years, from 1906 to 1911, the balance of trade in that staple was changed from an importation of 22,000 tons to an exportation of 8,000 tons.

The same methods have also been applied with great success in Italy.

Incidental to the plan as applied specially to rice irrigation it is pointed out that the main canal from the Red River will also be available for navigation, and that the surplus waters impounded in the reservoirs may be used for the development of power. The claim is made that there will thus be rendered available sufficient water with the necessary head for the development by hydro-electric means of 50,000 horse-power, with the further claim that this power could be delivered in New Orleans at half the cost of generation in the city as at present.

An engineer, who was not present at the meeting, made the remark afterwards that one doubt in his mind as to the practical working of this scheme would be the trouble encountered from sedimentation in the main canal due to the large amount of silt carried by the waters of the Red River. This point was not touched upon in the discussion, and it might be of interest to have Mr. Bradford give a further statement covering that question.

In fact, we take this opportunity to remind our members that these published papers are always open for discussion in the columns of this journal.

The Pitot Tube.—We are in receipt of a very interesting little pamphlet recently published by the firm of A. M. Lockett & Co., of this city and Houston. The pamphlet is well illustrated with half tone cuts showing the different forms of tube manufactured by the company with instructions for their application and use. References to the technical literature on the subject of the Pitot Tube are given, and there is appended a table of "Constants for Locating Stations for a 10-Point Traverse", as well as a "Head-Velocity Table for the Pitot Tube." A. M. Lockett & Co. will be glad to send a copy of the pamphlet to any engineer who may be interested in the subject.

Our Military Members.—The following list of names of men who are serving their country directly in either the military or the naval branch has been compiled by the Secretary and the Editor from such information as they had available. It is probably incomplete, both as to the number of men included as well as to their respective offices and locations. We should like to have it is complete as possible and would welcome, therefore, any information from our members to make it so. Please communicate same to the Secretary or to the Editor of the Proceedings.

Bate, H. H. Second Lieutenant of Engineers, U. S. R.

Bres, E. W. First Lieutenant of Engineers, U. S. R.

Coleman, E. H. Captain of Engineers, U. S. R., Camp Pike.

Commagere, J. A., Jr. At Second Training Camp.

Creighton, W. H. P. U. S. Navy.

Diettel, A. A.

Fortier, L. J. First Lieutenant, 17th Field Artillery, Sparta, Wis.

Garsaud, Marcel. Major of Engineers, U. S. R., Camp Pike.

Gregory, W. B. Major of Engineers, U. S. R. American Expeditionary Force in France.

Grehan, B. H. Second Lieutenant of Engineers, U. S. R., Camp Pike.

Gwinn, J. M., Jr. U. S. Aviation Corps, Mineola, L. I.

Hawkins, E. C. Ensign U. S. Navy, N. O. Naval Station.

Hornot, E. M. First Lieutenant U. S. R., Camp Pike.

Hotard, N. A.

Joubert, C. E. Captain of Engineers, U. S. R.

Lewis, J. H. Captain of Engineers, U. S. R.

Manly, R. S. U. S. Navy.

Nolte, R. W.

O'Brien, J. A. Second Lieutenant of Engineers, U. S. R. In France.

Shaw, A. M. Major of Engineers, U. S. R. Chief Constructing Quartermaster at Camp Beauregard, La.

Silsbee, J. A. First Lieutenant Sanitary Co. No. 1. Camp Greenleaf, M. O. T. C., Fort Oglethorpe, Georgia.

Sprague, F. E. Second Lieutenant, Ordnance Department.

Stem, C. H. Second Lieutenant of Engineers, U. S. R.

Wilson, V. Second Lieutenant of Engineers, U. S. R.

Wyler, C. J. Second Lieutenant, Coast Artillery, Fort Barrancas.

OBITUARY

Reinier Swart, non-resident member of this society, died at his home in Baton Rouge, August 16, 1917, in the seventy-second year of his age. He was born in Amsterdam, Holland, the son of prominent Dutch parents, in the year 1845. He came to this country when quite a young man and took up the study and practice of Civil Engineering, finally locating in the city of Baton Rouge. In 1884 he was married to Miss Louise Geselly of Baton Rouge, four children being born of this union. They are Reinier Swart, Jr., Civil Engineer, located at Warren, Arizona; W. Swart of Baton Rouge, Mrs. H. V. Collins and N. Swart of Baton Rouge.

Mr. Swart was a member of the Knights of Pythias. For many years he was City Engineer of Baton Rouge, and was engaged in the active practice of his profession until quite recent years, when he was forced to retire on account of failing health. He became a member of the Louisiana Engineering Society in 1898, and continued his connection therewith until the time of his death.

Foster Olroyd, resident member of this Society, died at his home in New Orleans, October 8, 1917, in the fifty-sixth year of his age. Mr. Olroyd was born in this city September 20, 1861, and he received his preliminary education here in the public schools. He married Miss Florence Krapp in 1888, and is survived by her and eight children. They are Mrs. Theodore Hotard, Mrs. B. Kroutter, Foster, Francis, Aidan, Ethel, Ira and Miss Sidney Olroyd.

Practically his whole professional career has been identified with electrical work, his first position having been with the Baltimore and Ohio Telegraph Company in 1886. After two years of service with this company he joined the ranks of the Western Union Telegraph Company. He shortly afterwards became connected with the Edison Electric Light Company and remained in their service until 1895. He resigned from this company to become Superintendent of the Algiers Waterworks and Electric Company, and was responsible for the development of that system. In 1901 he was appointed City Electrician, which office he filled with credit and distinction until the time of his death.

Mr. Olroyd became a member of the Louisiana Engineering Society in 1901. He later resigned, but again resumed his membership in 1915 and was a member until he died. He was also a member of the Choctaw Club, the Jovian Order and the International Association of Municipal Electricians.

PAPERS AND DISCUSSIONS

NOTES ON SHIPBUILDING.

By

F. J. French,

Engineer, Mexican Petroleum Corporation.

(Read before a joint meeting of the Louisiana Engineering Society and the Local Chapter of the A. S. M. E., Sept. 10, 1917.)

I have been asked to outline, in as few words as possible, the problems which present themselves to the prospective shipbuilder; rather with a view to promoting discussion on the subject with especial reference to local conditions than with any intent to disseminate uninteresting and unimportant data on the subject of design.

Let us assume first that the shipyard owner is approached by a client who desires a vessel built for his particular service. His requirements will be primarily governed by ships that he already has in service; modified by the recommendations of his Marine Superintendent and his Port Engineer as to type of cargo, desired carrying capacity, draft, speed, and indicated horse power, and further modified by that very misleading factor "cost per deadweight ton," which is so widely quoted, regardless of speed required.

To illustrate the fallacy of using this unit of cost, take a vessel of 5,000 tons deadweight capacity and assume, from data already to hand, a speed of 10 knots with an I. H. P. of 1500. If the owner desires his ship to make 13 knots instead of 10, it will be found that (as, for normal speeds, the power varies with the cube of the speed) the required I. H. P. will be in the neighborhood of 3300, or more than double the original figure, and the power plant weight and cost will, of course, be in similar proportion.

The primary characteristics having been decided upon, the problem now passes to the builder's Naval Architect, who corelates all of the factors determined upon by the principals and sends to the estimator the weights, horse-power, etc., who in turn makes an estimate of cost upon which the contract is finally signed. It goes without saying that the estimate takes into full account whether or not the vessel is for bulk oil or molasses, which requires a much higher grade of workmanship than for package freight.

In addition to the particular requirements of the owners, it will also be specified that the ship is to be built to the requirements of either Lloyds, The American Bureau of Shipping or some other recognized classification society, and the surveyors of the chosen society will see to it that their requirements are lived up to. It may be pointed out in passing that the rules of the various societies specify, to the thirty-second of an inch, the size and thickness of all members entering into the structure of the ship, as well as the size and type of all fastenings; their rules being based primarily upon the theoretical strains experienced by ships subjected to the action of deep sea waves, but modified by scores of years of experience covered by comprehensive reports of hundreds of catastrophes at sea, these reports being made by surveyors of the societies who are themselves sea-faring men, and who have carefully investigated the probable causes, and possible preventive measures, in each particular case.

Let us now assume that all the particulars of the ship to be built have been decided upon; the contract plans completed and the contract signed, and place ourselves in the position of the successful bidder.

We find that we have on our hands a contract to furnish all material to construct, launch, power and equip a ship of 5,000 tons deadweight, which is (say) 350 ft. in length by 48 ft. in width by 28 ft. in depth, and has engines of 1500 to 2000 I. H. P.

Perhaps, under present conditions, we have not done much more than select our site for building. If this has been done, it goes without saying that a frontage was chosen on as deep and wide a waterway as was compatible with financial and engineering considerations, and also that the site selected is reasonably accessible to a labor market.

The next step is to lay out our building ways to suit the water into which we propose to launch. We have now a choice of two methods of launching, i. e., stern first, or sideways. The stern-first method is universal at all Atlantic Coast yards and wherever the required width and depth of water is obtainable. The side launching is largely confined to the yards on the Great Lakes and to other points where for various reasons it is found desirable to build on the banks of a narrow waterway.

For the stern-first method, the following conditions will govern. The building ways will be so located that the stern of the vessel will be close to the water's edge and three to four feet above the ground. From this point back they will be given a rise of about five-eighths inch per foot which would put the keel line at the bow of a three hundred fifty-foot ship some twenty-one feet above water. A yard having a natural easy slope toward the water is therefore desirable as facilitating the construction of the underbody of the ship without the necessity of filling to the desired grade. The building ways consist of a series of blocks spaced about four feet centers and made up of 12″x12″ timbers five or six feet long set transversely and resting on piling.

The launching ways consist of two parts, the standing and the sliding ways, and are parallel to the centerline of the ship and about one-third to one-half the half breadth from it. They are constructed of heavy longitudinal timbers laid on piling and are usually given a camber or round-up of about a foot in their length for the purpose of overcoming the resistance of the water as the vessel nears the end of the ways.

A customary slope is about ½″ per foot at the bow of the ship, increasing to ¾″ per foot at the submerged end of the ways. This lower end should be five or six feet below the surface and should be well supported by clusters of piles, as at the moment before the bow drops off the end, nearly half the weight of the ship bears on this point. The construction outlined is the common practise in tidewater yards and the datum plane taken is that of high tide.

