THE PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

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PRESIDENT REINHARD A. STEINMAYER

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXXI FEBRUARY, 1945 NO. 1

CONTENTS

EDITORIAL NOTES AND COMMENT

Our New President. The man with pipe in hand, on the opposite page, is our genial new President, Prof. Reinhard A. Steinmayer. The Steinmayer family crest should include at least one transit or other instrument peculiar to the engineering profession, after four generations have followed the leader in the choice of a career, as in the case with Reinhard A. Steinmayer, Professor of Geology and head of the Department of Geology in Tulane University's College of Arts and Sciences.

He is the son, grandson, and great-grandson, a brother and a father-in-law, of engineers. If that does not constitute a record of some sort, it can do until a real one comes along.

A graduate of the University of Illinois—in engineering, naturally—Professor Steinmayer, who is "Rein" or "Steinie" to his intimates, later studied geology at the University of Chicago, and has worked as an engineer, valuator and geologist for several railroad and oil companies, and as consultant to Federal and tate Boards and offices, and to private engineering concerns in New York and New Orleans, in addition to a score of oil producing companies here and elsewhere.

He is a familiar figure on the witness stands where lawsuits involving oil and gas lands and properties are concerned, and has been awarded a grant-in-aid from the National Research Council at Washington for his study of Lake Pontchartrain sedimentation.

The professor is a veteran of World War I, and held the rank of major in the engineer reserves, United States Army, until 1942. He is listed among the American men of science, in Who's Who in Engineering, and is the holder of numerous scholastic and professional honorary keys, including Tau Beta Pi, Sigma Tau, Sigma Xi, Gamma Epsilon Omega, Scabbard and Blade, and the reserve officers' presidential key.

A fellow of the American association for the advancement of science, and the American geographical society, he is a member of the American Association of Petroleum Geologists, and has served as president of the New Orleans Chapter of Reserve Officers' Association of the United States, New Orleans Academy of Sciences, Swiss-American Historical Society, and as vice-president of the New Orleans Geological Society. He is the author of numerous papers and articles in scientific publications; he is also the curator of the Tulane university museum.

Other officers and board members serving with President Steinmayer are as follows: First Vice-President, Dean Leo J. Lassalle; Second Vice-President, Clayton L. Nairne; Secretary-Treasurer, John P. Fernandez; and Directors, Robert E. Gosa, Charles M. Kerr, John A. McNiven, John K. Mayer, Lawrence K. Nelson.

Our New Secretary-Treasurer. Following the annual meeting, Professor John P. Fernandez took over the reins of the Secretary-Treasurer. We believe that our new officer has all the attention to detail and willingless to work that are so essential in the proper discharge of the duties of his office. The Society is fortunate in having the services of such an able young engineer; we wish him success in his new responsibilities.

The Report of the Retiring President. Retiring President Kerr presented his report at the installation of the new officers on Thursday afternoon, January 11, 1945. It is a very comprehensive review of the year's activities. If you were not present at its presentation, you will do well to review it to learn how active your society is.

Thursday, January 11, 1945

Members of the Louisiana Engineering Society,

Ladies and Guests:

It is a distinct pleasure to welcome you to the 1945 Annual Meeting of the Louisiana Engineering Society.

Your Board has endeavored to provide a varied and interesting program, and we sincerely trust that you will attend as many of the technical sessions as possible. Unfortunately, time limitations necessitate the presenting of at least two papers simultaneously, but your General Chairman, W. Stone Leake, has worked hard and faithfully to so syneronize the arrangement of events as to make it possible for you to attend all the sessions in which you are most interested.

Your Secretary, John K. Mayer, has covered in his report such details of finance and routine facts as are of general interest to you. However, I believe it will interest you to note that the Membership of the Society has increased by forty-two, while we are some $300.00 better off than we were at the start of the year 1944. In consideration of the fact that special concessions have been made in regard to the dues of members enlisted in Our Armed Forces, this maintenance of our assets at their usual level is particularly satisfactory. We have a total of 130 of our membership in the active service of our country.

Although your Board of Direction has without exception been, as individuals, called upon to serve in unusual and

varied activities brought about by world war conditions, its members have faithfully attended all monthly and special meetings, and have lent every effort in assisting me in the direction of the affairs of your Society. Attendance at our monthly meetings has been exceptionally good, and your Chairman of the Year Program, Michael C. Abrahm, arranged a series of lectures and talks which were without exception interesting and instructive. Particular reference may be made to our "Guinea Pig" programs. The success of the first one in March justified a "repeat" in November, and the reception accorded these sessions was such as to warrant a continuance of this type of meeting. While we are members of a technical society, and serious subjects dealing specifically with the various branches of engineering are our main object, an occasional admixture of non-technical subjects with public or popular appeal is both welcome and pertinent. I would like to impress upon everyone the importance of attendance at our monthly meetings. The contacts made, and the friendships formed and fostered upon these occasions are invaluable to all of us, and we need, especially during these wartime years, such periods of relaxation. I believe that the idea of our joint meeting with the Local Sections of the various National Engineering Societies represented in our State should be encouraged. Full cooperation with the local sections will not only enable us to obtain better and more interesting talks, and bring men of prominence before us as lecturers, but will have a marked influence in interesting their personnel in becoming members of the Society. In holding these joint meetings, however, the fact should always be borne in mind that the Louisiana Engineering Society, is, so to speak, the "parent" Society, and should play host and be given prominence at all times, even though the Local Section is, in a manner of speaking, a paying guest.

Special stress should be laid on the establishing of Local Sections throughout the State. While efforts have been made to induce the membership resident in the larger towns and cities to organize and form their own Local Sections, no definite results have been realized. The success attained by

the Baton Rouge Section is a matter of record, and the Membership of our Capitol City is to be congratulated upon a job well done and maintained. The annual meeting of the Baton Rouge Section was an occasion both interesting and instructive,and an unusually large number of "visiting delegates" attended. It is hoped that every effort be made toward interesting our members in creating local sections in Shreveport, Lake Charles, Monroe and Alexandria.

Your President entertained an ambition to accomplish two main objectives during his term of office. Both fell short of realization. The first was the establishment of a club house that would be the home of all branches of Engineering in our city. Wartime conditions were not coonducive to the success of this effort, and it is questionable if any definite results can be obtained until normal times return. The need of an Engineering Club House is vital, however, and it is hoped that the coming administration will lay stress upon this fact, and that we wll see our efforts crowned with success sometime in the not too distant future. The failure of the passage of the License Law for Professional Engineers was a matter of greatest disappointment to all of us, and to me in particular. From early indications, we were led to believe that no serious opposition would develop to prevent the passage of the Engineering bill; however, three serious obstacles presented themselves shortly before the bill was to have been introduced in the Legislature. Two of these were overcome by mutual agreement, but the third, which came up unexpectedly at the eleventh hour, presented difficulties which were impossible to overcome to the satisfaction of the only licensed Engineering group in the State, the Civil Engineers. Unfortunately, this opposition developed in the ranks of the very group that should have given the bill its main backing and support—the Civil Engineers. A general emergency bill should be presented at the next Legislative Session, as the professional engineers of the State of Louisiana are placed at a distinct disadvantage by its non-existance. Should the same opposition develop it might be expedient to present a bill sponsored by all engineering groups, exclusive of the Civils. While the existence of two

varied activities brought about by world war conditions, its members have faithfully attended all monthly and special meetings, and have lent every effort in assisting me in the direction of the affairs of your Society. Attendance at our monthly meetings has been exceptionally good, and your Chairman of the Year Program, Michael C. Abrahm, arranged a series of lectures and talks which were without exception interesting and instructive. Particular reference may be made to our "Guinea Pig" programs. The success of the first one in March justified a "repeat" in November, and the reception accorded these sessions was such as to warrant a continuance of this type of meeting. While we are members of a technical society, and serious subjects dealing specifically with the various branches of engineering are our main object, an occasional admixture of non-technical subjects with public or popular appeal is both welcome and pertinent. I would like to impress upon everyone the importance of attendance at our monthly meetings. The contacts made, and the friendships formed and fostered upon these occasions are invaluable to all of us, and we need, especially during these wartime years, such periods of relaxation. I believe that the idea of our joint meeting with the Local Sections of the various National Engineering Societies represented in our State should be encouraged. Full cooperation with the local sections will not only enable us to obtain better and more interesting talks, and bring men of prominence before us as lecturers, but will have a marked influence in interesting their personnel in becoming members of the Society. In holding these joint meetings, however, the fact should always be borne in mind that the Louisiana Engineering Society, is, so to speak, the "parent" Society, and should play host and be given prominence at all times, even though the Local Section is, in a manner of speaking, a paying guest.

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separate bills would not be the most desired solution, it would be preferable to a continuance of existing conditions in which only the Civils are protected. The threat of Unionization still persists, and while only the American Society of Civil Engineers has as a body officially recognized this fact, the situation is such as to command a thorough investigation and every effort should be made to arrive at a solution acceptable to the engineering profession as a whole. This may be hard to accomplish due to the apathy and indifference of many of us who feel that we may not be concerned personally. However, if this threat ever becomes a fact, we will find ourselves in difficulties which may be impossible to overcome. In furtherance of this thought to protect ourselves from the encroachment of outside influences, which would possibly have the effects of lowering our standards and endangering the high position that the professional engineer now enjoys in both our public and private contacts and associations, I would like to see the formation of a supreme National Professional Engineering Society, which would include in its membership all branches of Engineering. It should be similar in principal and scope to our own Louisiana Engineering Society. I would like to plant this thought in the minds of all our membership, because if we acted as a unit throughout the country, we could as a profession wield tremendous influence in our national affairs —and incidently be powerful enough in our own right to guard and protect ourselves in every conceivable situation. I want particularly to impress our membership with the fact that the Louisiana Engineering Society holds, by virtue of its personnel, a position in our State second to none. With this in mind, we should realize that we are supreme in the determination of our conduct and the management of our affairs, and that we should always maintain this position of leadership. There may be difficult times ahead of us in the Post-War period, and we must prepare to meet conditions as they develop, so that the profession will not again find itself faced with the situation that prevailed during the unfortunate existence of the W. P. A. In our efforts to lend every aid towards the winning of this War, let us find time to face and prepare for the future and

strive to the best of our ability to plan for Post-War prosperity.

The past twelve months have not been all work and worry, however, and the Annual Meeting of the Baton Rouge Chapter hereinbefore mentioned, and our local Golf Tournament were high lights in a year filled with many and varied activities. The untiring efforts of Michael C. Abrahm, Chairman of our Technical Papers Committee and Benny Bell, Chairman of our Entertainment and Outing Committee, were productive of the most successful and satisfactory results, and I know that our entire membership joins with me in my expression of appreciation of their work. I want to thank the officers and the entire members of the 1944 Board of Directors for their untiring and friendly co-operation. It is difficult to single anyone individual out for special mention, and my appreciation of support extends to the whole of the Society. I leave the office of President with sincere regret, as the year's experience has been most pleasant and profitable, but I have consolation in the fact that I will serve during 1945 as a member of the Board of Directors. It will be a pleasure and a privilege to continue to devote my time to the interest of the Society in the years to come.

Our December Meeting With The A.I.E.E. The Society met jointly on December 5 with the N. O. Section of the American Institute of Electrical Engineers. Lt. Lawrence R. Spiekler, A. A. F., gave a very splendid chalk talk on some of the fundamentals of the Norden Bomb Sight. One of the sights was on display, and it goes without saying, created much interest. We are indeed indebted to the A.I.E.E. group for scheduling such a splendid meeting with us.

The Annual Meeting. A bouquet is indeed due the General Committee on Arrangements for the Annual Meeting, headed by Stone Leake. The program was a well balanced one and all papers were ably presented. Attendance was excellent; the total registration was 403.

The Friday night program at Dixon Hall was well attended and those present were entertained with a vivid description,

both with words and movies, of the Paricutin Volcano. The Woman's Auxiliary staged a very amusing skit, involving the naming of a baby and various characteristics of engineers of our state. The Auxiliary members are to be complimented on their contribution to an interesting and enjoyable evening.

The grand finale on Saturday night was enjoyed by a capacity crowd. Retiring President Kerr was presented with a silver tray; Retiring Secretary-Treasurer John K. Mayer was given silver tea service. The tokens of appreciation on the part of the members were justly deserved by these two retiring officers.

At the business session on Thursday afternoon, in addition to the key note address and installation of officers awards were made as follows: Junior Memberships: Paul A. McKim, George L. Cunningham, Benjamin S. Brupbacher; Life Memberships: Lester F. Alexander, Frederick N. Billingsley, J J. Bulliung, C. G. Cappel, Alvin M. Fromherz, Bernard H. Grehan, Farrar P. Hamilton.

Keynote Address. Your particular attention is directed to the reprint "How Can We Keep Freedom" appearing in the back of this issue. Mr. Vennard certainly presented a graphic picture of how "mass thinking" is frequently inaccurate, is far from the actual facts. Don't fail to read this reprint; it is a narrative and presentation of facts that will appeal to every engineer and to every one who is interested in the continuance of private enterprise is these United States.

Baton Rouge Sixth Annual Meeting. The Editor has a very attractive folder describing events at the meeting of the Baton Rouge Section on Tuesday, December 12, 1944.

Apparently an excellent meal was enjoyed by those present Officers for the ensuing year were elected. Members of the section were listed on the folder—almost one hundred—a splendid showing.

New Members. Below are listed members elected to our Society since the publication of the last issue of the Proceedings. We welcome them in to our midst, and hope that they

will take an active part in the meetings and the affairs of their Society.

For Member

Bertram, George, Age: 37. Endorsed: C. M. Kerr, W .H. Rhodes, J. K. Mayer. B. E. in Mech. & Elect. Engr., Tulane University, 1929. Employed by the Norco Refinery of the Shell Oil Co. Inc., for the past twelve years. Inspector of Cracking and Topping until equipment for 3½ years. Assistant Head Stillman in charge of the Cracking Dept., for past 7½ years. Responsible for operations, equipment and personnel required by six U.C.P. thermal cracking units; under direction of Head Stillman. Norco, Louisiana.

Betz, Allen W., Age: 32. Endorsed: S. V. Massimini, L. B. Savage, R. L. Nail. B. S., Tulane University, 1937. Industrial Chemist, Freeport Sulphur Co., Port Sulphur, La., June 1937 to December 1939. Chemical Engineer, Gulf Engineering Co., April 1939 to February 1941. Sales Engineer, Barada & Page, Inc., February 1941 to January 1943. Chemical Engineer, Gulf Engineering Co., January 1943 to date. 215 Rose Ave., New Orleans, La.

Coughlin, Frank Hugh, Age: 47. Endorsed: Stanley Nelson, Stone Leake, James Todd. 6/15-4/17, Chicago & Northwestern Ry. Rodman-Mngr. Dept. 4/17-1/19 U.S. Army, Second Lieutenant; 1/19-2/22 University of Michigan, B. S. in Civil Enginering (Tau Beta Pi); 2/22-12/23 Consumer Power & Light Corp. (Okla.) Engr. Supt. Gas Operation; 2/23-8/26 Illinois Power & Light—General Supt. Major Construction; 8/28 Consumers Natural Gas & Power Co., Big Spring Public Service Co., Minden Gas Co., Southwest Ice Co., Texas Elec. Co. Texas Water Co., Texas Power Co., Central Texas Natural Gas Co., Clarksville (Arkansas) Gas Co., Vice-President and General Manager— Principal Properties of above now operated as empire Southern Service Company and Empire Southern Gas Company. Respondent is Sponsor and Vice-President· 1938— Louisiana Ice & Electric Co., Inc., Vice-President and General Manager; Three Counties Ice Company, President and General Manager. 2133 Mayre St., Alexandria, La.

Gutweiler, John J., Age: 35. Endorsed: Theo T. Chenet, E H. Goodloe, L. D. McCorquodale. 1930, Graduate Civil Engineer, B. S.-C. E. 1931-33, Engineer Aide (Instrumentman), Highway Construction. 1933-35, U.S. Coast & Geodetic Survey, Observer and Party Chief, 1st Order Triangulation & Traverse, 1935-37, State Highway Department, Res. Engr., Highway & Bridge Construction. 1937-39, Public Works Agency, Res. Engineer Insp., Engineering Supervision of Water & Sewerage Systems. 1939-41, Federal Works Agency, Field Engineer, Supervision of Engineering on airport construction. 1941-44, Fed. Pub. Housing, Engineer, Site Imp. War Housing and slum clearance. 906 Main St., Pineville, La.

Hegge, Erwin, Age: 56. Endorsed: R. L. Gilbert, W. S. Leake, B. S. Nelson. 1932-36, Electrical and Mechanical Engineer with Tooke & Reynolds, Arcadia, La. 1936-44, Electrical and Mechanical Engineer with La. Ice and Elec. Co., Inc., Alexandria, La. Pineville, La.

Lehmann, Bryan J., Age: 47. Endorsed: W. H. Rhodes, G. R. Hammet, J. E. Coyne. Connected with Shell Oil Co. for the past 25 years as follows: 2 yrs. operating stillman; 4 yrs., Head Treater in charge of operation and maintenance; 4 yrs., Head stillman at Cracking Dept., in charge of operation and maintenance and cleanout crews; 7 yrs. in charge of Gas Dept.; 7 yrs., Head stillman of Cracking, Topping and Asphalt Dept., including the light oil treating and maintenance, having supervision over 93 men. Shell Oil Co., Inc., Norco, La.

Lcehte, William Andrew, Age: 46. Endorsed: Carl Schneider, W. H. Rhodes, J. H. Collins. B. S. in Engr., University of Washington, Seattle, Wash. Ingall Shipbuilding Corp., Pascagoula, Miss., Gulf Shipbuilding Corp., Mobile, Ala., Brown Shipbuilding Corp., Houston, Tex., U.S. Merchant Marine, Licensed Engineer 2nd. Smith, Hinchman & Grylls, New York, N. Y., 401 8th Ave., Brooklyn, N. Y.

Randol, Paul E., Age: 41. Endorsed: C. P. Knost, W. S. Leake, B. S. Nelson. Have been engaged in the electrical profession since I was 18 years of age beginning under the tutorship of my father; technical training is through home study.

Worked for Marvel Light Co., Marmaduke, Ark., 2 yrs. Studebaker Corp., South Bend, Inc., 3 yrs. Arkansas Utilities Co., 1½ yrs. La. Ice and Electric Co., 17 yrs. Box 329, Bunkie, La.

Trott, Harry M., Age: 52. Endorsed: A. H. Douglas, O. G. Kirby, Lovett Young. 1935-44, The Solvay Process Co., Plant Engr. 1930-35, The Solvay Process Co., Construction Engr., 1928-30, Hub City Const. Co., Syracuse, N. Y., President. 1926-28, White Const. Co., New York City, Const. Supt. 1922-26, The Barahona Co., Dom. Rep. Division Engineer. All of above were in responsible charge. Colby College and I.C.S. Course Civil Engineering. 2234 Hollywood Dr., Baton Rouge, La.

For Affiliate Member

Boelte, J. Edwin, Age: 40. Endorsed: D. W. Stewart, K. P. Kammer, J. J. Bulliung. Eight years service Engineer for the Sperry Gyroscope Co., Inc. Five years Dist. Mgr., Gulf District Office, Sperry Gyroscope Co., Inc., 19 Maryland Drive, New Orleans, La.

For Junior Member

Johnston, William H., Age: 22. Endorsed: E. A. McLellan, J. M. Todd, K. P. Kammer, B. S. in Mechanical Engineering University of Notre Dame. Worked periodically during summer vacations, etc. at Dodge Mfg. Corp. of Mishawoka, Ind. Following graduation, worked in their sales office from February 1944 to July 1944. Have taken training programs designed for applications Engineer at: Reeves Tully Co., Reliance Elec & Engr. Co., Union Chain & Mfg. Co., and D. O. James Mfg. Co., Am now with F. N. Johnston, Inc. 1637 S. Jeff. Davis Pkwy., New Orleans, La.

LeBlanc, Joseph Hugh, Jr., Age: 25. Endorsed: A. M. Hill, E. A. McLellan, J. K. Mayer. Graduated from Tulane University in M. E. in 1941. Worked for Tenn. Coal, Iron and R. R. Co., of Fairfield, Ala. Plant till February 1942, as Junior Steam Engr. Since that time have been employed by Welding & Mfg. 609 Calliope St. as Supt. of Machine & Plate Shop. 2309 St. Charles, New Orleans, La.

Matherne, Russel A., Age: 34. Endorsed: H. O. Marquart, L. J. Lassalle, H. W. Waterfall. January 1943, B. S. M. E., La. State University. February 1943-July 1944, Layout Engineer and Flight Analyst, Boeing Aircraft Co., Seattle, Wash. Aug. 1944 to present, Inspector, Safety Inspection Division, Standard Oil Co., Baton Rouge, La., Jr. Member, A.S.M.E. 425 S. 21, Baton Rouge, La.

For Transfer from Junior Member to Member

Angelo, Ernest James, Jr., Age: 27. B E. in E. E., N. C. State U., 1939, Now Asst. Prof. of Elect. Eng., Tulane University.

Dodge, Farrar R., Age: 29. B. E. in Ch. E., Tulane U., 1937. Now M/Sgt., U.S. Army, foreign service.

Ellis, Sidney, Jr., Age: 29. B. S. in Ch. E., La. State U., 1939. Now Lt. (j.g.) U.S.N.R

Hall, W Hansen, Age: 28. M. S., La. State U., 1940. Now Instructor in Physics, U. of Oklahoma.

Pominski, Joseph, Age: 29. B. S. in Ch. E., La. State U., 1935. Asst. Chem. Engr., So. Regional Research Laboratory, New Orleans, La.

Reiss, Frank, Age: 28. B. E. in M. E., Tulane U., 1936. Now Estimator & Field Supervisor, Geo. J. Glover Co., New Orleans, La.

Tobin, John Paul, Age: 30. B. E., Tulane U., 1939. Now Major, U.S. Army, foreign service.

For Transfer from Student Member to Junior Member

All degrees received from Tulane University, October 25, 1944.

Franklin Delafayette Cardwell, B. E. in M. E.

Kenneth Miles Decossas, B. E. in Ch. E.

Thomas Alvin Fromherz, B. E. in C. E.

Nathaniel Butler Knight, Jr., B. E. in E. E.

Richard Adoph Piske, Jr., B. E. in M. E.

Junior Membership Award for Highest Scholastic Standing at Tulane University

Benjamin Simon Brupbacher, Jr., B. E. in M. E.

Can Something Be Added? The "Proceedings" is primarily a record of the papers of the Society and the activities of the Society. What are ways in which it can serve the organization to better advantage? If you have ideas along this line, please pass them on to President Steinmayer or write to Mr. J. H. Collins, 317 Baronne St., who is chairman of our publication committee.

FINANCIAL REPORT OF SECRETARY-TREASURER FOR 1944

Receipts—1944		
Dues	$3475.28	
Advertising	345.58	
Pro Rata from Joint Meetings	95.57	
*Income from Investments	121.41	
Liq. Dividends from Frozen Deposits	300.78	
Sale of Certificates and Buttons, profit	.92	
Sale of Proceedings	2.70	
Miscellaneous	.10	
Total Receipts		$4342.34
Expenses—1944		
Cost of Proceedings	$1120.24	
Stationery, Printing and Postage	315.49	
Refreshments for Meetings	342.66	
Rebates to Baton Rouge Section	254.75	
General Expense	91.49	
Salary, Secretary-Treasurer	900.00	
Maid, 422 St. Charles Hotel	20.00	
Presents to Retiring President	33.84	
Golf Tournament—Net Deficit	108.04	
†Annual meeting, 1944—Deficit	513.33	
Library Expense (subscriptions)	11.00	
Refund of Dues	4.00	
Employes Tax, Penalty and Interest 1-1-40 to 9-30-44	130.93	
Annual Meeting, 1945 (partial)	128.00	
Total Expenses		$3973.77
Total Receipts		$4342.34
Total Expenses		3973.77
Net Income		$ 368.57

*Includes $65.91 credit to accounts, but for which no checks were received.

†This does not include $13.00 paid in 1943.

Assets—Dec. 31, 1944

Cash, Whitney National Bank, Checking Account		$2020.48
Columbia Building & Loan Association	357.93	
Commonwealth Bldg. & Loan Association	305.24	
Greater New Orleans Homestead Assn.	1448.55	
Security Building & Loan Association	500.00	
Sixth District Bldg. & Loan Association	500.00	
Union Homestead Association	500.00	
Series F, U. S. Bond (1942)	745.00	
Series F, U. S. Bond (1943)	749.00	
Savings Account, National Bank of Commerce	774.13	
Total Insured Investments		5879.85
Total Available Assets		$7900.33

Frozen Funds

Canal Bank and Trust Co., Book Value	$ 64.57
Interstate Bank and Trust Co., Book Value	1534.25
Total	$1598.72

MEMBERSHIP REPORT FOR 1944

Members Elected

Members	52
Affiliate Members	3
Junior Members	9
Student Members	10
Total	74

Changes in Grade of Membership

From Member to Life Member	7
From Junior Member to Member	7
From Student Member to Junior Member	26

Members Lost

Dropped for Delinquent Dues	19
Resignations	7
Deaths	5
Total	31
Net Gain in Membership	43
Total Membership on December 31, 1944	634
Members in Armed Forces	130

1945

MEMBERSHIP LIST

C. M.: Charter Member
H. M.: Honorary Member
L. M.: Life Mmember
A.: Affiliate Member
Assoc.: Associate Member
J.: Junior Member

— A —

ALFRED E. ABAUNZA, (1938), *Civil Engineer*, General Manager, Gulf Engineering Co., *Mail:* 7307 Burthe St., New Orleans, 18.

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— C —

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FRANK L. REYNOLDS, (1916), *Construction Engineer*, Vice-President, Irons & Reynolds, Inc. Home: 115 Ocean Ave., Brooklyn. *Mail*: 420 Lexington Ave., New York City.

HAMPTON REYNOLDS, (1937), *Civil Engineer*, 1525 Short St., New Orleans 18.

WILLIAM H. RHODES, (1927), *Civil Engineer*, Southern Asphalt Supervisor, Shell Oil Co., 600 S. Jefferson Davis Parkway. *Mail*: 1519 Exposition Blvd., New Orleans 15.

ROBERT BRUCE RICHARDSON, (1937), *Civil Engineer*, Construction & Maintenance Engineer, Louisiana Department of Highways, 975 Ingleside Drive. *Mail*: La. Dept. of Highways, Baton Rouge, La.

GEORGE J. RICHAUD, (1937), *Civil Engineer*, Roadway Engineer, New Orleans Public Service Inc., 317 Baronne St. *Mail*: 710 Third St., N. O. 20.

CLAIRE WILLIAM RICKER, (1929), *Electrical Engineer*, Professor and Head, School of Electrical Engineering, Tulane University. 717 St. Peter St. *Mail*: College of Engineering, Tulane University, New Orleans 15.

ANSON F. RIDEOUT, (1937), *Civil Engineer*, District Engineer & Manager for states of Louisiana and Texas, J. B. McCrary Co., Inc. 410 Bon Ami Street. *Mail*: Thompson Bldg., DeRidder, La.

FRANK RIESS, (1941), *Mechanical Engineer*, Estimator and Field Supervisor, Geo. J. Glover Co., Whitney Bldg. *Mail*: 924 Audubon St., New Orleans 18.

JOHN RIESS, (L. M.), (1906), *Civil Engineer and Contractor*, 17 Audubon Blvd. *Mail*: Carondelet Bldg., New Orleans 12.

CAPT. JOHN A. RILEY (J), (1941), *Mechanical Engineer*, U. S. Army. Address unknown.

FRANK M. RITCHIE, (1943), *Surveyor*, Chief Engineer and Supt. of Lands, The Louisiana Land & Exploration Co. 928 Crescent Blvd. *Mail*: Box 231, Houma, La.

CHARLES L. RITTENBERG, (1937), *Civil Engineer*, Insurance Engineer, Meyers, Whitty & Hodge, 1024 Canal Bldg. *Mail*: 429 Lowerline St., New Orleans 18.

WILLIAM S. ROATEN, (1940), *Mechanical Engineer*, Erecting Supt., Worthington Pump & Machinery Corp., Buffalo, N. Y. *Mail*: 132 13th St., Oakdale, La.

JAMES M. ROBERT, (L. M.), (1908), *Mechanical Engineer*, Dean, College of Engineering, Tulane University. 2141 State St. *Mail*: College of Engineering Tulane University, New Orleans 15.

A. RODI RODRIGUEZ, (1938), *Civil Engineer and Naval Architect*, Consulting Engineer and Designer, Private Practice. 1628 N. Dupre St. *Mail*: 701 Interstate Bank Bldg., New Orleans 12.

EDWIN J. H. RODRIGUEZ, (1918), *Chemical Engineer*, Johns-Manville Sales Corp., 101 Marietta St., Atlanta, Ga.

EVERETT G. ROESSLE, (1926), *Civil Engineer*, 1624 Second St., Gulfport, Miss.

CHARLES M. ROGERS, (1944), *Mechanical Engineer*, 317 Baronne St., New Orleans 9.

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NORMAN H. ROSS, (A), (1938), *Sales Engineer*, Secretary, Ole K. Olsen, Inc., 4516 S. Johnson St. *Mail*: 823 Perdido St., New Orleans 12.

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RALPH K. ROTHROCK, (1938), *Mechanical Engineer*, Private Practice, 5316 Dryades St., New Orleans 18.

—S—

WILLIAM C. SAGE, (1942), *Mechanical and Civil Engineer*, President and General Manager, Cia. Manufacturara de Tubos de Acero, S. A. *Mail*: Calle Paris 337, Monterrey, Mexico.

HENRY DAY SALASSI, (1944), *Engineering Draftsman*, Squad Leader, La. Dept. of Highways, *Mail*: 1070 Glenmore Ave., Baton Rouge.

COMMANDER HARRY S. SALZER, (1927), *Civil Engineer*, District Marine Engineer Officer, U. S. Coast Guard. 6028 Catina St. *Mail*: 327 Custom House, New Orleans 16.

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JAMES J. SAURAGE, (1942), *Highway Engineer*, Laboratory Testing Engineer, La. Dept. of Highways. 2242 Stanton Ave., Baton Rouge. *Mail*: Highway Testing Lab., La. Dept. of Highways, Baton Rouge.

LEON E. SAVAGE, (1943), *Civil and Mechanical Engineer*, Chief Engineer, Marrero Division, Celotex Corporation. 3936 Louisiana Avenue Parkway, New Orleans. *Mail*: c/o Celotex Corp., Marrero, La.

WALTER HOWARD SCALES, (1929), *Architectural Engineer*, Southern Manager, National Lumber Manufacturers' Association. 2319 Lowerline St. *Mail*: 550 Canal Bldg., New Orleans 12.

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A. ALFRED WOODS, (L. M.), (1914), *Civil Engineer*, Chief Engineer Maintenance of Ways & Structures, Southern Railway System, Western Lines. Home: 2492 Observatory Road. *Mail*: 307 East Fourth St., Cincinnati 2, Ohio.

D. F. WOODS, (1922), *Civil Engineer*, Lutcher, La.

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THOMAS H. ZUMWALT, (1944), *Civil Engineer*, Port Sulphur, La.

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CHARLES H. WEATHERLY,
3618 Coliseum St., New Orleans 15.

ANDREW P. WHITMAN, JR.,
5243 Constance St., New Orleans 15.

Summary

Honorary Members		1
Charter Members		1
Life Members		45
Members:		
Local	206	
State	152	
Non-Resident	92	
Address Unknown	4	454
Associate Members		2
Affiliate Members:		
Local	13	
State	1	
Non-Resident	2	16
Junior Members:		
Local	19	
State	16	
Non-Resident	58	
Address Unknown	2	95
Student Members		5
Total		619

MINUTES OF MEETING AND BUSINESS OF THE SOCIETY

Minutes of Meeting of Board, December 11, 1944

The meeting was called to order by First Vice-President Steinmayer, with the following members present: Gossa, Kammer, Nairne, Nelson and Mayer. President Kerr was present during the latter part of the meeting.

Minutes of the last meeting of the Board were read and accepted.

It was announced that the following members were elected on the October membership ballot:

For Member

Blaize, Sylvester Clarence
Estopinal, Fernando, Jr.
Hannaman, Fred Anthony, Jr.
Ibach, Clarence Augustus
Lyons, Byron Phelps
Monroe, John Edward, Jr.

For Affiliate Member

Brodnex, Ernest N.

For Junior Member

Flewellen, Eugene Holand, Jr.

The following members having paid dues for 30 years were designated to receive Life Membership certificates at the Annual Meeting:

Alexander, Lester F.
Billingsley, Frederick N.
Bulliung, James J.
Cappel, C. Glenn
Fromherz, Alvin M.
Grehan, Bernard H.
Hamilton, F. Petrie

A Committee of J. M. Robert, Chairman, A. L. Dunlap and C. M. Kerr, was appointed to draw up resolutions on the death of Dr. D. S. Elliott.

Mr. W. S. Leake reported briefly on the progress of the plans for the Annual Meeting.

The resignation of J. K. Mayer as Secretary-Treasurer of the Society, effective at the Annual Meeting, was accepted with regret; also the resignation of Sylvan Cromer, A. A. Gustafson and J. J. Pollard, to become effective Dec. 31st.

There being no further business, the meeting adjourned.

J. K. MAYER,
Secretary-Treasurer.

Minutes of the Joint Meeting of the Society and the New Orleans Section American Institute of Electrical Engineers—Monday, December 11, 1944

The meeting was called to order by President Kerr with approximately 200 members and guests present.

It was voted to dispense with the reading of the Minutes of the last meeting.

Chairman K. P. Kammer of the Nominating Committee reported the following candidates for officers of the Society for the coming year:

For President—Reinhart A. Steinmayer

First Vice-Pres.—Leo J. Lassalle

Second Vice-Pres.—Clayton L. Nairne

Secretary-Treasurer—John P. Fernandez

Director for 2 years—John A. McNiven

Director for 2 years—John K. Mayer

President Kerr announced that according to the statute, the names of these candidates should be submitted to the voting membership of the Society on a letter ballot.

General Chairman W. S. Leake read the program of technical papers to be presented at the Annual Meeting and reported on other plans for the meeting.

President Kerr then turned the meeting over to Chairman B. H. Bell, New Orleans Section of A.I.E.E., who conducted a brief business meeting of the Section. Mr. Bell then called upon Mr. Ben Segall, Chairman of the Program Committee, who, in turn, called upon Mr. Charles P. Knost to introduce the speaker of the evening.

Mr. Knost introduced Lt. Lawrence R. Spickler, who presented a very interesting discussion on some of the problems involved in high-altitude bombing, and exhibited the Norden Bombsight; Lt. Spickler answered a number of questions from the floor during the discussion.

Chairman Bell thanked the speaker on behalf of the A.I.E.E., and returned the meeting to President Kerr. The meeting adjourned with a rising vote of thanks to Lt. Spickler.

J. K. Mayer,
Secretary-Treasurer.

OBITUARY

OF

ROYAL ALBERT POLHAMUS

In the death of Mr. Royal Albert Polhamus, on August 12, 1944, the Louisiana Engineering Society has suffered a distinct loss.

He was born at Charlotte, Michigan, April 12, 1879.

Mr. Polhamus was associated for many years in various types of engineering work, including Marine, Civil, and Mechanical Work but his specialty was as a Naval Architect. Among other outstanding work in his career was the design and construction of drydocks in San Francisco.

During World War No. 1 he was Superintendent of the Mobile Shipbuilding Company at Mobile, Ala., and also did work at Savannah, Ga., shipyards.

After World War 1, he was at different times connected with the American Bridge Company at Pittsburgh, the Ambridge Company, Gary, Ind., and the McClintic Marshall, Pittsburgh, Pa. He took part in the design and construction of the Southern Advance Bag and Paper Company mill at Hodge, La. and was Superintendent of power at this mill.

In recent years he was connected with the Orange Car and Steel Company, Orange, Texas, and Jones & Laughlin Co., of New Orleans.

During the current War he was connected as Architect and Naval Engineer with V. M. Friede, Inc., and at the time of his death had a similar connection with B. C. D'Antoni and Associates.

Mr. Polhamus is survived by his widow, the former Leonide Pernot, whom he married in 1926, and by his sister, Mrs. George E. Zederbaum of Charlotte, Michigan.

Mr. Polhamus became a member of the Louisiana Engineering Society in March 1940.

It is only fitting that the Louisiana Engineering Society should pay tribute to our late fellow member Mr. Royal Albert Polhamus and by adopting resolution, attest this fact,

Therefore, be it resolved that the Louisiana Engineering Society adopt resolution embodying the facts as expressed above and

Be it further resolved that these resolutions be spread upon the minutes of the Society and published in its proceedings and that copies be sent to Mrs. Polhamus and Mrs. Zederbaum as an expression of our sympathy.