It will at once be seen that we meet insurmountable obstacles when we propose to adapt this method to a river such as the Mississippi, where a variation occurs of twenty or more feet, and this so gradually that months may elapse between two successive periods of high water. If, for example, it has been planned to launch at high water and completion has been delayed for four or five months beyond the schedule, the builder is confronted with the alternatives of waiting for the next high water or flattening the launching ways and extending them some four hundred feet further, a procedure which would not appeal to the Yard Superintendent very favorably.

It has been suggested that ships could be built behind the levee or in a sort of semi dry-dock with gates, the grade being established midway between high and low water. A little consideration will show the impracticability of this scheme, for both high and low water conditions must be met. A levee must surround the building ways in case launching is to be at high water and for low water nearly the same impractical length of ways would be required as have been already described.

So far then, as building on the Mississippi is concerned, it is believed to have been shown that the only practical location is upon a locked canal, and this, of course, involves a side launching.

With this method, the keel is laid parallel to the bank, and instead of two sets of ways there are perhaps a dozen or more at right angles to the keel. The construction of the ways is similar to those already described, except that they may either be carried below the water surface (in which case the final camber is much greater than for the longitudinal ways) or they may be stopped off short above the surface and the vessel "dumped" off. In either case the launching is a much more delicate proposition than the "stern first" method, as all the ways must be released at precisely the same instant; any variance carrying the practical certainty of disaster.

With either type of ways the maximum loading per square foot of sliding surface should not exceed two and one-half tons, especially in warm weather, as heavier loading forces out the grease and chars the ways.

The next most important step is the ordering of the structural material, and this is done by Builder's Superintendent from the Contract Plans which consist of Midship Section, Inboard Profile, Deck Plans, Bulkheads, and (if the vessel is to be of steel) the plating model. The latter is accurately made from the line drawing, and on it are shown the exact sizes and thicknesses of all shell plates as well as data concerning seam and butt riveting, doubling plates, longitudinals, and transverse frames. All plates are ordered to within a half-inch of the desired size and are so shipped by the mills. Every plate, channel, or angle is inspected and tested at the mill by the surveyor of the Registration Society and a permanent record made of its characteristics as well as its location in the finished vessel.

In the interval preceding the delivery of the material the loftsman is busy with his force laying down to full size and fairing the lines of the ship on the mold-loft floor. These lines are the intersections of vertical transverse, vertical longitudinal, and horizontal planes with the outside shell of the ship, and the three views must be made to agree precisely or the resulting surface will be unfair. In some yards the lines are first drawn and faired to a quarter-inch scale in the drawing room, the offsets or ordinates from this set then laid down and re-faired to a one-inch scale on a marble slab, and finally the offsets from the slab laid down and faired to full size on the mold-loft floor.

Methods have been evolved for deriving mathematically the lines of a ship of given characteristics, but as the simplest of these methods involves the use of formulae with five variables they have not become altogether popular.

From the lines as drawn are now derived the exact contour of each transverse frame as well as its bevel; the location of plating seams, and the traces of longitudinals and decks.

Templates of thin white pine are made of the frames and on these are shown all the information necessary to enable the shop to fabricate them. These templates then go to the bending floor and the frames when bent and beveled go to the punch shop and are finally set up on the blocks and tied to the center keel and keelson plates which have preceded them. With the frames secured in place with longitudinals and temporary ribbands, templates are made from the skeleton for each shell plate and these templates applied to their plates which have now arrived from the mills. If the ship is what is known as a "full" ship and has a considerable percentage of parallel middle body, much of this work may be done in the loft and one template be made to answer for a dozen or more plates.

By intelligently applying the above principle to the original design a great amount of unnecessary labor may be eliminated, not only in the shell but on bulkheads and decks as well.

The advantages above outlined would not, of course, apply in the same degree to the construction of a wooden vessel, as, in this case, once the frame templates are out it is largely a case of cut and fit for each timber and plank.

It is only reasonable to believe that by a judicious duplication of parts, by adhering as far as possible in a given yard to a given size and type of ship (as is now done in England), by reducing the number of plates which must be "lifted" from the ship itself, and by the introduction of efficient cost keeping methods we will be able, when the present abnormal conditions have passed, not only to hold our own but actually to take the lead in this industry.

Turning for a moment to the power plant side of the question, the builder and owner are faced by the necessity of deciding upon exactly the kind of plant desired. Let it be assumed that the I. H. P. and speed have been determined. The combination of the two will give within reasonable limits the R. P. M. of the propeller or propellers. There is then the choice of twin or single screws with either compound, triple expansion steam engines, turbines with gear reduction, Diesel engines or a turbo-electric system. In the particular case of four rather small vessels now building in the vicinity of New Orleans the advantage was found to lie with the latter system in price, weight, and delivery, and that system was therefore adopted.

It is believed that there are very few, if any, shipbuilders in this part of the country who are at present equipped to economically construct marine engines, though it is hoped the opportunity will be afforded by the United States Shipping Board for local shops to become accustomed to this type of work so that they may intelligently and profitably undertake merchant work when the present shipping crisis has passed.

With regard to boilers there are a number of shops in the immediate vicinity which are entirely competent to undertake the construction of fire tube marine boilers to meet any requirements. As to type, the only fire tube boiler in common marine use is the Scotch or wet back type, in which the combustion chamber is integral with the boiler and is surrounded by water.

Of the water tube type there are many makes, such as the Babcock & Wilcox, Heine, Sterling, Yarrow, Ward, etc., all of which are manufactured in both land and marine styles.

In direct connection with the choice of engine and boiler arises the question of whether or not it is desirable to superheat the steam, and if so, what type of superheater should be adopted. With many of the water tube boilers the superheaters are integral, that is to say are really an extension of the tube surface. With the Scotch boiler, however, they are usually independent and are placed in the breeching.

In addition to the main power plant there will be required a main condenser with air and circulating pumps, boiler feed pumps, fire pump, anchor windlass, steam capstans, steering engine, ventilating engines or motors, electric lighting sets, refrigerating plants, winches, and possibly a towing engine, as well as evaporators and distillers. For the windlass, capstans, steering and towing engines we turn naturally to the Hyde Windlass Company or the American Ship Windlass Company; for pumps, to the corporation represented by Henry R. Worthington; and for refrigerating plants to the Brunswick or some other equally well-known manufacturer. These auxiliaries are fairly well standardized and the purchaser is sure of getting what he pays for, provided the Government doesn't intervene.

For the valves, pipe and fittings, of which there are thousands of dollars worth on a ship of any size, some (not all) of our local houses are willing to exert themselves to the extent of quoting from a set of piping plans with bill of material attached. Others prefer apparently not to do so when there is enough business coming their way without any effort on their part.

Having disposed in our allotted "few brief words" of Yard, Hull, and Power Plant, we have nothing left to think of but arrangement of living quarters, carpenter work, joiner work, ladders and gratings, rigging, plumbing, ventilation, galley and linen stores, boatswain's stores, life boats and davits, carpenter's stores, fire extinguishing apparatus, running lights, cooking and mess equipment, engine room telegraphs, bilge and ballast system, and if we are so fortunate or unfortunate as to be building oil tankers, the entire cargo handling system.

From the local builder's point of view there is one question which eclipses even the difficulty of securing delivery of materials under present conditions, and that is the problem of obtaining, in competition with the large Northern yards, labor skilled in the art of shipbuilding. The ship carpenter, of the days of the old wooden clipper ships, of whom was written "Build me strong, Oh worthy master," is almost as extinct as the Dodo bird, while ship fitters, ship smiths, loftsmen, and other skilled workers are demanding and receiving wages that would have seemed affluence five years ago. At least one local yard (of which the writer has personal knowledge) is doing remarkable work in the training of colored labor for all except the most responsible positions in these trades and is achieving excellent results in quality of workmanship.

To summarize briefly, it would appear that success of the Southern shipbuilder rests on the following points:

1. Judicious selection of site.
2. Rational layout of yard, with due regard to receiving, handling, storing, and routing of material.
3. Foresight in design, with a view to standardization of all possible parts, ond the elimination of special and the use of stock fittings which may be purchased in the open market.
4. An efficient cost keeping system.
5. The training of the labor which is locally obtainable and may reasonably be counted upon to remain.
6. Promotion of a knowledge of the principles of shipbuilding by the establishment of classes in the public night schools.

DISCUSSION

Mr. Coleman—Mr. Chairman, I was furnished with a copy of Mr. French's paper on Saturday, by the chiarman of your Committee on Technicial Entertainments, with a statement to the effect that the committee and Mr. French desired to have me discuss the paper. I wondered why I had been selected to discuss this paper, and would have had a suspicion that these gentlemen were perhaps members of a certain club that I belong to, if I didn't know differently, because at the lunch table where I frequently take lunch at this club, where there are about ten of us, there is a well established rule that no man is permitted to discuss any subject brought before that lunch table if he may be presumed really to have any knowledge about that particular subject. For instance, if a medical question is raised, lawyers, engineers and merchants answer that question; or if an engineering question is raised, an engineer is barred from discussing it, because he may be presumed to have some knowledge on this subject. Now, as I know that these gentlemen do not belong to that particular club, and do not take lunch at that table, the only reason I could adduce for their naming me as one to discuss this paper was because of two professional, or semi-professional, engagements which I have had in the quite recent past, to which more or less newspaper publicity has been given. In justice to myself, before this particular body of men, the Louisiana Engineering Society, I would like to say something in explanation of those two particular engagements.

The first of those was in regard to a project which had been submitted by Mr. Peter S. Lawton for the construction of a ship-basin over here, in connection with the Algiers Naval Station. Mr. Lawton prepared an elaborate plan for the construction of a ship-building and ship-repair basin, which project was to be submitted to the Committee on Naval Affairs from Congress, and a great many questions were raised concerning the feasibility or practicability of constructing this basin according to the plans which had been formulated by Mr. Lawton. The whole matter was submitted to me, to pass judgment on the practicability of Mr. Lawton's scheme, in so far as the construction by that plan was concerned. I stated to linen stores, boatswain's stores, life boats and davits, carpenter's stores, fire extinguishing apparatus, running lights, cooking and mess equipment, engine room telegraphs, bilge and ballast system, and if we are so fortunate or unfortunate as to be building oil tankers, the entire cargo handling system.

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So that was my connection with the shipbuilding interests, if we would eliminate a few barges for the transportation of sand and shells, and an occasional hull for a dredge boat, or a pile driver; and I think you will agree with me that on the basis of that experience I could not qualify as an expert in the discussion of a paper on shipbuilding operations.