Respectfully submitted,
(Signed)
A. M. Lockett
B. S. Nelson
Jas. P. Henderson

Minutes of Meeting of the Board of Direction, January 18, 1945

The meeting was called to order by President Steinmayer, with the following members present: Messrs. Gosa, Kerr, Mayer, McNiven, Nairne, Nelson and Fernandez. Also present by invitation were Messrs. David Stewart and Arthur M. Hill. Minutes of the meeting of December 11 were read and accepted.

Mr. Stewart reported that an effort is being made to organize an engineers' club in New Orleans and stated that a planning committee would be formed, consisting of two members from each local engineering association. It was moved and seconded that the president appoint two members to work out plans and report on preliminary conferences, whereupon President Steinmayer appointed Messrs. Charles Kerr and Clayton Nairne to serve in this capacity.

Discussion took place regarding improvement of the Proceedings published by the Society, and it was decided to increase the number of cuts printed therein. It was moved and seconded that a sum not to exceed $1,450.00 be budgeted to cover the cost of publishing proceedings for the year.

It was also decided that the address delivered by Mr. Edwin W. Vennard at the annual meeting be published in full in the February issue.

The financial report for 1944 and the report on attendance at the annual meeting were read by the Secretary. It was moved and seconded that the books of the Society be audited, and Mr. Clayton L. Nairne was appointed to investigate the cost of such an audit.

President Steinmayer appointed Mr. Charles M. Kerr to represent the Society in the Association of Commerce for 1945.

It was moved and passed that the entrance fee for membership in the Society be waived for all those joining in 1945.

It was suggested that the president write a letter of thanks to Mr. W. Stone Leake on behalf of the Board of Directors for the splendid work done by his committee and the Woman's Auxiliary in connection with the annual meeting.

Resignations of the following members were accepted with regret:

D. E. Fuellhart, A. J. Landry, Robert D. Cowherd.

The following names were dropped from the membership roll for nonpayment of dues:

R. T. Basnett, E. L. Cowan, W. S. Simpson.

The following Junior Members, transferred from the grade of Student Member in March 1944 were reported as having paid no dues since then:

E. S. Gaiennie, George Long, J. K. Simpson.

According to the by-laws, this was taken as an automatic resignation of these members.

The secretary was instructed to write a letter of condolence to Mrs. Charles D. Evans on the death of her husband, a former member of this society.

It was moved and passed that the Society's savings account in the National Bank of Commerce be closed and the funds used for the purchase of U. S. War Bonds, Series F, to the nearest denomination.

Chairmen and vice-chairmen to serve on the various standing committees were appointed.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ,
Secretary-Treasurer.

HOW CAN WE KEEP FREEDOM?

Next to the problem of winning the war, the primary problem that confronts us all is: How can we keep our freedom once the war is won? The problem is not new. People have been struggling with it, probably since the beginning of man.

The solution of the problem depends upon human attitudes, emotions, beliefs and desires—and upon the people's knowledge of public affairs. In America's early days, the Town Hall offered the opportunity for a free exchange of ideas and information. Although modern society has grown too large for the Town Hall, we now have an excellent substitute.

In recent years a new science has come into being—the science of sampling public opinion. We need no longer guess what people think—what they want—and why. We can find out, accurately, by asking. When these surveys disclose an absence of a knowledge of the facts, those people in possession of the facts may present them through all the modern channels of mass publicity, radio and advertising. We now have a new, modern, nation-wide Town Hall in which all—including the people—can express themselves. This new possibility for the mass exchange of ideas offers the greatest hope for the best solution of our problem. We can apply "human engineering."

Most of what is said here is based upon these surveys of public opinion.

What Are We Fighting For?

Of course, first of all, we are fighting *against* the foreign forces that would either destroy us physically or destroy the principles we cherish more dearly than life itself. But in the broad sense Americans are fighting *for* freedom—individual freedom—freedom of speech and worship—freedom to make their own decisions, to build self-reliance—freedom to work in the job of their own choosing, working either for themselves or for whom they please—freedom to progress faster by working harder, doing more—freedom to produce whatever they wish—freedom of the individual to profit in proportion to his personal expenditure of physical or mental

energy—freedom to save the difference between what they earn and what they consume so that they may own property and thus become capitalists—freedom to take the risk of investing their capital and to profit in proportion to their judgment, mindful that the burden of mistakes will fall on their shoulders, individually, and will not be borne by someone else.

Americans want freedom to elect government representatives of their own choosing, which representatives will make and enforce laws to give assurance that each individual respects the rights of others—plays the game fairly and pays a penalty for wrongdoing.

Americans want business enterprise to have freedom of operation by men selected by experience and merit—freedom of business to start new enterprises that give labor more jobs at better wages—freedom to employ research and invention to stimulate and supply new wants—to make more and more commodities available to more and more people at lower and lower costs.

¶ "THE *form of government given to us by our founders was designed to promote and preserve freedom . . . but many people conscientiously believe that there are forces acting from within our country that may be so strong as to permanently destroy the framework of our society which makes freedom possible.*"

Americans have had a high degree of freedom since the beginning of the nation. The form of government given to us by our founders was designed to promote and preserve freedom. Under the stress of emergency and war it has been thought necessary at times to depart from some of the fundamental principles of this form of government. Along with these departures has necessarily gone some of our freedom. Some sacrifice of freedom is necessary during periods such as we are now experiencing—but many people conscientiously believe that there are forces acting from within our

country that may be so strong as to permanently destroy the framework of our society which makes freedom possible. The people still have control of those forces. But the people must be constantly alert to turn back these forces if and when they become so strong as to endanger our American principles. It would be a tragedy without parallel if we should win our battle for freedom on foreign shores and then lose freedom by reason of forces acting within our own borders.

To answer the question: How can we keep freedom? We need an answer to: How can we keep the form of government under which freedom is possible? Technically speaking, America is a Republic in that the people express themselves through their chosen representatives. But in the broad sense America is a Democracy. How can we *keep* democracy?

Public opinion surveys indicate a high degree of confusion on the part of the public concerning the terms used to describe some of the forms of society involving our fight for freedom. We speak of "democracy," "communism," "socialism," "naziism," "fascism," "totalitarian state," "public enterprise," "private enterprise," "free enterprise," "capitalism," "profit system," "planned economy," "administrative democracy," and many others.

Let us go back to fundamentals.

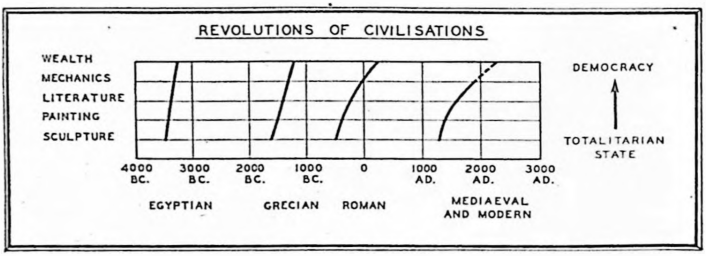
Two Forms of Society

There are but two general fundamental philosophies of government. On the one hand there is the strong central power which makes and enforces laws. The people have little or no voice in the government under which they are ruled. The forms of society commonly referred to as: Socialism, communism, fascism, and naziism, although different concepts, all gravitate to this form. They are totalitarian states. The people are subordinate to the state. The government is supreme. There is little or no individual freedom.

On the other hand, there is the system under which the people through their chosen representatives make the laws under which they are governed. The people employ (or elect) others to enforce these laws. The people have full voice in government. This system

is called a democracy. The state is subordinate to the people. Government representatives are servants of the people. There is individual freedom.

In man's struggle for freedom through all history, he has had to face this distinction between these two philosophies of government. There has been a definite relationship between the progress of civilizations and these two basic forms of society. Apparently the world has experienced four primary civilizations since the beginning of history; namely, the Egyptian, the Grecian, the Roman and the present, or modern, civilization. Each of the civilizations has passed through successive stages of sculpture, painting, literature, mechanics (or science) and wealth—requiring somewhere between 400 and 1200 years to complete the cycle.*



Significantly, the early stage of each civilization was marked by a strong central governing power led by the individual who conquered the country. This evolved into a form of oligarchy, later to be followed by class rule such as we experienced in our modern civilization among the French aristocrats. Finally, there was a form of democracy, or rule by the people. Thus, the people through their struggle for individual freedom, bring about through evolution or revolution a form of democracy. There was a democracy in Egypt, in Athens, in Rome. Civilization reaches its peak at the peak of individual freedom under democracy.

However, it appears that once a state of pure democracy is reached, the indolent majority votes for measures that tend to take away from the productive and the thrifty. The political party in

*"The Revolutions of Civilisation" by W. M. Flinders Petrie. Published by Harper & Brothers, London and New York, 1911.

power, desiring to perpetuate itself, caters to the majority and taxes the productive and thrifty to give to and provide public works for the indolent. The continuation of this process brings about economic weakness and finally decay which prepares the way for some strong and unscrupulous power to come in and destroy the civilization.

This is not a fatalistic study. Trends don't just happen. Trends are made—by individual people. The people have control in a democracy. They can keep it as long as they will.

¶ *"*GERMANY *had a democracy after World War I. The German people had freedom. The German people voted Hitler into power. They voted to keep him there. But that doesn't mean they wanted the form of government he finally gave them. When once in power Hitler manipulated the inside forces through which he could perpetuate himself in power without the people suspecting it. He first assumed* CONTROL *of business enterprise—of basic industries."*

To analyze the problem further, let us examine more recent history. Germany had a democracy after World War I. The German people had freedom. The German people voted Hitler into power. They voted to keep him there. But that doesn't mean they wanted the form of government he finally gave them. When once in power Hitler manipulated the inside forces through which he could perpetuate himself in power without the people suspecting it. He first assumed *control* of business enterprise—of basic industries.* Gradually, he took over enough control to assure control of a majority of votes. Thus, economic freedom was the first lost. The press and speech then had to be controlled to stop all opposition. The people then heard only Hitler's viewpoint. Soon there

*How Nazi Germany Controls Business—The Brookings Institution—Washington, D. C.

was complete loss of freedom. Dictatorship was the natural result. The German people now suffer the consequences.

Much the same pattern was followed by Mussolini in Italy.

Huey Long followed about the same plan in Louisiana.

Forces acting from *within* can and do destroy freedom.

Many students of this problem are concerned about the increasing tendency of our government towards the operation and control of basic industries. The pattern being followed here is similar to that followed in those countries where the change has been made from a democracy to a totalitarian state with the ultimate loss of individual freedom, the thing for which we are fighting.

Let us not concern ourselves with the particular party that may be in power at the particular time. Let us not concern ourselves especially with those few individuals or organizations which believe in the kind of society foreign to our American ideals. Rather, let us concern ourselves with the people—how they think, and why they think as they do. In the long run, in a democracy, the administration and the Congress will follow the will of the people.

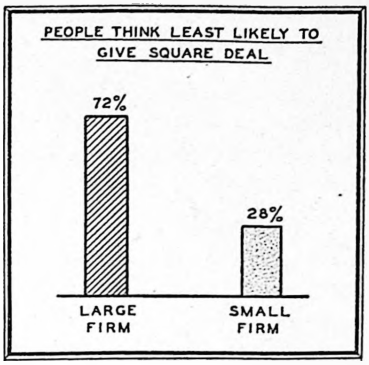
And rather than criticize others, let us analyze ourselves as individuals to see what we can do to stop the dangerous trend.

Separation of Powers

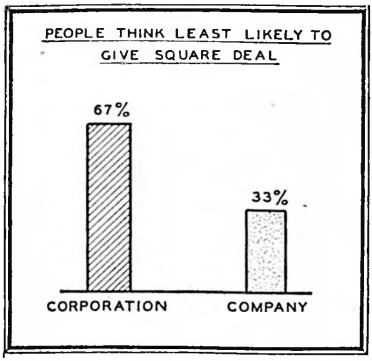
This, then, raises questions respecting the operation of our business enterprise system and the relationship between its operation and our political and social system. Here again we find some confused thinking on the part of the public. We speak of "government ownership" or "public ownership" as compared to "private ownership" of business and property. We speak of "private enterprise" as distinguished from "public enterprise."

What do people think? Wherein is this thinking contrary to fact and what can we do to correct the thinking by presenting the facts?

In a recent survey of public opinion, nearly 60% of the people expressed themselves as thinking the large business organizations in the country are owned by a few individuals or by Wall Street or the international bankers.



When asked whether a large firm or a small firm is least likely to give the customer a square deal—72% of the people mentioned a large firm. Only 28% mentioned a small one.



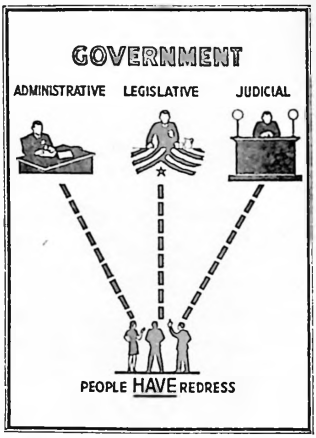
When asked whether a corporation or a company is least likely to give a square deal, 67% mentioned the corporation as least likely to do so. Only 33% said company.

The large corporations include: Steel companies, automobile companies, electric and telephone companies. The people consider these and the other large companies that are such a vital part of our whole enterprise system as privately owned. The fact is that most of the country's big businesses are largely publicly owned. The stocks are owned by all classes of people; bonds are owned by insurance companies, banks and the like which take the people's savings and put them into such business enterprises. The managers of these businesses represent the investing public.

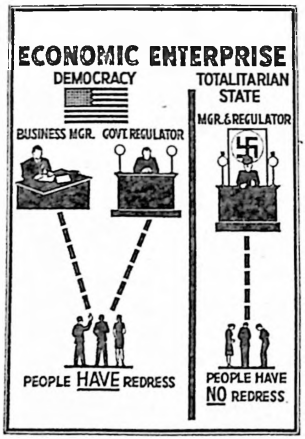
Public interest requires these concerns to be large so that mass production can be accomplished. Many people band together to become the owners of or investors in these large corporations.

Likewise, under the American system the people elect government representatives to make and enforce laws to protect the people's interest. Government acts as regulator of business—as umpire or referee.

Thus, we have in America a fundamental principle for the maintenance of freedom and democracy —a separation of powers.



Businessmen operate the enterprise system and government representatives regulate it. The people maintain their freedom under such a system because they have redress from wrong—and protection from exploitation by either of these groups. This separation of economic powers is just as essential as the separation of government into administrative, legislative and judicial branches.



The forces that tend to destroy democracy from within work gradually through government encroachment on the operation and control (as distinguished from regulation) of business enterprise and especially through operation of the basic industries. No one step in the process of encroachment is decisive, but gradually that degree of governmental control is reached where there is control of a sufficient number of votes to perpetuate the political party in power. Once that point is reached, we will then have established a totalitarian state with the ultimate loss of the freedoms for which we are fighting.

¶ "FREEDOM *and democracy can be maintained just so long as the people who manage and control business enterprise are different people from those elected to regulate business.*"

Our first move must be to acquaint people with the fact that government operation and control of business leads away from democracy and freedom.

HOW FORCES WORK FROM WITHIN

Let us not make the mistake of assuming that all the forces tending to destroy democracy emanate from socialistic and communistic sources. This is not a fact. There are many people who cannot be classified under any of the isms who believe in what they might term a "planned economy" under which the government owns or controls all the basic industries and plans the operation of the whole enterprise system, telling manufacturers what they can produce and at what price, telling employes where they can and cannot work and at what wages. Let us examine some of the forces that consciously or not are leading towards a strong central government and ultimately a totalitarian state.

1. Encroaching Socialism

There is a small but highly effective and articulate group that, for more than 20 years, has been working under a specific plan for a complete change in our American system. This group is composed of some socialists and communists; but, many of its members can be classified as neither. However, this makes little difference because all believe in government ownership or control of basic industries, the end result of which is dictatorship and loss of freedom. These people are against a quick, shooting revolution. They say it is impractical in America. The standard of living is too high. The people must be destitute to be aroused to shooting. So this group employs the technique of encroaching control—boring

from within. They believe in taking over industry piecemeal. No one step seems significant. They believe in working under the Constitution realizing Americans do not believe in going around the Constitution.

The philosophy of this school of thought was well expressed in 1927 by a Mr. H. S. Raushenbush who first mentioned the difficulties of bringing about revolution and then pointed to the more practical scheme of taking over industry a small part at a time. He said:

> "Our long-time aim is the abolition of the profit system for private use . . . we must force our experts on agriculture, trusts, coal, power, subways, housing, milk, etc., to tell us correctly what the next steps are . . ."*

In another document, he said:

> ". . . It is not pleasant to give up that dream of violent triumph . . . we are sensitive about it."

* * *

> ". . . one good man with his eyes, ears and wits about him inside the Department . . . can do more to perfect the technique of control over industry than a hundred men outside."**

* * *

Mr. Raushenbush is now on the inside of one of the departments and has been for a number of years. He is and has been a key factor in bringing about government ownership and operation of a large section of one of our basic industries.

There are literally hundreds of individuals of this same belief working with the same undercover technique now on the inside of the various bureaus in Washington.

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*From two articles "Cataclysmic Socialism or Encroaching Control" and "Gradual Socialization of Industry" appearing in the March 5 and 12, 1927, issues of *The New Leader.*

**"The Socialism of Our Times—A Symposium," edited by Harry W. Laidler and Norman Thomas. The Vanguard Press, League for Industrial Democracy, 1929.

2. Bureaus Beget Bureaus

There is one common characteristic of all governmental bureaus. They all work towards expanding their functions and authority and perpetuating themselves. This is a powerful force in working towards central government control. Figures will be shown shortly to illustrate the extent of this expanding force.

¶ "THERE *is nothing to indicate that the men who represent the people in the employ of a government bureau are any more honest than the men who represent the people in the management of business enterprise.*"

3. Punitive

Part of the government operation and control of business enterprise is the result of the punitive attitude of government towards business in the past eleven years. Business has made mistakes. There have been abuses. Business must be regulated. It is government's duty and responsibility to make and enforce laws that bring about proper regulation of business. However, this should be done through the democratic principles of *regulation.* Evil in management is not necessarily corrected through governmental operation and control of business. There is nothing to indicate that the men who represent the people in the employ of a government bureau are any more honest than the men who represent the people in the management of business enterprise. Government must refrain from direct operation and control of business enterprise if we are to maintain the separation of powers, one of the principal requirements for the maintenance of democracy and freedom.

4. Taxes

No one should object to high taxes at this time. However, taxes must not be discriminatory. Government owned businesses and cooperatives pay no Federal taxes. This encourages govern-

ment ownership and results in unfair competition with taxpaying businesses, thus forcing companies into bankruptcy. Thus, some tax policies are lined up with the forces acting from within to destroy freedom and democracy.

What do the people think on this question? Public opinion surveys indicate that 65% of the people do not know that government-owned electric power projects pay less taxes than the electric companies. The fact is that government-owned projects pay only about one-third of the taxes paid by the companies. However, 64% of the people think that government owned projects *should* pay taxes the same as the electric companies.

The American people want to be fair.

5. Personal Ambition

Personal ambition is a force for the good of society when directed in the right channels. Able individuals with ambition to play a part in the management of industry can find a place in business. Too often, however, such ambition is found in a government employe who seeks power and position through government control or management of business. Let government representatives direct their energies towards efficient *regulation* and not control of business.

These are indicative of the type of forces which are acting from within our borders. While less tangible and working more slowly, they are just as destructive of freedom as the forces of the German army.

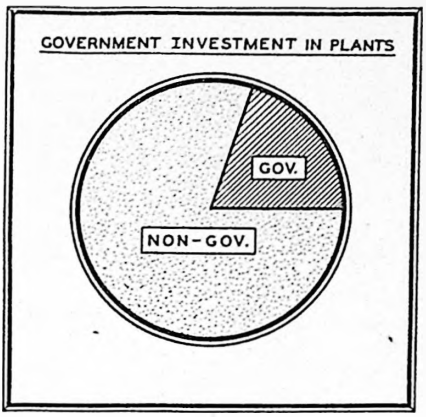
Let us see what these inside forces have accomplished and what the effect has been on public opinion.

Democracy in Reverse

It should be emphasized here that this discussion is not intended to indicate a criticism of the social accomplishments of the past ten years. Many of the new laws were necessary in public interest and for the preservation of freedom. The purpose here is

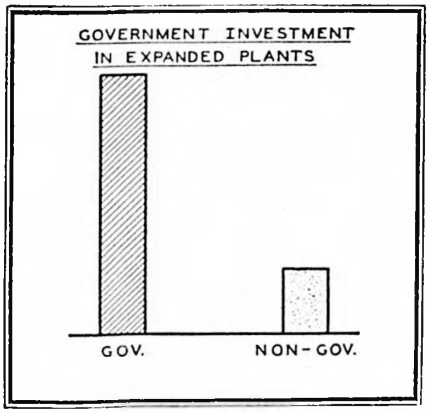
to analyze the forces leading to dictatorship; especially the forces acting through government operation of business.

Here are some danger signs:



1. The Federal government is committed to invest or has invested 14 billions of dollars for plants in new industries. This represents about ⅓ of the total non-governmental investment in American factories and mines in the year 1939.

Is this enough economic control to enable the political party in power (whichever it may be) to perpetuate itself? Maybe so.



The government has almost 4 times the non-governmental investment in expanded war plants.

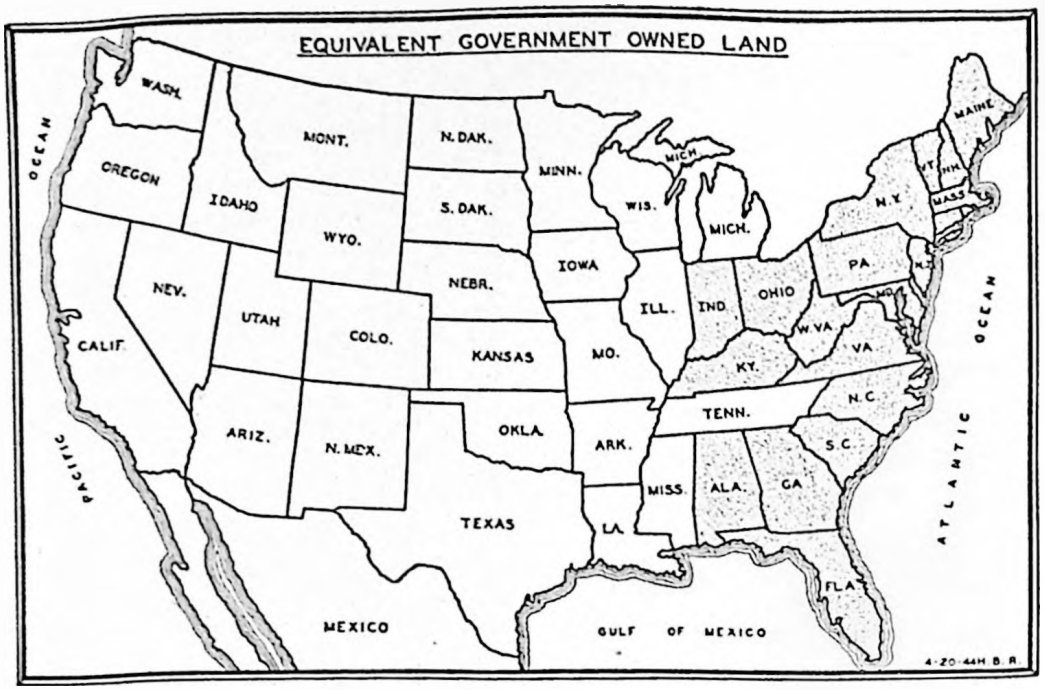
The Defense Plants Corporation alone has built and equipped 1,022 plants in 43 states.*

Much of this may have been necessary as a war measure. The people should know of the hazard and extent of government operation so they can insist that the government not retain it when the war is over.

2. Federal ownership of real estate in the United States will comprise over ⅓ of the entire land area of the country if pending condemnations, purchases and prospective acquisitions are consummated.

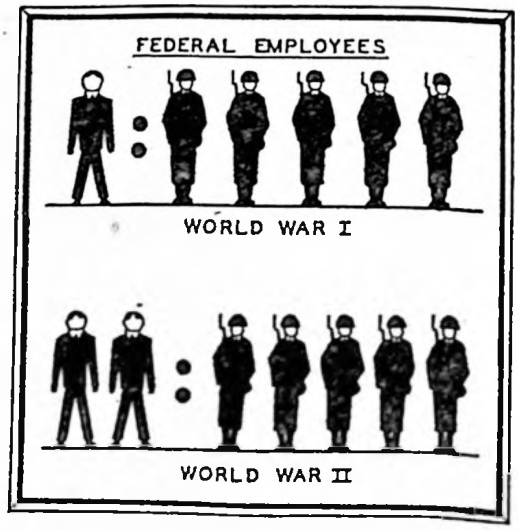
This is equal in size to the combined area of Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut, Penn-

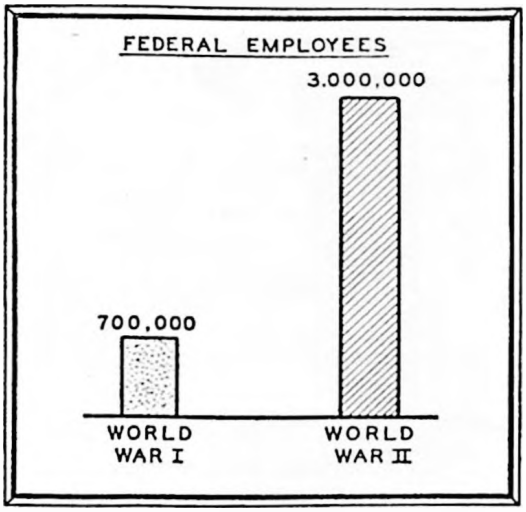
*Jesse Jones, Radio address, July 21, 1943.



sylvania, New York, New Jersey, Delaware, Maryland, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, Ohio, Alabama, Kentucky and Indiana.**

3. The Federal government now has more than 3,000,000 employes (exclusive of those in the armed service) as compared to less than 1,000,000 in World War I.



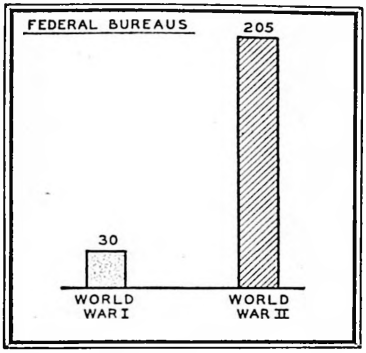


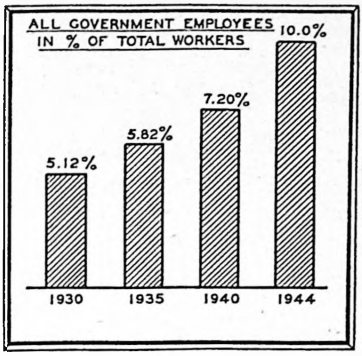
In World War I the Federal government had 1 employe

**Senate Document No. 130, Reduction of Non-essential Federal Expenditures, pursuant to Sec. 601 of the Revenue Act of 1941. Federal Ownership of Real Estate, Nov. 18, 1943.

for every 5 soldiers. Today there are 2 for every 5 soldiers.

Today there are over 6,000,000 employes in all government including municipal, county and state governments. This is 10% of all workers.





This was 5.1% in 1930, 5.8% in 1935, 7.2% in 1940.

4. At the end of World War I, there were 30 Federal administrative units; today there are more than 205.

This is real bureaucracy. At some point soon it will have a working control sufficient to keep itself permanently in power. That will be the end of democracy and freedom.

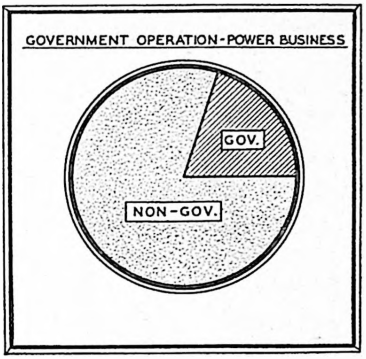
5. Reference has been made to the plan of those who believe in bringing about a complete change in our American system by taking over key industries piecemeal and by working from the inside of the government. The plan prepared by that group selected the Electric Light and Power Industry as the first to be taken over. Other industries would follow. The Tennessee Valley Authority (TVA) is typical of government encroachment in the power business. This is a super-state engaged in such activities as flood control, navigation, prevention of soil erosion, assistance to farmers, malaria abatement and the sale of electric power. It is all accomplished through a series of so-called "multiple-purpose" dams. The people are led to believe that a new way has been found to bring about all these benefits. However, the real purpose behind the scheme is to put the government into the power business.

¶ "THE *fact is that if TVA operated according to the American principles of our enterprise system; that is, if TVA paid the market interest rate that the people want for the use of their money when used in such electric power enterprises and if TVA paid taxes on the same basis as business-managed and investor-owned electric companies, TVA would have to double its electric rates to break even on the power part of the program. And in addition, the taxpayers would have to support the other TVA functions.*"

The point is this. There is no quarrel with the government for performing the functions of flood control, navigation, prevention of soil erosion or assistance to farmers—if the people want it—and want to pay the price. However, there is no reason why the government cannot perform these *non-business* functions directly as it is doing outside the Tennessee Valley. There is no need for the government to be in the power business—to establish a power authority —with its inherent dangers to our enterprise system and democratic principles. The Federal government has spent about 700 millions of dollars of American taxpayers' money on TVA. TVA pays practically no interest on the money. And the American people are led to believe that the sale of electric power at very low rates pays for the costs of all the other functions of TVA. This is not so. The power part of TVA does not even stand on its own feet; that is, does not even pay its own way much less pay the cost of the other TVA functions. Besides paying no interest on the money it uses, TVA pays no Federal taxes. The TVA power program is supposed to be a model for the electric industry with its yardstick rates. The fact is that if TVA operated according to the American principles of our enterprise system; that is, if TVA paid the market interest rate that the people want for the use of their money when used in such electric power enterprises and if TVA paid taxes on the same basis as the business-managed and investor-owned electric companies, TVA would have to double its electric rates to break even on the power part of the program. And in addition, the taxpayers

would have to support the other TVA functions. In other words, all American taxpayers are supporting TVA. But, that is the way it works when the government goes into *business.*

Let the government control rivers with dams if the people desire it, but let it sell the by-product electric power to existing electric companies at the dam site under the stipulation that the companies operating under government regulation pass on to the public any and all benefits derived from the absorption of this power.



TVA is both managed and regulated by the same federal employes. This is a long step in the direction of dictatorship.

Government now operates nearly 20% of the power business. That trend must be stopped if we are to stop the trend towards the German system.

Effect on Public Attitude

What has been the effect on public opinion of all of the publicity and activities concerning government operation of business? Recently one of the country's largest and leading industries, representing many separate manufacturing companies, made a national survey of public opinion dealing with some of these basic questions.

The first part of the survey dealt with questions such as: Which industries will do most for the American people in the future? Which one is doing most now to help win the war? Has the price been satisfactory? Has the product been good? Has the industry helped build the standard of living, etc.?

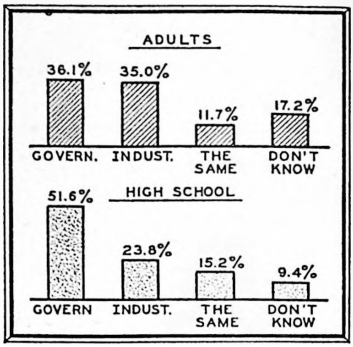
All of these received answers favorable to industry.

Then came this question:

> "If the ..... manufacturing industry were run by the government instead of the present management, do you think you would get more or less for your dollar?"

The results were as follows:

	Adults %	*High School* %
Get more	36.1	51.6
Get less	35.0	23.8
The same.....	11.7	15.2
Don't know....	17.2	9.4
Total %.....	100.0	100.0



Think of that! A majority of the adults with opinions think they would be better off if the government operated the industry! High school students voted two to one in favor of government operation of industry. These are the voting citizens of tomorrow. But what might be expected? These students have known none other than the present administration, so highly articulate in favor of government and derogatory concerning business.

When asked why they think as they do, the people gave reasons as follows: Government operates with no profit. Government would run it cheaper. Government is more efficient. Government has been successful. Government works for all of us. Government tries to help the people. Government is not so competitive.

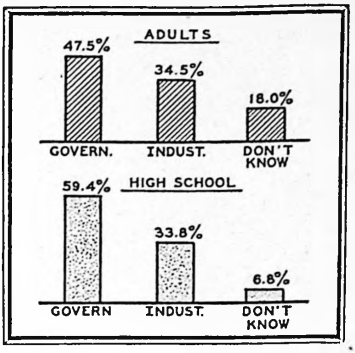
The government has certainly sold itself. These beliefs are largely contrary to fact; but, that makes little difference. The important fact is that the people think that way—and that kind of thinking leads to dictatorship as it did in Germany. What are we doing to correct that kind of thinking? If we are to keep freedom, people must want the government to *not* operate business.

Then this question was asked:

> "Where would you rather work, in some department of the government or in the ..... industry?"

The results were as follows:

	Adults %	*High School* %
In some department of the government ..	47.5	59.4
In the industry.	34.5	33.8
Don't know	18.0	6.8
Total %.....	100.0	100.0



These results are as enlightening as the previous ones. The reasons for desiring work in the government were as follows: Stability of employment. Job security. Better working conditions. Better wages. More faith in government. Government is fairer.

Amazing results! But that's the problem. And we must solve it if we are to keep the freedom we are now fighting for. Apparently the people have been terribly misled by government publicity.

¶ "THAT *(American) production is now possible because for 160 years Americans have had freedom—individual freedom—freedom of enterprise —which freedom has been possible because government has* NOT *operated business enterprise . . . Apparently the people do not realize that if we had government operation of industry here in America as their opinion seems to favor, we will then have in America the German system of government."*

What the people do not realize is that they have this present high standard of living in America—far in excess of any other country in the world—because the government has *not* operated business enterprise. They do not know we are winning this war for freedom because of America's stupendous production of war materials.

That production is now possible because for 160 years Americans have had freedom—individual freedom—freedom of enterprise—which freedom has been possible because government has *not* operated business enterprise. The people do not realize apparently that it is this basic freedom in our American democracy that has made it possible for this American industrial giant to again save the world for democracy.

Apparently the people do not realize that if we had government operation of industry here in America as their opinion seems to favor, we will then have in America the German system of government. We will then have a totalitarian state—a dictatorship—the thing we are waging a war to defeat. They do not realize that freedom and democracy for which we are fighting cannot exist under a system where government operates and controls business enterprise.

And why do people have these erroneous ideas? Because the publicity emanating from Washington has *created* that impression. Trends are made; they don't just happen. And business managers, and others, who know better have not done enough in publicity and advertising to create the correct impression about our enterprise system and its relation to democracy and freedom.

True, the government is selling the easy way and business must sell the hard way. People like to be told society owes them a living, that they can get more for less work, that the government will guarantee security, that people can have both absolute security and complete freedom.

It is not easy to sell the people the more difficult way of life. But it must be done if we want freedom—and it *can* be done. And, we had better be getting around to doing it pretty soon. Is there any more important problem to solve?

Possibly the government has over-sold this desire for security, thus leading the people to believe that they can have security through government operation of business and at the same time can maintain their freedom. This is just not possible. The quest for an easy way to security often leads to loss of freedom. Maximum security is incompatible with freedom. The slaves in the South were secure. Convicts are secure. Both groups had, or have, almost absolute

security—housing, food and clothing—without worry—without care. But no freedom.

Hitler eliminated unemployment in Germany. When he took over the control of all basic industry, he put everybody to work. But by the very process he made them slaves of the state. He fixed their wages and hours. He fixed their job. He ended all unions. He took away their economic freedom. There followed the loss of all freedom. That is the system of dictatorships.

Public Benefits of American System

What are the public benefits of this American freedom of enterprise system where government does *not* operate business? The best measure is the standard of living of the people living under the system. We can measure its growth here in America. We can compare it to other countries.

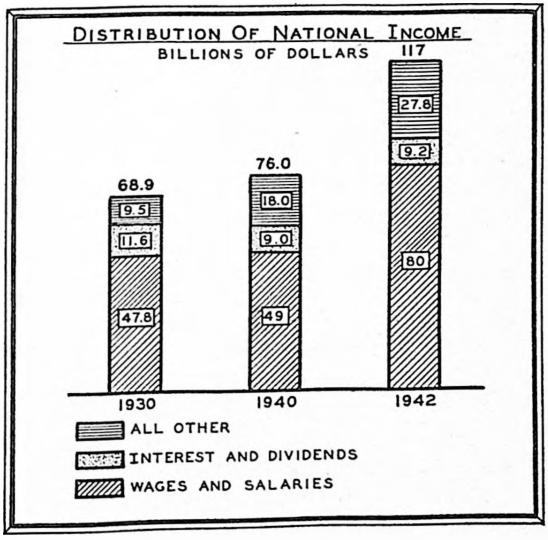
The system isn't perfect—it needs constant improvement—but let's be sure we stay free so we can improve it.

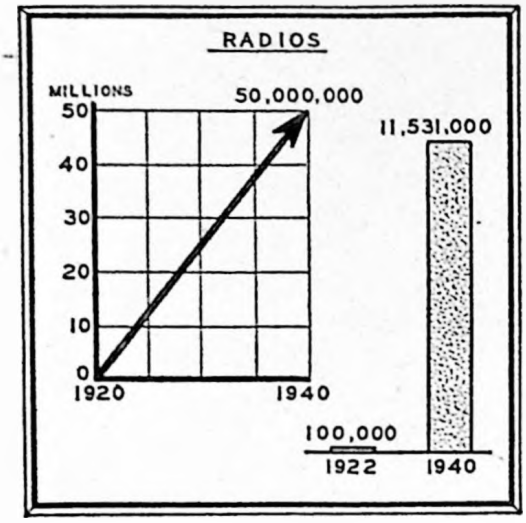
We can't examine here all the indices, but a few will suffice for illustration. They may be familiar to some, but we need constantly to remind ourselves.

INTERNAL IMPROVEMENT

1. Distribution of Income

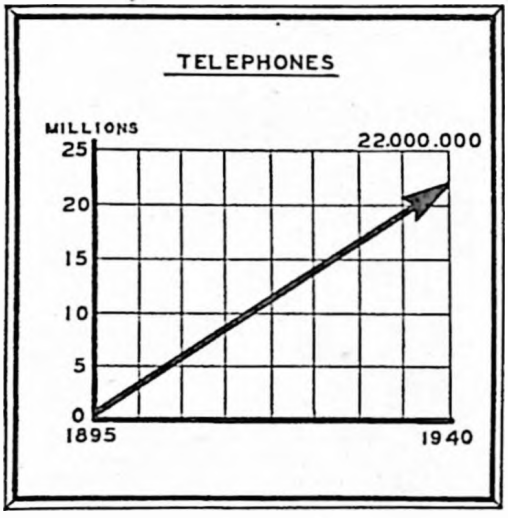
Most of the income goes to the people as wages and salaries. Interest and dividends take relatively little.





3. Automobiles

From none to 32,000,000 in 40 years. 22,000 cars were sold in 1904; 187,000 in 1910; 4,000,000 in 1940.



5. Electricity

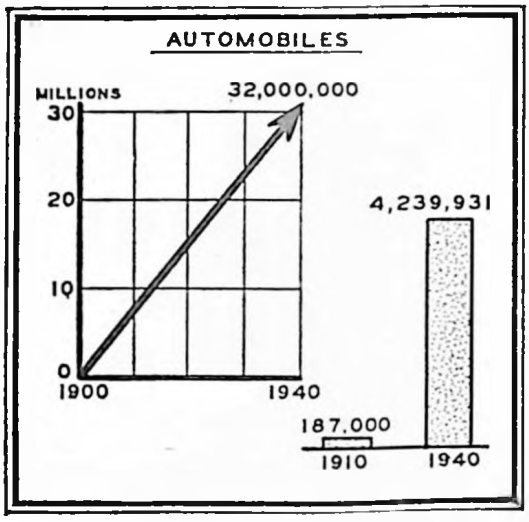
In about 60 years electricity has transformed the American home.

80% are wired.
95% have Electric Irons.
63% have Electric Refrigerators.

2. Radios

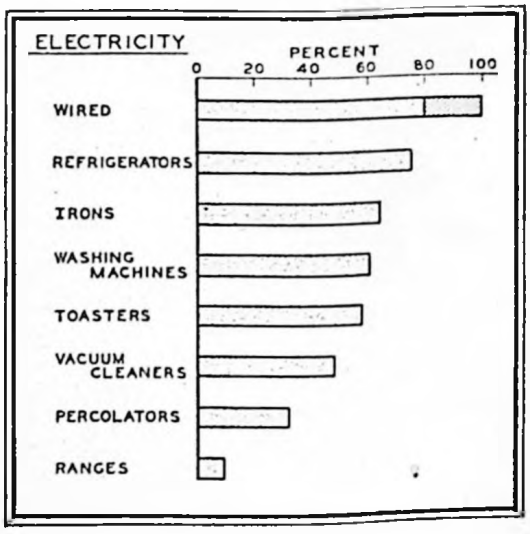
From none to almost 50,000,000 sets in use in 20 years.

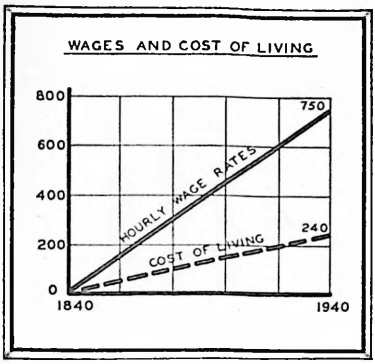
100,000 radios were sold in 1922 as compared to 11,531,000 in 1940.



4. Telephones

In 1895 Americans used 339,500 telephones. In 1940 Americans used 21,928,000 telephones.



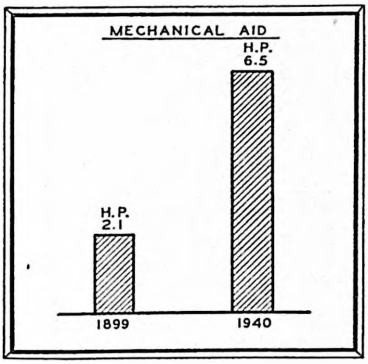


61% have Washing Machines.
58% have Toasters.
49% have Vacuum Cleaners.
33% have Electric Percolators.
10% have Electric Ranges.

The government didn't do that.

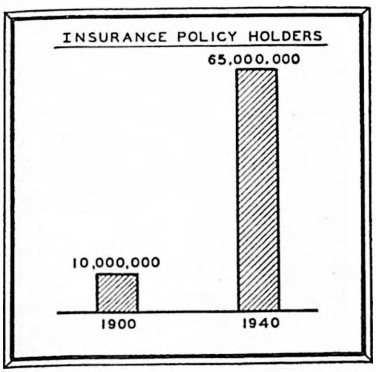
6. Wages and Cost of Living

Since 1840—in 100 years of freedom of enterprise — hourly wage rates have increased 7½ times while the cost of living has increased only 2½ times. Real wages have increased four-fold. And without government control.



7. Mechanical Aid

In 1899 American industry used 2.1 horsepower of mechanical aid for each worker. In 1939, it provided 6.5 horsepower for each worker. This is one reason we all get more in return for the hours we work.



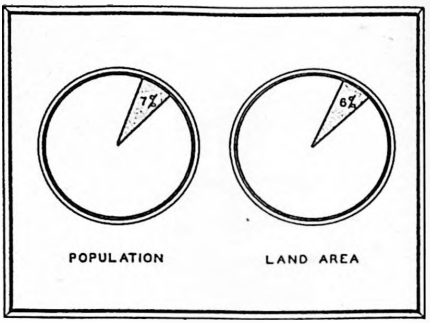
8. Insurance Policy Holders

In 1900 there were 10,000,000. In 1940, there were 65,000,000. Six times as many although population was less than twice as large.

By all the measures of growth in standard of living, Americans have done remarkably well. That is because they were free. 130,000,000 free people can think of ways to better themselves and can produce to satisfy their wants far better than a few hundred bureaucrats in a central government.

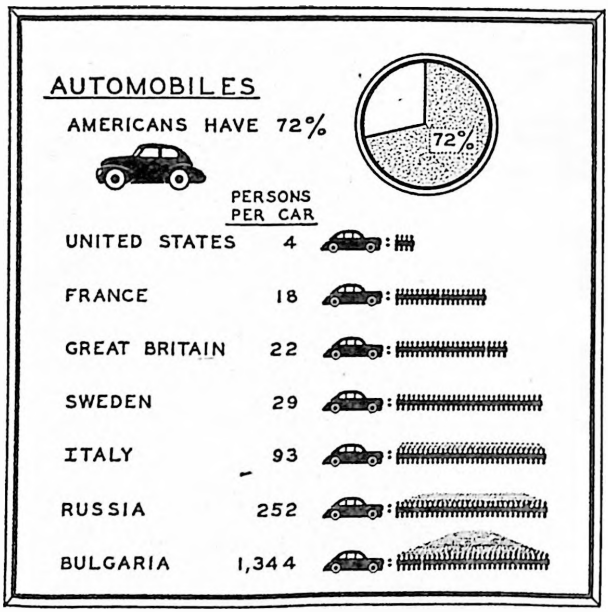
COMPARISON WITH THE WORLD

How does the American standard of living compare with the rest of the world, where all kinds of political systems have been tried. That's the acid test. Let us make a few comparisons.



Americans represent 7% of the world's population. We live on 6% of the world's land area.

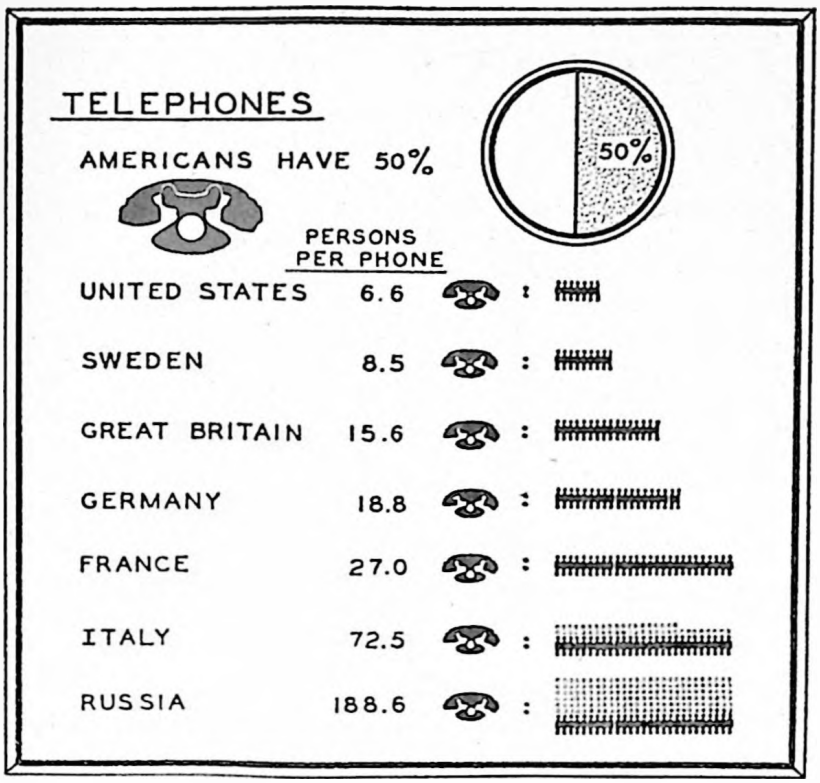
1. Automobiles



Americans have 72% of the world's automobiles. We have 1 auto for every 4 persons. France has 1 for every 18 persons. Great Britain, 1 for 22. Italy, 1 for 93. Russia, 1 for 252.

The government didn't make those American cars.

2. Telephones

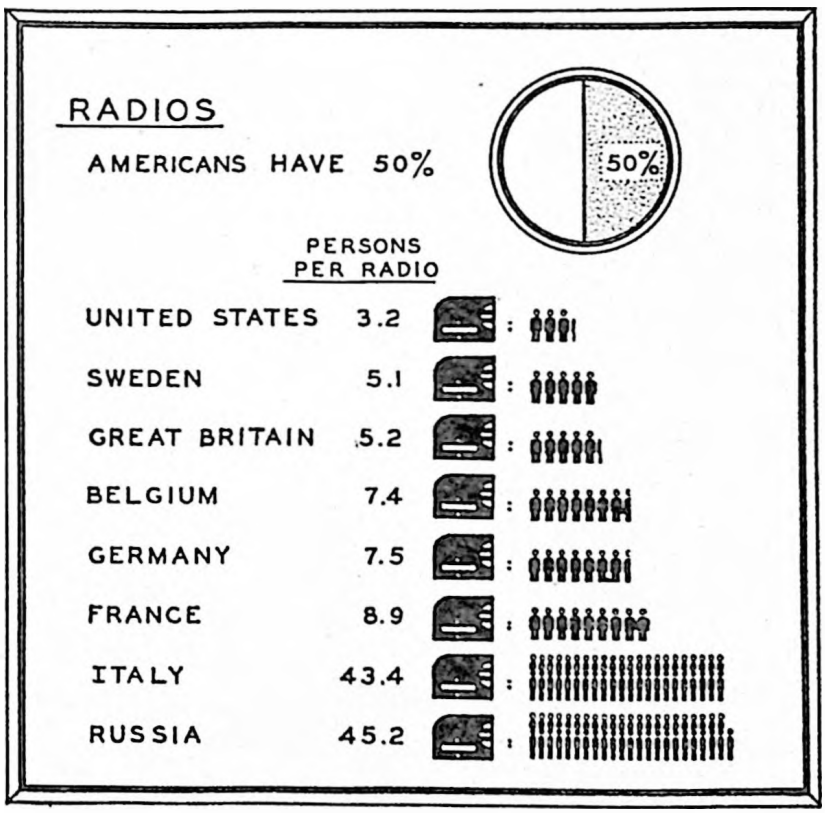


Americans have 50% of the world's telephones. One to every 6.6 persons. Sweden is next, 1 to every 8 persons. Germany, 1 to 18. Italy, 1 to 72. Russia, 1 to 188.

The telephone business in America is *not* run by the government.

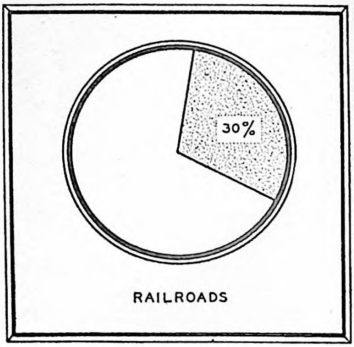
3. Radios

Americans have 50% of the world's radios. One to every 3 persons. Sweden, 1 to 5. Germany, 1 to 7. Italy, 1 to 43. Russia, 1 to 45.



4. Railroads

Americans have 30% of the world's railroad mileage. The government does not run the railroads here.



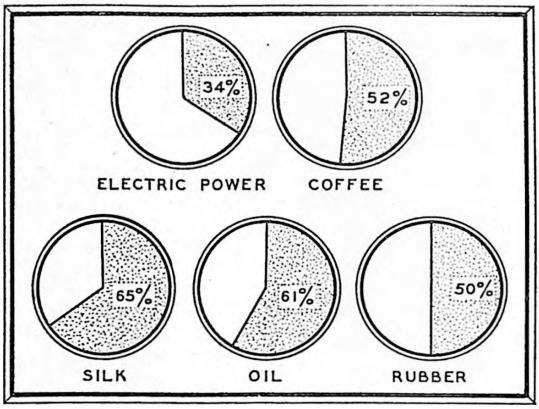
5. Americans consume (1940)

34% of the world's electric power

52% of the world's coffee

65% of the world's silk

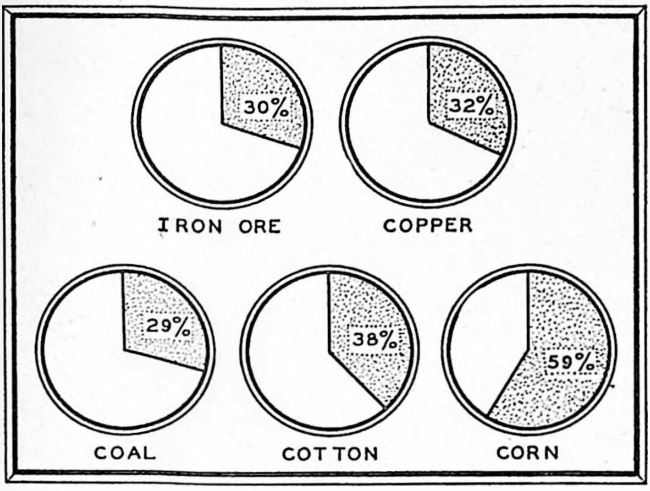
61% of the world's oil



50% of the world's rubber.

Look at it! The government did *not* create that purchasing power. It was created by the American system of *non-government* operation of business.

6. Americans produce

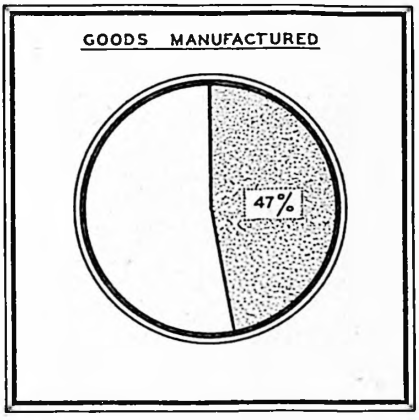


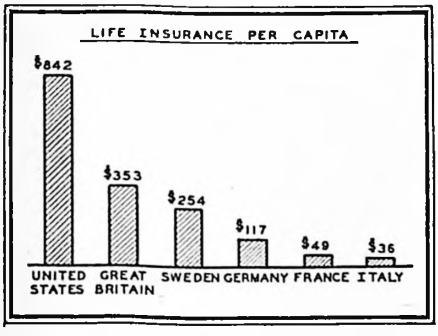
30% of the world's iron ore
32% of the world's copper
29% of the world's coal
38% of the world's cotton
59% of the world's corn

7. America produces

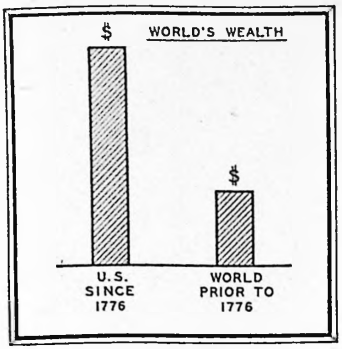
47% of all the goods manufactured in the world.

Think of that! 7% of the world's people produce half the world's goods. And yet we let a handful of bureaucrats in Washington sell the American people on the idea that the government can do it better.





8. Americans have the highest life insurance per capita in the world.



9. Since 1776 America has produced 3 times as much wealth as the entire world before that date.

That is a sample of the American standard of living.

¶ "By *all the measures of public benefits—by all the standards of producing the greatest good for the greatest number of people, our American system of business management under government regulation—our American system of* NON-*government operation of business, has outstripped any other system known in any country at any time.*"

And since that standard of living is what it is *because* business men operate business and *because* government does not—the problem of maintaining democracy and freedom resolves itself into making that fact known to the American people.

What Can We Do About It?

In general we can do two things:

1. Management-Employe Relations

As a first and necessary step in the solution of our problem, let management continuously examine its employe relations. Management need no longer guess employe attitude nor need it rely wholly upon expressions of opinion from labor's representatives. Let management employ the science of sampling employe attitude. Ask the employes what they think and why they think as they do.

Management's first duty is to so operate industry as to *earn* the right to continue its management. This requires:

(a) A fair, enlightened and liberal policy in dealing with employes,

(b) Well informed employes with a full knowledge of the company's affairs and the economics of the business.

2. Inform the Public

Finally, the people must be constantly informed with respect to the facts concerning the public benefits resulting from the efficient business management under government regulation of America's basic industries.

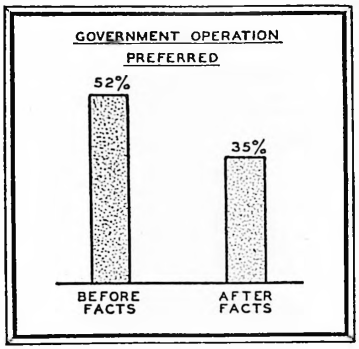
"Under *present circumstances when there is so much involved in this question, dignified silence (or silence for fear of government reprisals) becomes a refined form of suicide—and suicide for American freedom and democracy.*"

Many business managers have chosen to remain more or less silent on these basic questions involving government operation of business. Under present circumstances when there is so much

involved in this question, dignified silence (or silence for fear of government reprisals) becomes a refined form of suicide—and suicide for American freedom and democracy.

Time and time again public opinion surveys have indicated that most of the unfavorable attitude towards continued business management of industry can be traced to a lack of knowledge of the facts. Time and time again, individual cases have illustrated that public attitude changes when the people are given the facts.

In one case of 25 companies selling a well known commodity, the survey indicated 52% of the people preferred government operation. The companies presented the facts through newspaper advertisements extending over two years. Public opinion changed 15% in favor of continued operation by the companies' business managers.



Business management is in a preferred position in knowing the facts concerning the public benefits derived from the American system of freedom of enterprise. It is management's responsibility to present the facts in such a way that the people can understand and realize those benefits.

Business management has at its command almost unlimited avenues through which the public can be informed. Employe meetings and bulletins, news releases, reports to the employes and the public, newspaper advertisements, national magazine advertisements and the radio.

Many industries are beginning to realize this greater responsibility in showing the relationship between their operation and the enterprise system. Too many, however, are advertising the benefits of freedom and democracy. There is no need to sell these to the American people. They already want freedom—want it desperately.

What they want and need to know is how to *keep* their freedom—how to *keep* democracy—how to *stop* these trends towards a dictatorship. Business management can render no greater service to the people than by speaking to them frankly and telling them plainly not once but over and over again that these benefits that the people have derived have been possible because the government has *not* operated business and telling them plainly that government operation and control of business enterprise is the road to the totalitarian state and dictatorship, the German system we are now fighting.

This is not a responsibility of management alone. The responsibility is shared by all who have anything to do with presenting facts to the people.

And so that is our problem. That is How We Can Keep Freedom. This solution offers no easy way, but rather a hard way—and the only way. And the reward? Far greater and far richer than any reward we have reaped this far, for we will see the building of a greater fellowship between employes and management. We will see a gradual development of a greater public realization of the principles upon which our republic is founded. We will see the preservation of democracy and freedom for which our sons are now fighting and paying so dearly.

* * *

The number of requests for copies of this monograph prompts the offer to furnish additional copies upon request for the cost of printing—now running about $10 per 100.
Small quantities will be furnished without charge.

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OF THE
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CONTENTS

EDITORIAL NOTES AND COMMENT

OBITUARY

OF

WILLIAM BENJAMIN GREGORY

William Benjamin Gregory was born on March 13, 1871 on a farm near Penn Yan, N. Y., and with an only sister was the son of Ezra Eugene Gregory of Penn Yan, N. Y., and Mary Elizabeth (Bush) Gregory of New York. The typical American instincts and character instilled in his early life on the farm were reflected in his unselfish actions, kindness and moderated

attention, thoughtfulness and consideration of others throughout life.

His early schooling was secured in Penn Yan while assisting on the farm. He graduated from Penn Yan Academy. Later, he attended Cornell University and was graudated in 1894 with the degree of Mechanical Engineer. While at Cornell his activities were normal. He was enrolled in the military unit of the university and was a member of the crew squad.

Immediately following graduation, he became associated with the Department of Agriculture, U. S. Government, Washington, D. C., which was then engaged in early studies of hydraulics and irrigation in Louisiana and the Southwest. This association had much bearing in his later specialization in hydraulics and irrigation. In the fall of 1894, he accepted appointment as assistant professor of engineering at Tulane University, New Orleans, La., in charge of drawing, hydraulics, mechanical and experimental engineering. The university that year had just expanded and moved to the new campus. The organization of the engineering school became the responsibility of Professor Gregory and two other associates. At that period, engineering schools in the United States were few in number and limited in scope. Because of his thoroughness in visualizing future educational methods and needs of the engineering profession, the engineering school of Tulane University gained much prestige while he was a member of the faculty. While a member of the engineering faculty. Professor Gregory continued his association as consultant engineer for the Department of Interior and in addition, was engaged on many of the larger projects in the South, both as an irrigation and hydraulic consultant. He conducted wide-spread experimental work in the development of irrigation and the growing of rice in Louisiana and Texas. The U. S. Government was very much interested in this type of work, as well as the development and measurement of streams and many engineers were sent by it to become associated with Professor Gregory to be indoctrinated with the theories and the studies he had initiated and perfected. These engineers in turn were assigned to various parts of the United States and ear-marks of the early developments, experiments, irrigation investigations and studies in this section can now be found throughout our Nation. It was during this early work that Professor Gregory perfected the Gregory-Pitot tube which has been adopted and is universally used for precision measurements of streams.

In 1917, with imminence of World War I, Professor Gregory applied for duty and on March 21, 1917, was commissioned Major in the Corps of Engineers. In September 1917, he was sent to France where he served in a staff capacity as engineer-consultant on various hydraulic and water-works studies and projects until March, 1919. Because of his active and constructively outstanding work, he was cited by General Pershing and awarded the Purple Heart decoration. He was retired after World War I with the rank of Lieut. Col. of Engineers. He later was advanced to the rank of Colonel, which rank he held during four subsequent assignments with the U. S. Engineers.

While in France, he was associated with Andre Tardieu, who had attained national prominence as an engineer before entering political fields. This association was continued in later years,

and M. Tardieu renewed the association on his trip to the United States. Professor Gregory was for sometime a member of the Societe des Ingeineurs Civils de France.

In March, 1919, Professor Gregory returned to his work at Tulane University and his consultant practice. Several large projects were undertaken by him and he was retained by the United States Government as a consultant on the study and control of the Mississippi River.

In 1908 Professor Gregory on Sabbathical leave attended Cornell University where he was engaged in experimental engineering research and studies. His work was noteworthy and because of it, he was elected to membership in Tau Beta Pi and Sigma Xi, honorary engineering societies. Degree of Master of Mechanical Engineering was conferred upon Professor Gregory by Cornell University in 1908.

The development of the U. S. Experimental Hydraulic Laboratory at Vicksburg, Miss., was to a large degree due to his efforts and many of the present designed procedures in experimentation were initiated by him. As a U. S. Engineer consultant, he was active in the design of the Bonnet Carre Spillway on the Mississippi River just north of New Orleans, the original model and experiments being made by him.

In 1938 Professor Gregory was retired from Tulane University with the title of Professor Emeritus of Experimnetal Engineering, and Hydraulics, devoting his activities to consulting practice.

During this later period of his life he remained active. He served as Engineering Examiner for the P. W. A. office at Fort Worth, Texas, Resident Engineer Inspector for P. W. A. at Hammond, La., as well as associate consultant with New Orleans Engineering firms.

Professor Gregory was active in all concepts of the engineering profession. He was a charter member and later served as president of the Louisiana Engineering Society. He twice served as vice-president of American Society of Mechanical Engineers, and was also an active member of the American Society of Civil Engineers, American Society of Consulting Engineers, and Society of American Military Engineers which published many of his papers. He was also active in the cultural and civic development of New Orleans, being a member of the Round Table Club, American Legion and the Reserve Officers Association. As a firm believer in preparedness he aided in the establishment of military and naval training units in the state.

Professor Gregory was a most lovable character. His personal magnetism and sympathetic attitude toward his students and his freely proferred assistance to young, as well as contemporary engineers, made for him a place which will be most difficult to fill. He was never too busy to listen and assist students in their troubles or to work with his fellow engineers in devoting his professional knowledge and experience to solving their problems brought to him. He was unswerving in his assistance and determination to place engineers in suitable and responsible positions, and could always be relied on to make each instance one of personal effort, both in recommending and securing professional recognition.

He was awarded the Worcester Reed Warner Medal in 1940 by The American Society of Mechanical Engineers for distinguished service in hydraulic engineering.

In 1936, Professor Gregory suffered a heart attack from which he never fully recovered. In his later years he was confined to his home, and daily there were visits from friends of the City and other parts of the Nation, calling to renew their former acquaintance and to enjoy a few minutes reminiscent conversation.

In 1898 he was married to Selina Elizabeth Bres who survives his as does a son, William Bres Gregory of Dallas, Texas, a daughter, Angela Gregory of New Orleans, and four grandchildren residing in New York and Texas. Another daughter, Elizabeth Gregory Ferris, died in 1942.

He will be missed at the gatherings of our Society for we always wanted, in fact sought, his wise counsel.

Respectfully submitted,

DEAN JAMES M. ROBERT,

MR. JAMES M. TODD,

COL. EDWARD S. BRES, Chairman.

MEMOIRS

GEORGE ARTHUR SEAVER

LIFE MEMBER, LOUISIANA ENGINEERING SOCIETY
MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS.

BORN — NOVEMBER 23, 1886

DIED — JANUARY 20, 1945

George Arthur Seaver, the son of Majorie Ford of Virginia and G. A. Seaver of New York State, was born in New Orleans, Louisiana on the twenty-third of November, 1886.

He received his preliminary education at Ferrill's School, and upon graduation, he enrolled in the School of Civil Engineering at Tulane University. He had the distinction of earning his way through College, and not only worked during vacation time, but remained out of school for about two years, during which period he was employed by the Johnson Shipyards in Algiers, and by the firm of Sanderson and Porter, Engineers of New York City, as office and field assistant engineer in the installation of Underground Utilities and Cables, and on the construction of the Market Street Power House and the Elysian Fields Avenue Substation and Tunnel, of the New Orleans Public Service Inc. He was later assistant general superintendent of construction for A. B. Stannard, contractor for the erection of the New Orleans Court House.

He returned to Tulane, and in 1910 was graduated with the idegree of Bachelor of Civil Engineering.

Arthur Seaver then entered the employ of Geo. J. Glover, General Contractor, and in 1924, when the firm was incorporated into the Geo. J. Glover Company, Inc., he was made a member.

His entire business life was devoted to the interests of his Company, and his last two assignments were as Project management of the construction of the LaGarde General Hospital, and later of the Consolidated Vultee Aircraft Plant, all in New Orleans, Louisiana.

In 1916, as a member of Battery C of the Washington Artillery, he served as Chief Mechanic in the activities along the Mexican Border.

Arthur Seaver was of a retiring nature, and was intensely interested in his home, devoting his spare moments to his work shop. His chief diversion was tennis, and he actively took part in this sport throughout his life time. He developed a design for a brick dust court which was successfully used in the New Orleans Lawn Tennis Club, and in the public playgrounds of the City of New Orleans.

He was a member and past president of the New Orleans Lawn Tennis Club, and was engaged in a match when fatally stricken on the twentieth day of January, 1945.

He was awarded the Worcester Reed Warner Medal in 1940 by The American Society of Mechanical Engineers for distinguished service in hydraulic engineering.

In 1936, Professor Gregory suffered a heart attack from which he never fully recovered. In his later years he was confined to his home, and daily there were visits from friends of the City and other parts of the Nation, calling to renew their former acquaintance and to enjoy a few minutes reminiscent conversation.

In 1898 he was married to Selina Elizabeth Bres who survives his as does a son, William Bres Gregory of Dallas, Texas, a daughter, Angela Gregory of New Orleans, and four grandchildren residing in New York and Texas. Another daughter, Elizabeth Gregory Ferris, died in 1942.

He will be missed at the gatherings of our Society for we always wanted, in fact sought, his wise counsel.

Respectfully submitted,

DEAN JAMES M. ROBERT,

MR. JAMES M. TODD,

COL. EDWARD S. BRES, Chairman.

MEMOIRS

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Among his professional associates, Arthur Seavor was known as an Engineer of great experience and of marked ability, and as an outstanding factor in the field of building construction.

His many friends and acquaintances knew him as a man of high integrity and valued their associations with him.

His passing away is a keenly felt loss, both to his wide circle of friends and to the business world.

He is survived by his wife—the former Miss Nellie Fischer of New Orleans, whom he married in 1921, and by his three children—Mrs. Gelon Hann Doswell, George Arthur Seaver, III and John Wyman Seaver.

Arthur Seaver was a life member of the Louisiana Engineering Society and a member of the American Society of Civil Engineers.

BERNARD H. GREHAN.

CHARLES M. KERR.

Southern High School Standards. The Science Clubs of America recently announced the names of forty science-talented high school seniors who are finalists in the fourth annual Science Talent Search. These forty boys and girls will compete for $11,000 in Westinghouse Science Scholarships. Fifteen thousand examinations were requested by high schools in every section of the country, and the forty finalists were chosen from the 3000 high school students who completed all of the requirements of the contest. The science aptitude examination was designed not to test the actual scientific knowledge of the student but rather his ability to think problems through to a logical solution. The forty students who reached the finals may logically be termed the outstanding youthful scientific minds of the country.

The disheartening aspect of the results lies in the fact that only one of the forty finalists, Alice Beck Dale, 17, Central High School, Columbia, Tenn., was trained in a southern school. Miss Dale is, of course, to be highly congratulated, but we are sorry that there are no others from neighboring states to join her when she travels to Washington for the final competition.

We would say that the results of this contest support the statement frequently made by the faculties of Southern Technical schools, that "much valuable time is lost because first year engineering students must waste a whole year in college reviewing fundamental material they should have learned in high school."

The fact that the Science Talent Search tests were aptitude tests rather than information tests indicates clearly that it is no lack of scientific equipment but rather a lack of teaching ability throughout both scientific and non-scientific courses that handicaps Southern high school students. Logic may be learned as readily from English as from mathematics.

We, as Southern engineers and manufacturers, can do something about this. Investigate the situation in your own city or town. Meet the high school teachers. Find out what their qualifications are and what they are paid. Find out what courses are required for graduation and take a look at the final

examinations in these courses for the past few years. Then go to the school board with the results you have found.

We believe one of the first things you will find is that high school teachers are underpaid in the South—in fact we know that without an investigation, but while trying to remedy this tough situation, some other hopeful results may come from your efforts. From "Southern Power and Industry."

Baton Rouge Meeting. We have an announcement of the meeting held on March 29 by the Baton Rouge Section. Mr. C. G. Morrison of the Standard Oil spoke on "The History and Development of Natural Rubber." Refreshments were served following the paper and discussion.

February Meeting. Our February Meeting was held jointly with the New Orleans Section, American Society of Mechanical Engineers. Mr. Otto de Lorenzi, Director of Education, Combustion Engineering Co., spoke on the subject of "A Study of Liquid and Gaseous Fuel Burners." A color film was shown, many of the views taken at extremely high speeds. No formal paper was presented.

Where Do You Belong? Our well known member Ole K. Olsen recently sent in the following verse. It's well worth your reading.

Where Do You Belong?

Are you an active member,
The kind that would be missed,
Or are you just contented
That your name is on the list?

Do you attend the meetings,
And mingle with the crowd,
Or do you mostly stay away
And crab both long and loud?

And do you take an active part
To help your club along,
Or are you satisfied to be
The kind that "just belong?"

Do you ever have suggestions
That are both good and slick,
Or leave the work to just a few
And talk about a clique?

There's quite a program scheduled
That means success, if done,
And it can be accomplished
With the help of everyone.

So be regular at meetings
And help with hand and heart,
Don't be just another member
But take an active part.

And if you live too far away
But have some time to spare,
To introduce new members
Will help you do your share.

If you're not in good standing
We're sure you want to be,
So dig up the amount you owe
And send along your fee.

Now think this over, member,
Are we right or are we wrong,
Are you a real live member
Or do you—just belong?

From "Scandivanian News"
Toronto, Canada. February 24, 1945

The Society library has just received a copy of a "Cane Sugar Handbook" by George P. Meade (member of the Society) and the late G. L. Spencer. This splendid text on sugar processing is an appreciated addition to our books. Mr. Meade is with Colonial Sugars, at Gramercy, La.

American Oil Chemists' Society Meeting Canceled. Cancelation of the 36th Annual Meeting of the American Oil Chemists' Society which was to have been held in New Orleans May 9 to 11 has been announced by Dr. Klare S. Markley, President of the Society. This action was taken in order to cooperate with the Office of Defense Transportation.

In This Issue. R. A. Barton, an engineering student in the V-12 navy program at Tulane University presented a most interesting paper at the annual meeting. His subject was photoelasticity; the paper is presented in this issue.

The subject of gas turbines is one of growing interest. Paul R. Sidler told us of some of the high lights in the development and application of this new prime mover.

PAPERS AND DISCUSSIONS

PHOTOELASTICITY

R. A. Barton

Editor's Note—This paper won first prize at the recent Louisiana Engineering Society Convention. The author, a Civil Engineer, was a member of Tau Beta Pi, Glendy Burke Debating Society, Techni-Torque and President of the Tulane Society of Civil Engineers.

There are a number of methods of stress analysis. Foremost among these is mathematical analysis. From a mathematical consideration of elasticity, certain functions are evolved from which exact stresses may be computed. Unfortunately, however, calculations sharply multiply when boundaries and loadings become irregular. When such conditions occur, the design engineer must turn to experimental methods for determining internal stresses. It is precisely at this point that science of stress analysis which is known as photoelasticity enters the picture.