One more word I would like to say before I take my seat. This is a very live subject, as the chairman said, a while ago, and one in which many of us may be forced to take some part in the near future, so it does occur to me as timely that we should receive suggestions from Mr. French, and from others who have had broad experience, as he has had, in this line, and that our Library Committee should acquire literature for the benefit of the members of the society on that subject, and suitable textbooks, so that we may study them, if we have the opportunity.

THE CHAIRMAN—Is Mr. David Hunter in the audience? He was given a copy of the paper for discussion.

We have a written discussion from Mr. Warren Johnson, which the secretary will probably read.

MR. JOHNSON: (Mr. Johnson's discussion is in the form of a copy of a letter to Admiral H. H. Rousseau.)

July 3rd, 1917.

Admiral H. H. Rousseau, Asst. Genl. Mgr.,
U. S. Shipping Board Emergency Fleet Corp.,
Washington, D. C.

SHIPBUILDING ON MISSISSIPPI RIVER.

Dear Sir:—Replying to your inquiry of the 27th instant as to the reasons for lack of shipbuilding enterprises on the Mississippi River, beg to state that generally the River presents many objections from a commercial point of view, although probably no insurmountable obstacles.

I have personally been in the boat building business for the past nineteen years, with a small boat yard on the Mississippi River, at New Orleans, La., and have designed and built in the neighborhood of one hundred and twenty (120) small steel and wood boats and barges, half of which range from seventy-five (75) feet to one hundred and forty (140) feet in length.

The rise and fall of approximately nineteen (19) feet once during the year is the prime objection to shipbuilding on the Mississippi, because, to take care of this situation, it would be necessary to build the hull above high water, and it might be necessary to launch at low water. At an inclination of 5/8″ per foot for the launching ways, the ship would have to travel three hundred and sixty-five (365) feet if launched at low water, and there would be this unnecessary length of ways to provide in the cost of developing a shipyard.

The river banks for many miles through the lower portion of Louisiana are leveed, which means that the land on the shore side of levee is anywhere from ten (10) to twenty (20) feet lower than the River at high water. This means a large amount of reclamation, or expensive pile foundation construction for erecting platform, etc., and a consequent expensive handling of all materials going into the construction of vessels.

Also there is some question in my mind as to whether or not, regardless of the above consideration, a pile foundation can be built within reasonable cost sufficiently secure and substantial to hold the weight of a battleship just prior to its launching, as it is the practice here to allow not more than ten (10) tons per pile, depending entirely on friction for supporting ability.

We are not annually in imminent danger of crevasses and overflows at any time or any point during high water, these crevasses usually occurring after a considerable fall in the river, but there is always a possibility that a crevasse will occur at high water, and some times they have happened, resulting in incalculable damage to the adjacent area, which remains hopeless until the river falls and the levee is restored.

Another objection, although possibly not a very material one, would be in launching, with the river say at ten feet above its low stage, or at high water, during which time there is considerable silt in the water. This silt deposits on the ways, and in one case it actually stopped the launching of a vessel that weighed less than one hundred and fifty (150) tons, although this was because of failure to properly wash off the silt that had settled on the under-water portion of the ground ways.

Just after my appointment, and before the cost plus contract had been superseded by the lump sum, it occurred to me that the Corporation might be considerably interested in the value of ship-yards after these yards had completed their Corporation contracts, and, in event that the owners thereof would not pay a reasonable price to retain their plants, the Corporation would have these yards on its hands. A considerable proportion of the cost of all large shipbuilding yards on the lower Mississippi will represent a dead loss to their builders as compared to a tide water yard, and normal times will magnify this feature.

It might not be of any significant importance, but the torpedo boat chasers, one hundred and ten (110) feet long, now being built at the New Orleans Navy Yard, will be launched by a derrick.

I have noted in the newspapers many statements regarding a proposed shipyard at the Chalmette Slip, a short way below this city on the East bank of the river.

This slip is about six hundred (600) feet wide (with the length of the river) and about one thousand (1000) feet deep (at right angles to the river). and it was built for a ship and railroad terminal by the Frisco Railroad several years ago.

This Slip is surrounded by a concrete wall resting on a piled foundation, and after the piles were driven and the walls built, the levee was cut and the water alowed to come in.

A suction dredge boat then started dredging to obtain the necessary depth, and in the dredging operations the piling that was supporting the concrete wall was undermined to such an extent that the wall began to topple towards the basin. This trouble, however, has been remedied, and although it might have been due to faulty engineering, inasmuch as the concrete work had not sufficient depth, this circumstance lends a little weight to any suggestion that a large shipyard should not of necessity be located on the Mississippi.

This slip is subject to considerable filling up, becuase it acts like a settling basin for the silt in our river water when the river is high, and there will always be more or less dredging necessary to maintain sufficient depth, although this can be done and is done at present along our wharves and docks at no great expense.

Another objection to the building of a large shipyard surrounding this slip is that it would be limited in its extent by the original size of the slip, excepting at a considerable expense, and it appears to me that a careful study of this difficult problem results adversely to such a site.

Although I had a casual inquiry from Natchez, Miss., where the average annual rise is forty-five (45) feet, the only application I have had for approval of a site on the Mississippi River was from Messrs. Schwartz, Krauss, Allen & Fetterly, all of this city, who agreed that it would be disadvantageous to locate on the river and who readily sought tide water sites.

I am a native of New Orleans, having lived here all my life and all my interests are here; I am deeply interested in the welfare of this city and Louisiana, and, therefore, have every sentimental reason to encourage all kinds of industries to build up my home State and City, but I fear that the encouragement of large shipbuilding on the Mississippi River would result in commercial disaster, and prove an injury rather than a credit to this community.

If the Emergency Fleet Corporation is to be interested in the cost of a shipyard on the Mississippi, I would suggest that any company contemplating such development be required to furnish for your careful investigation complete and specific plans covering their entire development.

(Signed) WARREN JOHNSON,
District Officer.

MR. FRENCH—Mr. Johnson brought out the cost of the additional length of launching ways. I want to say that there is a good deal more to be considered in that than the cost of the ways, because I don't think any shipyard superintendent could be persuaded to launch a ship over four hundred feet of space before he reached the water.

THE CHAIRMAN—Is there any great practical objection to building ships in sectional docks? Could they be built in sectional docks?

MR. FRENCH—Do you mean such a dock as the naval station dock, for instance?

THE CHAIRMAN—Yes; something like that.

MR. FRENCH—There would be no objection whatever, except that the naval station dock represents an investment of something over one million dollars.

THE CHAIRMAN—I mean for this particular emergency. I thought maybe wooden docks—

MR. FRENCH—There are several objections, the chief of which would be handling materials down to the dock. Now, the banks of the Mississippi River are such that nothing but a floating dock is practicable here, and a floating dock, in order to dock a ship, must be in fifty to sixty feet of water, and therefore quite a distance from the shore, and no railroad tracks could be laid out to it, practically, consequently, the cost of handling material to and from the ship to the machine shop and *vice versa* would be almost prohibitive, when added to the initial cost of the dock itself over that of the ordinary building ways.

The Chairman—I did not thing it was an ideal condition, only certain promoters were talking about building locks and excavating basins for launching ships, and I thought probably the cost of the sectional dock would not be so great in comparison.

Mr. French—A basin for building a ship would be directly comparable to a graving dock, and the ordinary timber graving dock represents an expenditure of $1,000.00 to $1,500.00 per lineal foot. A floating dock is almost equally expensive, and not as satisfactory for the purpose under discussion.

The Chairman—Is there any further discussion of this paper?

Mr. Hutson—I have been seeing a great many items in the newspapers about the yellow pine people not keeping up with their schedules. I 'phoned the Yellow Pine Association asking them to have a representative here. Is there anybody here representing them?

Mr. Putman—I represent them.

Mr. Hutson—May I read this article, first, and then you can defend yourself?

Mr. Putman—According to the rules of the club just mentioned by a gentleman who spoke a few moments ago—that a lack of a man's knowledge of a subject is considered as fitting him for discussing that subject, it might be appropriate for me to talk on shipbuilding.

Mr. Hutson—This is an extract from the *Southern Lumberman*, dated September 1st. It reads:

Pine Mills Producing Only Half of Ship Timber Requirements.

(Special to the *Southern Lumberman*.)

New Orleans, La., Aug. 29.—Three hundred and seventy-five million to four hundred million feet of

Southern yellow pine timbers will be needed within the next twelve months to complete the government's ship-building program, according to W. J. Haynen, production officer of the Emergency Fleet Corporation. Mr. Haynen, who left tonight for work in the Texas territory, has recently made an extensive tour of the mill districts of Florida and Alabama and parts of Mississippi.

Yellow pine manufacturers are now cutting and shipping between 500,000 and 600,000 feet of ship timbers daily, says Mr. Haynen. This is little more than half the requirements. As a result of the scarcity of materials at present arriving at shipbuilding points many yards are wholly or partially idle. Two hundred and fifty wooden hulls are under construction.

In an authorized interview Mr. Haynen said:

"We are now cutting and shipping between 500,000 and 600,000 feet per day, which is only barely a little over half of our requirements to insure the success of the building of wooden boats under the present program of the Emergency Fleet Corporation. We have got to cut and ship 1,000,000 feet of yellow pine timber per day for the next eleven or twelve months, and if the submarine menace and the destruction of boats continues this will have to be materially increased.

"At the present time we have got about 250 wooden hulls under construction. There are at least twenty shipyards either idle or which will be idle within three or four weeks unless we can increase the shipments at once. The entire yellow pine industry and its reputation is at stake to furnish the material required to complete the emergency fleet program, and the program only means enough boats to equip and feed the soldiers in France. If the lumber people of the South will stop and think over the matter seriously, and consider the time it takes to build steel vessels (from eight to twelve months from the time of laying the keel) they can easily see that the wooden ship will be the salvation of our troops in France, will shorten the war, and save many thousands of lives if completed just as early as possible.

"The Emergency Fleet Corporation program first called for the launching of hulls in November, 1917, but the majority were to be launched after January, 1918. We are now trying to get the lumber so that we can start the launching of hulls in October and advance the 1918 program from 30 to 60 days, and to do this we need the help of all the Southern pine manufacturers.

"We have arranged to take some of the items in cypress, and the cypress manufacturers are now investigating so as to give us their entire help and co-operation, to advance and complete the program.

"About sixty per cent of the mills in the Southern pine territory, and among them the largest mills, are doing their utmost working night and day, going to extra expense, and putting every log that they can possibly get into their mills into ship timbers. The other forty per cent of them have not yet realized what it means to have the ship program delayed, and I hope on this trip through the South to impress them with the actual conditions, the necessity, and get their help in the same spirit that we have the sixty per cent that are turning out from half a million to six hundred thousand feet per day."