Photoelasticity is, as its name implies, the study of elastic properties of materials by means of light. It is the purpose of this article to give some insight into the theory of photoelastic analysis, and to point out some of the information which can be obtained therefrom.

The first question which should occur to any scientifically minded individual upon being introduced to photoelasticity is, "How can stresses be determined by means of light?" Just what connection is there between the elastic properties of engineering materials and the optical properties of light? A full answer would be a lengthy treatise in itself, but a general understanding of the physics involved can be had in a comparatively short time.

The first principle which must be understood is that of polarized light. This phenomenon can best

be explained, for our purposes, by means of an analogy. If a rope were attached to a wall, then passed through a horizontal slot in a panel a few feet from the wall, and if the free end were then rotated, a vibratory wave motion would be induced, which would be filtered out at the slot into wave motion in only a horizontal plane. Thus the motion of the rope between the panel and the wall would be "polarized". In a similar manner light is considered to be polarized; that is, all the wave components except those in one plane are filtered out. In photoelasticity, two beams of polarized light, oriented at ninety degrees to each other, are projected through a transparent plastic material—Bakelite, in our case.

We are all familiar with the fact that light is retarded when passing through water, or any other transparent materials. Some materials, and Bakelite is one of them, exhibit the property of retarding light vibrating in one plane to a greater extent than light vibrating in another. The discovery that the relative retardation in such a material of two beams of polarized light (at 90° to each other) was directly and linearly proportional to the internal stresses resident in the material, led to the development of the science of photoelasticity. The law which governs this property may be stated more exactly as:

$$Rt = C\ t\ (p-q), \text{ where}$$

Rt is the relative retardation of the two beams of light, C is a constant

t is the thickness of the material under stress,

p is the major principle stress,

q is the minor principle stress.

From this it can be seen that if light of a single wave length, or monochromatic light, were polarized and passed through a Bakelite model in beams oriented at ninety dgerees to each other, patterns of reinforcement and interference would appear on a

screen on the opposite side of the model, and that the study of these patterns would reveal the internal stresses developed.

Let us turn, now, to the actual laboratory apparatus which is used in the determination of stresses. The first illustration shows the polariscope and load-

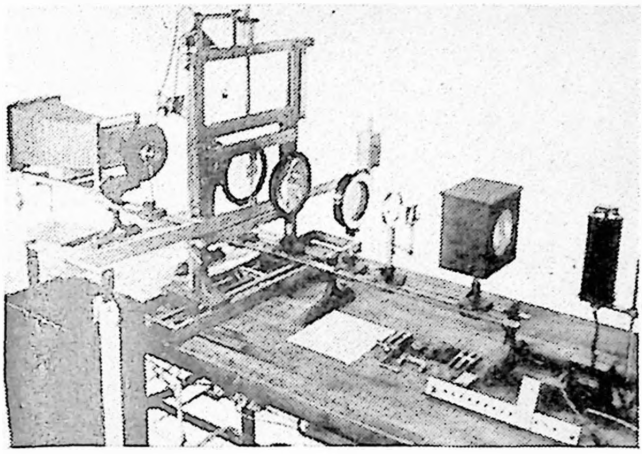

FIG. 1

ing machine as it is generally used. At the extreme right in the picture is a mercury lamp, source for non-chromatic light. The water cooling cell is to the left of the lamp, followed by a filter and auxiliary lens. Clamped together in the center of the picture are polarizer and the quarter plate. The polarizer eliminates all the light except that oriented in a single plane, and the quarter plate breaks that one orientation into two at right angles to each other, as explained previously. Next to the quarter plate is the collimation lens, which corrects the light for an infinite light source. Next comes the loading machine, in which the model to be tested is placed. This loading machine is so constructed that any number of of variations of loading conditions may be made. Behind the loading machine is a condenser lens, which undoes the work done by the collimating lens. Next,

and partially obscured by the loading machine, is the quarter plate and analyzer, and last comes the camera, which may be replaced by a screen for visual study.

A beam of monochromatic light is thus polarized, broken into two beams at ninety degrees to each other, passed through a loaded plastic model, and retarded in such a manner that patterns of reinforcement and interference are set up which may be photographed or viewed on a screen. The correct interpretation of these patterns will give the stresses resident in the model both qualitative and quantitatively.

It would be interesting to examine now a photoelastic pattern. The second illustration shows a

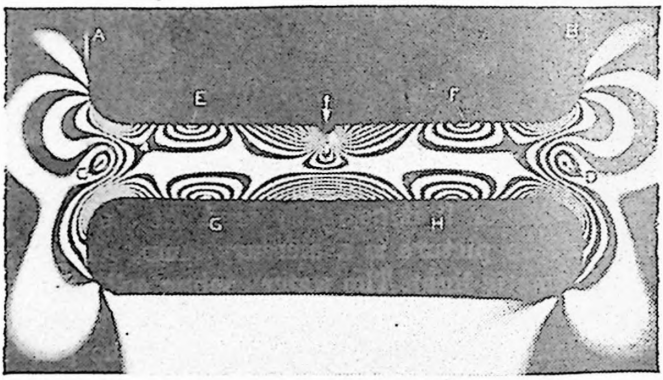

FIG. 2

beam with ends restrained subjected to a single concentrated load at midspan. Before the load was applied, the entire model showed up black. As load was gradually applied, the various areas of the model went through cycles of black to white and back to black. It is the number of such cycles which a point goes through from no load to full load which gives the indication of the stresses resident in the model at that point.

It remains only to evaluate a constant by which to multiply the number of cycles to find (p-q), the difference between the major and minor principle stresses. This constant may be evaluated by testing a one-inch specimen of the same thickness as the model to be used, in pure tension. A certain increment of load may be applied, during which time the specimen will go through a certain number of cycles. The constant, F, is then found by dividing the increment of load by the number of cycles. Then, for the stresses at any point,

$$\tfrac{1}{2}\,(p\text{-}q)=Fn, \text{ where}$$

$\frac{1}{2}$ (p-q) is the maximum shear at the point, and can be quite easily proved to be equal to one-half the difference between the major and minor principle stresses.

F is the previously derived constant, and

n is the number of cycles through which the model has passed at that point.

With this in mind, let us examine the second figure more carefully. It would have been seen, had we watched the model as it was being loaded, that certain points did not pass through any cycles. It is evident, then, that at these points, there is no shear; that is, p-q=O. Points C, D, E, F, G, and H are such points. With these points established, we can go on to find the shear at any point. For example, at the point midway between C and E there were four cycles, as noted. Hence the maximum shear was 4F, and F for the particular model was 250 pounds per square inch, giving an actual shear of 1000 psi. It can be seen from observation that directly under the loading, a positive moment was induced, giving tension in the lower fibers and compression in the upper fibres. The value of these stresses at the boundary of the model can be had, since one of the principle stresses will equal zero at the boundaries. Further observation tells us that negative moments were induced at the supports, and the boundary

stresses there can also be determined. The points E, F, G, and H are points of counterflexure, and points C and D are isotropic points.

It is interesting at this point to note that the highest stresses occur where boundaries are irregular or where a load is applied. Such is always the case, and as boundaries become more and more restricted, stresses become greater and greater. This fact is quite often the limiting factor in the design of machine parts, and for this reason it is often advisable to make such parts of a ductile steel instead of a brittle steel. For when a ductile steel exceeds its elastic limit, it will deform slightly and in so doing will distribute the stress concentration over a greater area. A brittle steel, on the other hand, is inclined to fracture when the elastic limit is exceeded. It is always well for the machine designer to remember that confined boundaries and irregularities will always increase the stress concentration, and so reduce the effective strength of the entire part. The structural engineer, too, should heed this fact, for it does not become apparent from the purely theoretical mathematical consideration of elasticity, and he may find that he has badly overstressed his material.

Another value of photoelasticity to the structural engineer is in the design of reinforced concrete structures of odd shape. For it is not always apparent where the reinforcing steel should be placed, and if steel is not where it is needed, the concrete will not take the tension and the entire structure fails.

Figure three shows a compilation of data obtained from the analysis of a simple beam subjected to a single concentrated load at midspan, in graphical form. Depth of the beam vs. vertical (or horizontal) shear was plotted for four sections along the beam. These curves show a variation from the theoretical

shear, which is plotted as a dotted line. At a section 0.05 inches from the point of application of the load, the maximum value of shear, instead of occurring at the center of the beam, as indicated from the

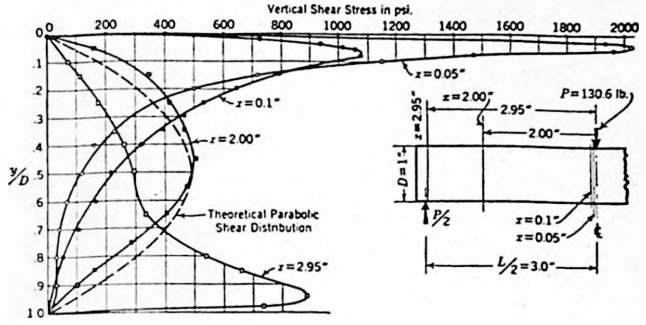

FIG. 3

theory, occurs at a point very near the top, and is approximately four times the indicated theoretical value. At a section 0.1 inches from the point of application of the load, the maximum horizontal shear has decreased to about twice the theoretical value, and is still very near the top of the section. A section taken very close to the third point gives a shear distribution similar to the theoretical distribution. Close to the support, the shear diagram is again distorted, this time giving a maximum close to the bottom of the beam.

In addition to finding the shear developed in a model, it is possible to evaluate the values of p and q independently. However, this involves an application of partial derivatives between finite limits, and it is beyond the scope of this paper. Suffice it to say that it is a reasonably simple operation for a confirmed mathematician. With the independent values of the major and minor principle stresses, and a knowledge of the method of graphical analysis developed by Mohr, and known as the Mohr Circle

Method, it becomes possible to obtain all the data required in the most complete analysis of elastic properties.

Space will not permit us to examine special structural shapes or machine parts. However, it would be well to remember that it is in the study of such special shapes and machine parts that photoelasticity is of the most value. Design engineers are finding it a great aid to their work, and because of photoelasticity better and more efficient designs are coming off the drafting boards.

The Ford Motor Company has constructed gear assemblies of plastics, and is now studying stresses developed in these gears as they transmit power. At Tulane University research is being made on a plastic model of a fixed-end arch, which is as difficult to analyze theoretically as any structure the civil engineer is likely to encounter. These are only two examples of the vast amount of research going on today which will produce a better world tomorrow. Photoelasticity is today an adult science, giving accurate results, both qualitatively and quantitatively. As the world looks to greater structures and better machines in the future, photoelasticity stands ready to help the design engineers in the fulfillment of the world's dream of better things to come.

Photographs and graph reprinted by permission from "Photoelasticity" by Max Mark Frocht, published by John Wiley & Sons, Inc.

THE BROWN BOVERI COMBUSTION GASTURBINE

PAUL R. SIDLER *

BRIEF HISTORY

Many papers on gasturbines and their possibilities, which have been presented in engineering meetings or printed in technical periodicals during the last 3-4 years have devoted very considerable space to a historical survey, going back to a first gasturbine patent issued in England to one John Barber in 1791. While it is not recorded that Mr. Barber ever built such a turbine there have been numerous attempts since the beginning of this century. Most of them had no practical result in that the power developed by the turbine proper was not sufficient to drive its auxiliaries, notably the compressor furnishing its combustion air. Noteworthy among them is the gasturbine built by Armengaud and Lemale in Paris in 1906, which developed no useful power either but was the immediate cause for the design of centrifugal air compressors. These machines have since found application in many different fields.

Only the explosion gasturbine of Dr. Holzwarth achieved a certain measure of success and developed useful power. It was first conceived around 1905 and carried through various stages of development; several units have been built through the years and have seen continuous operation for some time.

Brown Boveri & Co. carried on research and development work on some of the problems present in the Holzwarth cycle since 1909 and actually built some explosion turbines for Holzwarth's account. These activities provided valuable experience in many related fields and helped materially in the ultimate design of continuous combustion turbines. Before such turbines became a reality it was, however, necessary to solve many other problems connected with high temperature applications of metals, aerodynamics as related to compressor design, etc.

A new field of application for supercharging was opened by the war in Europe and the resultant shortage of gasoline or oil in Switzerland. The possibility of using wood producer gas

* Resident Engineer, Brown, Boveri & Co. Ltd. Presented at the Annual Meeting of the Society, January 13, 1945.

in internal combustion engines had already been studied before, but always ran up against the obstacle of a power loss between 25 and 40 per cent on account of the lean fuel. A certain improvement could be obtanied by increasing the compression ratio of the engine.

By supercharging the wood gas producer to deliver its gas under a higher pressure, (about 5 lbs. gauge) and also furnishing the combustion air at the same pressure, the original power rating is restored to the gasoline or Diesel engine, without the need for increasing the compression ratio.

A large number of trucks have gone into operation in Switzerland during the recent war years and have been a real salvation in the maintenance of essential road transport. While some of these plants will no doubt be re-converted to gasoline or Diesel oil after the war, there is probably a field for supercharged wood-gas producers in many parts of the world where the supply of oil fuel has always been difficult. Lumber camps in remote regions are one instance.

Over 2000 exhaust-gas turbine driven superchargers of the Brown Loveri design are in operation in the world today. This does not include superchargers on airplanes as no records are now available on this application. This contribution to the gasturbine power unit has been twofold:

a) steady improvement in centrifugal compressor efficiency and design.

b) experience in design and operation of turbine blading at high temperature, especially also from airplane superchargers.

It should also be noted in passing that an application of the same supercharging principles to other problems of combustion or in chemical processes has achieved many worthwhile improvements and further advances on the road towards a self-contained gasturbine. Two of them will be presently discussed.

VELOX STEAM GENERATOR

During the early work in connection with Holzwarth explosion turbines certain observations on heat transfer deviated

substantially from the expected results based on the known theory. This led to a systematic investigation of heat transfer prbolems under varying conditions of speed, surface shapes etc. and provided sufficient data for the development of the Velox Generator around 1930. Fig. 1 shows its basic layout. Combustion takes place under a pressure of 20 - 35 lbs. gauge

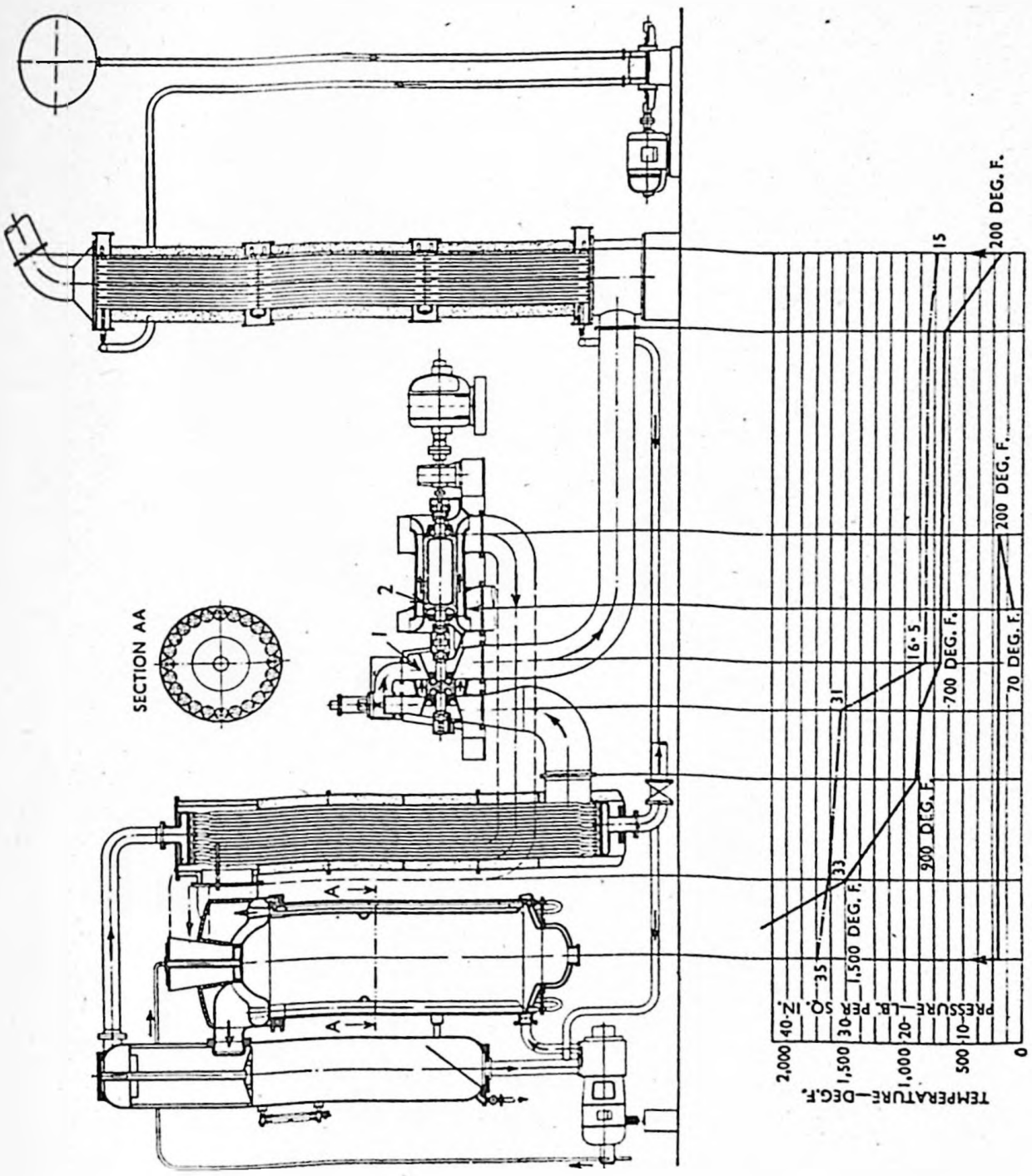

Fig. 1. Velox Steam Generator
1. Gas Turbine
2. Compressor

and results in very high gas speed along the evaporator surfaces and correspondingly high heat transfer rates. This in turn makes it possible to generate steam in a space about one-tenth of that occupied by an ordinary water tube boiler for the same output. After passing the superheater the gases expand through a turbine of 4-5 stages which drives an air compressor for delivering the combustion air. At the right is an electric motor for starting the charging set and thus the boiler, and for furnishing additional torque to initiate load changes.

Over 75 Velox Boiler installations of various sizes are in operation in the world today, not counting a considerable num-

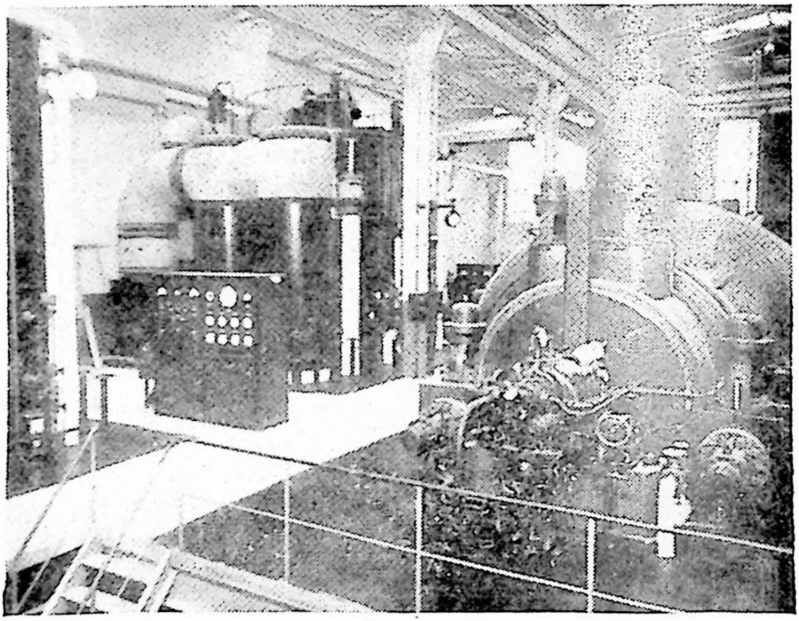

Fig. 2. Velox Steam Generators, Steam Turbine. Oslo, Norway.

ber of units in naval vessels. They operate on oil or gas fuel; some also alternating between the two, depending on supply conditions.

Fig. 2 shows the initial plant at Oslo, Norway, completed late in 1936. At the left are two Velox units, each of 176,000

lbs. of steam per hour, 400 psi, 800°F, total temperature. At the right is the turbo generator set which consumes their steam and develops 31500 kw. In 1938 a third Velox unit of the same size was installed to serve as stand-by. It will be noted that the Velox design makes it possible to install boilers and turbine side by side. Obviously this results in important economics in building costs and particularly also operation.

All Velox units built since 1934 have axial air compressors and the power surplus from the charging set is sufficient to drive the other auxiliaries, the circulating, fuel and feed pump.

HOUDRY UNITS

While many of the large oil companies in this country were only moderately interested in the Velox Development, two of them, Sun Oil and Socony-Vacuum, saw early in 1936 a possibility of using some features of the Velox cycle, particularly its charging set—taken separately and magnified—in their newly developed Houdry process of catalytic cracking. This process requires large volumes of air to re-activate its catalyst, by burning off coke and carbon deposits at regular intervals. This operation is carried out under a pressure of 45-50 psi and the resulting combustion gas, issuing at a temperature of 900°F, is expanded in a gasturbine.

The turbo-compressor set is started by the starting motor, here designated as generator. When it reaches about 20 per cent of its normal speed the air delivery of the compressor is already sufficient to start the burner in the combustion chamber to produce hot gas for the turbine. This turbine then brings the speed up to normal and the air supply to the process can be switched on. This air is brought up to about 900°F. The pressure drop through the process is about 7 lbs. The turbine expands the gas down to atmospheric pressure and a temperature of about 600°F, thereby developing not only the entire driving power for the compressor but a sizeable surplus which can be fed back into the electrical system through the starting motor, now running as generator.

Fig. 3 shows the first gas-turbine driven axial compressor set built for the Houdry Process in 1936, with the top-half of the casing removed. At the left is the five-stage gas-turbine,

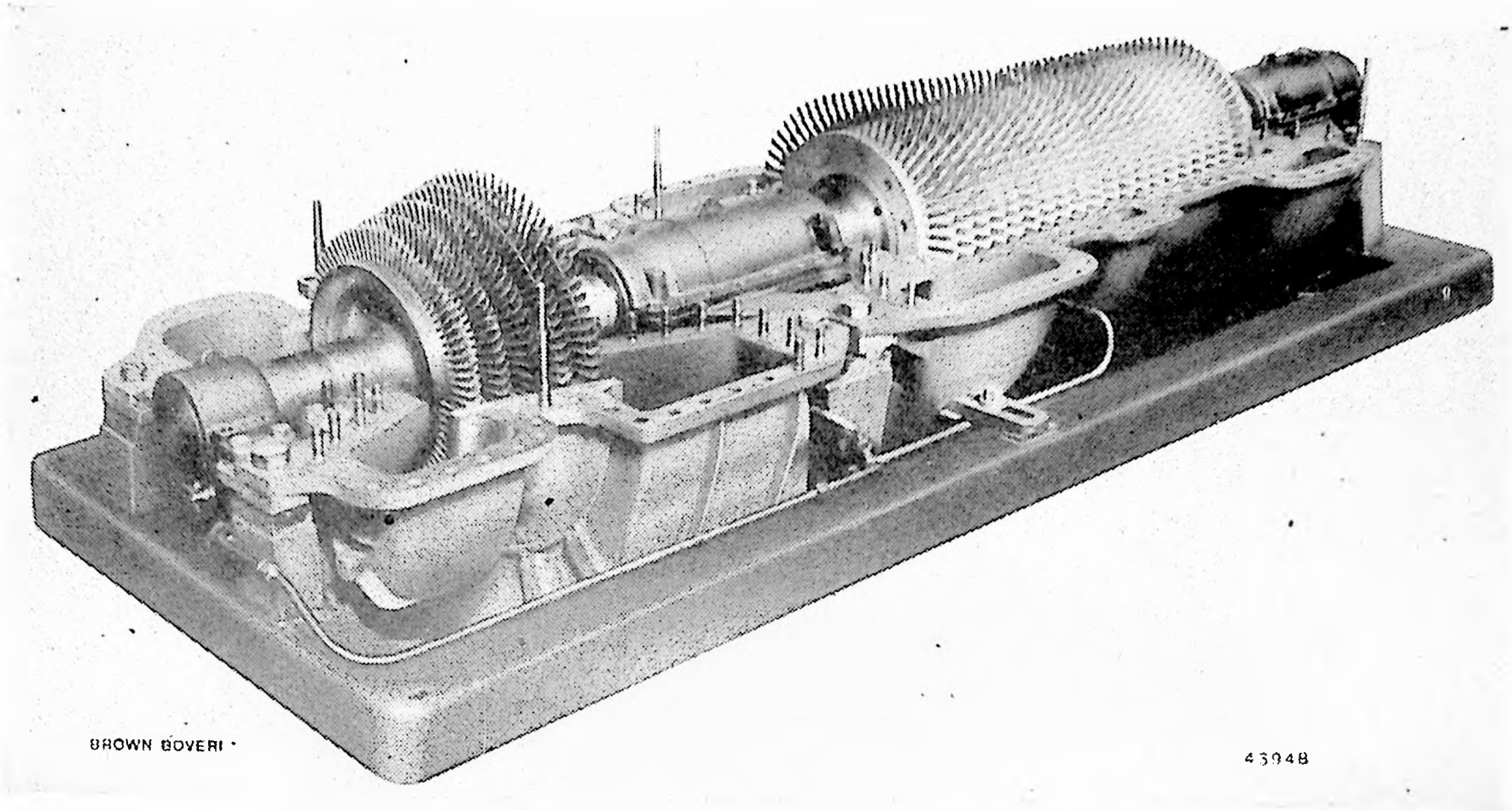

Fig. 3. Five Stage Gas Turbine, Twenty Stage Axial Compressor.

at the right the axial compressor of 20 stages. The compressor is rated for 40,000 cfm of free air. At full load it requires an input of approximately 4400 kw. The gasturbine develops an output of 5300 kw, thus leaving a surplus of 900 kw, which is taken out in the form of electrical energy. The actual installation thus includes a reduction gear 5200/1800 rpm,

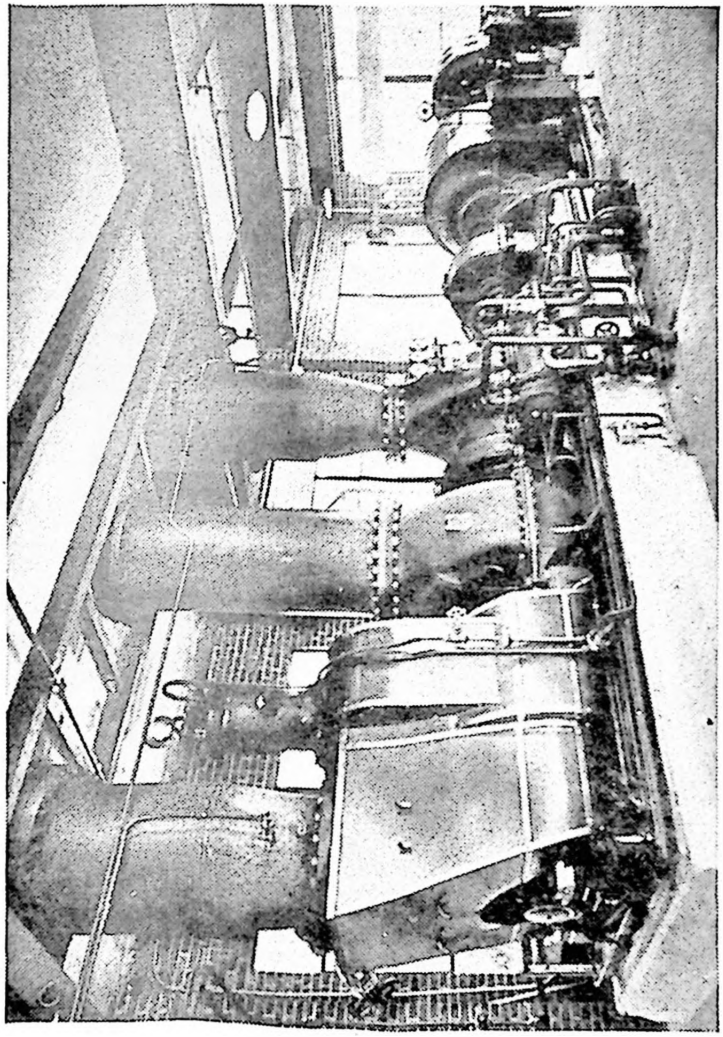

Fig. 4. Installation at Sun Oil Co., Marcus Hook, Pa.

coupled to the right end of the compressor, an A.C. generator and a starting motor with detachable coupling.

This installation is shown in Fig. 4. It is located in the refinery of the Sun Oil Company at Marcus Hook, Pa., and has been in practically continuous operation since January, 1937, without requiring more than routine maintenance.

These two sizes have since become standard and have been duplicated many times. The first eight units, four of each size were imported from Switzerland while subsequent units were built by Allis-Chalmers in Milwaukee under license from Brown Boveri. Nearly 30 units are now in essential operation in this country for the production of high octane gasoline.

Although the primary purpose of these units is the supply of air under conditions directed by the requirements of the Houdry Process, this power surplus—as a welcome by-product—makes them already gas-turbines in the true sense of the word. They also include all the essential elements of the power gas turbine. It was then a relatively small further step to the gas turbine built for power production exclusively.

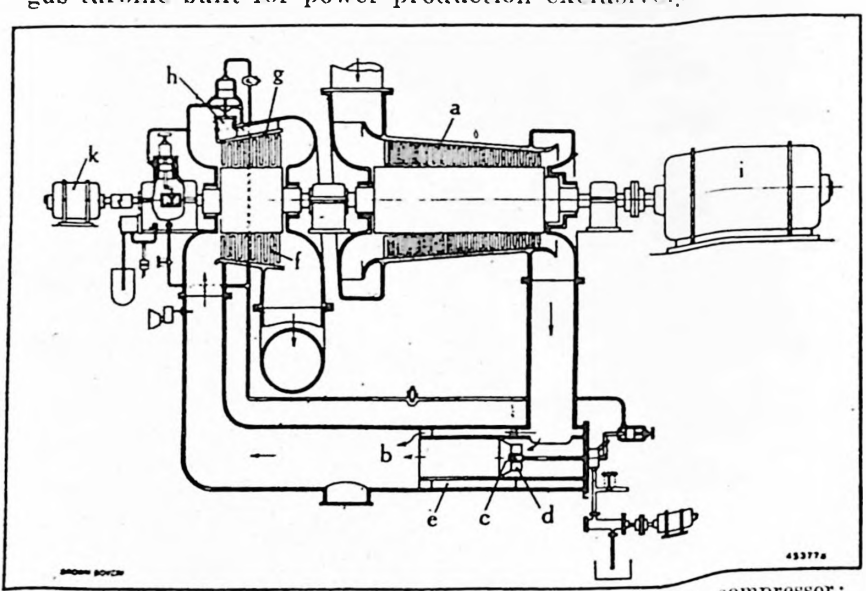

Fig. 5. Simple Gasturbine Driving Generator. a. Axial compressor; b. Combustion chamber; c. Ignition point; d. Burner; e. Burner jacket; f. Gas-turbine blading; g. Reaction type gas turbine; h. By-pass safety valve; i. Electric generator; k. starting motor.

GAS TURBINES FOR POWER

Fig. 5 shows the diagram of a gasturbine plant in its simplest form. It is closely similar to the one shown for the Houdry application, except that this process equipment is eliminated.

The air is taken into the compressor from the atmosphere and compressed in about 24 stages to about 60 psi gauge. The temperature of the air at the compressor discharge is about 360-380°F, assuming an inlet temperature of 60°F. It then enters the combustion chamber, where it is subdivided. A smaller part (about 25%) goes through the burner and actually participates in the combustion of the liquid or gaseous fuel. The greater part of the air is by-passed around the burner and serves to cool it. Its main purpose is, however, to dilute the hot combustion gases and to reduce the temperature of the gas-air mixture to the present limit of 1100°F, for which the inlet elements of the turbine can be built. The pressure drop through the combusion chamber is about 1-1½ psi, so that the gas mixture enters the turbine with a pressure of 58½-59 psi gauge. It is expanded to atmosphere through 6 or 7 reaction stages and has exit temperature of about 600-615°F.

In the simplest layout the gas is then discharged to the open air. It becomes clear immediately that it is possible to utilize the heat contained in the exhaust gas, at the expense of a small back-pressure. The most obvious arrangement is to use the exhaust gas, at the expense of a small back-pressure. The most obvious arrangement is to use the exhaust gas for preheating the combustion air between the compressor discharge and the inlet of the combustion chamber.

At this point we might pause briefly to consider the theoretical basis of the gas turbine. It follows the constant pressure or Joule cycle—sometimes and I believe erroneously, also called the Brayton cycle. Fig. 6 shows a temperature entropy diagram. First assuming that there are no losses, we start at point A, at atmospheric pressure and 68°F inlet temperature to the compressor. Adiabatic compression to about 60 p.s.i. gauge brings us to point B. We then heat at constant pressure to point C (1112°F) and expand adiabatically through the gas turbine to point D, back at atmospheric pres-

sure and about 600°F. Returning to the starting point with inlet conditions completes our diagram.

In actual performance there are of course losses in compression and expansion and our real diagram is A-B'—C-D'. It will be noted that the lines of constant pressure are divergent and the net output is represented by the excess of the expansion work C-D' over the compression work A-B'.

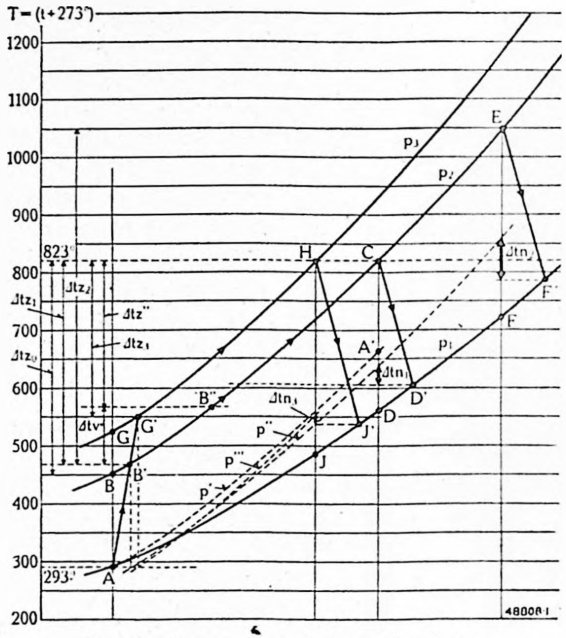

Fig. 6. Temperature Entropy Diagram

The diagram also shows the influence of higher temperature at the gas turbine inlet—heating up to point E and expanding to F' or the gain from higher pressure—compressing to G' and heating to H' with expansion to J'.

The first power gas turbine of 4000 kw, built as a stand-by unit for the City of Neuchatel, Switzerland follows the basic gas-turbine cycle just described. This set was completed in the summer of 1939 and operated for several months at the Swiss

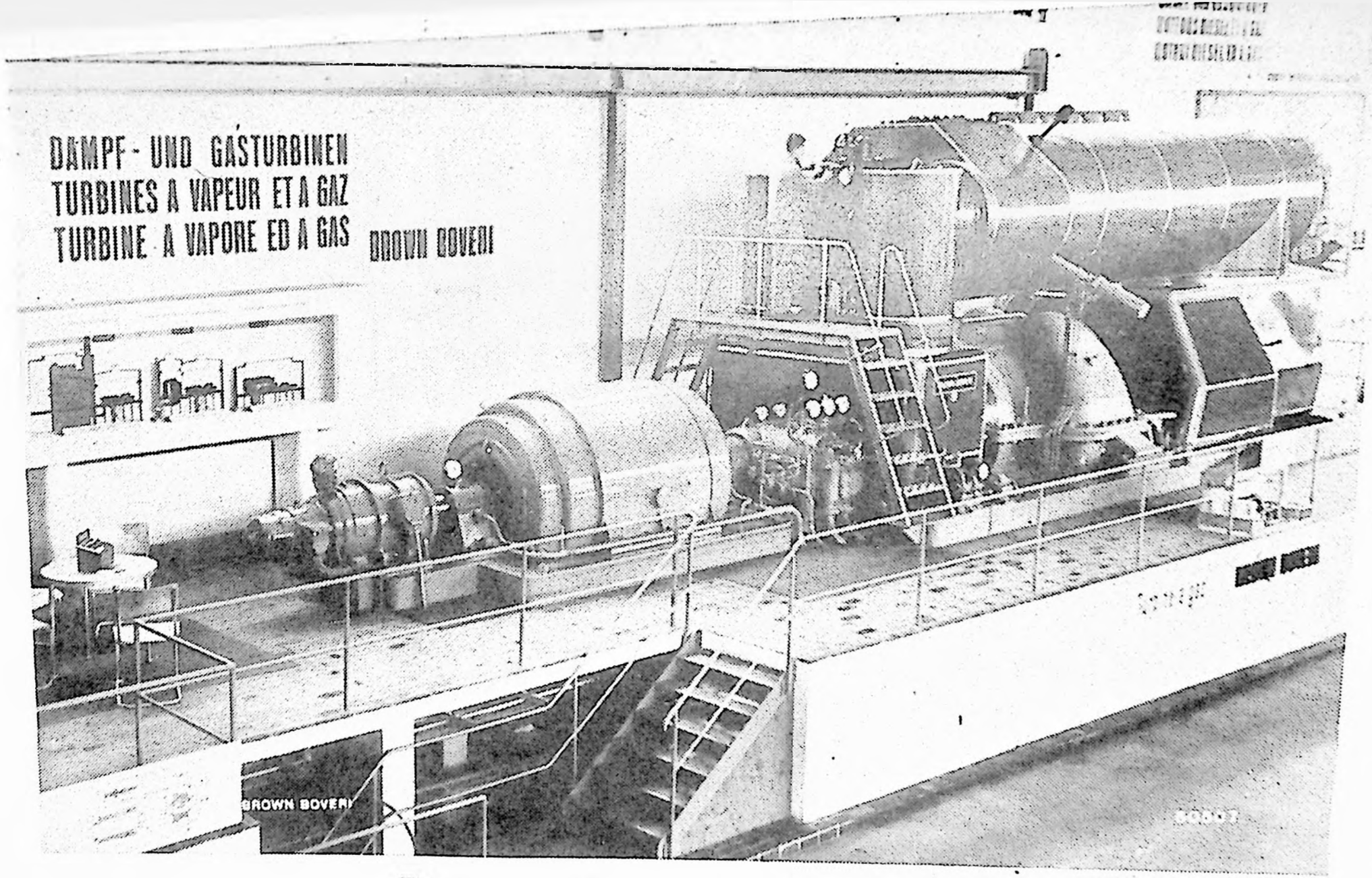

Fig. 7. A 4,000 KW Unit, Neuchatel, Switzerland.

National Exposition in Zurich. Fig. 7 shows this installation. After the close of the Fair it was transferred to the final location in a bomb-proof tunnel, where it has since served for peak-load or emergency service. With a full load output at the turbine coupling of 15664 kw and a compressor input of 11480 kw, the net output at the generator coupling was 4184 kw, and at the terminals 4041 kw. The thermal efficiency at this load was 18% referred to the generator coupling. By adding a heat exchanger of about 10,000 sq. ft. surface—using the exhaust after the turbine to preheat the air before the combustion chamber—the thermal efficiency would have reached 22%. As it was not intended to use this gas turbine for continuous service, even this addition was dispensed with.

The same basic arrangement, but with an air preheater, was adopted in the gasturbine locomotive 2200 hp. completed for the Swiss Federal Railways in the summer of 1941. Fig. 8 shows the diagram of this power plant without the electrical transmission to the axle motors. The main elements are as follows:

A Combustion Chamber
B Gas turbine
C Axial compressor
D Air Preheater
E Speed reduction gear
F D.C. Generator
G Supporting frame with lubricating oil sump

The compressed and preheated air is introduced into the combustion chamber partly as combustion air through the nozzle ring 1 and partly as cooling air through slots 2. The fuel enters through the injection nozzle 3. Combustion gas and cooling air mix in chamber 4 and form the driving gas proper (about 1100°F) which expands through the gas turbine. The exhaust gases which still have a temperature of about 690°F pass the air preheater from 5 to 6 and then leave through the locomotive roof. The air inlet to the compressor is at point 7. The outlet duct 8 from the compressor to the heat exchanger is provided with several expansion joints 9 to allow for differences in expansion in the turbine set and the preheater.

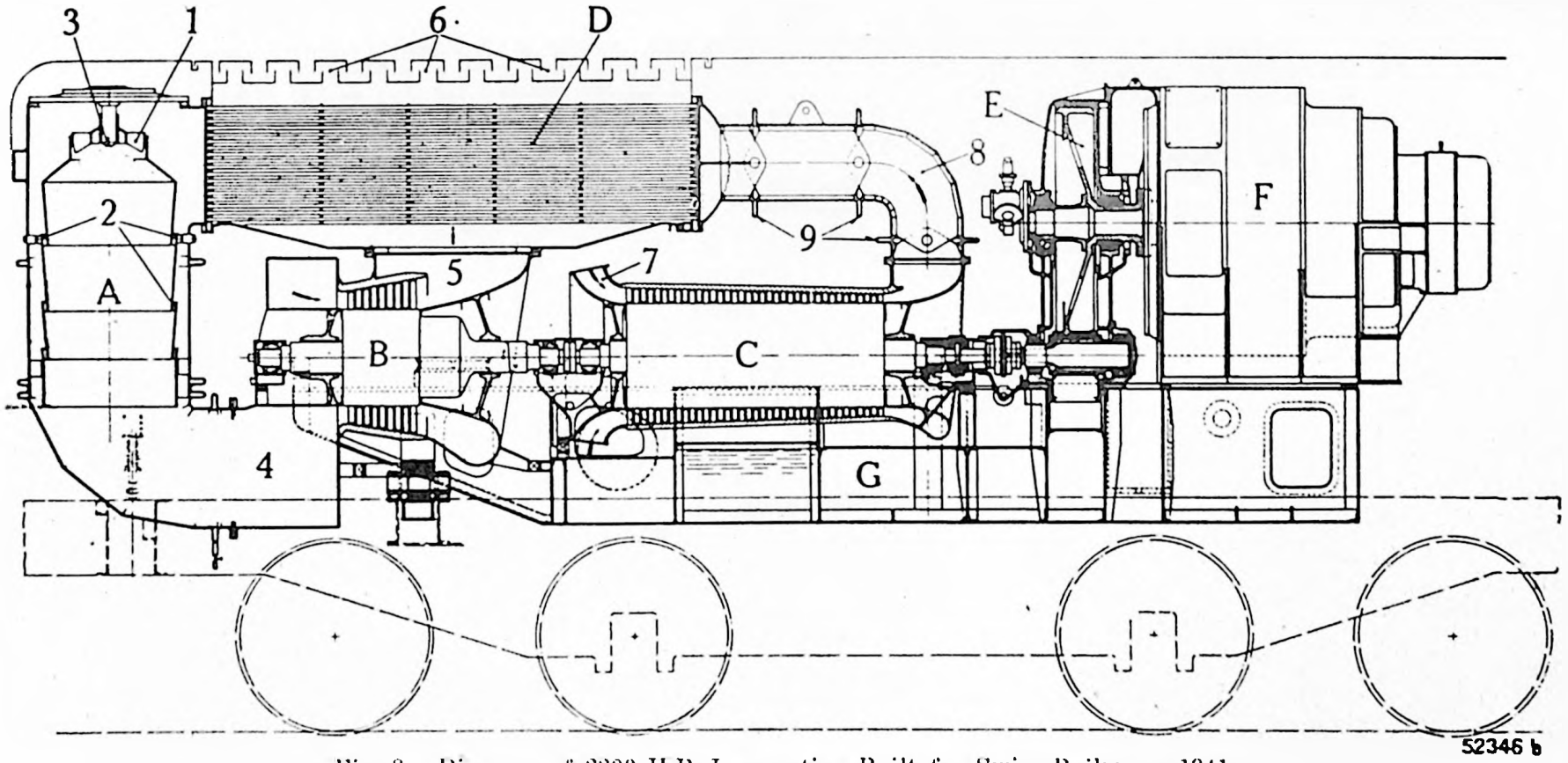

Fig. 8. Diagram of 2200 H.P. Locomotive Built for Swiss Railways, 1941.

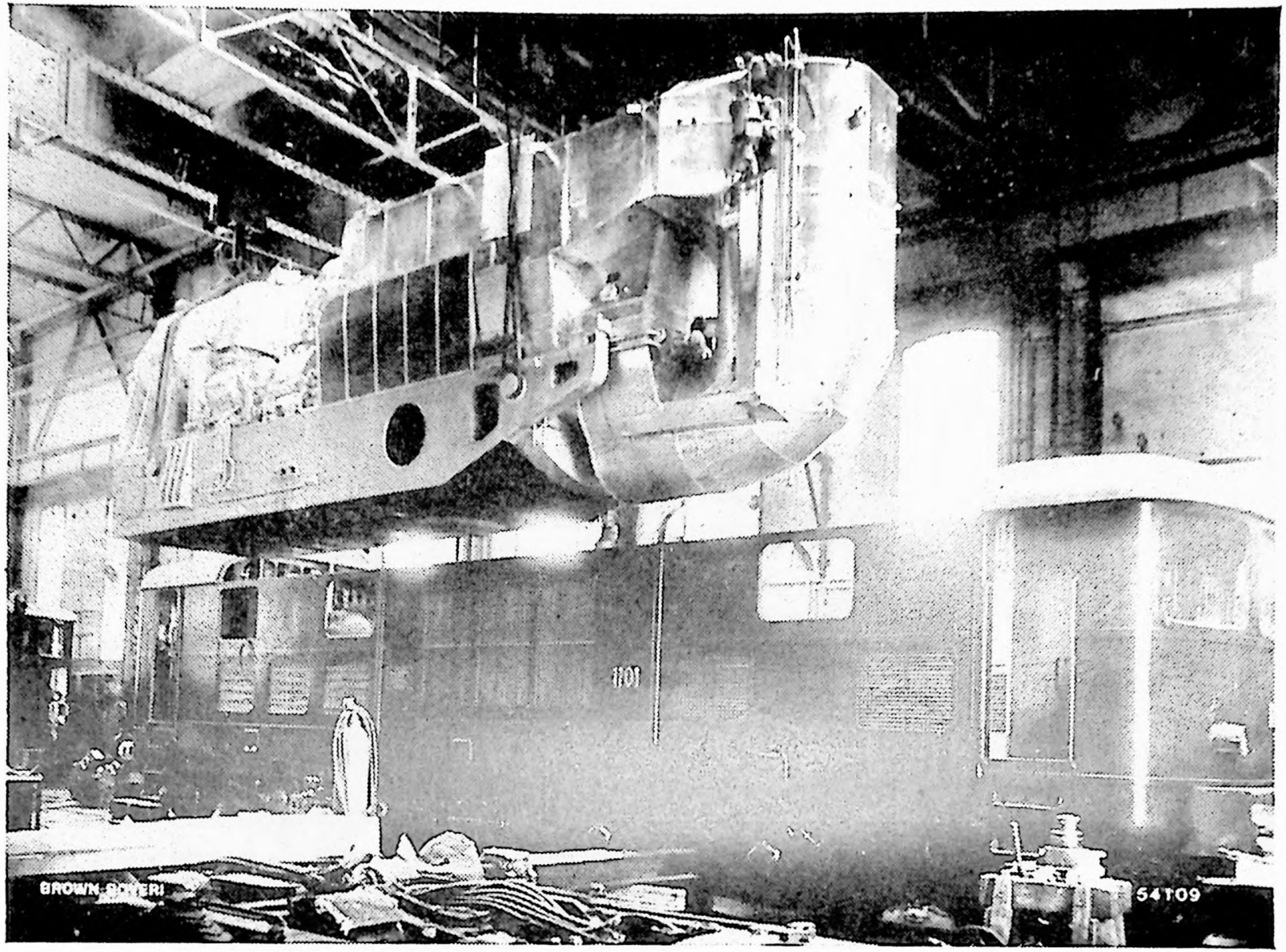

Fig. 9. Power Plant Being Lowered Into Locomotive Frame.

Fig. 9 shows the power plant being lowered into the locomotive frame.

Extensive trial runs were carried out with this locomotive in the fall of 1941 over various routes and steep grades and showed that all guarantee conditions had been amply met.

Tests have already demonstrated that the gasturbine locomotive holds great promise. For use in this country several details must, of course be changed to comply with American practice.

Using the experience gained with this locomotive power plant and with other gas turbines that are in regular operation, it was possible to redesign the locomotive unit to give 2500 hp. instead of only 2200 hp. With this "standard" unit and heavier electrical equipment detailed studies on locomotives for main line service in the United States resulted in two solutions which will cover all the service conditions now contemplated by American Railroads or fulfill all the tasks now performed by Diesel-electric locomotives on the several streamliners.

Fig. 10 shows a 5000 hp. locomotive for passenger or freight service with fuel tender. Its power plaint consists of two standard units of 2500 hp. each. The overall length of the locomotive is 98 ft. Diesel-electric locomotives for approximately the same capacity would require 3 or 4 lengths, totalling 193 or 210 ft., depending on the service.

OTHER APPLICATIONS

Aside from the two most promising applications just discussed there are several others which show similar advantages, and are entirely practical now. One of them covers the use of gas turbines as power plants for wind tunnels, as used extensively in airplane research. These plants require large blocks of power during relatively short test periods and are thus not very desirable customers for utilities. The inherent characteristics of the gas turbine—especially its rapid starting ability from cold to full load in 3-5 minutes—make it ideally suited for this service. In this application it is desirable to install two gas turbines, one rated for driving the air compressor only and the other, corresponding to the net surplus power,

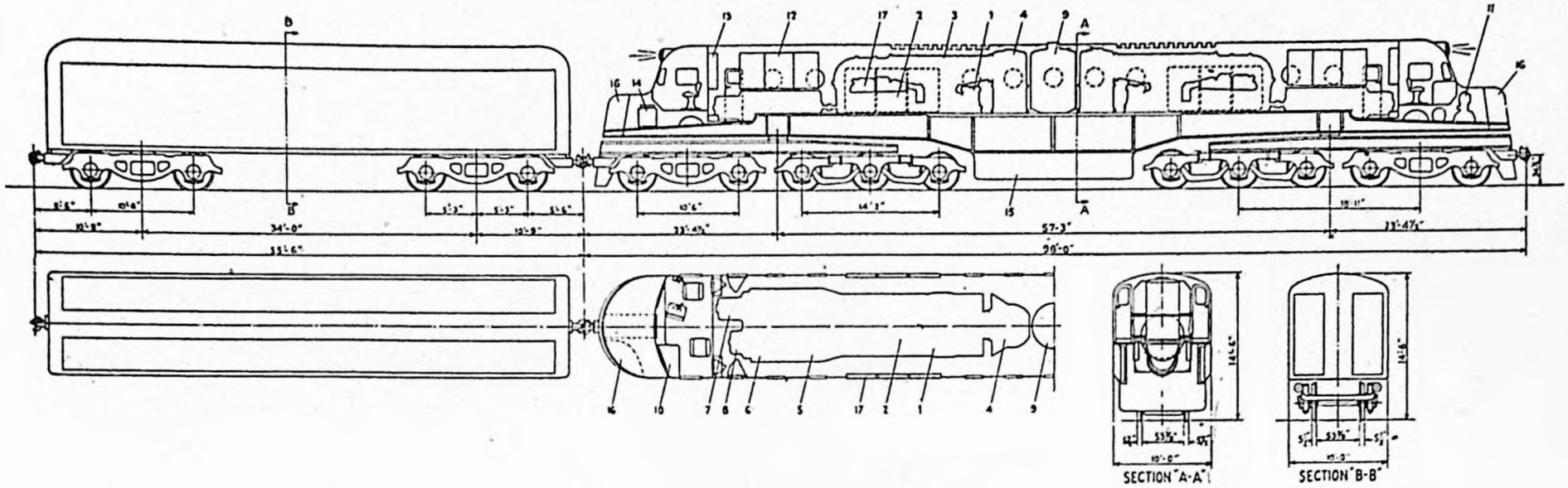

Fig. 10. 5,000 H.P. Freight and Passenger Locomotive With Fuel Oil Tender

1 Gas turbine
2 Turbocompressor
3 Air preheater
4 Combustion chamber
5 Reduction-gear set
6 Main generator group
7 Auxiliary generator
8 Brake-excitation generator
9 Steam boiler for train-heating
10 Storage battery
11 Auxiliary Diesel generating set
12 Electrical control apparatus
13 Control apparatus in engineer's cab
14 Air-brake compressor set
15 Water tank for steam boiler
16 Fuel-oil tanks, main supply from tender
17 Lubricating-oil radiators

coupled to the wind tunnel fan through gearing. Two units, each of about 2500 kw net capacity, have been completed nearly five years ago and have been in operation for about four years. Unfortunately war .time restrictions have so far prevented any disclosure of operating results.

Another interesting application which has already been translated into practice in two or three instances, is found in blast furnace plants. Here the gas turbine is fired by blast furnace gas and the air compressor furnishes not only the combustion air, but also the blast air. As the air required for combustion and cooling has a much larger volume than the blast, even large changes in the delivery of blast air only result in moderate variations in the total volume of the axial compressor.

When designing these sets it was expected that the adiabatic efficiency of the air compressor for blast furnace (bout 35000 cfm) use would be at least 18%, i.e. already substantially higher than a plant with boiler and condensing steam turbine driving a blast furnace blower. Tests with the completed machines have shown a somewhat higher efficiency, thus making it possible to improve the guarantees for future machines.

I realize that blast furnaces are not too frequent in this part of the country. There is however a rather close relation of this application—where the useful power is taken out in the form of compressed air—to a use of gas turbine driven compressors in natural gas pipe lines. The blast air is tapped from the axial compressor at a suitable pressure. This arrangement would be followed for small and medium sized units, up to a blast volume of about 60,000 cfb. For larger units design limitations make it desirable to split up this single axial compressor into two units coupled together, one handling the combustion and cooling air for the gas turbine and the other delivering the blast air.

If we picture the set with these two separate compressors and now run one of the compressors on natural gas, we have a unit suitable for pipe line compressor stations.

In this application we normally would not pick up the natural gas at or near atmospheric pressure but with a line

pressure of 200-500 psi and would compress it to 400-750 psi, depending on the pipe line layout, distance between compressor stations and other factors. This corresponds to a compression ratio of only 1.5-2, for which the axial compressor is ideally suited.

In an actual plant, it will not be necessary to provide for an electric starting motor. The unit could probably be started up more simply by the incoming gas. Again the fuel gas compressor will not be needed. On the contrary it may be necessary to reduce the natural gas pressure through a reducing valve before going to the burner.

The advantages of gas turbine driven sets as against reciprocating engines are of the same nature and magnitude as discussed for blast furnace applications. A very considerable space reduction, coupled with lower cost, lower maintenance, and the ability of the axial compressor to handle much larger volumes in one unit, make gas turbine compressor sets very attractive in this field. Gas compressors handling 150,000-200,000 cfm of natural gas, referred to standard conditions, are entirely practical now. With a heat exchanger of reasonable size, thermal efficiencies of 22-24%, corresponding to about 15600-14300 BTU/kwh, can readily be obtained and guaranteed.

Another most promising field for the gas turbine is as main power plant for ships, both merchant and naval. Some remarks about experimental work undertaken by several firms in this country for the U. S. Navy have already appeared in print. No details have, of course, been published and probably will not be published for some time to come. One manufacturer is also building an experimental gas turbine propulsion unit for the Maritime Commission.

It can be assumed that these experimental plants will have electrical transmission. There is, however, no need to go to electrical transmission in a ship propelled by a gas turbine. By adopting an arrangement as mentioned before for wind-tunnel drives, i.e. with separate gas turbine for the useful net power, it is readily possible to obtain the advantages of the gear drive. At the same time the problem of astern-operation or reversibility—which many consider as impossible of solu-

tion with a gas turbine—is solved in a manner following established steam turbine practice.

A definite project for a commercial tanker was worked out and accepted just before the outbreak of the war in Europe, but has not as yet been put into construction due to the war. The power plant develops 4000 Shaft HP and follows the arrangement with two pressure stages in gas turbine and compressor, with intercooler between the two compressors, but no air preheater. There are two gas turbine-driven compressor sets, also the two combustion chambers and a separate power turbine driving the propeller through double reduction gear. Built together with this propeller turbine, on the same shaft, is the astern turbine for 2800 Shaft HP. Two steam boilers are provided, feeding the two steam turbine-driven generator sets, each of 300 kw for port and auxiliary services, lighting etc.

The following additional data may also be of interest:

Speed of high pressure turbo-compressor set: 81000 r.p.m.
Speed of low pressure turbo-compressor set: 5350 r.p.m.
Speed of propeller turbine: 6500 r.p.m
Speed of Propeller: 75 r.p.m.
Final compression pressure at H.P. stage: 132 psi gauge.

For this plant an overall thermal efficiency of 21% would be guaranteed, corresponding to a consumption of fuel oil of 0.68 lbs./SHP. While this is not up to the results of the most modern steam propulsion plant of large capacity ships, it is better than most steam power plants on medium sized ships that were in operation in 1939.

In comparison to Diesel propulsion it has the advantage of substantially lower cost and particularly space and weight ($-106/HP complete; 50 lbs/SHP; 4.8 cuft/SHP). The fuel consumption is much higher than that of a Diesel plant, but the fuel used is also much lower in cost (2:1 or at least 5:3). Maintenance will be of the same order as for steam turbines, i.e. only a fraction of the maintenance on Diesel engines.

These studies were made in 1939. Based on further experience and operating results obtained since that time, a ship's plant of 4000 SHP could now be built for a fuel consumption

of 0.56 lbs./SHP (the older one was 0.68 lbs./SHP) without going above 1112°F. in the gas turbine inlet temperature.

APPLICATIONS STILL IN RESEACH AND DEVELOPMENT STAGE

All gas turbines built up to now burn oil or gas fuel. The field of application would, of course, be increased tremendously if it were also possible to use solid fuel.

Research and development work on a powdered coal burning unit has been going on for over three years, paralleled by similar work on a coal-burning Velox boiler. The results obtained so far are encouraging but a lot remains to be done until a practical unit for continuous service emerges from this work.

It has been pointed out that the development of the axial compressor was the most important step on the road towards a practical gas turbine. Gratifying as the performance of this compressor is, it still has its limitations. One of them, which has not been seriously felt in the present applications, is its somewhat narrow range of volumes, especially when speed variation is not permissible. Variable pitch blading, similar to variable pitch propellers on airplanes or ships, will produce an equally satisfactory solution for this problem.

An experimental three-stage high-speed blower of this type, has been built for a systematic development program in 1941. While the rotor is running at constant speed of about 7800 r.p.m. the blades can be adjusted between 0 and 45 degrees, thereby changing the delivery volume from zero to 6400 cfm. at a maximum pressure of about 16.5 psi gauge. Axial blowers with this wide regulating range will no doubt find any uses, entirely independent from gas turbine plants.

OUTLOOK

All the gas turbine sets for Houdry Process applications or the six prime movers previously described have been built for gas inlet temperatures not exceeding 1112°F (600°c) and pressures between 45 and 60 psi gauge.

Improvements in efficiency of the cycle can immediately be obtained by adding heat exchangers and also by subdividing

both the compressor and the turbine into two pressure stages with reheating of the gas between the two turbines and possibly an intercooler between the two compressors. An example of this arrangement was the 4000 SHP ship's plant just discussed.

Theoretical computations published on various occasions have demonstrated that much higher efficiencies would be obtained if this subdivision were carried still further and also by increasing the pressure of the cycle. Such solutions will, however, result in complicated plants which are also expensive and difficult to operate. Suitable compressors of other types for obtaining considerable higher pressure are yet to be developed.

Other engineers have advocated increasing the gas inlet temperatures to 1500°F or even higher, but admit that suitable metal alloys for building turbines to withstand these temperatures continuously, are not as yet available.

Based on the experience accumulated during nearly forty years of constant effort in this field, Brown Boveri feels certain that efficient gas turbines can be built without going to any extremes in temperature and pressure and without sacrificing the low cost, small space and simple layout achieved in the several units built up to now

Let us, however, consider some of the possibilities for improving the cycle.

It has already been mentioned in connection with the Neuchatel turbine that by adding a heat exchanger of 10,000 sq. ft. surface the thermal efficiency will be raised from 18 to 22%. It is desired to raise the efficiency, especially at fractional loads, a two-shaft arrangement is a suitable answer. Here will be found a gas turbine driving the axial compressor only and another turbine driving the generator, fed from a common combustion chamber. This layout includes a heat exchanger using some of the heat in the exhaust gas after the turbines to preheat the combustion air before it enters the combustion chamber. The improvement comes largely from the fact that the compressor set can run at its most advantageous

speed corresponding to given partial load and is not tied down to constant speed by the frequency of the electrical system.

For the present it is entirely proper to stay on firm ground and be satisfied with a thermal efficiency of 25.5% at 1200°F inlet temperature. Let us recall, however, that we can gain 3-4% by adding a heat exchanger of reasonable size, and another 2-3% by subdivision, reheating and possibly intercooling between the two compressor stages.

Whether these refinements are necessary—or even desirable—at the sacrifice of simplicity and cost must, of course, be decided for each individual application.

Today we are not quite ready to go to 1200°F, but we know definitely that gas turbines for a maximum continuous temperature of 1112°F—with occasional short time peaks up to 1200°F can be built for reliable long time service.

An arrangement with compression in two stages and intercooling, but without heat exchanger is shown in our next diagram Fig. 11. This layout would come into consideration for capacities between 5000 and 12000 kw where low cost is the main object and not highest efficiency, such as peak load or standby units. A 10,000 kw set following this diagram is now being built in the Brown Boveri shops and should be ready for tests in the near future.

For base load units a heat exchanger of suitable size will, of course, be added. Fig. 12 shows the diagram for a high efficiency plant of this type. You will again observe the 2 G.T. driven compressor sets, the low pressure set at the bottom and the high-pressure set with direct coupled generator at the top. In the upper left corner is the heat exchanger using the exhaust gas from the L.P. turbine to preheat the air before it enters the high-pressure combustion chamber.

A set of 10,000 kw net capacity can be built with a guaranteed overall thermal efficiency of 27.7% at full load. This corresponds to a heat rate of 12400 BTU/kwh and compares very favorably with steam plants for the same capacity. Its cost is materially below that of steam plants even with the

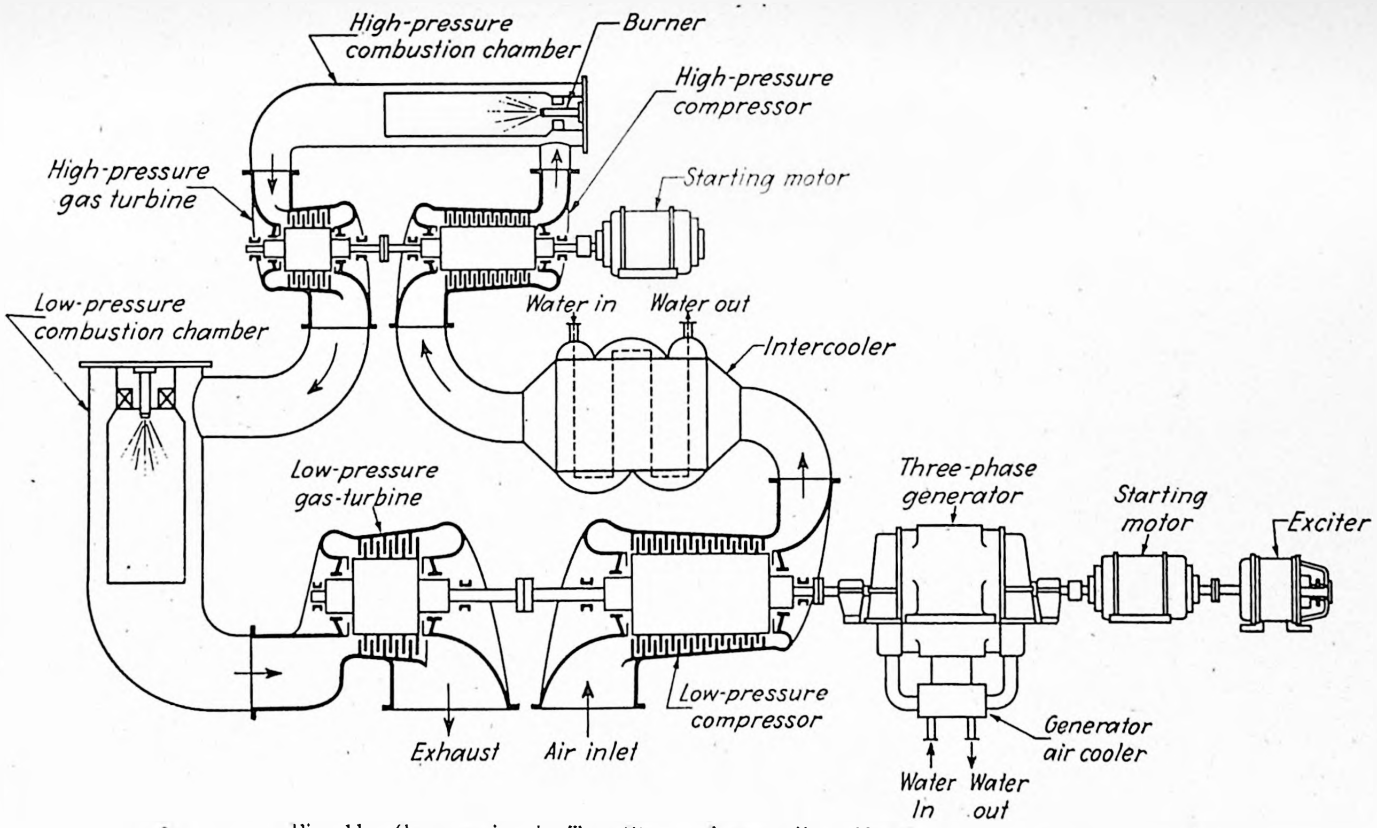

Fig. 11. Compression in Two Stages, Intercooling, No Heat Exchanger.

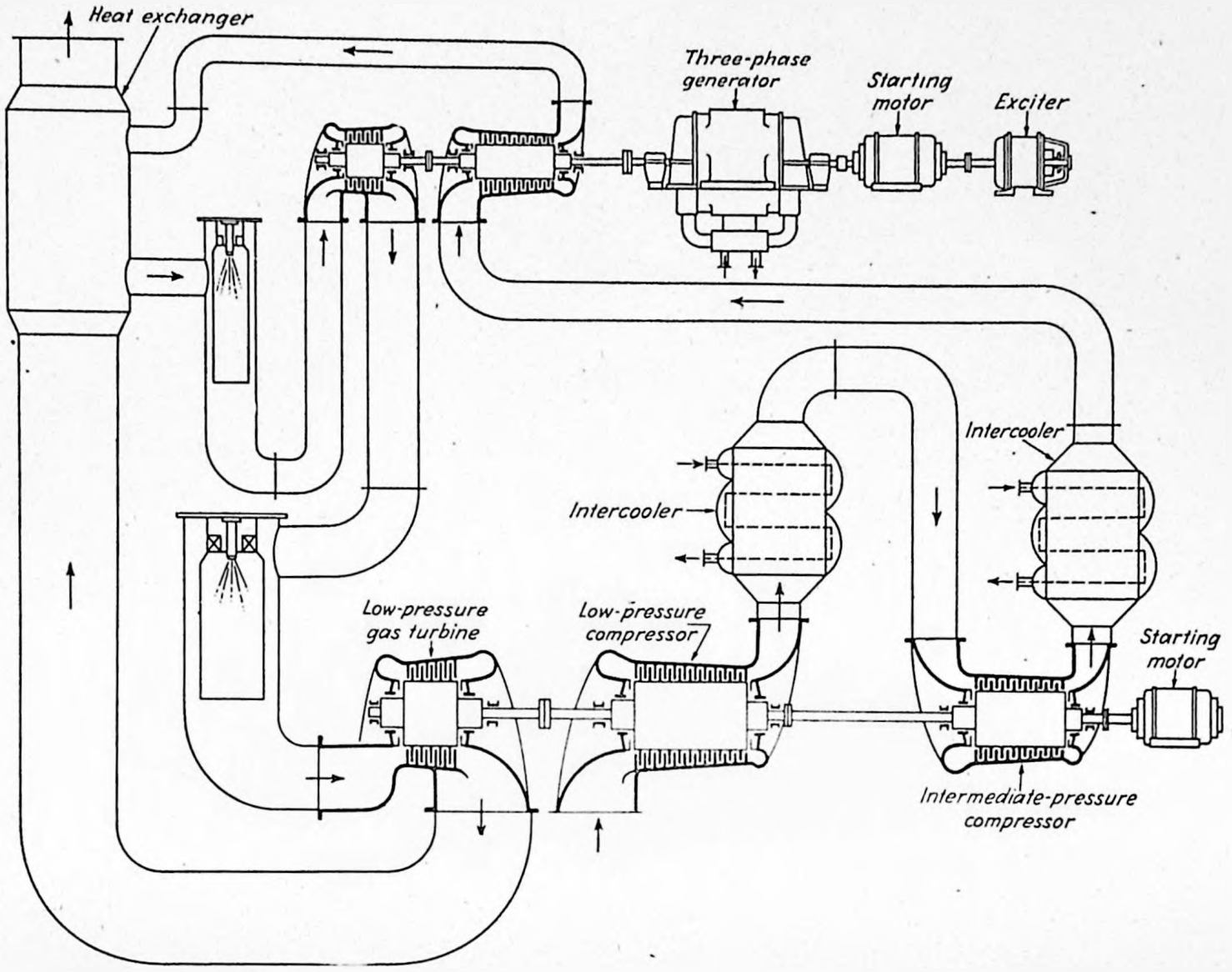

Fig. 12. Two Stage Compression, Intercooling, Heat Exchanger.

present high production cost which affects the gas turbine more directly than the long standardized boiler steam turbine combination.

In maintenance gas turbines will not require more attention or expense than is customary for steam turbines. Many gas turbines in Velox plants and the earlier Houdry units built by our Company have meanwhile operated 50,000 to 70,000 hours without any major overhaul. In particular they still work with the original gas turbine blading.

I hope I have made it clear that the gas turbine power unit is entirely practical now, i.e. without awaiting future developments in high temperature alloys. We are ready to build gas turbine generator sets between 1000 and 1200 kw net capacity for stationary plants or other applications with firm guarantees on workmanship, output and efficiency, that is to say on the same basis as steam turbines.

If high efficiency is not of particular importance, and where simplicity and low cost are most important—as for instance in peak load and standby-plants—we are prepared to build 500 kw units also.

Considering all these factors, we believe that gas turbine generator sets deserve the serious attention of engineers for immediate use wherever liquid or gaseous fuel is freely available and where water is scarce.

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of the Annual Meeting of the Society, January 11, 1945

The meeting was called to order by President Kerr, with approximately 150 members and guests present. Before the business of the meeting was taken up, an appeal for volunteers was made by Lieutenant Whitmore, Naval Recruiting Officer, who stated that a need exists for men with electrical, mechanical or civil degrees.

It was voted to dispense with the reading of minutes of the previous meeting.

The chairmen of various engineering groups were introduced by President Kerr.

Mr. Edwin M. Vennard, Vice-President, Middle West Service Company of Chicago, delivered a most interesting and informative keynote address entitled "How Can We Keep Freedom?"

The financial and membership reports for the year 1944 were presented by the secretary-treasurer. The annual report, reviewing the Society's activities for the year, was presented by President Kerr.

Juniors membreship awards to the following were announced by the president: Paul A. McKim, Louisiana State University; George L. Cunningham, Jr., Tulane University; Benjamin S. Brupbacher, Jr., Tulane University.

Life membership presentations were made to the following: Lester F. Alexander, Frederick N. Billingsley, James J. Bulliung, C. Glenn Cappel, Alvin M. Fromherz, Bernard H. Grehan, Farrar P. Hamilton.

Mr. K. P. Kammer, Chairman of the Nominating Committee, presented the teller's report and requested certain members of the Society to escort the newly elected officers to the front: Reinhard A. Steinmayer, President; Leo J. Lassalle, 1st Vice-President (absent); Clayton L. Nairne, 2nd Vice-President; John P. Fernandez, Secretary-Treasurer; John A. McNiven, Director for 2 years; John K. Mayer, Director for 2 years.

Retiring President Kerr then handed the gavel to President-elect Steinmayer, who made a brief summary of plans for the year. Several announcements were made regarding other events on the meeting program and, there being no further business, the meeting adjourned.

Secretary-Treasurer.

JOHN P. FERNANDEZ.

Minutes of Meeting of the Board of Direction, January 30, 1945

The meeting was called to order by President Steinmayer. Present were Messrs. Gosa, Kerr, Mayer, Nairne and Fernandez. Minutes of the preceding meeting were read and accepted.

Mr. Nairne reported that he had contacted several auditors and that the cost of auditing the Society's books by a certified public accountant would be approximately $100.