Officials of the Southern Pine Association, which represents the greater proportion of the mills cutting ship timbers, advise that as far as can be ascertained the association's subscribers are cognizant of their obligations to the government, and every effort is being made towards the fulfillment thereof. In some quarters difficulty is encountered by reason of the shortage of labor, which condition will be aggravated if the eight-hour bill introduced by Senator Poindexter is passed.

However, it is hoped that the opposition, which is steadily growing, will defeat this injurious legislation. Further difficulty is encountered by reason of the offcut resulting from the manufacture of ship timbers.

> This by-product in various commercial sizes and grades must be shipped to prevent congestion at the mills, and where adequate cars are not furnished for commercial shipments the efficiency of the mill in its service to the government on ship timbers is seriously impaired. It is reported that steps are being taken to see that an extra supply of cars is furnished mills cutting ship schedules, as an auxiliary aid to the government's ship program.

I have seen a number of news items of that sort, to the effect that they were not keeping up with schedule, and I knew there must be some difficulties in the way, and I thought that the representative of the Southern Pine Association could tell us something of these difficulties, and it would help to educate us on the shipbuilding problem in the South.

In the early days of the war, I was a strong advocate of building wooden ships, not knowing the true difficulties, but I began to realize the difficulties in the way of wooden shipbuilding, and I thought a representative of the Southern Pine Association could give us some information.

MR. PUTMAN—Mr. Chairman, my name is L. R. Putman. I am the Director of Advertising and Trade Extension for the Southern Pine Association. I was notified that a representative of our association had been requested to be present at this meeting, and I seem to be the only one here. I came here, but did not bring any data, as I did not know what I would be expected to do. I have just returned from a trip through the East, where I spent a few days in the office of our Emergency Bureau in Washington, and there we had a report from our Emergency Bureau in New Orleans, in the form of a sheet, and my recollection is that we had been requested to furnish ship schedules for the government to the extent of 144, and that we had succeeded in getting our mills to take on 113, leaving 31 to be placed. These 31 had every evidence of being placed in a few days, as some of the mills had completed their quota and were asking to have more schedules placed with them. For instance, Mr. Hollowell, of the Industrial Company in Louisiana, had just completed two schedules and said he would take from two to five more; and the Great Southern had six, and I think they are pretty well out.

The day I was there, the Shipping Board sent for a representative of our organization, and when he appeared before them they said they would like to have 100 more schedules, which would make 244. Now you gentlemen probably do not understand what it means to get out 1,400,000 feet of high-class long leaf yellow pine to be suitable to the parties concerned. That is probably only $1\frac{1}{2}$ days cut for some of the mills, but I have become satisfied, in meetings with representatives of our mills, and that represented 211 of the biggest mills in the South, —these gentlemen told us, talking confidentially to each other, that not more than six to ten per cent of the logs which came to the saw in the course of a day's run would make lumber fit for these schedules, under the plan which was drawn, I think, by Mr. Ferris for the vessels.

In the first place, I might tell you how the proposition came about. I suppose we have, probably, in fact, very much the largest lumber organization in the world. We spend something like half a million dollars through our office for the promotion of Southern pine, not to fix the price or govern the output, but to develop the business and to get higher efficiency in conservation, manufacture and distribution of Southern pine lumber. Knowing this, the government asked us to send representatives to Washington immediately to confer with them along the line of furnishing ship schedules, and that, except to a very small percentage of our mills, was some proposition. They didn't know what the requirements were. So we called a meeting of our subscribers in the matter, and Mr. Downman's instructions were—he is the chairman of the lumber committee on the Council of National Defense—he said we would be expected not only to furnish the stuff, but to make the price at which the stuff would be furnished. This was something altogether out of our line of business, so we had to call every subscriber and have him delegate the power to a few men to go and make a price on this article, which was a rather ticklish business. But we sent a committee to Washington. They had no idea what they were going to figure on until they got there. General Goethals told them he would send for Mr. Ferris, who was, I think, in New York, to come down. I don't think Mr. Ferris had a great deal of experience in that line, but he had made these plans and he brought them down to Washington, and our men had to take this material off, pretty largely, which is more or less of a job, especially to a sawmill man. They took that bill off and made figures on it. Now our fellows did carry the resolve that they were called upon along the lines of patriotism, and they went with the right spirit, and our officers and directors put them in the right state of mind and told them it was up to us to do the right thing by the government. The figures they made for the cantonments were some \$2.00 or \$3.00 less than the market price, and later on it was cut down another \$2.00 below the market price. Then when the ship schedules came along they figured this at the regular price. I might say, for your information, one thing that makes it difficult is the size of the timber. The trees don't happen to grow that big, down in this country. Some of these possibly will run 16 by 20 and 50 feet long, and if you have had any knowledge of sawmill work it takes a tremendously large tree to show all clean stuff 16 by 20 and 50 feet in length. And some are 40, some 36, and other lengths in that neighborhood. Mr. Ferris did not have in mind the facilities for getting the stuff out, when he drew that plan. He just had the boat in his head, and he did not attempt to make the ship easy to construct or the timbers easy to get. So they had to take it as it was, and they figured out each item at the price they figured the item was worth, based on the current market price for such material; then they took the 1,400,000 feet and made an average, which in my recollection was about \$43.00 or \$44.00 a thousand; then they got together and said: "The government expects it for less than we sell the stuff at; we feel we ought to go down in our jeans and take off the profit." So they took off about 14% of the selling price, making the average price about \$35.00 a thousand. Now the human element creeps in on these 211 sawmill owners, just the same as on any other body of men. With a price of something like \$15.00 a thousand less than the market price, I believe some of our human sawmill men hesitated on the price, while others were for running it down \$15.000 a thousand more. They didn't realize how important the ship industry was to the government. And we have had a good many spirited talks in our meetings, until today I do not think there is a mill man in the association who has got the ability to get this stuff out but who is in the woods trying to get it out.

Now, as to the short-leaf pine in Arkansas, Mississippi, Texas and Oklahoma or Missouri, you cannot use that, unless in a small way.

Another thing, our mills were not fitted to dress this stuff. Some sawmills were not equipped to get out a log 50 feet long, because that had not been the requirements before. Twenty-four to thirty feet was the longest timber they expected to cut, and when they got to 50 feet this was all wrong, the carriage was not fitted to do that. Another stipulation made by the government was to the effect that each mill cutting ship timbers must furnish a complete schedule. For instance, the Industrial Company, up here, or the Bogalusa plant, could furnish a lot of this stuff to help out another fellow who could not furnish it, but the government said it must be a complete schedule from one mill. Now they have allowed, through the Southern Pine Emergency Bureau in New Orleans, the getting of it where it was possible, and that will facilitate matters very much. Then again, the ship builder wants the stuff to come in the order of his needs,—he wants some of it today and some tomorrow, and the trees do not happen to grow that way on the land, and if you are four or five miles from a railroad with these 50-feet logs you spend many an hour with ox-teams; but that has been necessary with some of the schedules placed.

This thing came at a time when we were piled up with other business, and when we were being beat on the back for lumber for the cantonments, barracks and camps and all that, and they piled on a lot of stuff we were not fixed to handle, so you can see it will take some little time to get organized and get our facilities lined up. Take, for instance, a foreman: he is asked to handle 1,400,000 feet of this stuff, and he gets cross; he says "What do you want to take that blamed order for? We have orders on the books worth money; we can't get that out." And it takes two weeks, maybe, to put it into his head that we have to have it. So all the way we have been meeting with the human element. Some of the mills have yelled their heads off for cars and have not been able to get rolling stock.

That has been bettered now, because they got the railroads to understand the situation also. All the way through we had to organize ourselves to handle the business, and I think from now on we will have much better service. I have not heard of any material coming up in bad order, and when you stop to think that five or six hundred thousand feet of lumber a day is going in, that is a lot of stuff and a big proposition.

If you want to ask any questions which I can answer, I will be very glad to do so.

Mr. French—In regard to Mr. Putman's point about the size of the timbers shown in the ship's plans and the timbers as they grow, I might say that wooden ship building has been a relic of the days when the forests were growing and the largest timbers could be picked anywhere. Wooden ship designs at that time, from an engineering standpoint, were illogical. As the demand for tonnage grew and the size of the ship increased, the evidences of the illogical nature of the design began to be apparent, and first iron, and then steel, began to supersede the wood; and, as the tonnage grew larger and the timber grew smaller, there came a point when wooden ship building practically disappeared, and the only thing that brought it back into being has been this emergency for tonnage of any kind whatsoever, and it has been rather difficult to bring the public to understand that it is not possible, or at least not practicable, to build very large ships of wood, and there have been several attempts to modify the designs of wooden ships to bring them in correspondence with ordinary mill practice. The design Mr. Putman speaks of is along the lines of the old practice. It is a practical design on the Pacific Coast. We had a design sent here, in types we are now building of steel—the design was sent originally from the Pacific Coast, for wooden ships, calling for something like five or six 20x24 timbers in the keelson, which was entirely impossible to get anybody to figure on; it was entirely out of the question. So while the design is entirely practical for the Pacific Coast, it is not at all so for the yellow pine States. Among others who have tried to accommodate the designs to mill practice may be mentioned the Hough design.

Mr. Putman—What do you think of that design?

Mr. French—I have not seen the complete design. I understand that it looks reasonably logical. And there is the Donnelly design, somewhat similar to the Hough design. I think, however, the wooden ship has its limitations. I think for small ships it is entirely practical, with certain modifications from the old type of designs, modifications which are intended to accommodate themselves to modern methods of manufacture, and not require a mill man to turn the mill wrong side out and waste half of his timber.

Mr. Putman—I have been thrown with shipbuilders more or less, recently, and I have had an engineering education at a State University, but never was very close to the water and didn't have any experience with shipbuilding. I was in Chicago the other night with a couple of men who told me they had taken contracts for 18 composite ships,—I think of the Ferguson design. That struck me (while I am promoting wood, I think it should only go where it would be suitable) as a pretty good design. That is built, first the entire frame of steel, and then the laminations or side-boards, are put on after, and if it is found later on that the wood cannot stand the ravages of the sea, they can be fabricated, I understand, of steel.

Mr. French—There is one point General Goethals brought out that I don't think everybody understood. We all know what seasoned timber is, and why it is more advantageous than green timber, but it is particularly so with reference to wooden ship building. When a ship is planked the caulking is driven home solid with sledges, and the caulking ties the planks together and makes it an absolute unit. Now if we put green timber in, it draws away from the caulking,—perhaps not enough to let the water in, in smooth weather, but enough to decidedly damage the strength of the ship, from the structural standpoint; and when she gets into a heavy quartering sea she begins to twist, and the first thing you know the caulking works out and the water comes in.