A letter from Mr. John K. Mayer, thanking the Secretary for the silver service presented to him upon his retirement as secretary-treasurer, was read. The secretary also reported that letters of thanks had been received from Mesdames Daniel S. Elliot and G. Arthur Seaver for flowers sent to the funerals of their respective husbands, and from Mrs. A. J. Naquin for the corsage presented to her by the Society.

President Steinmayer appointed a committee consisting of Messrs. B. H. Grehan, chairman, and Charles M. Kerr to write a memorial letter honoring the late G. Arthur Seaver. The president also appointed a committee composed of Colonel Edward S. Bres, chairman, Messrs. James M. Robert and James M. Todd to write a memorial letter in honor of the late William B. Gregory.

The budget for the year 1945 was discussed and it was moved and seconded that the chairman of the Publications Committee be urged to increase the number of advertisements appearing in the Society's Proceedings. Mr. C. L. Nairne, who made the motion, offered to assist the committee in securing new advertisers.

The secretary announced that an invitation had been received from the American Society of Military Engineers to attend their meeting on February 5. The invitation was accepted, and the secretary was instructed to notify local members of the meeting.

It was moved and seconded that the president write letters to the mayor of the city and the governor of the state, calling attention to the fact that out-of-state engineers have been employed by their respective governments and suggested that, wherever possible, the services of local engineers be used.

There being no further business, the meeting adjourned.

Secretary-Treasurer.
JOHN P. FERNANDEZ,

Minutes of Joint Meeting of the Louisiana Engineering Society and the American Society of Mechanical Engineers, February 19, 1945

The meeting was called to order by President Steinmayer, with approximately 100 members and guests present. Before the business of the meeting was taken up, President Steinmayer gave a few suggestions on procedure and parliamentary law. It was voted to dispense with the reading of the minutes of the previous meeting.

Mr. Mario Zervigon, chairman of the Technical Papers Standing Committee, announced that the speaker at the March meeting would be Mr. W. P. Schambra, director of the Chemical Engineering and Analytical Laboratories, Dow Chemical Company, Texas Division, on the subject "The Dow Magnesium Process at Freeport, Texas".

President Steinmayer read a letter from the Architectural Association extending an invitation to the Louisiana Engineering Society to attend their meeting on February 26.

The meeting then was turned over to Mr. Arthur M. Hill, chairman of the American Society of Mechanical Engineers, who, after conducting the business of that organization, introduced the speaker of the evening, Mr. Otto de Lorenzi, director of Education, Combustion Engineering Company, who gave a very enlightening discourse on "Liquid and Gaseous Fuel Burners".

Following Mr. de Lorenzi's address, Mr. Hill returned the meeting to Louisiana Engineering Society and President Steinmayer called upon Mr. Charles M. Kerr to read a memorial letter in honor of the late George Arthur Seaver, a former life member of the Society.

The meeting then adjourned with a rising vote of thanks to Mr. de Lorenzi.

Secretary-Treasurer.

JOHN P. FERNANDEZ.

Minutes of Meeting of the Board of Direction, March 6, 1945

The meeting was called to order by President Steinmayer. Those present were Messrs. Gosa, Lassalle, Mayer, McNiven, Nairne and Fernandez. Minutes of the preceding meeting were read and accepted.

It was proposed and agreed that the audit of the Society's accounts be made in April.

A proposed letter to be sent to the Governor of the State and the Mayor of New Orleans, regarding employment of Louisiana engineers on state projects, was read and approved with the exception that it was decided to send separate letters to each official instead of a joint letter addressed to both.

A letter from the chairman of the Membership Committee "B", recommending the following applicants for election to membership, was read:

W. D. Holloway, R. F. Messina, F. G. Hornsby, W. D. Morris, J. E. Quarles, D. R. Mabel, S. L. Hebrard, H. R. Mason, Earl Porter, R. G. Patterson.

It was moved and passed that the action of the Membership Committee be approved and the applicants' names be included on the next ballot.

Mr. Nairne reported on the preliminary meeting held in connection with the formation of an Engineers' Club in New Orleans. No action was taken by the Board.

The Engineers' License Law was discussed and in this connection it was proposed that Mr. W. H. Scales, chairman of the standing committee on legislation, be invited to attend the next Board meeting.

Mr. Mayer recommended that a card index of the entire membership be made. It was brought out that in preparing such an index a history of the Society could be made. It was moved, seconded and passed that $100 be appropriated for the preparation of a history of the Society and an all-time membership card index.

The matter of securing more engineer representation on the committees of the Association of Commerce was discussed, but action was delayed pending receipt of a list of committees from the president of the association.

There being no further business, the meeting adjourned.

Secretary-Treasurer.
JOHN P. FERNANDEZ.

Minutes of Meeting of the Louisiana Engineering Society, Monday, March 12, 1945

The meeting was called to order by President Steinmayer, with approximately 60 members and guests present. Minutes of the February meeting were read by the secretary and accepted.

Mr. M. G. Zervigon, chairman of the Technical Papers Committee, announced the speaker and the subject to be presented at the April meeting.

Mr. W. F. Scofield, chairman of the finance committee, reported that an estimate of $4,300 income and $4,700 expenditures was anticipated for the current year. President Steinmayer stated that it is hoped the apparent deficit of $400 would be overcome by an increase of advertisers in the Proceedings.

Mr. Harold E. Levey, chairman of the publicity committee, reported that his committee had been functioning smoothly and that it was their intention to acquire publicity not only for the society and its members but for any outstanding engineering work accomplished in this area.

Mr. James M. Todd read the high-lights of a memorial honoring the late William B. Gregory, and it was moved, seconded and passed that the memorial be accepted. A moment of silence then was observed in tribute to the deceased member.

Mr. J. H. Collins, chairman of the publications committee, reported that his committee would begin the solicitation of advertising for the Proceedings as soon as new contracts forms were received from the printer. An appeal was made for the names of prospective advertisers.

Mr. Nairne gave a progress report on the formation of the proposed Engineers' Club.

Mr. Levey then introduced the speaker, Mr. W. P. Schambra, who gave a most instructive talk, accompanied by colored slides, on the subject, "The Dow Magnesium Process at Freeport, Texas". Following his address, the meeting adjourned with a rising vote of thanks to Mr. Schambra.

Secretary-Treasurer.

JOHN P. FERNANDEZ.

Past Presidents

*Sidney F. Lewis.....1898
*Thos. L. Raymond.....1899
Henry J. Malochee.....1900
*Frank M. Kerr.....1901
*Alf. F. Theard.....1902
*Alf. Raymond.....1903
*J. F. Coleman.....1904
W. B. Wright.....1905
*W. H. Hoffman.....1906
*G. W. Lawes.....1907
*C. W. Wood.....1908
*J. T. Eastwood.....1909
*W. B. Gregory.....1910
*J. C. Haugh.....1911
D. S. Anderson.....1912
*A. M. Shaw.....1913
W. H. Williams.....1914
*L. C. Datz.....1915
*Samuel M. Young.....1916
A. T. Dusenbury.....1917
John Klorer.....1918
Ole K. Olsen.....1919
John Reiss.....1920
R. S. Manley.....1921
Donald Derickson.....1922
*J. S. Bareli.....1923
James M. Robert.....1924
Marcel Garsaud.....1925
Farrar P. Hamilton.....1926
Edward S. Lanphier.....1927
John L. Porter.....1928
Frederick H. Fox.....1929
James M. Todd.....1930
*Frank G. Frost.....1931
Frederick N. Billingsley.....1932
John H. O'Neill.....1933
A. L. Dunlap.....1934
Edward S. Bres.....1935
Allen S. Hackett.....1936
C. S. Williamson.....1937
Bernard H. Grehan.....1938
David W. Godat.....1939
William H. Rhodes.....1940
David W. Stewart.....1941
C. Glenn Cappel.....1942
Karl P. Kammer.....1943
Charles M. Kerr.....1944

* Deceased.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXXI JUNE, 1945 NO. 3

CONTENTS

EDITORIAL NOTES AND COMMENT

Private Versus Public Enterprises. Our membership is now considering certain resolutions dealing with the proposed valley authority, which may or may not be patterned after T.V.A. In any event, it will mean the government is entering into the utility field. For some enlightenment along this line it is worthwhile to review the appended article in the February issue of the Proceedings entitled "How Can We Keep Freedom."

New Members. We welcome the following new members of the Society.

For Member

Babin, Benton P. Age 46. Endorsed: K. P. Kammer, D. W. Stewart, J. M. Todd. Graduate L. S. U., E. E. 1920; 1920-24

Westinghouse Student and office work; 1924-26 Westinghouse Central Station, application engineer; 1926 to date, Westinghouse, New Orleans office, general application engineer. Associate A.I.E.E. New Orleans Section.

Burton, Charles A. Age 29. Endorsed: J. E. Monroe, Jr., R. L. Nall, Allen Betz. Degree, B. E. in Chemical Engineering, Tulane University; American Sugar Refining Co., 5 years, Engineers' clerk and Ass't. Plant Chemist; The Flintkote Co., Foreman, Colas Dept., 1 year; John H. Carter Co., Service Engineer, 1 year; The Flintkote Co., Ass't. to Plant Engineer, ½ year.

Butler, Soule. Age. 41. Endorsed: Charles A. Myers, N. E. Lant, H. L. Lehmann. Graduate of L. S. U., B.C.E. 1927; C.E. 1934. Resident Engineer, Arkansas Highway Department, 1928-31; Resident Engineer, La. Dept. of Highways, 1931-41; Associate Engineer, U.S.E.D., Galveston, Texas, 1941-44; Resident Engineer, La. Dept. of Public Works, 1944; present position: City Engineer, Alexandria, La.

De Buys, Rathbone. Age, over 50. Endorsed: C. M. Kerr, O. L. Olsen, John Riess, B. E. Graduate Tulane University, Civil Engineering; Ph. B. Graduate Yale Sheffield Scientific, Civil Engineering; 2 yrs. Asst. City Engineer, City of New Orleans; 2 yrs. Asst. Engr. Illinois Steel Co.; 1½ yrs. Resident Engineer, Illinois Steel Co.; Architecture & engineering over 30 yrs.

Erickson, Waldo Alton. Age 29. Endorsed: A. L. Dunlap, J. K. Mayer, G. Bertram. Graduate of Tulane University, 1937, M & E Eng'g.—B.E. Employed by Shell Oil Co., Norco, La., June 1937; Trainee, 1937-40 Inspector, 1940-42, Asst. Master Mechanic (Acting); 1942-44, Senior Engineer, 1944- to date.

Hebrard, Sidney L. Age 40. Endorsed: H. L. Lehmann, N. E. Lant, H. B.Henderlite. 1920-26 Instrument man on various land surveys; 1926-27 Chief of party, Rio Grande Valley; 1927-40 Ark. Highway Dept. Highway design; 1940-41 George P. Rice, New Orleans, Chief engineer on roads..... 1942-43 Fromherz Associate, New Orleans; 1943- date La. Dept. of Hwys., Baton Rouge, La., Highway Engineer grade 2.

Holloway, William Davis. Age 47. Endorsed: L. Vivien, D. W. Stewart, George Hammett. Approximately 15 yrs., as Erecting and Field Service Engineer for Westinghouse Elec. & Mfg. Co. 1935-41 Gulf Refining Co., Industrial Lubrication Service Engineer; 1941- date Gulf Refining Co., Superintendent of Industrial & Technical Lubricating Oils.

Hornsby, Franklyn Gordon. Age 41. Endorsed: W. Stone Leake, W. P. Knost, J. B. Coltharp. Twenty years experience with the Transmission and Distribution Dept. of The Gulf States Utilities Co. Supt. of Meters and Service.

Mabel, Daniel P. Age 31. Endorsed: C. W. Ricker, A. L. Dunlap, J. K. Mayer. B. E. in Mech. and Elect. Eng'g. Tulane University 1935; 1935-1939 Georgia Power Company; 1939-43 Westinghouse Elec. Supply Co.; 1943-44 Bell Aircraft Corp.; 1944- date Anaconda Wire & Cable Co.

Mason, Hiram Russell. Age 49. Endorsed: S. W. Elberson, C. W. Ricker, A. J. Dubus. Bachelor of Elect. Eng'g. Ohio State University 1917. Engineering Officer, U. S. Marine Corps 1917-19; 1919-25 Various engineering duties in the Marine Corps; 1926-29 Ass't. Professor fo Electrical Engineering Rose Polytechnic Institute, Terre Haute, Ind.; 1929 to present Professor of Electrical Engineering, outhwestern Louisiana Institute, Lafayette, La. Present title Professor and Head of the Dept. of Elect. Eng'g.

Messina, Richard Frank. Age 40. Endorsed: R. E. Gosa, C. Glenn Capel, J. K. Woolf. Bachelor of Engineering, Civil Engineering, Tulane University, 1930. Nine years of engineering work for general contractors, six years as sales engineer for equipment company of which a partner (Wm. F. Surgi, Equipt. Co.). Associate Member of A.S.C.E.

Annual Outing of the Society. Entertainment Chairman Dugan is working with his committee on plans for the golf tournament and dinner. The event is planned for July. It has always been a popular event; let's hope the weather man cooperates with plans for the occasion.

What of the Future? A letter from the Engineers' Council for Professional Development is presented in part. It will be worth your while to read it; some interesting facts and ideas are brought forth.

"The Engineers' Council for Professional Development has felt a very keen responsibility not only toward professional engineers practicing their profession who have entered the armed services but also to those young people studying for the profession whose education has been interrupted by the war.

"One of the most important matters to which I might direct your attention is the question of the demand for engineers in the post-war years, a question which not only involves practicing engineers in the armed forces but student engineers as well. **Personal opinions** of competent engineering executives and others in a position to know indicate that our demand for engineers will be tremendous and in excess of those here stated. We have tried to separate in our thinking the **factual matter** from the **matter of opinion.** The following **facts** seem to be pertinent and certainly represent an absolute minimum.

"From 1935 to about 1942 engineering graduates met the professional demand. Since 1942, due to the need of the war effort, it has not been possible to graduate engineers in numbers to meet even the current yearly demand. In the early part of 1945 we face a deficit, in this year alone, of about 18,000 engineers. If we should assume a demand in the post-war years comparable with that in the years before the war, we would face a total deficit in the year 1948 of 46,000 engineers. If we could meet this deficit we would have to take in this year as college freshmen about 90,000 students in place of the 25,000 we usually take in.

"This, if possible, would strain our facilities to the utmost, and while our hope is to take in as many of these freshmen as we can and to supplement them with as many returning servicemen as possible, it would seem that if we are to do anything to remedy this critical situation we must start immediately by using every source at our disposal to cut down the deficit. If not, we will continue to provide an insufficient number

of engineers for industry for a considerable number of years.

"This, of course, means that we must immediately enroll freshmen in as great numbers as we can, as soon as we can, and that we will want as many men as possible who have had any training in engineering who are now in the armed forces; men with one, two and three years of college training are important to us. The more training they have had the shorter will be the time required to wipe out the deficit.

"And just a word about the community responsibility with respect to the training and adjustment of these engineers and prospective engineers. It goes without saying that their placement and training will take place at the local level. It seems to me that the adjustment must be made where the contacts really are, and while we may attempt to plan nationally and regionally, the actual, realistic contact between the man and his problem is in his own community. While the community must comprehend, perhaps, the nature of the problem on a national level, something must be **done** about it on the community level.

If while the engineer, actual or prospective, is in the service, he could receive some indication that in his own community his professional society remembered him and were planning for him as a part of the community life; and if in addition to this definite interest, information could be furnished which would help him to solve his problems or to make his readjustment easier, it would be about the most helpful thing that could be done. It seems it would be beside the question to promise anything in the way of jobs or service, but it does appear that a live, local organization sensitive to the post-war professional needs can do much even now to help in the solution of future problems."

New Advertisers. Several new ads have been secured through the efforts of Chairman Collins and his committee members. These firms are helping us; let us not forget them when business is placed.

OBITUARY OF
WILLIAM FRANKLIN COOPER

The sudden death of William Franklin Cooper at Monroe, Louisiana on February 5, 1945, has brought a sense of keen loss to his many friends in Louisiana and adjoining states.

Mr. Cooper was born November 5, 1872 at Shiloh, Union Parish, Louisiana. He received his early education in the secondary schools of his native parish and at Mississippi College, Clinton, Mississippi. He entered the Freshman Class at Louisiana State University in 1892 and pursued the course in Civil Engineering. During his college career, he was quite active in various student activities. He and his cousin, the late Ruffin G. Pleasant, organized the first L.S.U. band which has continued from year to year up to the present time. He was president of the Kappa Sigma Fraternity and was ranking officer of the Cadet Corps in his senior year. He received the degree of B.S. in Civil Engineering in 1896.

From 1896 to 1922 Mr. Cooper had rather a varied experience. As engineer for the Rock Island Railroad, he located a road from Junction City to Winnfield, Louisiana and later as chief engineer for the Louisiana and Arkansas Railroad he located and constructed a line from Winnfield to Rinehart, Louisiana. He laid out the towns of Dubach and Jonesboro, both in Louisiana. He became mayor of Winnfield for a time and during this period conducted a hardware, lumber and feed business, and acquired ownership of the Winnfield Water Works and Light Plant. Leaving Winnfield, he moved to a plantation which he had bought on Red River near Natchitoches. He operated the plantation for about two years and during this time did private engineering work for logging companies and for Winn Parish. Later he became engineer for Caddo Parish. From 1917 to 1922 he served as Assistant State Highway Engineer for the Highway Department as organized at that time.

From 1922 to 1929 he served the Louisiana Highway Commission under the following assignments:

From 1922 to 1923, he was Assistant State Highway Engineer and during this time he located the Dixie Overland Highway from Shreveport to Vicksburg, the Slidell-Mississippi Highway and the Ponchatoula-Frenier Highway.

From 1923 to 1924 he was Vice-Chairman of the Louisiana Highway Commission which brought to the membership of that body an experienced engineer to assist in public relations in regard to government standards of location and construction.

From 1924-1927, he was State Construction Engineer in charge generally of all construction work. His outstanding accomplishments during this period were, the location and construction of the pioneer road from Sulphur to Cameron, connecting the parish seat of Cameron Parish with the main land for the first time; the location and construction of the highway from Sicily Island to Clayton across the Tensas River swamp; the location of the Airline Highway from Baton Rouge to New Orleans and the location and construction of the Vinton-Orange Highway and Bridge across Sabine River connecting Louisiana and Texas.

From 1928 to 1929, he was State Maintenance Engineer, in charge of all maintenance. During the disastrous Mississippi River flood of 1927, he rendered invaluable aid in assembling equipment and material, organizing labor crews and furnishing engineers wherever they were needed. He reconstructed and repaired all highways and bridges damaged by the flood.

From 1929 to 1931 he was engaged in private engineering and contracting work at Oak Grove, Harrisonburg and Sicily Island, but returned to the Louisiana Highway Commission in 1931 and remained with that body continuously from that time up to the date of his death in the following assignments:

From 1931 to 1941, he was Right of Way Agent for the first year and then became District Maintenance Superintendent of the Winnsboro District in charge of all highway and bridge maintenance in ten parishes of Northeast Louisiana. In conducting this work, he made a complete record of each road and bridge indicating the type and dimensions of all members of each structure.

From 1941 to 1945, he was District Construction Engineer in charge of all highway and bridge construction in fourteen parishes of Northeast Louisiana with headquarters at Monroe.

In 1902 Mr. Cooper married Mae Powell of Shiloh, Louisiana. From this union there were four children, three of whom are now living, William E. Cooper of Tampa, Florida, Mrs. J. M. McGuiness of Kansas City, Missouri and William F. Cooper, Jr., of Camden, Arkansas.

He was married for the second time in 1918 to Margaret MacBee of Clinton, Louisiana. Mrs. Cooper now resides in Monroe, Louisiana. Their only child is Corporal MacBee B. Cooper, U. S. Army, now stationed at Del Rio, Texas. He is also survived by two brothers, J. R. Heard, and E. P. Heard, of Winnfield, Louisiana, and two sisters, Mrs. C. F. Fleishel, Spring City, Tennessee, and Mrs. M. W. Laurence, Bernice, Louisiana. He was active in Masonic circles as a Shriner and a 32nd degree Mason. He has been licensed Civil Engineer since 1919 and has been a member of the Louisiana Engineering Society since 1943.

Mr. Cooper has left a long and enviable record of achievement in engineering. He was thorough and efficient in all of his work but excellent in the field of road location. He had the ability, in a marked degree, of being able to reproduce the topography of a region from sketches made on reconnaissance. Of splendid physique, he was tireless in his work, often to the discomfort of those who tried to keep pace with him.

Because of his big heart and kindly disposition he was universally esteemed by those who knew him. He has left a host of friends who are saddened by his loss but who find comfort in the thought that many of his engineering works will stand as enduring monuments to his memory.

The Committee.
B. W. Pegues,
N. E. Lant,
W. L. Thompson,
J. E. Jarman.

In This Issue. Brig. General Max C. Tyler presented at the annual meeting an interesting paper on the history of the work of the Mississippi River Commission. You will find the account of its activities worth while reading.

An important industrial generating station in this state was described for us by Mr. B. A. Fleshman. Complete details are provided in his paper.

PAPERS AND DISCUSSIONS

POWER, STEAM GENERATION AND DISTRIBUTION SYSTEMS, CITIES SERVICE REFINERY, LAKE CHARLES, LOUISIANA *

As a component part of the Cities Service Lake Charles Basic Refinery, a power plant was designed to furnish power to the Refinery, the Butadiene Plant, the Firestone Synthetic Rubber Plant, and secondary power to the Power Pool of the district. Process Steam at the rate of 982,000 lbs./hr. is supplied at 250 p.s.i. to the Basic Refinery from a low pressure boiler house and as extraction steam from the 825 lb. main turbine units.

The total estimated power requirements of the Refinery, Butadiene Plant, and Synthetic Rubber Plant—31,175 K.W. can be met at all times in the event of failure of one high pressure turbine, provided that in this emergency 7000 K.W. of power can be supplied from outside sources.

To care for this contingency a 15,000 KVA, 13,800 Volt tie has been provided from the Power Plant bus to a 15,000 KVA 13.8 KV/66KV step up substation built by the Defense Plant Corporation and tied in with six miles of 66 KV line to other plants in the area.

The general power set up was approved by the Power Division of the War Produciton Board.

The design of the Power Plant was carried forward by Gibbs and Hill, Inc., New York City.

In the design of the power house and low pressure boiler house the following factors were considered:

(1) Simplicity of flow diagrams and convenient arrangement of equipment.

(2) As compact an arrangement as possible in keeping with obtaining good operation and maintenance.

*Presented at the annual Meeting of the Society, Jan. 12, 1945 by B. A. Fleshman, Technical Assistant to the Chief Engineer. Mr. Fleshman is a graduate of the University of Missouri, and has been associated with utility work for the past 20 years.

(3) To locate as much equipment outdoors as possible.

(4) To utilize concrete and other construction wherever possible because steel at the time of design was considered a critical material.

(5) To use the minimum number of accessories and at the same time provide as much flexibility as possible. This resulted in a considerable saving in valves, regulators, etc.

(6) To provide as much flexibility as possible in the supply of process steam as between the low pressure boiler plant and the high pressure turbines.

(7) Where omissions were dictated by critical material shortages or other reasons, to provide for later additions. An example of this is that no 13,800 volt transfer bus was provided but provision was made in design and construction for the installation of the bus at a later date with a minimum of effort. A spare circuit breaker was installed with sufficient length of cable to take any position in the bus structure. This breaker ultimately will be the transfer bus breaker.

The following descripitions of the main parts of the plant will give a conception of the completed plant. An appended equipment list shows the major items of equipment.

HIGH PRESSURE BOILERS:

Two (2) Babcock and Wilcox two drum boilers are insfalled. These are designed for 950 p.s.i. and will each deliver 325,000 lbs. of steam per hour at 850 p.s.i. and 825°F. total temperature at the superheater outlets.

The boilers are equipped with tubular type air heaters and two speed induced draft fans. Boiler gases are eliminated through a 125 foot radial brick stack.

The boilers are designed to burn fuel gas or oil but are equipped now to burn only fuel gas which is a mixture of refinery gas and natural gas. The boilers are located outdoors with only the front enclosed. A unique feature is that the forced draft duct is brought over the top of the boiler to the front thus forming a roof over the boiler.

When burning fuel gas of 1040 Btu per cu. ft. the efficiency of the boilers is predicted at 79.9% at 325,000 lbs. per hour flow.

Bailey feed water regulators as well as complete Bailey automatic combustion control are provided for each boiler.

The feed water supply to these boilers comes from two sources, main unit condensate and refinery process condensate returns.

Three stages of feed water heating are provided; low pressure heaters using steam from 13th stage extraction and main unit condensate; deaerating heaters (400,000 lbs. capacity each) using 6 p.s.i. auxiliary exhaust, main unit condensate and refinery process condensate returns; high pressure heaters using 25 p.s.i. process steam for heating the predicted final feed water temperature is 260°F.

Four (4) six tage feed water pumps driven by 700 horse power turbines are provided for feed water supply to the high pressure boilers. The high pressure boilers are equipped with continuous blow down which exhausts into a 5 p.s.i. flash tank, the 5 lb. steam being recovered in the 5 lb. exhaust steam system and the effluent from the tanks goes to the intermittent blow down pit.

TURBO GENERATORS

Two (2) 25,000 K.W., 31,250 KVA, 3,600 r.p.m., 13,800 volt, 3 phase 60 cycle, General Electric Company, parallel flow condensing single automatic turbo-generators with direct connected exciters and pilot exciters are installed. Each generator is equipped with a surface air cooler and automatic CO_2 fire protection. The turbines are designed for 825 p.s.i. 825°F throttle conditions, 250 p.s.i. back pressure on the extraction section and 1½" of mercury at the exhaust of the condensing section.

The machines are unique in that they are really two turbines on the same shaft and in the same shell, one operating as a back pressure element, and the other as a condensing element. Each element is governed by a separate inlet valve system and governors, with the governor systems interlocked for control. The machines may be operated either for manual or automatic extraction. Each turbine oil system is equipped with a Hanon Crane oil purifier and storage is provided in a two compartment 8,000 gallon tank. Provision is also made to treat the

turbine oil by use of a DeLaval Centrifuge and a blotter press filter.

The turbine room is equipped with a 75 ton traveling crane with a main hook and 10 ton auxiliary hook. The maximum lift is 40'.

MAIN UNIT SURFACE CONDENSERS

Two (2) 18,000 square foot Allis Chalmers, surface condensers with cast iron shells, water boxes, steady plates and Admiralty tubes are installed one under each main unit.

Each condenser is equipped with all auxiliaries including one motor driven and one steam driven condensate removal pump and steam jet air ejectors.

Circulating water for the condensers is supplied by one 300 hp. 22,000 GPM motor driven vertical Pomona pump for each condenser and a similar steam driven unit which is cross connected so that it may be used with either unit. The circulating water discharges into a seal pit outside the turbine room. The circulating pumps are located in the Process River Water Pump House located about 350' east of the turbine room.

PRESSURE REDUCING STATIONS

One pressure reducing valve is installed for reducing 825 p.s.i. saturated steam to 250 p.s.i. This valve has a capacity of 20,000 lbs. per hour and will furnish emergency 250 p.s.i. steam for auxiliaries in the power house. Another pressure reducing valve is installed for reducing 25 p.s.i. refinery return process steam to 5 p.s.i. steam with a capacity of 60,000 lbs. per hour. This station permits 25 p.s.i. refinery process steam to be utilized in the 5 p.s.i. header for feed water heaters and in the low pressure plant water softening plant.

The drips and drains from the 5 p.s.i. and 25 p.s.i. piping are discharged through traps to a condensate receiver and pumped by sump pumps to the low level condensate storage tanks.

The traps on the 250 p.s.i. piping are discharged to the deaerators and the traps on the 825 p.s.i. system are discharged to a condensate receiver and the trap from this drum discharges to the deaerators.

The 25,000 K.W. generators are connected to the station bus by two 1,750,000 CM per phase insulated cables in non-metallic

conduits supported under the turbine floor levels. Generator neutrals are grounded through suitable impedances and oil switches. These are located under the generator foundation along with the main exciter field rheostat. Normal operation is with one generator neutral grounded.

The main 13,8000 volt bus is located in the electrical bay on the turbine room level. The bus structure is General Electric cubicle type steel enclosed, rated at 15 KV. There are 19 circuit breakers, 1,000,000 KVA interrupting capacity.

Each air breaker is equipped with an air receiver having a capacity for several operations. A normal pressure of 250 p.s.i. air pressure is maintained on the air receiver by a compressed air supply from dual compressor sets. A unique feature is an annunciator alarm system which is located at the main control board and notifies the operator of low air pressure or air failure at the compressors and any breaker.

The main bus is divided into two sections closed by a bus tie breakers. One generator and one auxiliary power bank is located on each section. The 15 power feeders are interlaced on the two sections of the bus to insure the maximum reliability of service. The later installation of the transfer bus mentioned above will increase this factor.

All feeders leave the plant in an underground system. Each outgoing feeder is equipped with a Westinghouse 0.3 OHM reactor in each phase located on the electrical bay mezzanine floor. The purpose of these reactors is to limit faults on the feeders to not over 500,000 KVA so as to be within the interrupting rating of substation equipment.

Two thousand three hundred volt station auxiliary power is served by two (2) 13,800/2300 Volt, three phase transformers. The 2300 volt bus and switching is metal clad. Vertical lift switchgear sectionalized by a bus tie breaker. This equipment is located on the turbine room floor.

440 volt station auxiliary power is served by two (2) 2300/440 volt, three phase O.I.S.C. transformers. These transformers are connected to a two section 440 volt metal enclosed air circuit switchgear located on the ground floor of the power house. The two sections are closed through a bus tie breaker.

120/208 three phase lighting and power is served by (2) two 75 KVA 440/120/208 volt transformers connected to a distributing bus located adjacent to the 440 volt board and switchgear.

The main power house control board is located in a glass enclosure facing the turbine room on the turbine room level. This board is a General Electric Company vertical panel duplex set.

The main power house also houses four air compressors, one steam driven and three synchronous motor driven with a combined capacity of 6000 CFM. The air compressors discharge into an air receiver with a storage capacity of 4500 CFM free air at 110 pounds.

To serve the refinery are two air systems, one for refinery plant air and one for the instrument air. Pressure is maintained on the instrument air system by a pressure reducing switchboard. The necessary instruments and control switches for operation of the generators and 13,800 volt circuits located on the front panels and the watt hour meters and protective relays are located on the back panels.

Direct current for the operation of circuit breakers, controls and emergency lighting is provided by a 60 cell Exide flat plate battery and a 10 KW diverter pole Motor Generator valve at 90 p.s.i. A spill valve is installed in the 110 lb. plant air line to protect the instrument air system. The instrument air is cleaned in filters using activated alumina as the filtering medium.

The Butadiene Plant has its own 400 p.s.i. 600°F. 500,000 lbs. per hour capacity boiler plant. There are two reasons for this (1) The long transmission distance from the Basic Power Plant and (2) The desirability of 400 p.s.i. steam for process and driver duty. Some steam for process is reduced to 200 p.s.i. and a tie for 100,000 lbs. per hour capacity to the Basic Refinery system is provided for emergency use.

To provide refinery process steam at 250 p.s.i. above the amount of 250 p.s.i. extraction steam from the turbines there are installed:

Two Riley steam generators having a capacity of 200,000 lbs. per hour at 250 p.s.i. 600°F.

Four used B & W cross driven sectional header boilers have been set over newly designed Detrick furnaces and each will have a steam capacity of 120,000 lbs. per hour at 250 p.s.i. and 600°F.

These boilers are equipped with Republic flow meter company automatic combusion and Bailey feed water control and are designed to burn either fuel gas or oil. The oil to be burned is an asphalt residue from the Desalting and Deasphalting Unit of the Refinery.

Four feed water pumps, two motor and two steam driven are installed for feed water supply.

The boilers are set out doors with one Riley and two B & W boilers on each side of a 20 foot aisle. Provision is made for expansion and installation of additional boilers at a late date.

The boilers are equipped with continuous blow down which discharges to a 25 p.s.i. flash tank and then to a 5 p.s.i. flash tank located on the deaerator bay of the main power house.

Since condensate returns are routed in a selective manner which will provide for 100% returns to the highpressure boilers a large amount of treated water will go to the low pressure boilers.

To provide for this make up an Infilco hot process water treatment plant has been installed. This system will handle and treat 600,000 lbs. per hour of raw well water. The hardness will be reduced to approoximately 15 p.p.m. and the Silica reduced from 50 p.p.m. to 6 p.p.m. residual hardness will be removed from the low pressure boilers by the addition of phosphate fed to the boilers directly.

The Infilco system will also heat and deaerate a maximum of 400,000 lbs. per hour of refinery condensate returns.

A complete laboratory for water analysis, and water control is provided in the chemical house adjacent to the water treating plant.

The expected feed water temperature to the low pressure boilers is 220°F.

Refinery condensate is delivered to two 5000 barrel steel tanks and pumped from them by four (4) 680 GPM motor driven pumps to the low pressure boiler plant water treatment plant and the high pressure plant deaerating heaters.

Fuel oil storage at the low pressure boiler plant is provided by two steel tanks equipped with steam heating coils. All lines handling fuel line are steam jacketed or steam traced to facilitate handling the asphalt oil which we propose to burn.

ELECTRIC DISTRIBUTION SYSTEM

There are thirteen—eight K.V feeders from the Power Plant bus feeding the substations. These feeders start at the outgoing terminals of the 13.8 K.V. breakers then through 500 Amp. reactors to the underground cables.

Circuits 13001-2-3 feed the River Water Pump House. 13001 feeding from No. 1 bus section and 13002-3 from No. 2 bus sertion, which should prevent a complete outage at the river water pump house in case of a failure of either of the bus sections. Three 3750 KVA banks are provided for the pump house. These banks step the voltage down to 2400 from 13,800 for utilization. There are 15 five hundred horsepower synchronous motors driving pumps. These motors provide some power factor correction for the system. Two 300 horsepower Induction motors for Power House circulators.

The 13.8 K.V. underground cables are carried from the Power Plant in and underground duct system of modern construction. Fiber conduit encased in concrete is used. The manholes are of reinforced concrete. Sufficient in size to provide for splicing and proper racking of the lead covered cables. The cables are all fireproofed in each manhole to prevent damage to adjacent cables in case of a failure.

Seal pits are provided between manholes to prevent migration of gas through the duct system and to prevent an explosion from carrying through between manholes. To accomplish this special seal off, fittings are used in the pit on each conduit to give a gas tight seal around the cable in the duct.

There are 10 combination power and lighting substations and five lighting substations. Also there is a tie substation

which furnishes a connection into the transmission network in the Lake Charles area.

Metering is provided for both the Firestone and Butadiene at Number 1 substation. Substation Number 3 provides power and lighting for the catalytic cracking units. This station is normally fed from feeder 13007 with feeder 13008 for emergency and lighting. Automatic change over is provided from 13007 to 13008 in case of a failure of Circuit 13007 normal power feeder. There are two 600 KVA three phase banks from 13,800 volts to 460 volts in this station.

Substation Number 4 is the utility tie staion and is fed by two 500 MCM three conductor lead covered cables in parallel. These cables have a continuous capacity of approximately 17,-500 KVA and for a two hour peak—about 25,000 KVA.

In the station is a 15,000 KVA three phase transformer—13,800 to 66,000 volts—a step type voltage regulator of 15,000 circuit KVA capacity and a 66 K.V. outdoor oil circuit breaker. The voltage regulator provides for control of the reactive flow between the Cities Service Refining Corporation Plant and the 66 K.V. network.

This station is operated by remote control from the main switch board in the Basic Power Plant. Relaying is provided for automatic sectionalizing in case of a line or cable failure. Differential relaying protects the transformer and regulator.

All of the substations supplied by Westinghouse in the Basic Refinery are furnished with outdoor metal clad switch gear with lift type breakers. The transformers are of the totally enclosed type.

Various precautions have been taken to provide uninterrupted service; some of which are, automatic throwover from normal to emergency feeder at the main substations, duplicate feeders to each station, feed from different bus section in the Power Plant and duplicate feed to important 2300 V power loads.

STEAM DISTRIBUTION AND CONDENSATE RETURN SYSTEMS

The steam distribution and condensate return systems were designed in a U shape with the Power Plant feeding into the

steam distribution system approximately at the center of the U. Steam comes from the Power Plant through three 18 inch pipe lines carried on a trestle to provide road clearance and at the end of the trestle drops down to the distribution system lightly below ground level in a concrete paved trench. This same trestle in addition to carrying the three 18 inch steam lines, carries a refinery clean exhaust steam line, a refinery condensate line, a fuel gas line and a fuel oil line to the Power Plant. Compressed air for general refinery service and instrument air are also carried on this trestle to the pipe trench from the Power Plant. The concrete paved trench in addition to serving the steam systems carries fuel gas, natural gas, compressed air and instrument air lines.