Mr. Putman—I might tell you something that will probably surprise you, but Southern pine, in weight, pound for pound, is stronger than the best of steel; so that, if the construction is properly held together, there is no question about the lasting quality of it.

LOUISIANA WATERS, AND THEIR INDUSTRIAL POSSIBILITIES.

By

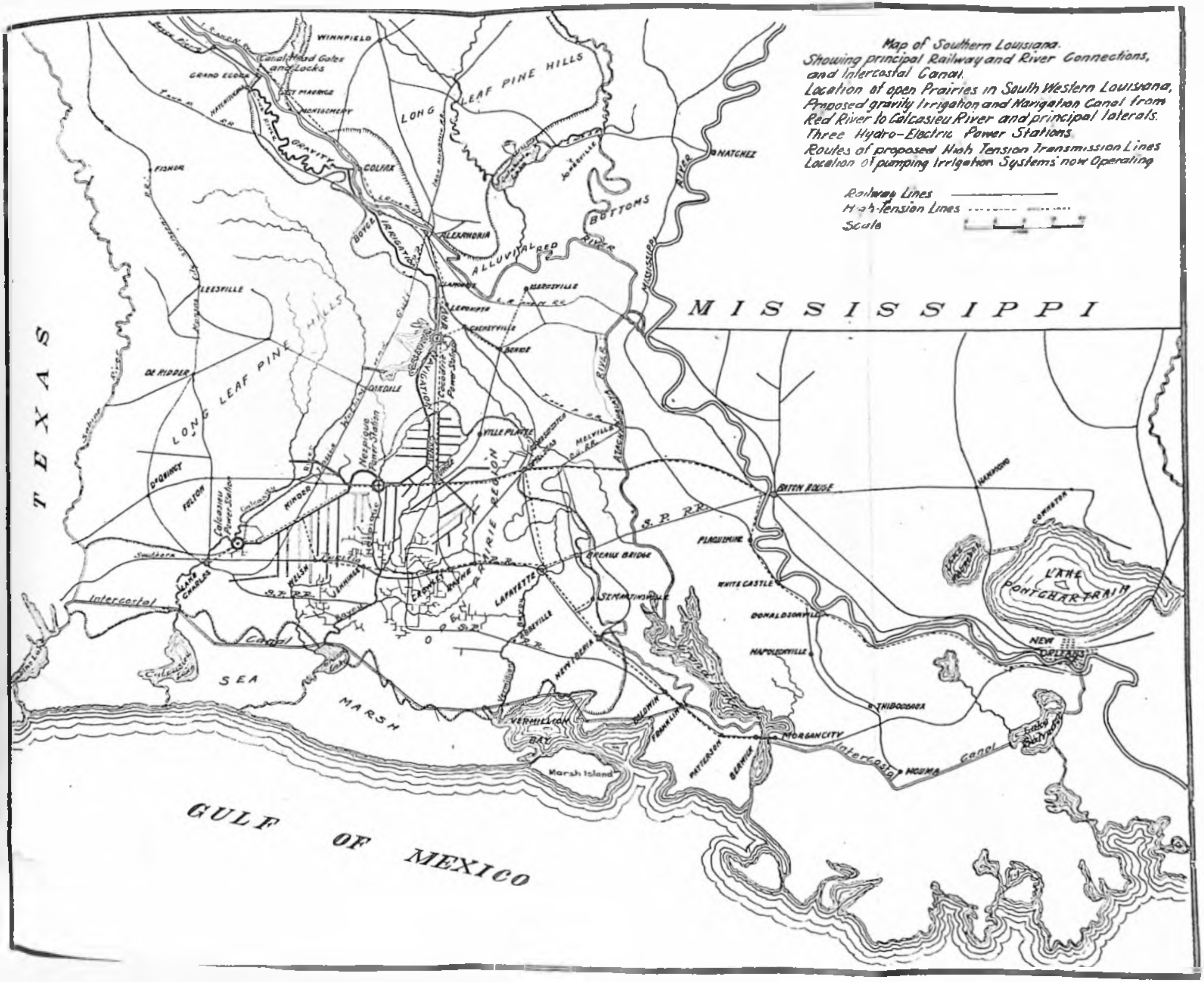
WELMAN BRADFORD.

Read before the Society, October 8, 1917.

For many years Louisiana has been looked upon as being either in a state of inundation, or in a state of swamp and overflow, this appellation being actually applicable, however, to less than one-half of the State's area. Within this portion of the country nature in the modern ages has been very busy in leaving for man an everlasting wealth of the richest agricultural lands imaginable, barring not even those of the historic Nile with its limitless productivity.

All through this enormous area of alluvial land this same power of formation has left thousands of miles of navigable streams easily converted to the use of humanity as navigation channels, or sources of water supply for agricultural development. The remaining portion of the State is divided into two great natural features; high uplands from which the rain-fall quickly runs off into the drains which feed the streams discharging into the "Alluvial-Delta," and the apparently level prairie table lands of Southwestern Louisiana. This latter region being at an elevation below the high uplands, places its agricultural and industrial development entirely at the will of the engineer who would harness these now useless water wastes to man's economic uses.

By the application of modern engineering skill we now see, what our forefathers used to speak of as impassable and useless swamps, rendered by our peerless levee system, into one of the greatest agricultural regions within the United States. Benefitting by the great foresight and perseverance of that distinguished engineer, Capt. James B. Eads, and he being guided by that genius, the world's greatest consulting engineer, the late Dr. Elmer L. Corthell, Dr. Sc. and C. E., we can now point to one of the greatest ports of the world, NEW ORLEANS, as a monument to modern engineering skill in the guiding and conducting and keeping within its bounds the mighty Mississippi.


Map of Southern Louisiana.
Showing principal Railway and River Connections, and Intercostal Canal.
Location of open Prairies in South Western Louisiana,
Proposed gravity Irrigation and Navigation Canal from Red River to Calcasieu River and principal laterals.
Three Hydro-Electric Power Stations
Routes of proposed High Tension Transmission Lines
Location of pumping Irrigation Systems now Operating
Railway Lines
High-Tension Lines
Scale
MISSISSIPPI
TEXAS
GULF OF MEXICO
LONG LEAF PINE HILLS
ALLUVIAL RED RIVER BOTTOMS
PRAIRIE REGION
SEA MARSH
WINNFIELD
COLFAX
ALEXANDRIA
NATCHEZ
LEESVILLE
DE RIDDER
KINDER
LAKE CHARLES
WELSH
CROWLEY
LAFAYETTE
NEW IBERIA
BATON ROUGE
PLAQUEMINE
WHITE CASTLE
DONALDSONVILLE
NAPOLEONVILLE
THIBODEAUX
HOUMA
MORGAN CITY
FRANKLIN
PATTERSON
BERWICK
NEW ORLEANS
LAKE PONTCHARTRAIN
VERMILLION BAY
Marsh Island
Intercostal Canal

Vast labors and immense possibilities are in store for the engineer and scientific agriculturist of to-day in reviving the world's most ancient agricultural development,—"IRRIGATION." The ancients understood this principal even in prehistoric days, and we know that China has enjoyed the benefits of irrigation for more than 2,000 years. The Aztecs in Arizona, New and Old Mexico, the Toltecs in Peru as well, all had their perfected systems of irrigation, some of which are now being rehabilitated by modern engineers.

The Prairie Table Lands of Southwestern Louisiana.

Included within certain boundaries there is in Southwestern Louisiana an open prairie region, bounded on the north by undulating timbered uplands, on the east by the alluvial deposits of the "Delta of the Mississippi," on the south by the sea marshes of the Gulf of Mexico, and on the west by the Calcasieu River, containing a total of 2,237,766 acres of irrigable lands; and inviting and urging the engineer and scientific agriculturist to their utmost capacity in its industrial development. Every acre of this region is susceptible of "GRAVITY-IRRIGATION" directly from the timbered uplands by the easy deflection of their water courses at elevations above the general level of the prairies. This, together with a system of reservoirs holding the winter accumulations in order to even the supplies, or to tide over such deficiencies as might occur, is what makes this section of the State so very inviting from an industrial and engineering point of view.

The Red River.

Coincident with the annual rise of Red River and the agricultural requirements for fresh water in the growing rice development, nature has placed at our disposition inexhaustible fresh water, heavily charged with the richest fertilizing elements. The experts of the Department of Agriculture at Washington have discovered that the silt held in suspension in the Red River, when applied by gravity irrigation to a depth of one foot, would leave a deposit of more than 8,000 pounds per acre of soluble fertilizing material of various kinds. The principal ingredient is lime, to the amount of 1,300 pounds per acre, being just the fertilizing material necessary for these prairies, and converting them into the very richest agricultural lands under the sun. From the Red River an inexhaustible supply of water can be had, not only for irrigation, navigation, hydro-electric development, but for fertilizing the lands as well.

The U. S. water gauge records for the past forty-seven years show that a "gravity flow" of water would be possible at all stages of the river, and the action of the War Department in specifying the stages at which water may be withdrawn makes it possible to receive this gravity flow during the months of December to August inclusive, covering completely the entire irrigation period.

During these months, and at such times as more water would be required, a system of reservoirs holding 1,961,920 acres feet, (more water than would be impounded in the great Roosevelt Dam), would be called upon to help out deficiencies that might occur, as well as to control the "run-off" from watersheds from Shreveport to the edges of the prairie region, covering an area of 2,954,356 acres.

The First Stages of Gravity Irrigation.

Nearly twenty years ago I conceived the idea of laying out shallow contours or ridges, small levees, with a difference between levels of 0.2 to 0.3 foot, in order to hold water in the rice fields on these prairies of Southwestern Louisiana. This was soon followed by the installation of pumps, which lifted up the waters from the streams throughout that portion of the State, and the cultivation of rice on a much larger scale than had been heretofore contemplated. This was accomplished by the large influx of emigration from Western States of people who had formerly grown wheat and other cereals. The prairies were easy of cultivation, being free from noxious weeds and grasses so prevalent in the then rice section of the State along the rivers and bayous throughout the alluvial delta. Not many years were required to demonstrate that rice cultivation was a success on the prairies where water was available.

Soon all of the available sites were taken up with pumping plants sucking up the waters from these streams, until, the year of the last census, we see that more than 800 pumping plants were in operation in that section of the State, these being of various kinds and utilizing 46,620 H. P. of engine capacity. With the growing scarcity of fresh water for economic irrigation, this cultivation soon spread into Texas, then into Arkansas, and lastly into California. By this I do not mean to say that the territory for rice cultivation was limited, it was the supply of fresh water that was limited. This had a tendency to concentrate this development in regions where the cost of pumping would be a minimum.

For this reason we have witnessed the development of rice irrigation in those regions where the elevations were hardly greater than 30 feet above tide water, this limitation being due to two causes:—

1. The cost of pumping irrigation water was too great above that elevation, as the farmers as a rule paid to the irrigation companies a certain portion of their gross crops for the water so supplied, the market values of these rices not being sufficient to meet these additional expenses.
2. The uncertainty as to the actual quantity of fresh water within the streams which flowed through or past this region. When the supply of fresh water was actually exhausted, salt water was forced up stream from the Gulf of Mexico, since all of the streams within the rice belt of Southwest Louisiana have their beds well below the level of the Gulf, thus making the cultivation of rice on a large scale a very precarious project.

Dr. Corthell in recommending the proposition stated that it was the only solution of the rice problem for Southwestern Louisiana and the complete elimination of the salt water troubles.

During many years of land surveying, running levels for various purposes, and taking part in the irrigation development of Southwest Louisiana, I soon saw that it was a question of only a few years before all of the available fresh water would be exhausted by the many pumping plants then operating in that section, and unless some system be installed whereby reservoirs be established, or "gravity water" from some unfailing source be had, that the rice development, in so far as Southwest Louisiana was concerned, would continue to be limited.

The system of pumping up water into surface canals for irrigation of rice was very good for a small development, but an exceedingly expensive proposition, because, according to data in the U. S. Census, the cost of operation is in excess of 53% of the entire cost of construction and equipment. This shortage of fresh water forced some farmers to the use of deep wells for irrigation purposes. Hundreds of these wells were soon in operation, beginning with their water level at approximately 25 feet below the surface of the fields to be flooded. Soon this level dropped to from 50 to 65 feet, thus verging dangerously on an excessive cost of operation.

With a constantly increasing demand for rice, greater than could be economically produced under the present systems of production, which actually called for every acre that had been heretofore cultivated, and requiring an additional acreage of 200,000 acres annually, I was inspired to continue in my investigations for the discovery of a plan upon a scale sufficiently extensive to invite the investment of large capital. Such a plan would make investments safe and open to cultivation a section of country apparently destined by nature to become the greatest rice producing center on the American continent.

The Brazilian Government, desiring to develop their rice industry, invited me to introduce into that country the system which had proven so successful in Southwest Louisiana, that of shallow contour irrigation. From the years 1906 to 1911 I had *carte blanche* to do such work as I might see fit in the development of rice culture in that country. The question of expense was not considered, "success" being the slogan. Brazil faced an importation of more than 22,000 tons of clean rice in order to supply their home demands, and before the expiration of my contract these importations had ceased, and Brazil was exporting to the Argentine Republic more than 8,000 tons of clean rice, making a difference in five years of more than 30,000 tons.

The system established was that of "GRAVITY." This method consisted in deflecting streams at elevations above the fields to be irrigated, so regulating the waters that "ALTERNATE-IRRIGATION" could be established, flooding each contour for a period of ten days, withdrawing this water at the end of the tenth day and draining it upon other contours lower down, giving the fields sunshine so that the growing crops could receive the stimulating effects of the hot sun, carefully guarding against the growth of grass or weeds, and applying the next flooding so that all vegetation other than the rice would be drowned. Thus the rices were supplied with fresh water at these intervals, until such time as the plant began to show signs of full growth; then all of the contours were kept well filled, allowing all excess waters to flow from one contour to the next below, and never at any time permitting the waters to become stagnant. The result of this plan of operation was the production of 28 to 30 sacks of rice per acre on lands which were considered absolutely worthless and unproductive, only 12 inches of water being used for a full crop.

The Italian Government, learning of this development, sent a commission to Brazil to make a study of this newly introduced system. The late lamented Dr. Corthell, while upon a tour of investigation of the various systems of irrigation in the old world, learned from members of this commission that they had introduced this system into the Vercelli District with the result that they were then producing 40 barrels per acre.

During my stay in Brazil I was especially fortunate in renewing my acquaintance with Dr. Elmer L. Corthell, and a strong bond of friendship grew up between us, so that on my return to this State we very soon began, or rather, took up the investigations where I had left off, with the result that we shortly discovered a plan by which "GRAVITY WATER" could be obtained in unlimited quantities, in fact in such large quantities that the present demands for irrigation would, when satisfied, leave enormous quantities still to go to waste or remain unused.

The result of these investigations showed that with a canal with a 50′ bottom, slopes 1½ to 1, with inside berms of 20′ each, carrying a minimum of 24′ and a maximum of 28′ inside the embankments, with crowns of 14′, and with a gradient of 0.2

foot per mile, giving a velocity of from 3 to 3½ miles per hour, we could have "gravity-water" directly from Red River at a point 6 miles above Natchitoches, where the locks and head gates would be located. Water could be supplied for the irrigation of 700,000 acres of rice fields to a depth of one foot by the "Alternate System" which had been so successfully introduced in Brazil, and now adopted in Italy, and could develop some 50,000 H. P. of electric energy.

Hydro-Electric-Development and Inland Navigation.

The primary object of these investigations was to evolve a system of "Gravity Irrigation" for rice on a large scale and in keeping with the growing demands, which would make previous investments safe, and open to future development large areas not now susceptible of economic production.

The inland navigation feature was forced into the issue most naturally, when we realize that the only additional cost of construction would be the location of the necessary locks in order to connect the navigable Red River on the north with the navigable Calcasieu and Mermentau Rivers on the south.

The establishment of electric power plants likewise became necessary to utilize the enormous quantities of water so easily obtainable, as will be shown later on.

The shortest possible route for navigation from Northern Texas to all South Texas ports is via Red River, the Main Canal, Calcasieu River, and the Intercoastal Canal. Likewise the shortest route from Northern Texas to New Orleans is via Red River, Main Canal, Mermentau River, and Intercoastal Canal.

Reservoir Capacities and Run-Off.

With 55,360 acres in reservoirs in the swamps of the Calcasieu River, between banks now covered with long leaf pine, and Lake Cocodrie, there could be impounded, 1,961,920 acre-feet of water, gathered from a total acreage of watershed of 1,270,656 acres of high lands, the run-off from which during the five irrigation months amount to 434,943 acre-feet. This region lies to the south of the Red River Divide.

The completed canal would serve as drainage for the basin formed by Bayou Pierre from Shreveport down to Grand Ecore, where the locks and head gates would be situated; it would use Cane River for its entire length, drawing off its storm waters. It would run thence through the length of Rapides Parish, gathering the storm waters which now are a menace to the finest body of agricultural lands in the Red River Valley. Thence cutting through the foot of the Ozark Ridge below Cocodrie Lake, where the upper edge of the prairie region is encountered at its highest point, and following in a southerly direction and crossing to the upper edge of the immense Calcasieu prairies, it would irrigate and distribute fertilizing waters to all of the prairie region above described, covering a possible area of 2,237,766 acres.

Surplus Waters.

On the completion of the system, aside from the inflow directly from Red River, there would be the run-off from a total watershed drainage of 2,954,116 acres, besides the reservoirs holding 2,397,863 acre-feet of available waters for emergencies.

Spill-Ways and Escapements.

At the deflections and crossings of streams which now form the natural drainage there would be located spillways for all excess waters over and above the full capacities of the Main Canal, and at the locations of the power plants at the Cocodrie crossing there would be a constant flow of water to the full capacity of the stream, serving not only as a means of navigation, but a means for supplying the streams which now carry off the waters of the Cocodrie, Courtableau, Teche, and Vermillion. This would give to these regions ample waters not only for navigation, but for pump-irrigation as well in the case of localities remote from this intended development.

The surplus waters passing through the power plants on the Mermentau would serve as an asset for these existing irrigation systems now so badly in need of fresh water for their fields, and the escapements into the Calcasieu River would serve a like purpose for the plants in operation along the lower reaches of that stream.

The Proposed Immediate Development.

As is the case in all large engineering projects, the question here, aside from its practicability and ultimate financial success, is the adoption of a plan by which *immediate* results may be secured, so that the work can be pushed from season to season in such a way as to be getting the maximum revenue from a minimum expenditure.

By the construction of a reservoir on the Upper Calcasieu, impounding 51,840 acre-feet of water, together with a like impounding of the Cocodrie watershed supplies of 1,730,360 acre-feet for the prairies on the east of the Nezpique, together with their run-off, giving a total of 1,989,848 acre-feet for immediate use, that region would be opened for development.

The deflection of the Middle Calcasieu with two reservoirs with capacities of 179,520 acre-feet and its run-off, making a total available of 425,015 acre-feet for irrigation purposes, we would be in readiness to supply the region on the west of the Nezpique and east of the Calcasieu River. By the construction of such canals along the route of permanent location, with carrying capacities to supply only 271,471 acres of rice fields, and by increasing the capacities from season to season until the main canals would have been excavated to their proposed ultimate capacities, the system could be extended from year to year, until Red River would have been reached.

By this plan of construction, not calling into immediate use the reservoirs for the first season, we would control sufficient run-off to irrigate the above area of 271,471 acres of rice fields, utilizing a little more than one-half of the available run-off. These estimates of run-off are based on utilizing only 11.86 inches of the actual run-off, while Newell places the annual run-off at 20 inches. And in computing the rain-fall we have only counted on using 48 inches, while Newell gives the actual rain-fall at from 50 to 60 inches.

These features were carefully gone into with my associate, the late Dr. Elmer L. Corthell, and but for his untimely demise last year he would have seen his endorsement of the project verified in part.

In his endorsement of the proposition as a whole he wrote:

> "With this project as now developed, I find nothing to object to from a physical, engineering, commercial or financial point of view, and I am heartily in favor of it, believing that it will be of great advantage to the entire Southwestern Louisiana, and that it will bring great and permanent prosperity to this important district, and will at the same time be of great advantage and profit to those who bring it to a realization."

Zones of Influence.

We have entered into long term contracts with most of the larger irrigation companies, whereby they have defined their especial "Zones of Influence," wherein each company will have the exclusive right to receive fresh gravity waters for a term of 15 years. Within their respective "zones," covering a territory of 779,000 acres of irrigable lands, each company will distribute as at present to their customers the irrigation waters, beside having within their "zones" large areas of virgin lands awaiting the advent of fresh water.