The steam distribution system was designed to distribute nominal 250 lbs. gauge pressure steam to all refinery units for their processing needs and driving prime movers. The condition of design was that the units at the extreme ends of the system (C_4 Recovery and Treating Plant) were to have steam delivered to them at a pressure of 225 lbs. gauge. The distribution system was therefore designed for minimum line pressure drop. Yarway expansion joints were used throughout the system in place of expansion loops to minimize line pressure drop.

Although the Butadiene Plant associated with this refinery has its own boiler plant, a 10 inch cross tie line has been provided between the two plants as an insurance of continuity of operation at the Butadiene Plant and a means of providing steam in an emergency.

The refinery clean exhaust steam system and the reciprocating pump dirty exhaust system have been segregated to prevent any oil contamination from getting into the boilers at the Power Plant. The steam from the reciprocating pump dirty exhaust system is used at the Catalytic Cracking Units and any deficiencies at these units are made up from the refinery clean exhaust system through check valves which open only when the pressure in the reciprocating pump dirty exhaust system drops due to steam demands on it. The reciprocating pump dirty exhausts system is checked to prevent it contaminating the clean exhaust system.

Pressure reducing stations have been provided between the 250 lb. steam distribution system and the 25 lbs. refinery clean exhaust steam system at the Treating Plant, the Deasphalting Plant and the C_4 Recovery Unit. These stations were installed to stabilize the pressure and supply and deficiencies in the refinery clean exhaust steam system.

Steam condensate is returned from the various refinery units to the Power Plant where it is received in two 5000 barrel storage tanks. These tanks were sized to allow sufficient settling time for any oil contamination to separate from the condensate before using the condensate for boiler feed purposes.

OUTSIDE LIGHTING FACILITIES

The outside lighting facilities for the refinery may be divided as follows: Fence lighting, Street Lighting, Flood Lighting, and the Aviation Warning beacon.

The fence lighting is fed from four 10 KVA constant current transformers. The four fence lighting circuits carry 400 candle power 6.6 Amp series lamps. The lamps are mounted on creosoted wood poles and the circuit is fed from underground cable. These lighting circuits are controlled from the Power Plant main switchboard.

The street lighting is similar to the fence lighting except that the lamps are 250 candle power and the transformers 7½ KVA. There are four (4) series street lighting circuits. The control is the same as for the fence lighting.

The yard flood lighting system is fed by 2300 volt circuits with individual transformers at the big flood lighting towers. There are 20 steel towers with two (2) to four (4) 1500 watt flood lamps, lighting the tank farm, dock areas. There are also several flood lights mounted on poles. The control system consists of small 2300 volt solenoid operated switches having a 115 volt coil circuit remote control.

The aviation warning beacon is mounted on top of the "B" Catalytic Cracking Unit approximately 230 feet above ground. This unit revolves and has an automatic lamp changer. The lamps are 1000 watt air beacon type. The beacon is controlled from the Power Plant switchboard and is turned on and off by the switchboard operator.

WORK OF THE MISSISSIPPI RIVER COMMISSION

By Brig. General MAX C. TYLER, Corps of Engineers, U. S. Army *

Over two hundred years ago the early settlers started to occupy the Alluvial Valley of the Mississippi. They had to fight the river from the start in order to maintain themselves and the fight is still going on. At the same time they used the river for communication, trade and travel. The Mississippi River Commission has had no small part in that war against the river and in the improvement of its navigation, which is my excuse for presenting this paper.

The Alluvial Valley of the Lower Mississippi extends from Cape Girardeau, Missouri to the Gulf of Mexico, a straight line distance of 600 miles and a river distance of 1,034 miles. The area of the Valley is 53,000 square miles of which 35,000 square miles were subject to overflow when the white man invaded the bottom lands. Cape Girardeau is 340 feet above the Gulf. Between Cairo, Illinois and Natchez, Mississippi, the valley averages over 75 miles in width and in nowhere less than 30 miles wide. Below Natchez it averages about 50 miles in width. The river in materials laid down during an earlier geological period in a deeper valley by its ancestor streams. The Lower Mississippi is a meandering river. For two thousand years, more or less, it has occupied its present meander belt south from Cario, Illinois, where it is formed by the junction of the Middle Mississippi and the Ohio. This meander belt is from 15 to 20 miles wide from East to West and within it the river has constantly changed its course and position by caving its banks in the concave sides of bends and building sand bars on the opposite convex sides. The river is against the eastern bluffs at several points on its course down the valley, at Wickliffe, Kentucky, Columbus, Hickman, Chickasaw Bluffs, Memphis, Vicksburg, Natchez, Fort Adams, Tunica, Bayou Sara, Port Hickey and Baton Rouge. On the West, the river is against high ground at Helena, Arkansas. With the

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same angle of attack or impingement of the current against a bank, the rate of caving or erosion varies inversely with the fineness of the materials in the bank. Sandy banks cave rapidly. Clay banks cave slowly. The meander changes of the river are rapid between Cairo and Old River, as sandy banks predominate. South of Baton Rouge caving is slow as fine silts and clays generally form the banks. The materials through which the river flows are not homogeneous and consequently there is no typical shape to bends. Abnormally long bends sometimes develop due to resistant clay deposits laid down by high waters in old abandoned loops. When a long bend caves its banks so that only a narrow neck of land separates its upper and lower arms, a cutoff may occur during high water. Within a few years as the cutoff develops into the full sized river, the old bend way is sealed off by deposits and becomes a horseshoe lake. The runoff from an area of 1,245,000 square miles, the area of the Mississippi drainage basin, varies widely with the incidence of storms and precipitation and with the seasons. There is a season of high precipitation, the winter and spring, and a season of low precipitation during the summer and fall. River stages, of course, correspond to precipitation. Exceptional storms over wide areas on the major tributaries cause the large floods. They do not happen every year. Since high stages last only for a fraction of the year and great floods are usually a number of years apart, the river was never able to excavate a flood channel adequate to carry all the water which must find its way to the Gulf even in moderate high waters. The river goes overbank at about one-half the maximum discharge of record. Stages before the construction of levees were never more than two or three feet above bank, for as soon as the river went over bank it could spread all over the valley. The coarser materials carried in suspension were deposited near the banks, particularly in the concave sides of bends and the fine materials found their way into swales, lakes and back swamps further from the river. Therefore, the highest and best drained lands were along the river and local drainage was first away from the river and then parallel to it down the valley to some point where the local runoff could get into

the main river. As the river swung back and forth across its meander belt it dug great quantities of materials from its banks; it deposited the sands on bars only a short distance downstream and carried the finer materials further down, some all the way to the Gulf to build the delta at the mouth of the river. The river caved about three quarters of a billion cubic yards of materials out of its banks each year. With all this activity, it has not scoured its bed deeper into the valley floor nor has it aggraded. For many centuries it has been working sideways, constantly changing its location in the meander belt and using up energy in the excavation and transportation of materials from its banks. That the river has not aggraded is proved by the fact that abandoned courses in the meander belt now occupied have the same bank levels as the existing channel in the same latitude. The river is what the geologists term a "poised" stream, neither cutting down nor aggrading. Forest growth covered practically the entire valley and caving banks brought into the river the trees growing along the banks. Consequently, every rise moved tremendous quantities of drift and the river channel was full of snags.

The romantic story of packet navigation on the Mississippi has been told in many books. It would take too much time for me to attempt to repeat it here. However, in reading old newspapers of the period before the Civil War and for thirty years after that conflict one cannot but wonder how so many packets could have made a profit or how so many people could have been willing to ride on them when every year a considerable number were destroyed by fire, boiler explosions and by running onto snags and sinking in deep water.

At the peak of the business there were about a thousand packets on the river although the low-water channel had a depth of only 4½ feet. That was the controlling depth at low water as late as 1880. In 1875 the War Department made a "no cure, no pay" contract with James B. Eads to improve South Pass by means of jetties to obtain an adequate channel for ocean-going ships. By 1878 a depth of 22 feet had been obtained in the bar channel and this was increased to 26 feet in 1879. The success of this work opened the Port of New Orleans

to ocean commerce on a large scale and increased the importance of improving the navigability of the river above New Orleans.

Since the highest and best lands were along the river and since the river afforded the only means of communication, trade and travel, the early settlers naturally located along it and cleared up lands there for their towns and for farming. They immediately found that only by having some protection from overflows would their habitations be reasonably safe and their agriculture at all dependable in its results. So they built small levees on the highest ground, near the banks of the river. At first, since these levees were not connected into a general system, and some broke in every high water, they had little effect on river stages; there was plenty of room elsewhere for the river to spread out overbank. However, as more lands were opened up and leveed and the disconnected levees were connected together, stages were raised by denying valley storage to the river. The levees already built were found to be inadequate in height and section and the process of strengthening them began. There was, of course, no statistical knowledge on the probable frequency of the greater floods and n information on valley storage and the discharge which a confined flood might have. The solution was groped for by the only method available—that of cut and try. More knowledge might well have discouraged even such determined people.

The story of the efforts of the people in this valley to build adequate defenses against the river has not been fully covered in books, but it is quite as interesting, at least to the engineer, as the story of the packet days on the river.

De la Tour, the engineer who laid out the City of New Orleans, included in his plans a levee to protect the city from overflow. By 1727 this three-foot high levee on the city front had been completed to a length of 5,400 feet with a top width of 18 feet. It was rapidly extended for miles, both above and below the city. The extension of the levees kept pace with the advance of settlements along the river. By 1812 the levees had been extended northward to Baton Rouge on the east bank

and to Pointe Coupee on the west bank. By 1844 levees had been built between Old River on the west bank and the mouth of the Arkansas. Many isolated levees had been built along the lower part of the Yazoo front in Mississippi. By 1858 there were levees along the front of each major basin on the west bank from Cairo, Illinois, to a few miles above Fort Jackson, and on the east bank from Memphis to Yazoo and from Baton Rouge to near Fort St. Philip. Compared to the levees of today all these defenses were extremely puny affairs. They were built by hand labor first, then with wheelbarrows and later with mules and slip scrapers. High waters overtopped and crevassed them at many points in every flood. For instance, New Orleans itself was inundated eight times between 1735 and 1849.

National interest was aroused by the damage wrought by the floods of 1849 and 1850. The result was the passage of the Swamp Land Act of 1850 by the terms of which the swamplands belonging to the Federal government were turned over to the States in the valley to be sold and the proceeds from sales to be used to finance levee construction. This was the first Federal assistance in financing flood control works. Louisiana, Mississippi Arkansas and Missouri appointed commissioners and organized offices to carry out the provisions of the Act. The results were disappointing.

All levee and river work was interrupted by the Civil War. At its close the financial condition of the people of the valley did not make for large expenditures on public works. However, the levees were repaired and strengthening of the system resumed by the local people without Federal assistance.

By 1879 a large part of the land near the river had been cleared and was under cultivation, though most of the interior of the valley was still in forest. Cultivated lands covered about 50% of the length of the river between Cairo and Baton Rouge and 100% below that city. The total population of the alluvial valley was about 800,000.

The need for improvement of the river channel for navigation and of better protection of the alluvial valley against

floods was generally recognized. There had been many excellent reports on the river, or on particular problems on it, beginning with a report by Captain Young in 1820. Captain Talcott reported on the Passes in 1838, Mr. Ellet submitted a report on the river in 1850 and the monumental and classic report of Captains Humphreys and Abbot was made in 1861. A Board of Engineers known as the "Levee Commission" made a report in 1874 and a Board on Transportation Routes to the Seaboard reported in 1875. In 1879 a Board of Engineer Officers came to the conclusion that a complete levee system would aid commerce during periods of high water but would have but little influence upon low-water navigation. The Board stated that the greatest obstacle to navigation improvement and levee maintenance was instability of the river due to bank caving.

It was apparent that if any progress was to be made toward solving the great problem of the control and improvement of the Mississippi River the Congress would have to empower an engineering organization to give it intensive and continuous study and would also have to appropriate funds for such engineering work.

A bill providing for the creation of the Mississippi River Commission was introduced in the House of Representatives by the Honorable R. L. Gibson of Louisiana and in the Senate by the Honorable Lucius Q. C. Lamar of Mississippi. With a few minor amendments the bill was passed and was approved by President Hayes on June 28, 1879. The Act is entitled "An Act to provide for the appointment of a Mississippi River Commission for the improvement of said river from the Head of Passes near its mouth to its headwaters." The Act provides for the appointment by the president of seven commissioners, three of whom shall be from the Corps of Engineers of the Army, one from the Coast and Geodetic Survey, and three from civil life, two of whom shall be civil engineers. Further, any vacancy which may occur in the Commission shall in like manner be filled. Provision is also made that the President shall designate one of the Commissioners appointed from the Corps of Engineers to be President of the Commission.

The duties of the Commission as prescribed in the 1879 Act may be summarized as follows:

First—To direct and complete such surveys of the Mississippi River between the Head of Passes and its headwaters as were then in progress; and to make such additional surveys and examinations of the river and its tributaries as were deemed necessary.

Second—To take into consideration and mature a plan, or plans, for deepening the channel of the river, improving it for navigation, protecting its banks, and preventing destructive floods; promote and facilitate commerce, trade, and the postal service; and with such plan or plans to submit an estimate of the coast of execution.

Third—To report specifically upon the practicability, feasibility, and probable cost of the plans known as the jetty system, the levee system, and the outlet system.

Fourth—To prepare and submit, prior to the completion of all the surveys and examinations, should it so desire, plans and estimates of cost of such immediate works as might, in its judgment, constitute a part of the general system contemplated.

The original members of the Commission were Colonels Q. A. Gilmore, president, C. B. Comstock and C. R. Suter of the Corps of Engineers, U. S. Army; Mr. Henry Mitchell of the U. S. Coast and Geodetic Survey; Mr. James B. Eads and Mr. B. M. Harrod, Civil Engineers; and Honorable Benjamin Harrison. All three of the Engineer officers had distinguished records; Mr. Mitchell's work in the Coast Survey had been widely noticed; Mr. Eads had an international reputation from his work on the Mississippi River bridge at St. Louis and the improvement of South Pass and Mr. Harrod had an outstanding record as an engineer in Louisiana and on the Gulf coast. In 1877 he was Chief State Engineer of Louisiana. Mr. Harrison became the twenty-third President of the United States in 1889.

The Act also included a provision that the Secretary of War detail from the Corps of Engineers of the Army an officer to act as Secretary of the Commission.

The Commission established its office in St. Louis. Its first meeting was held August 19, 1879. After organization, it inaugurated a general survey of the entire river; investigated and disapproved, for the time being, a plan for the improvement of navigation by means of headwater reservoirs; indorsed the system of improvement being carried on by the War Department between Cairo, Ill., and the Falls of St. Anthony; carefully considered and rejected a plan to secure reduction in flood heights in the lower river by means of artificial outlets; reached the conclusion that, upon a large part of the river, levees were essential to prevent destruction of life and property and that they were desirable through not indispensable aids to channel improvement; submitted for the Lower Mississippi a general plan for improvement by means of contraction and bank protection works and an estimate of cost of certain works to initiate the plan.

In general the plan provided for confining the low-water channel to a width of about 3,000 feet; the protection of caving banks; that the channel should be fixed and maintained in its present location; dredging as necessary where the material was too tough or heavy to be removed by scouring; closure of back channels and low-water chutes with a view to confining flow to a single channel.

Six locations for initial work were selected, one of which was the Lake Providence Reach in front of Lake Providence, Louisiana. The estimate for the first fiscal year was $5,233,000, of which $4,1113,000 was for low-water channel contraction and bank protection, $1,010,000 for closing gaps in levees, $210,00 for surveys, examinations and other expenses.

The River and Harbor Act approved May 3, 1881, carried an appropriation of $1,000,000 "For the improvement of the Mississippi River in accordance with the plan therefor recommended by the Mississippi River Commission." The Act also included the clause "provided that no portion of the sum here-

by appropriated shall be used in the repair or construction of levees for the purpose of preventing injury to lands by overflow or for any other purpose whatever except as a means of deepening or improving the channel of said river."

The Commission had got off to a good start in its engineering estimate of the situation, but the Congress either did not appreciate the magnitude of the task which it had assigned to the Commission or was willing to furnish the funds at a rate which would permit of orderly, efficient and economical progress.

The provision prohibiting the expenditure of funds for levee work except as a means of deeping the channel was far reaching in its effect. The Constitutional lawyers of that day and a majority of the Congress believed that the Constitution limited the Federal Government to doing only such work on our rivers as fell clearly within the scope of the commerce clause. That clause authorized the regulation of commerce with foreign nations and among the several States and with the Indian tribes. Decisions of the Supreme Court had firmly established the principle that the Government, under its authority to regulate commerce, had the right to improve any waterway on which foreign or interstate commerce could be carried. The belief that protection of property and agricultural lands against floods was a field into which the Federal Government could not legally venture had the effect of narrowly limiting the flood control activities of the Commission for 36 years, or until 1917, when a more liberal view of the powers of the Congress became current. For all those years the Commission was confined in its levee work to planning and advising local interests concerning recommended levee grades, locations and sections and to the repair and construction of such levees as could be held to have an effect upon the regimen of the river which would be beneficial to navigation.

The newly organized Commission found little detailed data on the lower river in existence. Exhaustive surveys and observations were, therefore, necessary and field work on surveys and discharge measurements was at once inaugurated. The

Coast and Geodetic Survey had covered the lower reaches of the river and the Lake Survey had done some work in the vicinity of Cairo and Memphis. The survey of the Comission consisted of control, hydrography and topography. Hydrography consisted of soundings made along the channel line and on frequent cross sections normal to the stream. The topography included shore lines, islands, sand bars and all features both natural and artificial within about a mile of the river bank. Five-foot contours were used to show relief. The scale of the finished work was fixed as 1:10,000. Charts were published as rapidly as field work was completed on scales 1:63,360 and 1:20,000. For control, triangulation and precise levels were run through and across the valley and to connect with established bench marks of other agencies outside the valley. One of the first maps prepared and published by the Commission was printed in 1887. It covered the Alluvial Valley below Cape Girardeau on a scale of one inch to five miles, and showed the main river and tributaries, towns, counties, railroad lines, trans-valley profiles, controlling levee lines, and by colored areas, the region subject to overflow based on the area overflowed in the 1882 flood. A similar map of the river and valley above Cairo was published in 1899. The original survey of the river from Cairo to the Head of Passes was gradually completed between 1879 and 1893. Between 1911 and 1914 a resurvey was made between Cairo and Red River. Through the entire life of the Commission surveys and discharge measurements have been a major activity. The low-water channel surveys, the bank line surveys to observe the rate of bank caving and the discharge measurements made at regular gaging stations throughout the year make up a tremendous store of information on the history, characteristics and habits of the river which has no equal on any other river in this country if anywhere else in the world. Daily discharges and stages for the important gages on the river are published annually by the Commission, The Commission also publishes annually, for the use of navigators, a book of charts, scale 1:62,500 showing the river from Cairo to the Gulf with overbank topography and location of shore navigation lights and marks. A survey of

Lake Pontchartrain and Lake Maurepas was made in 1893-94. In 1904-05 a survey of Atchafalaya River was completed which afforded a comparison with cross section elements of the surveys of 1880-81 and 1882 (earliest accurate surveys of Atchafalaya River). Later, in 1916-17, resurvey was made. In 1908 surveys including boring were made in connection with the report called for by Congress as to the feasibility of a 14-foot waterway from St. Louis to the Gulf. In 1913-14 surveys and examinations were made incident to studies of flood relief by means of spillways or waste weirs in the vicinity of New Orleans.

One of the most valuable mapping operations of the Commission has been the topographic mapping of the entire Alluvial Valley and adjacent areas and the publicaiton of topographic quadrangles in color on the scale 1:62,500. Under this program more than 250 quadrangles, covering over 62,000 square miles, were projected of which 212 have been published. This work is not only useful to the Commission in its own engineering problems but is of great value to the public in general and to all engineers practicing in the valley. This work was authorized in 1928. The quadrangles are revised frequently to keep them up to date.

The most recent original survey work of the Commission, just completed under arrangement with Louisiana State University for the services of Dr. H. N. Fisk of the Department of Geology, is a complete geological investigation of and report on the entire Alluvial Valley. It is hoped that this report can be published and made available to the public in the next few months. This work was made possible only by the use of aerial photography and the co-operation of oil companies in giving access to thousands of logs of wells. It clears up many questions about the river which have heretofore been obscure or debatable, and will be of great general value.

Channel work has two purposes: to improve navigation and better flood carrying capacity. The initial and early work of the Commission was directed toward getting a good channel for through navigation. The limited initial work made possible

by the Appropriation Act of 1881 was confined to two reaches, the Plum Point Reach 150 miles below Cario and the Lake Providence Reach 520 miles below Cairo. In both localities the river was wide and full of shifting sand bars which made low-water navigation difficult and often impossible. The plan of attack contemplated the closure of chutes and back channels and the construction of the main channel where necessary by means of permeable dikes, the work to be supplemented where necessary by the revetment of the banks. Operations were begun in 1881 and it soon developed that more substantial dikes would be required and that bank revetment was essential to prevent flanking of the dikes. However, the Act of 1886 forbade expenditures for bank protection "until after it shall be found that the completion of the permeable constructing works and uniform width of the highwater channel will not secure the desired stability of the riverbanks". This restriction was dropped out of the law later and bank protection became one of the important tools for dealing with the river. The strong opinions of people with little information or inadequate information are often as hard for the engineer to deal with as are the forces of nature.

By 1891 it was evident that, at any rate of appropriations which could be anticipated, dikes and revetments alone would not secure a satisfactory navigation channel in any reasonable time. Experiments were made with a dredge designed especially for Mississippi River conditions. The first such dredge, completed in 1895, was a definite success and the second principal tool of the river engineer was added to his kit. Up until this time no project channel dimensions had been prescribed by Congress. In 1896 a provision was enacted providing for dredging and authorizing a low-water channel below Cairo not less than 250 feet wide and 9 feet deep. With this authority, the Commission constructed additional dredges. As dredges have worn out they have been replaced by more powerful and more modern ones. In 1928 the Congress modified the authorized low-water channel to one 9 feet deep and 300 feet wide and the Flood Control Act recently passed authorizes a channel 12 feet deep by 300 feet wide to be obtained and maintained by

bank stabilization works and dredging. The fleet of dredges operated in the Memphis District from Cairo to the mouth of the Arkansas consists of 5 self-propelled pipe line dredges with dustpan type suction heads. In the Vicksburg District between the mouth of the Arkansas and Vicksburg, two pipe line dredges with bell type suctions are employed and two similar dredges are employed by the New Orleans District between Vicksburg and Baton Rouge. Powerful line dredges with cutter heads are leased from contractors as needed for major changes in channel alignment or closing chutes. For the past 10 years four such dredges have been in use most of the time on channel improvement dredging.

Modern cutter head pipe line dredges have made it possible to do things with the river that were impossible a few years ago. The fact and the availability of funds since 1928, when the present project was approved, have permitted us to materially shorten the middle portion of the river between Memphis and Old River by artifically cutting off 15 long bends. The river mileage thus cut out is about 170 miles. This has made for shorter turn-arounds of tows, for they make better time both up and downstream over the shorter distance. On very high stages they lose a little time upbound on account of the swifter current but that is compensated for when downbounds. The shortening of the middle section of the river has been effective in reducing flood heights from below Natchez to Memphis. At Arkansas City just below the Arkansas the reduction is about 12 feet and at Vicksburg about 7 feet.

The Commission maintains a channel patrol throughout the low-water season and issues weekly Navigation Bulletins for the information of pilots on the conditions of the navigation channel. It also maintains a contact pilot in each of the three Districts (Memphis, Vicksburg and New Orleans) whose duty it is to make actual contact with tows in transit, to discuss conditions with the men in the pilothouse, to exchange information, and get the views and suggestions of the navigator. It maintains buoys wherever they are required for safe navigation, under an agreement with the Coast Guard whereby that

service furnishes the buoys and reimburses the Engineer Department for its buoyage work. The Coast Guard places and maintains all shore light and marks. The channel is in such excellent condition and so well buoyed and lighted that the heaviest tows, 15,000 tons, do not hesitate to run at night during the lowest river stages.

In improving the river's channel for navigation and increasing its capacity to carry floods the dredge is the engineer's cutting tool. With it the alignment of the channel can be radically changed. Secondary channels can be closed. Artificial cutoffs may be made or natural ones expedited. But a cutting tool, in a river like the Lower Mississippi, cannot keep the new alignment from wandering. Dredging does not change the characteristics of the river and work done by dredging soon may be obliterated unless the modified alignment can be held. For that purpose a holding, or defensive tool is required. Bank stabilization by revetment work is that defensive tool. Properly located, such work serves to stabilize good alignment, or in extreme cases to keep bad alignment from getting worse. The Commission has developed several different types of good revetments. Woven willow, fascine willow and lumber mats, loaded with stone, were used for years. In late years, due largely to the limited supply of willows and the increasing costs of labor of which a large amount is required for willow mat construction, articulated concrete mats were developed and extensively used. It is the most satisfactory and economical type of bank revetment so far proven in service. A sheet asphalt mattress has been used with reasonable success below Red River where the currents are not too swift to permit of its satisfactory placement. Experiments with a new type of concrete mat are under way.

Revetments are absolutely essential to stop bank caving at locations where there is heavy concentration of population and property. Bends along city fronts at New Orleans, Plaquemine, Helena, Memphis and Cairo are examples.

Mattresses extend from just above the water line at the time of laying, out to or a little beyond the thalweg of the channel.

This distance normally ranges between 300 and 600 feet depending upon depth. The upper and the underwater bank is graded to a slope not steeper than one on three. The upper bank from the water line up to top of bank, or in some cases to somewhat below the top of bank level, is paved in various ways—with one man stone, concrete slabs, concrete or asphaltic concrete.

At the present time there are in place about 124 miles of bank revetment work on the river south of Cairo. It has been placed as a rule at unrelated localities where emergencies impended.

In a report submitted last spring the Commission expressed the opinion that the time had come, in the development of the Alluvial Valley, for a general stabilization of the river in order to stop the constant setting back of the massive levees from caving banks, and the sacrificing of the best lands, and for the purpose of making the investment of funds in water terminals more secure, and to obtain, as a by-product of such stabilization, a 12-foot channel at low water for navigation. This work was authorized in the Flood Control Act which recently was approved, at an estimated cost of $200,000,000.

No amount of channel work can ever get the big floods down within the banks of the river. When and if all the reservoirs on the tributaries which have been found feasible are constructed, floods will still go high overbank. The Alluvial Valley must depend upon its levee system, and the appurtenant works thereof, as the backbone of its defense against inundations.

Up until 1917 all levees, except those which could be shown to have a beneficial effect upon navigation, were financed and built by the local Levee Boards in the Valley. The financial burden on the local people was heavy. In 1882 the Commission set up a standard specification for levees and a levee grade 1½ feet above the high wate of 1882. These standards were revised from time to time as flood expereince dictated. The local levee boards co-operated with the Commission in attempting to conform to the standards recommended.

Three years after the turn of the century the Mississippi River was in flood and seven levee crevasses occurred; in 1907 the river was again in flood but no crevasses occurred on the main river lines. In 1912 a flood of unusual heights occurred exceeding all previous crest stages, except at Vicksburg. Fifteen crevasses occurred. The year 1913 brought another flood which broke the records established by the flood of the previous year. The levees already badly damaged were further breached and great damage to the valley resulted. Forty-five crevasses occurred. After the 1913 flood the Commission adopted a new grade and levee section based on the experience of the great floods which had just happened. The next flood was in 1916. Only one crevasse occurred. However, it and a bad Gulf storm in 1915 while the river was at bankfull stage at New Orleans revived interest in flood control and the Congress in March 1917 passed the first Flood Control Act by the terms of which the Federal Government would pay 2/3 of the cost of levee construction whenever local interests would contribute the rights of way and 1/3 of the construction cost and maintain the works after completion. This Act was followed by liberal appropriations for the years after the First World War and by 1927 the levees lacked only some 13% more or less of being completed to the Commission's 1914 grade and section.

General rainfall, extraordinary in its duration and volume, resulted in the flood which occurred in the winter and spring of 1927. Rainfall throughout the Mississippi River watershed was more abundant than ordinary during the fall of 1926 and during the period December 1926 to April 1927 heavy rains continued throughout the central area of the Valley. As a result of the December 1926 rains a flood wave passed downstream cresting at Cairo on January 8 and 16 days later at New Orleans. A second crest passed Cairo on February 6 and New Orleans on March 1. The third and final flood wave crested at Cairo, April 19-20 and at New Orleans on April 25. The levee system was under tremendous stress for more than three months; thirteen major crevasses occurred aggregating 5 miles in length, and approximately 23,000 square miles of the Allu-

vial Valley was flooded. The damage caused was greater than by any previous flood in the history of the Valley. Public interest in the flood problem in the Valley was aroused throughout the country and the opinion was formed that the problem could be solved only if the Federal Government took over all financial responsibility for the construction of levees, leaving to local interests only the responsibility of furnishing the rights of way and maintaining the works after completion. In 1928 the Congress adopted a comprehensive project for flood control of the Mississippi River in the Alluvial Valley as recommended by the Chief of Engineers. The project provided for levees of much larger cross section to confine a flood larger than any of record, for floodways where such confinement would require levees of unsafe heights and for channel improvements both for greater flood-carrying capacity and for navigation. Congress was liberal with appropriations and by 1937 work had progressed so that the greatest flood of record above the Arkansas was carried through to the Gulf without mishap. The project has been modified from time to time since 1928 as conditions have warranted. Levee grades are based on a hypothetical flood of 2,400,000 c.f.s. at Cairo, 3,000,000 c.f.s. at the Mouth of the Arkansas and 3,000,000 c.f.s. at the latitude of Angola or about 20% in excess of any flood of record.

I shall not take up your time with a detailed description of the entire project. It is the largest flood control job ever undertaken anywhere or by any Government. There are 2,500 miles of levee in the system, which when completed will contain about one and one quarter billion cubic yards of earth. For comparison, there are about 800 miles of dikes along the sea coast of Holland and about 500 miles of dikes along the rivers of that country. The excavation in the Panama Canal was 262,000,000 cubic yards. During the past 16 years more than 830,000,000 cubic yards of earth have been placed in our levees and about 85% of the authorized levee construction has been completed. In 1936 control of headwater floods on the Yazoo and St. Francis Rivers by reservoirs, levees and channel improvements were added to the project. The flood control dam has been built on the St. Francis and two of the four dams

planned for the Yazoo have been completed. Protection of the Yazoo and part of the Red River backwater was authoribed in 1941.

In the 1928 Act the establishment of a hydraulic laboratory to assist in solving the problems on the river was authorized. It was located at Vicksburg and is supervised by the Commission. It has come to be recognized as one of the outstanding institutions of its kind in the world. Many river problems have been solved. The laboratory known as the U. S. Waterways Experiment Station serves the entire Engineer Department and all sorts of hydraulic problems are sent in for tests. The designs of dams, spillways, outlet works, channel improvements, locks, and other structures are tested and aften improved at large savings in cost. Harbor works affected by tidal flows have also received careful study. The location of proposed break waters needed for harbor improvements in this war have been tested in models and the best locations found. Movable bed models have developed the theories of stream meander and the formation of bars and the caving of banks. At this time there is under way the construction of a model of the entire Mississippi River watershed by the laboratory at Clinton, Miss. This model will cover nearly a square mile of ground and will contain all the reservoirs which have been built or are projected. Its purpose is to check operational procedure . The Station also has a Division devoted to the problems of foundations, soils mechanics and flexible pavements which has done much work on testing emergency landing mats and foundations for pavements of airport runways.

The work of the Corps of Engineers and of the Mississippi River Commission here in the Alluvial Valley has been a joint undertaking with the people of the Valley as represented by the various Levee Boards and State Engineering Organizations. At all times, the District Engineers and the Commission are anxious to hear the suggestions and complaints of the people of the Valley. Too, under one of the provisions of the basic law creating the Mississippi River Commission, it makes two trips a year throughout the length of the river under its juris-

diction, giving full opportunity for all local interests to lay before it their needs, their complaints, and their suggestions. It is one of the Commission's most jealously preserved traditions that anyone who has anything to present shall be accorded a courteous and interested hearing and that whatever the nature of his cause, it shall be carefully, not perfunctorily, considered and appropriate reply vouchsafed. This system has engendered a feeling of partnership in a common cause which I feel has contributed in no small degree to whatever success you may feel has attended our efforts to date. The Federal projects for flood control and navigation have reasonably kept pace with actual need. While there is much yet to be done and there will never come a day when the great destructive power of the river can be disregarded most substantial progress has been made toward reasonable safety in the occupancy and development of this great Valley.

MINUTES OF THE MEETING AND BUSINESS OF THE SOCIETY

Minutes of Meeting Baton Rouge Section Louisiana Engineering Society
March 29, 1945

Officers present: Mr. J. T. O'Brien, president; Mr. P. J. Guelfi, first vice-president; Mr. William Whipple, second vice-president, and Mr. James J. Saurage, secretary-treasurer.

The meeting was called to order by President J. T. O'Brien who, after having the guests introduced, received the reports of the several Committee Chairmen.

The minutes of the last meeting was then read and adopted after which the Treasurer's report was given.

Some discussion was had on the subject of this year's joint meeting with the Parent Society. The President then introduced the speaker of the evening, Mr. C. A. Morrison of the Standard Oil Company who spoke on the subject entitled, "The History of the Development of Natural and Synthetic Rubber".

Mr. Morrison's talk was well illustrated by charts and samples of the various types of rubber as well as samples of many articles manufactured from the various rubbers.

At the conclusion of Mr. Morrison's most interesting talk, the meeting was adjourned and sandwiches and cold drinks were had as refreshments.

JAMES J. SAURAGE,
Secretary-Treasurer,
Baton Rouge Section.

Minutes of the Meeting of the Board of Directors
Tuesday, April 3, 1945

The meeting was called to order by President Steinmayer. Members present were Messrs. Kerr, Lassalle, McNiven, Mayer, Nairne and Fernandez. Mr. W. H. Scales, Chairman of the standing committee on Legislation, was present by invitation. Minutes of the previous meeting were read and accepted. It was moved and passed that the order of the meeting be dispensed with for convenience.

A letter from Mr. L. J. Pessin, President, New Orleans Academy of Science, requesting a joint meeting with the Society, was read. It was moved and passed that such a meeting be authorized, to take place on the first Monday in July.

It was also decided to authorize Mr. M. G. Zervigon, chairman of the Technical Papers Committee, to proceed with preparations for a joint meeting with the local section of the American Society of Civil Engineers, and to invite Messrs. Godat and Heft to lecture on "The Elimination of Grade Crossings and a Central Railroad Station for New Orleans". It was suggested that a number of scientific organizations be invited to attend this meeting.

Much discussion took place regarding the proposed license law in its relation to the engineering profession, and it was decided that the Committee on Legislation should begin planning for the passage of such a law even though the State Legislature does not convene during the current year.

The secretary reported that Mr. Charles Grimader, a certified public accountant, had examined the Society's books and quoted a price of $112.50 for an audit covering the years 1942, 1943 and 1944. The Secretary was authorized to have a complete audit brought up to date at a price not to exceed that quotation.

President Steinmayer announced that he had received from the Hon. Fred A. Earhart, Commissioner of Public Utilities, two volumes of the report of Messrs. Godat and Heft on "Proposed Railroad Grade Crossing Elimination and Terminal Improvement for New Orleans", which he has given to the Society's library.

The secretary reported that a volume entitled "Cane Sugar Handbook" by Spencer and Meade, had been presented to the library by Mr. George P. Meade, a member of the Society.

The proposed card-index of members was discussed and it was decided to postpone compilation until a search could be made for an index, completed through 1936, which is believed to be in existence.

The President's letter to Mrs. David W. Godat, thanking the Woman's Auxiliary and Mrs. L. R. Coerver for their efforts in entertainment of guests at the annual meeting, was read.

Letters to Messrs. Fleshman, Dubus and Myers regarding the formation of local sections in Lake Charles, Lafayette and Alexandria, were read. It was moved and passed that no refund would be made to local sections on dues received from members in the armed forces.

The President read a letter from the Woman's Auxiliary regarding a proposed change in the constitution of that organization, and was authorized to reply that no official recommendation could be given by the Society.

The Secretary read a report by Mr. W. Stone Leake, General Chairman, on the annual meeting, which was accepted.

A letter from the chairman of Membership Committee "B", recommending the following applicants for election to membership, was read:

For local member: B. P. Babin, Charles A. Burton, and Rathbone DeBuys.

For State Member: Soule Butler, Waldo A. Erickson.

For affiliate member: Jules A. Villemont.