This distribution will be carried out by each respective irrigation company free from any costs of pumping, the only running expense being that of operating and controlling the various head gates for the several farms or divisions thereof. The several irrigation companies will charge their respective customers a certain toll in rough rice, and will deliver this proposed company a fixed proportion of the said toll or rentals.

For the large irrigation companies who now expend more than 53% of their cost of construction in yearly operating expenses, for the deep well operator whose water levels are getting lower each year, and consequently more expensive, and for the individual farmer who, after planting his fields, can not tell whether he will have sufficient water for his requirements, or whether the water actually had will be fresh or salt, there must be relief if these enormous investments are to be made safe and productive.

With the construction and completion of this proposed system, I am firm in the belief that the rice industries of Southwestern Louisiana would be placed on as solid a foundation as ample fresh irrigation waters could place that development.

Dr. Corthell, in speaking of this proposition often remarked that it would be the most unique development from an engineering and revenue producing standpoint that he had ever had the pleasure of investigating, and that it would be the most beneficent project ever undertaken for this State, and that it would be a crowning glory to any man's career no matter how successful he had been.

DISCUSSION.

Mr. Hutson—I would like to ask Mr. Bradford some questions, and if I get to asking some that it is not good business to answer, he can just say so. He spoke of where the plant furnished water to those other canal companies, that the canal companies would take a portion of the rice from the farmers and then they would take a certain part of that. I have always understood that in most of the rice dsitricts the canal company gets one-fifh of the crop for water and one-fifth for land, when they own the land. That may not be universal throughout the rice country, but I know that that is the figure that is used, and I have often wondered what proportion of the canal company's revenue they had to spend for pumping and what proportion was interest on their canal investments and profits. I should like to know, if he does not mind saying, what amount of that one-fifth they would get, and have him give us a line on what the gravity water is worth.

Mr. Bradford—In arranging these contracts, we made it rather elastic in this way: The irrigation companies as a rule charge one-fifth the gross product for the use of the water. It costs them various prices, from one dollar up to six dollars an acre, to pump this water—the higher the lift, the greater the cost—and the graound rentals are paid to the individual landowners. Sometimes they charge one-fourth, sometimes just whatever they can get, but as a rule, the irrigation company receives one-fifth of the crop for the use of the water. In some instances, in later years, they have been supplying the water for five to six dollars an acre. They lost at that, so they went back to the old custom of charging a rental of one-fifth. Now, our plan was to enter into contracts with these various irrigation companies whereby we supply them with all the water to fill their contracts, so that the farmer, who was perfectly willing to pay one-fifth of the crop, would receive an absolute surety of getting fresh water when he wanted it. His work would be easily paid for, because his success would be sure, the canal company distributing the water at no expense; it is possibly 28 cents an acre for distribution on a large scale, which would be the only output which the canal company would have to meet, and that only for a few months during the summer. The subsidiary companies, or the canal companies, would get the water from our system at wholesale rates, distributing it to the farmers at retail rates, for which they get one-fifth, and they will give us one-half of what they get, either in gross receipts or in money rentals, in case they had contracts calling for money rentals. Now, these contracts run for fifteen years. The reason we put it at fifteen years was because Doctor Corthell thought that this time would or might be required within which to pay for the completed plan of development, and had not this European war come on when it did, the proposition as a whole would have been financed in Brussels and Paris; so he suggested that some plan of this kind be adopted, and that we had better make the contracts long enough to be sure they would get the entire plant perfected, not only the irrigation feature and the navigation feature, but the hydroelectric feature, which contemplates the development of approximately 50,000-horsepower of electric power at four different power plants, and with high tension transmission lines linking every town in southwestern Louisiana from Lake Charles on the west to Baton Rouge and New Orleans on the east. So he said: "You had better make those contracts long enough to cover that entire period of development and construction. After that we will have everything paid for, with a large portion of the bonds retired, and then we can give the canal companies and the farmers better rates." In the meantime, these varoius canal companies would have been recouped, as it were, for their expenditures in the purchasing of their pumping plants and in extending their system of small laterals into their virgin lands, so they will have been doubly recouped, and they can then afford to set their pumping plants aside or give them away. For that reason, we made them fifteen years, and after that will come a readjustment or refixing of the rates, as it were, so that the farmers can get the benefit of cheap water and we can get the benefit of revenue sufficient to set aside the remaining portion of the bonded indebtedness. As it is now, the area of rice territory is absolutely limited, just as limited as the standing capacity of this room. There is water in the Mermentau Basin for 160,000 acres of rice, for completed irrigation. Professor Gregory has spent three days with me in the last month and I went over that entire proposition with him. I threshed it all out with Doctor Corthell, and we found they are reckoning without their host. The water is not in the Mermentau Basin at all, and no matter how many dams you put in, there is no site for a dam in the Mermentau Basin which would hold any very appreciable quantity of water. Therefore, I say there must be more water brought into the Mermentau Basin, to enable these people to expand. The demand for rice is such as to call for 200,000 acres of virgin lands this year, and next year and the next, and so forth, to keep up with the growing demand for rice and the consumption. We are now consuming over 17 pounds of rice per capita per annum, with a much larger demand for it than we can possibly take care of.

Mr. Hutson—What you said in regard to the Mermentau is absolutely true with regard to every other river from the Mermentau to the Rio Grande, with perhaps one exception, and that is the Brazos.

Mr. Bradford—Yes. Now, then, here is one point to which I wish to call your attention especially. Here is the Cocodrie Reservoir. When this will have been dammed, holding more than a million acre-feet of water, the surface of the water in Cocodrie Reservoir, about 35,000 acres, the surface of that water will be 100 feet above tidewater, higher than the top of this building. And the highest point of the prairie region is here, 65 feet above tide, the Upper Mamou on the Rock Island Road. We go through the foot of the westerly ridge right in here (referring to the map), and come down to this point, a gravity fall from 100 feet to 64. Here is the Upper Calcasieu, with abrupt banks,—I say abrupt banks; I mean the pine hills of the banks, where water in depth of 20 feet can be held to 25 feet, covering completely the swamp, intersecting the bed of the Calcasieu where the bottom is 100 feet above tidewater. In other words, the bottom of the Upper Calcasieu River at this point would be on a level with the top of this immense reservoir when this reservoir is filled up. In other words, all of the Upper Calcasieu flow can be diverted into Cocodrie or into Cypress Bayou, coming down and intersecting with the main canal here. The next deflection of the Calcasieu would be at this point, where the bed of that stream is 50 feet above tidewater, and the highest point of Calcasieu Prairie is 50 feet above tidewater, with a drop in the bed of the stream from this point to that point of nearly 3 feet to the mile. That is on a tangent, in a direct line. Of course, there is sinuosity, so that this is taken up in many miles more. Now, then, when you will have impounded these two branches, the Upper Calcasieu with its 397,440 acres, and the Middle Calcasieu with its area of 711,936 acres of watershed, every bit of this water will flow out on to the top of Calcasieu Prairie by gravity, letting this water down by gravity into the various connections with the various canals that now pump their water from the Mermentau up to the prairie.

In order to allow these irrigation companies to be remunerated for their pioneer work and for the expensive machinery, we say: "Here, Mr. Kinder Company, you can irrigate, say, 4,000 acres. You have laterals enough to irrigate 10,000 acres, but you haven't got the water under control. At least, you haven't got the operating expenses. You have to duplicate your machinery, and is costs too much." This year they had to pump nearly 40 feet. We would set aside a zone here of forty-odd thousand acres of new land that has never had a plow in it. They will then go to work and have each individual farmer build his own laterals to connect with their system, and they then get the benefit of the difference between what they have now developed and what their zone of influence would be, so that they would be reaping the benefit of thirty-odd thousand acres for the next fifteen year's time, and they can do away with the pumping plant, burn it up or throw it away, as the case might be. After that, they would have earned sufficient in revenue, in savings, so that they can duplicate this system at a lower rate or put in more modern equipment and operate it more cheaply, or go back to the old plan of pumping, if they wish. In the meantime, we would have developed an enormous area above in Prairie Mamau here where there is no chance of getting water at all, except from deep wells, while the water levels are dropping lower and lower every year, with a less quantity of water. The same thing is true of the Calcasieu Prairie. Otherwise the rice industry for further expansion must go somewhere else and be subject to a more expensive rate of development. The only reason why the Texas and Arkansas rice development opened up was because this region was limited in the supply of water. And unless we can devise ways and means by which we can get fresh gravity water, the rice industry will not grow any more than it has done up to the present time. On the Mississippi River and these bayous here, it is a question of whether it will pay more to plant cane or to plant rice. Some years they will vary; some years they will fall back. But here is the idea: The prairie region is the rice country, where more rice can be made per acre and cheaper than anywhere else under the sun. There is just as fertile land here for rice cultivation as anywhere, and with the silt from Red River being distributed through gravity irrigation, would make them equally productive for any other cultivation, rendering them the richest lands under the sun.

Mr. Hutson—Mr. Bradford, you spoke of that alternate system of flooding, flooding and letting it dry out. In using that system, is it necessary to let rice lands lie idle every two or three years?

Mr. Bradford—No, sir. The plan that I adopted in South America was to use a bean which I had found in northern Italy to be an ideal renovator for any old land. It is a bean that grows all through the fall and winter and has very peculiar properties, and it will grow and continue to bear during several frosts. A heavy freeze will kill it. It is known as the Tremosa bean. As soon as I cut the rice, which will be in the month of

April, which corresponds to our month of September below the equator, I would plow the rice stubbles under and plant the Tremosa bean with an ordinary seeder.

When the crop would have grown, say knee-high, or nearly as high as this table, in the flower, in the month of September or October, disc this green stuff, plow it under, plant the rice, and before the rice would have attained its full growth, the roots would be feeding on this green vegetable matter which had by that time rotted, and the rice heads would be getting heavier and heavier, and the plants getting stronger and stronger every year. That is what the Italians could not understand;—how in the world we were getting such a large yield on lands, where the lands had been tested and analyzed, with no material whatsoever to make a crop of rice. I made the first year 28 sacks to the acre, the second year 29 and the third year 30, and so on. I cannot say that this was due entirely to the Tremosa bean. I say it was due to the fact that the water was put on in thin sheets of 0.2 to 0.3 ft. at a time and the ground thoroughly soaked, the water then being allowed to go on down to the next neighbor below, and so on until every part of that water would have been used up. After a week or ten days' sunshine, before the grass would have time to have grown or the weeds to have sprouted, here comes another flooding of the same amount of water, never once stopping for one second, water constantly moving, no insects to cut the rice, no sourness, no fermentation or anything at all, and in that way I made this crop with less than 12 inches of water to the year.

Mr. Hutson—I was reading a book on Chinese agriculture by Doctor F. H. King, who used to be at Madison, Wisconsin. He said that the Chinese would raise two crops of rice and then one crop of something else in the winter, and he nearly always spoke of their using green manure frequently, planting it in while the water was on the rice.

Mr. Bradford—Well, it had not had time to rot.

Mr. Hutson—They may have rotted that before. I know one of the pictures showed that. On the cost of irrigation, he said that most of their irrigation was done by pumping with a foot-power dredge, that they used about 16 inches of water to make a crop of rice and paying for labor at the rate they did, it cost them from 77 to 96 cents an acre. In other words,, they paid these coolies 15 cents a day, I believe, and that is what it figured up, making their cost of pumping with human labor a good deal less than our cost of pumping with steam engines and pumps.

Mr. Bradford—Well, they make from 40 to 60 barrels of rice to the acre. Every grain is transplanted by hand. But I thoroughly believe that when we would once have established this system of flooding a week at a time, that we can maintain a production of at least 20 bags to the acre. Some are producing that now, with the present system.

Mr. Olsen—Mr. Bradford, what are those beans used for? Are they cultivated at all for feed?

Mr. Bradford—Yes, the Italians use them for food. After being boiled and then dried, and salted, they eat them while drinking beer. They are about the size of a vest button, flat, and when boiled they look sort of salmon colored.

Mr. Olsen—Well, that would be only a small amount that would be used for beer production, wouldn't it?

Mr. Bradford—I don't know what proportion would be used with beer, but it is more valuable for a nitrogen gatherer on the roots. It is a bush bean, not a vine, growing to a moderate height and bearing bean pods about 3 or 4 inches in length. The bush will be covered with the pods, and the roots form a thick mass, with more nitrogen on them than either on the cowpea or the Florida bean. As soon as the plant is at full growth and is in the florescent stage, then I run the disc harrow right over it, chopping it all up, and plow it under shallow; plant the rice at once, and just about the stage when the rice roots have made their full growth and are ready to absorb the nourishment with which to fill out their full heads of rice, then they have the green fertilizing element right there easily within their reach to feed on. And that land will continue to produce from year to year.

as has been demonstrated by the Italians. They are now making 40 barrels of rice to the acre where formerly they made 15, 18 and 20.

Now, I claim we can do just as much and a little more.

Mr. Olsen—Have any other of you gentlemen anything to ask Mr. Bradford?

Mr. Roberts—How about water for navigation and the hydroelectric end of which you spoke?

Mr. Bradford—The only expense would be the location of locks in the Calcasieu and Mermentau. There would be from 24 to 28 feet of water within the canal. The hydroelectric feature will be the escapement of the surplus waters from this reservoir into Bayou Cocodrie, with a head of 44 feet, directly from the reservoir into the Cocodrie, or a head of 34 feet from the canal into the bayou, either way, depending upon the stage of water in the canal or within the reservoir. Now, there will be a drop of 20 feet at this point where the main canal will come down. There will be no waste of water at all at this point. When the water will have reached this point, we will have the additional water from the Middle Calcasieu, with the final discharge into the Mermentau above Jennings of say 40 feet, and a corresponding head of 40 feet in the Calcasieu above Lake Charles; so while it would not pay to dig a canal for navigation purposes or for hydroelectric purposes alone, we get the navigation feature for *lagniappe* simply by placing the head gates at the upper end and the locks at the lower end, and we get the hydroelectric power also for *lagniappe* by taking care of the excess waters in those watersheds at these points, this 20-foot drop here, and at the Mermentau here, and at the Calcasieu there (indicating on the map).

Mr. Hutson—What will be the capacity of the main canal in cubic feet per second?

Mr. Bradford—The completed canal would be over 10,700 cubic feet per second. That is simply the canal coming from Red River, you see. Now, we would have these augmented acre-feet in these reservoirs, in the Upper Calcasieu, in the Cocodrie and in the Middle Calcasieu, so that we would have available not only 10,700 cubic feet per second, but nearly 2,000,000 acre-feet capacity in these reservoirs.

Mr. Hutson—On the financial end, how long do you figure it would take for the canal to pay for itself? You spoke of it as very attractive from a financial standpoint.

Mr. Bradford—Well, by doing this immediate work here, controlling the Cocodrie, Upper Calcasieu and Middle Calcasieu, with a canal just large enough to develop 271,000 acres of rice land, that portion of it could be made completely payable or refundable in three years' time at four dollars a sack for rice. Now, with this revenue on this completed portion of the canal with which to extend the system, making the main canal of full capacity up to this point (indicating), we will then have the full water capacity of all of these watersheds; then up into Red River, when we would have the entire use of Red River water, plus several million acres more watershed above, so that within ten years' time, at a liberal calculation, everything ought to be paid for, without any further bond issue. It would have paid for itself within ten years time.

Mr. Hutson—I think the fact of your having customers for your water right off and being able to develop it gradually is the most attractive feature.

Mr. Bradford—That is what Doctor Corthell said; it would be the most unique proposition he had ever looked into at all.

Mr. Hutson—Most of the Government's irrigation projects would have been financial failures if it had been anybody but the Government. Even now, there is only about 50 per cent of the land they have prepared to irrigate that is under cultivation, I understand.

Mr. Bradford—Here is the Louisiana Irrigation and Milling Company. They could irrigate tomorrow nearly one hundred thousand acres of land, with the laterals already constructed, provided they had pumping capacity and sufficient water. We go through enormous prairies here, Mamou and Calcasieu, where the people are ready to put in rice tomorrow if they had the water.

With the hydroelectric feature, we will do the same as we did with the canal companies. We approach the town of Lake Charles, for instance, or Eunice, and say: "Here you are operating a 125 H. P. plant." Fixing their zone of influence, we would give them the power within that zone. Outside of that territory we would make special rates for the industries that might spring up. So that no one concern would ever go out of business. We would deliver power right at the doors of the municipality, and they could distribute it at a flat rate. But the water being worth more for agricultural development in rice than for power, of course, it would be to our interest to push the agricultural feature of it more strongly than the power feature of it. But even if we find that the price of rice gets so low that we would make more money by using this water for electric power, we can do it. We can bring the power into this city, or all over Southern Louisiana, at a much cheaper rate, by half, than that at which it can be generated on the spot with steam or oil. But that enters such a realm of figures and computation as to be so confusing that I did not touch on it at all. I know this, that we can develop 50,000-horsepower at these different stations, whether for the manufacture of cardboard or paper or pulp or rice mills or anything else. I think we would have power sufficient to take care of the manufacture of every bale of cotton raised in the State of Louisiana. We are raising 500,000 bales, and it is sent where? Most of it to Europe or to the New England States.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY.

Regular Meeting of the Board of Direction, October 8, 1917.

The meeting was called to order with President Dusenbury in the chair and Messrs. Olsen, Young, Riess and Robert present. Upon motion duly seconded, the applications of M. A. Beranger and L. A. Christy were ordered to the ballot.

The following bills were ordered approved:

D. Van Nostrand Co., Hole "Dist. of Gas"	\$7.50
Tulane University Press, Printing and Postage	4.75
Fabacher's New Rathskeller, Refreshments, Sept. meeting	9.60
Amer. Ry. Eng. Assn. Proceedings, 1917	6.50
Secretary's Salary—Aug.-Sept., 1917	60.00

Upon motion duly seconded, it was agreed to exchange publications with Facultas de Ciancias Fisicas, Matematicas y Astronomicas-La Plata, Republica Argentina.

Mr. ——— paid up his arrears and his resignation was accepted and the fact that he was dropped from the rolls for non-payment to be erased therefrom.

There being no further business, the meeting adjourned.

JAMES M. ROBERT, Secretary.

Regular Meeting of the Society, October 8, 1917.

The meeting was called to order with President Dusenbury in the chair and twenty-five members and guests present. The minutes of the previous meeting were read and approved. A letter from our guest at the last Annual Meeting, Professor L. P. Breckenridge, was read to the meeting.

The technical exercises of the evening consisted of a very interesting paper by Mr. Welman Bradford, of Alexandria, entitled, "Louisiana Waters and Their Industrial Possibilities." The paper brought out quite a great deal of valuable and interesting discussion by the members. At the conclusion of the exercises, Mr. Bradford was tendered a rising vote of thanks.

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

JAMES M. ROBERT, Secretary.

Regular Meeting of the Board of Direction, November 12, 1917.

The meeting was called to order with President Dusenbury in the chair and the following members present: Messrs. Klorer, Manley, Olsen, Riess, Young and Robert.

The resignation of James Geary was accepted, to take effect January 1, 1918.

Upon motion, duly seconded, the following members were transferred from Resident to Non Resident, to take effect January 1, 1918: George H. Ruggles and A. A. Diettel. The resignation of Mr. Chauncey French was held over until Mr. Olsen would see Mr. French in an endeavor to have him withdraw his resignation.

Upon motion, duly seconded, it was decided that Mr. F. E. Sprague, Jr., should pay his dues up to the time of entering the army, but that further dues will be suspended for the present.

Attention was called to the death of Mr. Foster Olroyd, Resident Member, and Mr. Reinier Swart, Non Resident Member.

Upon motion, duly seconded, the following bills were ordered paid:

M. C. Le Jeune, Reporting October Meeting	$ 10.00
Library Bureau, Cards for Library	1.20
Tulane University Press, Proceedings, August and October	237.55
Tulane University Press, Printing and Postage	22.65
James M. Robert, Salary and Incidentals	38.50

J. M. ROBERT, Secretary.

Regular Meeting of the Society, November 14, 1917.

The meeting was called to order with President Dusenbury in the chair and forty one members and guests present. The minutes of the previous meeting were read and approved. A letter from the American Society of Mechanical Engineers urging the Society to send a delegate to the meeting of the Committee of the Power Test Codes, December 7th, was read.

The technical exercises of the evening consisted of an address by Mr. R. E. Hartman of Braithwaite, La. Mr. Hartman's talk was an interesting discussion of the "Initiation of the Paper Making Industry from Southern Pinewood." This paper brought out a great deal of discussion which was enjoyed by all.

Upon motion of Mr. Lawes, the president was authorized to appoint a committee to draw up suitable resolutions upon the recent death of members of our Society.

There being no further business, the meeting was adjourned.

J. M. ROBERT, Secretary.

PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

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"PATRONIZE OUR ADVERTISERS"

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