It was moved and passed that the names of these applicants be placed on the next letter ballot.

The secretary was instructed to answer a letter from the chairman of Membership Committee "B" regarding the grade of Associate Member.

There being no further business the meeting adjourned.

Secretary-Treasurer,
JOHN P. FERNANDEZ.

Minutes of Meeting of the Louisiana Engineering Society, April 9, 1945

The meeting was called to order by President Steinmayer, with approximately sixty members and guests present. Minutes of the March meeting were read and approved.

Mr. W. H. Scales, chairman of the Legislation Committee, reported on the progress of his committee towards the proposed engineers' license

law. An appeal was made for suggestions and information relative to legislation affecting the engineering profession.

Mr. Henri Molaison, chairman of the Library Committee, announced that Mr. George P. Meade, co-author of "Sugar Cane Handbook" had presented a copy of his work to the Society's library.

Mr. Leo J. Lassalle then introduced the speaker, Professor W. P. Wallace of Louisiana State University, who spoke on "Modern Methods of Determining Pressure Distribution Through Soils". Following his address a lively discussion took place.

Mr. L. C. H. McLean, chairman of Membership Committee "A", reported on the progress of his committee, following which the meeting adjourned with a rising vote of thanks to Professor Wallace.

Secretary-Treasurer,
JOHN P. FERNANDEZ.

Minutes of Meeting of the Board of Direction, April 30, 1945

The meeting was called to order by President Steinmayer, with the following members present: Messrs. Gosa, Kerr, McNiven, Mayer, Nairne and Fernandez. Mr. J. V. Dugan, chairman of the Entertainment Committee, was preset by invitation. Minutes of the previous meeting were read and accepted. The order of the meeting was dispensed with for convenience.

It was decided that the golf tournament be held in the middle of June, the date and place to be determined by the Entertainment Committee. It was moved and passed that $100.00 be underwritten for expenses of the tournament.

The President's reply to the letter received from the Woman's Auxiliary was read.

A letter from Mr. J. H. Collins, chairman of the Publications Committee, suggesting improvements to the Proceedings was read. It was moved and passed that a committee of not more than five members be appointed by the president to report on Mr. Collins' suggestions at as early a date as possible.

A letter from Mr. Henri deBonneval with reference to the site of a proposed union station for New Orleans was read.

It was moved and passed that a committee of two be appointed to draw up a resolution to be sent to Louisiana congressmen objecting to the creation of regional or valley authorities. Messrs. Charles M. Kerr and C. Glen Cappel were then appointed to this committee.

The constitiution of the proposed Lake Charles Section was carefully reviewed.

There being no further business, the meeting adjourned.

Secretary-Treasurer,
JOHN P. FERNANDEZ.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXXI AUGUST, 1945 NO. 4

CONTENTS

EDITORIAL NOTES AND COMMENT

Baton Rouge Section. On June 23 the Baton Rouge Section carried through an interesting and well organized program. The afternoon was devoted to golf and other recreation; the evening meal was followed with interesting movies, furnished by Mr. Leake of the General Electric Co. Attendance was excellent. Mr. O'Brien, President of the Section and his associates should be justly proud of this meeting.

Our Library. How many of our members make use of our library at the St. Charles Hotel? Ask for the key for room 422 at the hotel desk, and sign a card when securing the key. If you have not already done so, pay the rooms a visit. If you have any suggestions, Library Chairman Henri Molaison will be glad to hear from you.

New Members. With this issue we welcome a number of new members. We hope that they will take an active part in the affairs of the society. Look over the names, get acquainted with your new fellow members. Note: In the list of new members in the June issue, Mr. Rathbone De Buys was listed as resident engineer, Illinois Steel Co. This should have read Illinois

Central Railroad. Incidently, Mr. De Buys first joined in 1898, a charter member.

Bartlett, Z. W. Age 37. Endorsed: F. B. Blackstone, C. O. Lee, K. T. Price. Graduate Texas A & M in Petroleum Engineering 1929; attended Graduate School Pet. Eng. of Stanford U., 1929-30; Freeport Sulphur Co., 1934 to date, Asst. General Supt. Registered Engineer, State of Texas; Member Am. Institute of Mining & Met. Engrs.

Beamer, Clayton M. Age 38. Endorsed: A. J. Ferguson, M. H Grosz, J. T. O'Brien. Graduate V.M.I., BS in chemistry. Standard Oil Company, 1929 to date. Head of Alcohol Dept., Baton Rouge Refinery.

Braud, Louis A. Age 32. Endorsed: H. J. Boudreaux, Jr., Leo J. Lassalle, T. Baker Smith. Instructor of related subjects and mechanical drawing for State Dept. of Education, Division of Trades & Industry, draftsman for Baton Rouge plant of E. I. DuPont. At present Engineer and Manager of Leach Machine & Boiler Works, Inc., Houma, La.

Breece, Grady L. Age 40. Endorsed: M. C. Abrahm, J. M. Gondron, L. C. H. McLean. 5 yrs. with Converse Bridge & Steel Company as structural draftsman; 8 yrs. Jones & Laughlin Steel Corp. as structural checker, estimator and designer; 6 yrs. (and presently) McWilliams Dredging Company as Chief Engineer & Naval Architect.

Burgess, Ray E. Age 42. Endorsed: Theo T. Chenet, E. H. Goodloe, Paul E. Lirette. Graduate University of Mo., C. E. 1924. 1924-26, K.C.S.R.R., St.L. & S.F. R.R., Crystal Oil Ref. Corp., Electric Bond & Share; 1926-29, La. Oil Ref. Co.; 1929-44, The Texas Company; 1944 to present, Cities Service Refining Corp. Licensed engineer Louisiana and Texas.

Campell, Kohlnman, Age 33. Endorsed: W. J. Drawe, Jr., Henri Molaison, C. S. Williamson. Graduate Tulane U., BE in Chem. Eng. 1932. Orleans Levee Board, 1933; Chalmette Petroleum Corp., 1933 to date. Present position, Chief Chemist. Member Tau Beta Pi.

Chapman, A. Watson. Age 39. Endorsed: Henri Molaison, James M. Robert, C. S. Williamson. Tulane University, BE in Chem. Eng., BS in Chemistry, 1927. July 1927 to date, Celotex Corp., now manager of Technical Operations. Senior member of A. I. Chem. Eng.; Fellow of Am. Inst. of Chemists; past president of La. Section, Am. Chem. Soc.; National Vice-Pres. of Alpha Chi Sigma chemical fraternity; member Tau Beta Pi.

Cockrell, C. M. Age 42. Endorsed: C. O. Lee, D. T. McIver, K. T. Price. Graduate Texas A & M, BS in M.E. 1927; V.P.I., ME 1930. American Welding Society, American Society of Metals. Engineer in charge of construction of nickel refinery, 1 yr., and supervised design of ore roasting plant, 2 yrs., for Nicaro Nickel Co. Design and construction work 10 yrs. for Freeport Sulphur Co. Registered professional engineer, Texas.

Earl, R. H. Age 40. Endorsed: F. B. Blackstone, C. O. Lee, K. T. Price. Graduate Rice Institute, BS in C.E. 1926. Freeport Sulphur Co. 1926 to date. Present position, Asst. Supt. of Eng. & Maint. Depts. Professional Engineer, Texas.

Fritchie, A. F. Age 52. Endorsed: J. H. Gillum, J. T. O'Brien, T. E. Peak. Graduate Cornell University, M.E. 1916. Salmen Brick & Lbr. Co., 1916-17; Lt., U.S. Army, F.A., 1917-19; Salmen Brick & Lbr. Co., Plant Mgr., 1919-20 Standard Oil Co. of La., 1920 to date. Present position, Asst. Gen. Supt. in charge mechanical.

Hall, Harvey Aldrich. Age 50. Endorsed: F. B. Grevemberg, B. P. Lyons, Leo M. Odom. University of Florida, BS, C.E. 1916; C.E. 1920. State Road Dept. of Fla., 1916-19 and 1919-29. University of Fla., 1930, Instructor in C.E. U. S. Engineer Office, 1930-34, Inspector. C. C. Camp Commander, 1934-35. Public Works Administrator, 1936-40; Major, U.S. Army Engineer Corps, 1941-44. Licensed C.E.

Hanson, Irven E. Age 52. Endorsed: F. B. Blackston, C. O. Lee, K. T. Price. 1914-16, Junior Field Mgr., Freeport Sulphur Co. 1917-18, Lt. U.S. Field Artillery; 1919 to date, Freeport Sulphur Co., various eng. assignments. Present position, Supt. in charge of Eng. and Constr. for Freeport Sulphur Co. and associated companies.

Hoyt, Charles P. Age 38. Endorsed: J. H. Gillum, J. T. O'Brien, T. E. Peak. Graduate Lafayette College, Easton, Pa., BS in M.E. 1929. Mechanical Inspector for Standard Oil Development Co., 1929-34; Standard Oil Company, 1934 to date. Present position, Head of Maint. & Const. Div., Baton Rouge Refinery. Member A.S.M.E.

Millard, George E. Age 50.Endorsed: Allan J. Harris, W. Stone Leake, James M. Todd. 1916-17, Test Engr., Fairbanks Morse Co., Three Rivers, Mich. 1917-18, Erecting Engineer FM&Co., New Orleans. 1918-19, U.S. Army; 1919 to date, various engineering assignments, Fairbanks Morse Co. Present position, Mgr. Diesel Engine Dept.

Nolan, Sidney D. Age 34. Endorsed: John E. Coyne, R. B. Richardson, Arthur W. McWhorter. 1929-41, La. Dept. of Hwys., Rodman, Instrumentman and Senior Draftsman. 1941-42, Silas Mason Engrs. & Contrs., Engineering Designer. 1942-43, Ford, Bacon & Davis, Eng. Designer. 1943, M. W. Kellog Co., Party Chief. 1943-44, John W. Harris Associates, Field Engr. 1944 to present, Cities Service Refining Corp., Eng. Draftsman. Member Southwestern Ass'n Engrs.

Oswald, Paul F. Age 34. Endorsed: H. A. Levey, R. L. Nall, Leon Savage. Graduate Northern Detroit High 1926, served a 4 yr. apprenticeship in 1½ yrs. Chrysler Jefferson Plant. Graduated Cass Tech., Detroit, night course in aero-dynamics. 1928-34, employed successively at Dodge, Buick, Lincoln, Ford, Pontiac & Chevrolet plants in tool, die and special Machine design. Completed night course, U. of D. in Industrial Engineering. 1934-41, Fisher Body Co., die design foreman. 1941, Lee Eng. Co., Detroit, in charge of design. 1941, Spalek Eng. Co., Detroit, designing aircraft tooling. 1941-44, A. J. Brandt Co., Detroit, in charge of tooling. (During this pd. was graduated from Plastics I.T. Inst.) 1944 to date, Oswald Engineering Service, New Orleans, private practice. Member S.P.E. (1942) Detroit.

Stewart, Chester A. Age 51.Endorsed: H. F. Carr, J. H. Collins, H. P. Watson. Graduate Ala. Polytechnic Inst., B.S. in M.E. 1914; ME 1921. 1914-17, Westinghouse Mach. Co., E. Pittsburgh, apprentice & draftsman. 1917-18, Jones & Laughlin Steel Co., Woodlawn, Pa., Stockhouse Foreman Blast Furnace Dept. 1918-19, U.S. Army, 37th Engrs. 1919, Casden Refinery, West Tulsa, Okla., Operating Engr. Power Plant. 1919-25, The Carter Oil Co., Parkersburg, W. Va. Cost. Foreman & Asst. Supt. Nat. Gas Dept. 1925-30, The Tropical Oil Co., Colombia, S. A., Supt. Nat. Gas Dept. 1930 to date, United Gas Pipe Line Co., Pipe Line Foreman & Dist., Supt.

Thompson, Abijah W. Age 43. Endorsed: Chas. M. Kerr, Leo M. Odom, James M. Todd. 1½ yrs. (and presently) Sr. Civil Engr., Pub. Wks. Dept., 8th N.D. 2 1/4 yrs. Designing Eng., Doullut & Ewin. 3 yrs. Head Structural Design, U. S. Engineer-Office, New Orleans. 15 yrs. additional engineering experience various positions. High School education with corr. courses from U. of Wis. Licensed C.E. in Louisiana.

Whitaker, Will A. Age 41.Endorsed: J. H. Gillum, J. T. O'Brien, T. E. Peak. Graduate U. of Va. in Elect. Eng. 1925.

1925 to date, Standard Oil Co. Present position, Asst. Head, Eng. Dept., Standard Oil Co. of La. Member A.S.M.E.

For Junior Member

Drake, Jesse D. Age 29 Endorsed: R. E. Gosa, Chas. P. Knost, W. Stone Leake. 3 yrs. in School of Eng., Miss. State College. Left May 1936. Miss. Pr. & Lt. Co., designing engineer, 1936-41; Chas. T. Main, Inc., Boston, in full charge of elect. design and inspection on four large govt. projects, 1941-43. Todd-Johnson Dry Docks Inc., in charge of elect. work, Engr. Dept., 1943 to date. Licensed Engineer, Miss.

Annual Golf Tournament. On Thursday, July 12, the Society staged its fifteenth annual outing. An afternoon of sports at the Colonial Club was finished off with a meal of barbecued chicken "with fixin's." A novel and entertaining floor show followed. Mr. Dugan and his committee did a grand job. Mr. Seago and his associates really "went to town" on the prizes. An account of the occasion would not be complete without an expression of thanks to Ole K. Olsen and his ice cold keg of vitamins.

William Benjamin Gregory Hydraulic Laboratory. On Friday, June 22 this laboratory at Tulane University was dedicated. In a simple but impressive outdoor ceremony Dr. W. M. White made the presentation of the dedication; Mr. Phelps accepted on behalf of the University. Major General William F. Tompkins gave the address of the occasion, briefly sketching Professor Gregory's many achievements. Dean Robert acted as chairman.

Missouri Valley Project. At the July 15th meeting of the Society a resolution was presented concerning the bill now being considered by Congress for the control of the water in the Missouri valley. Presentation and discussion of this matter indicates the interest of our engineers in matters of civic importance. Mr. John L. Porter read the resolutions; the members present voted favorably upon it.

WHEREAS THE LOUISIANA ENGINEERING SOCIETY IS OPPOSED TO THE CREATION OF FEDERAL CORPORATIONS, SUCH AS VALLEY AUTHORITIES SIMILAR TO THAT PROPOSED IN SENATE BILL NO. 555 (79TH CONGRESS) FOR THE MISSOURI RIVER BASIN, FOR THE DEVELOPMENT AND CONTROL OF WATER RESOURCES;

Therefore, be it resolved that the Louisiana Engineering Society disapproves in principle Senate Bill No. 555, 79th Congress, and similar bills; and

Be it further rseolved that the Louisiana Engineering Society considers that legislation on water use and control should be based upon the following principles:

Water is one of the most important of all natural resources.

Water, like other natural resources, belongs to the people, and it is a proper function of government to conserve and develop this resource for the greater good of the greatest number.

The development of water resources on a basis of river basins is logical and will be more efficient than development by individual states.

Ownership of the waters of the nation, except where private ownership has been legally acquired, is inherent in the sovereign state as the representative of the people.

The program of conservation and development of water resources should be administered by a local government agency representing, and directly responsible to, the people of the state, or states, in which the river system, or river basin, is located; and having authority to study and to direct the development and utilization of all phases of water use and control, subject to control by the federal government of the use of waterways for navigation, and the planning of flood control.

In view of the importance to the nation of the proper development of water resources and of the probable contribution of federal funds, the agency should include representatives of federal departments such as, for example, Department of the Interior, War Department, Department of Agriculture.

The local agency should have authority to co-operate with, and enlist the aid of, federal agencies which deal with water use and control, and to co-operate with state and federal agencies which deal with the related problems of land use and control in the making of investigations and plans, and in the construction of projects.

The advice and assistance of scientific and technical agencies of the federal government should be made available to such local agencies; and federal funds should be made available to the extent that developments and projects have a national character and value.

The agency should have the authority to contract with federal agencies, or to make such other arrangements as may be agreed upon, for the expenditure of funds appropriated by Congress for projects which involve national interests and benefits, e. g., construction of irrigation projects by the Bureau of Reclamation and of flood control projects by the War Department.

The appropriation of federal funds for water development projects may properly involve payment for the use of water for a sufficient period to pay for the cost of the project in whole or in part depending upon the particulars of the project; but should not involve transfer of ownership of the water itself from the states to the federal government.

Be it further resolved that copies of this resolution be sent to the Louisiana members of Congress requesting their active co-operation.

Engineering Briefs. In the McComb shops of the Illinois Central Railroad there is being fabricated an ultra-modern experimental refrigerator car. Alloys will reduce its weight by fourteen thousand pounds; glass wool insulation will be used. Construction is such that frozen foods as well as regular loads may be handled. It is designed to roll at sixty miles per hour, and will be a competitor of air express.

Most of us are familiar with the wind driven electric generator at Grandpa's Knob, Vermont. Plans are now being developed for a series of generating stations in the midwest, each unit to be 7,500 k.w. Construction will be somewhat different from the Vermont station. Two units equipped with two blade wheels will be mounted on top of a five hundred foot tower.

A definite effort is being made by those in charge of specialized war surplus material to utilize it to the best advantage. Universities and others are being asked to cooperate on an extensive research program to devise ways and means to adapt these materials to industrial and domestic uses. This will prevent the dumping of millions of dollars of war products at "junk" prices.

By placing sterilizing lamps in the air ducts supplying packaging rooms in a pharmaceutical house, the incoming air is practically germ free.

PAPERS AND DISCUSSIONS

MODERN METHODS OF DETERMINING THE DISTRIBUTION OF PRESSURE THROUGH SOIL

W. P. WALLACE *

FOREWORD

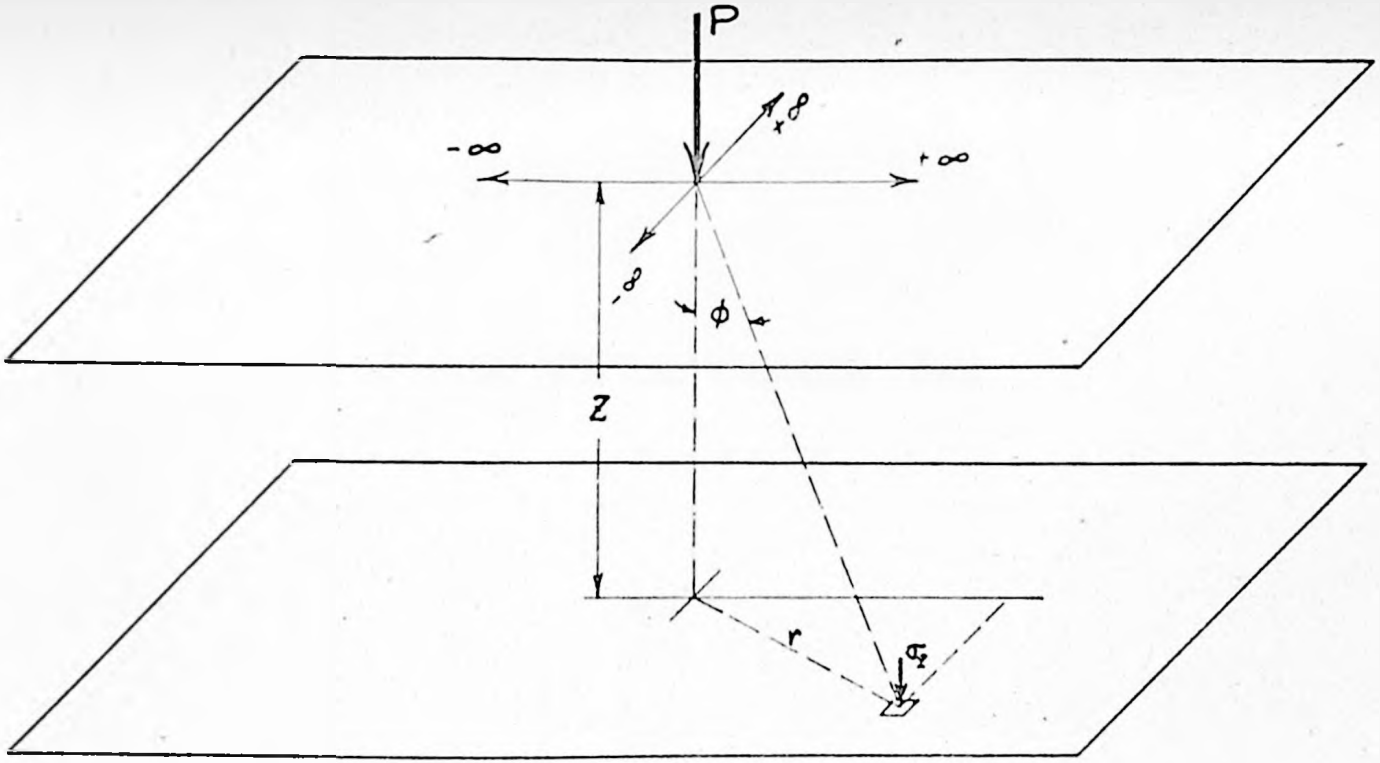
This paper is concerned with a correlation between the theoretical distribution of pressure and the acutal distribution as found from the experimental work of present day American and European investigators. Fallacies of the traditional assumptions of pressure distribution will be discussed in the light of the new tested theories.

For many years it was the practice of foundation engineers to consider the distribution of pressure on the lower soil layers beneath a footing as being uniform over some area. This area was to be bounded by planes passing through the edge of the footing and making some arbitrarily assumed angle with the vertical, usually a slope of 2 to 1 for convenience in calculations. This, of course, ignored certain properties of the soil and led to settlements of the structure that seemed inexplainable.

In 1885 Boussinesq (1)** published his "Application des potentials à l'étude de l'équilibre et du movement des solides lastiques," wherein he derived a formula for the radial pressure at any point of a semi-infinite body due to a single concentrated load applied to the boundary. In 1935, A. E. Cummings (2) brought this formula to the attention of foundation engineers and converted it to usable form.

* Assistant Professor of Civil Engineering, Louisiana State University. Presented at the regular meeting of the Society on April 9, 1945.

** Numbers in parentheses refer to Bibliograph at the end of the paper.



Boussinesq's Formula

$$\sigma_z = \frac{P}{Z^2} \cdot \frac{3}{2\pi} \cdot \frac{1}{\left[1 + \left(\frac{r}{z}\right)^2\right]^{5/2}}$$

$$= \frac{P}{Z^2} k_{90} \quad \text{where} \quad k_{90} = \frac{3}{2\pi} \cdot \frac{1}{\left[1 + \left(\frac{r}{z}\right)^2\right]^{5/2}}$$

FIG 1

Boussinesq's problem is shown in Fig. 1, and the formula for the vertical pressure (force per unit of area) at any point in the media is

$$\sigma_z = \frac{P}{z^2} \cdot \frac{3}{2\pi} \frac{1}{\left[1 + \left(\frac{r}{z}\right)^2\right]^{\frac{5}{2}}}$$

or (I)

$$\sigma_z = \frac{P}{z^2} K_{90} \text{ where } K_{90} = \frac{3}{2\pi} \frac{1}{\left[1 + \left(\frac{r}{z}\right)^2\right]^{\frac{5}{2}}}$$

We see that this is a three dimensional spread through the media and depends only on the coordinates of the point at which the pressure is desired and not on the modulus of elasticity of the material. This is fortunate for us as it allows application of the relation to different types of soil.

Formula I, which is much used today, is correct only if the media through which the pressure is distributed is perfectly homogeneous and isotropic, i. e. the elastic properties are the same in all directions, under either tension or compression. Since soils can take very little tension, if any at all, the allowance of a 90° spread of the pressure distribution is at once disturbing. If we examine the make-up of the soil closely, particularly cohesionless soils like sand, shown in Fig. 2 a, we

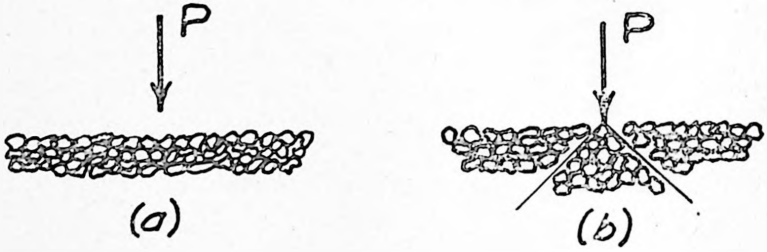


FIG. 2

see that although the grains are in contact before the load is applied, a pressure spread through the mass affects certain particles only, causing them to move downward, (Fig. 2 b), and destroys the contact. Since the lower particle was supporting the upper one and this soil possesses no tension characteristics, the upper grain contributes nothing to the pressure spread, but simply falls under the influence of gravity and rests on the lower one and we feel justified in concluding that the 90° spread is much too large. Even clays which sometimes have the structure shown in Figs. 3 (a) and (b) and

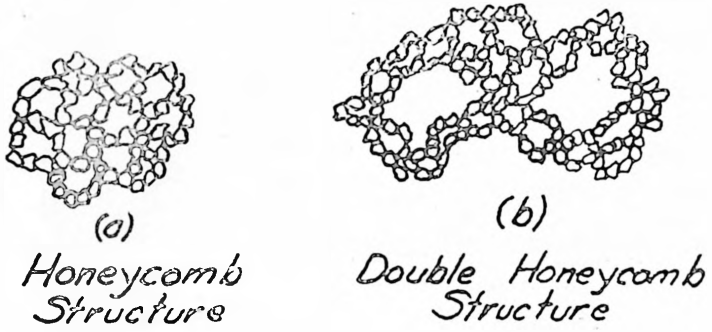


FIG. 3

a high cohesion between particles do not have enough to give a 90° spread.

If we plot values of the vertical pressure, as obtained by Boussinesq, on a plane, say 10 feet below the load, the pressure diagram will be a curved surface of revolution of which Fig. 4 shows a cross-seciton. As we go farther from the center, the ordinates become smaller and smaller, eventually becoming zero at $\pm$ 100. Note that at an angle of 65° with the vertical it has already reached an extremely low value.

Strohschneider (3) and other recent investigators made many experiments with sands and found the same general shape as the Boussinesq pressure distribution but a much larger pressure directly under the load than Formula I in-

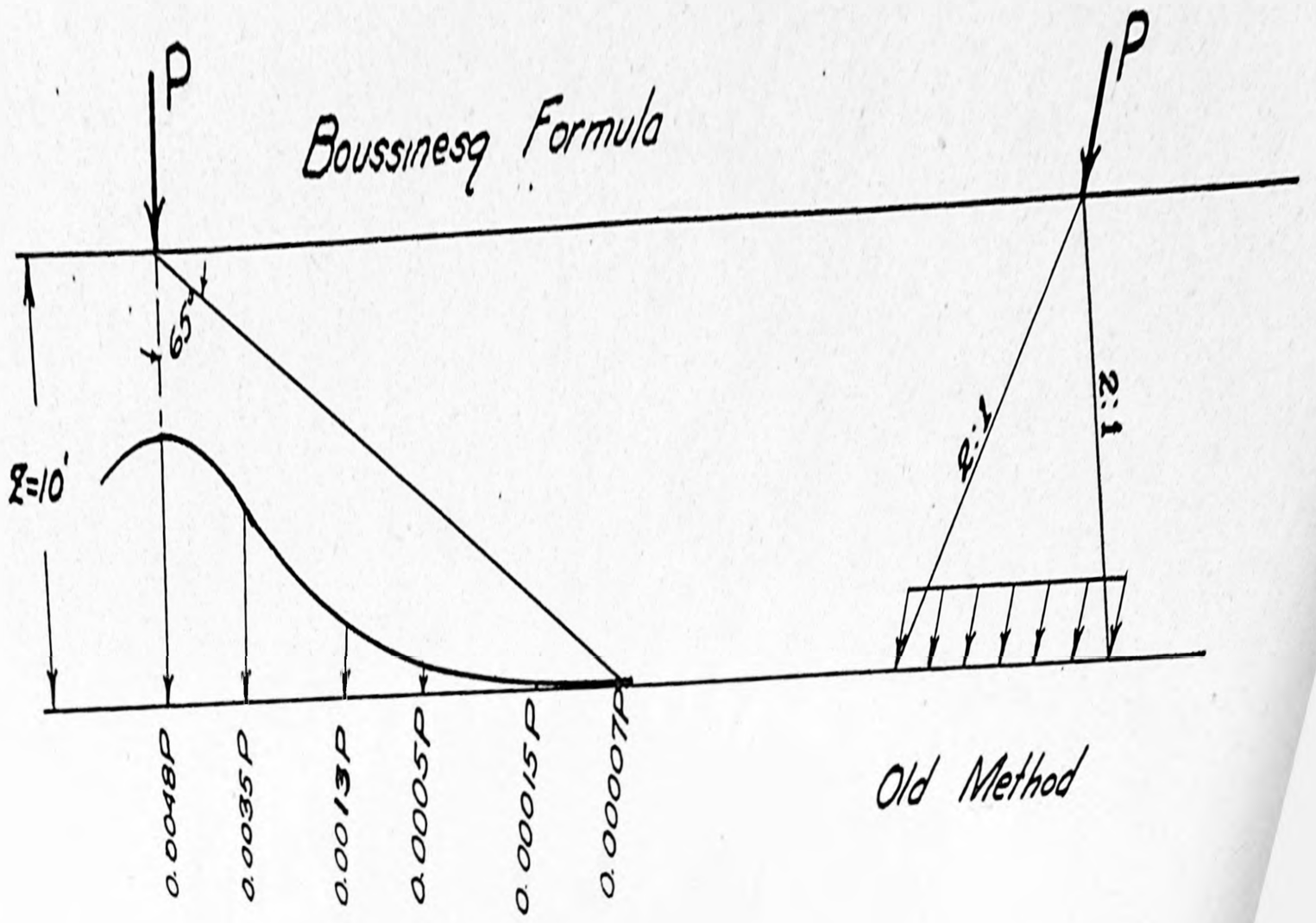

P
Boussinesq Formula
P
65°
2:1
2:1
2=10'
0.0048P
0.0035P
0.0013P
0.00005P
0.00015P
0.00007P
Old Method

FIG. 4

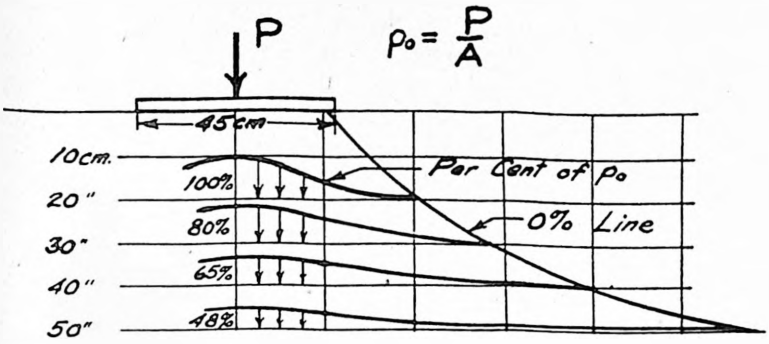


FIG. 5

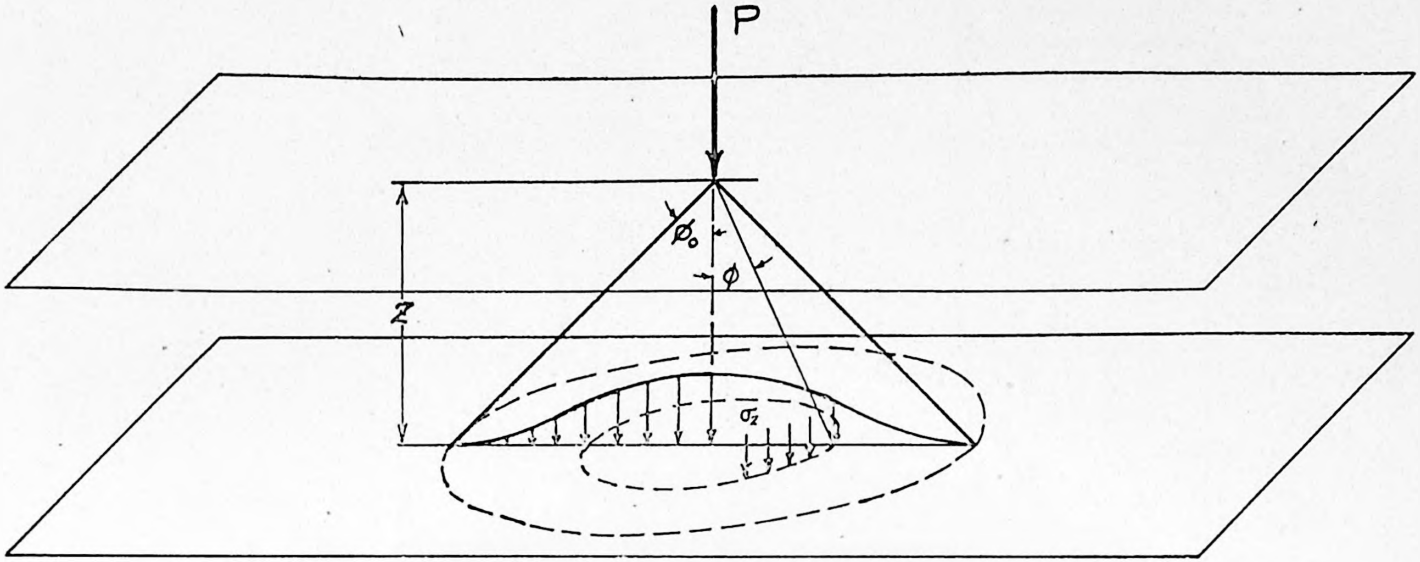
dicated. The results of such an experiment are shown in Fig. 5. To make the Boussinesq formula fit more closely the experimental results that he found, Strohschneider modified it to limit the spread to some angle ϕ_0 with the vertical, and obtained

$$\sigma_z = \frac{P}{z^2}\frac{3}{2\pi}\frac{(\cos\phi - \cot\phi_0 \sin\phi)\cos^4\phi}{1-\cos\phi_0}$$

$$= \frac{P}{z^2}k \qquad \text{(II)}$$

Strohschneider's problem is shown in Fig. 6. By thus limiting the spread, Strohschneider retained a similar shape of pressure diagram but eliminated the infinite area thereby obtaining central ordinates that agreed more closely with experimental results.

The value of ϕ_0 must be determined by experiment or, by judgment tempered by experience, with the soil concerned. Once ϕ_0 is determined or assumed, the distribution of the pressure on any plane may be calculated by the use of Table 1. In this table values of the variable angle ϕ and the quantity k



Strohschneider's Formula

$$\sigma_z = \frac{P}{Z^2} \cdot \frac{3}{2\pi} \cdot \frac{(\cos\phi - \cot\phi_0 \sin\phi)\cos^4\phi}{1 - \cos\phi_0} = \frac{P}{Z^2} \cdot k$$

FIG. 6

are tabulated for fixed values of ϕ_0 from 40° to 90°. Note that when $\phi_0 = 90°$, the result is the Boussinesq Formula. For sands ϕ_0 usually varies between 45° and 50° while for clays it varies from 60° to 70°, depending on the degree of fatness. Since clays have colloids present, which tend to glue the particles together, they approximate more closely the isotropic, homogeneous media that the elastic theories assume.

Determination of ϕ_0

One may easily determine experimentally, in the laboratory, the value of Φ_0 for sands by using Goldbeck cells or other pressure measuring devices. This is possible since a sand mass built up in the laboratory shows characteristics very little different from its counterpart in the field, but it has been relatively impossible to reconstruct a clay mass or attempt to insert a pressure cell in an exciting clay strata due to the structure of the clay, particularly if it is of the honeycomb or double-honeycomb type shown in Figs. 3 (a) and (b).

Some pressures have been measured in clay fills but the results are doubtful so the value of ϕ_0 for clay will still be largely a matter of judgment. The assumption of a value of 45° for sands and 70° for very fat clays with other values spaced proportionately in between, according to the amount of sand and clay present will yield results that are on the safe side. The important fact, however, is that the distribution is not uniform over the new area but varies from a maximum at the center to a value of zero at the edges.

Instead of using the curved pressure diagram of Fig. 6, a straight line may be substituted as shown in Fig. 7. The resulting cone, of which Fig 7 is a crosssection, must have a volume

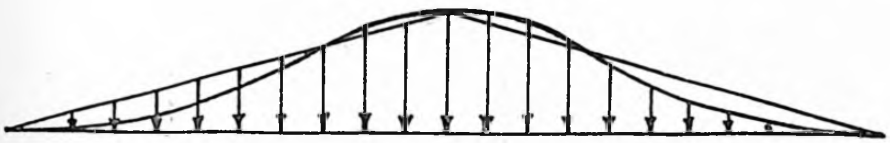


FIG. 7

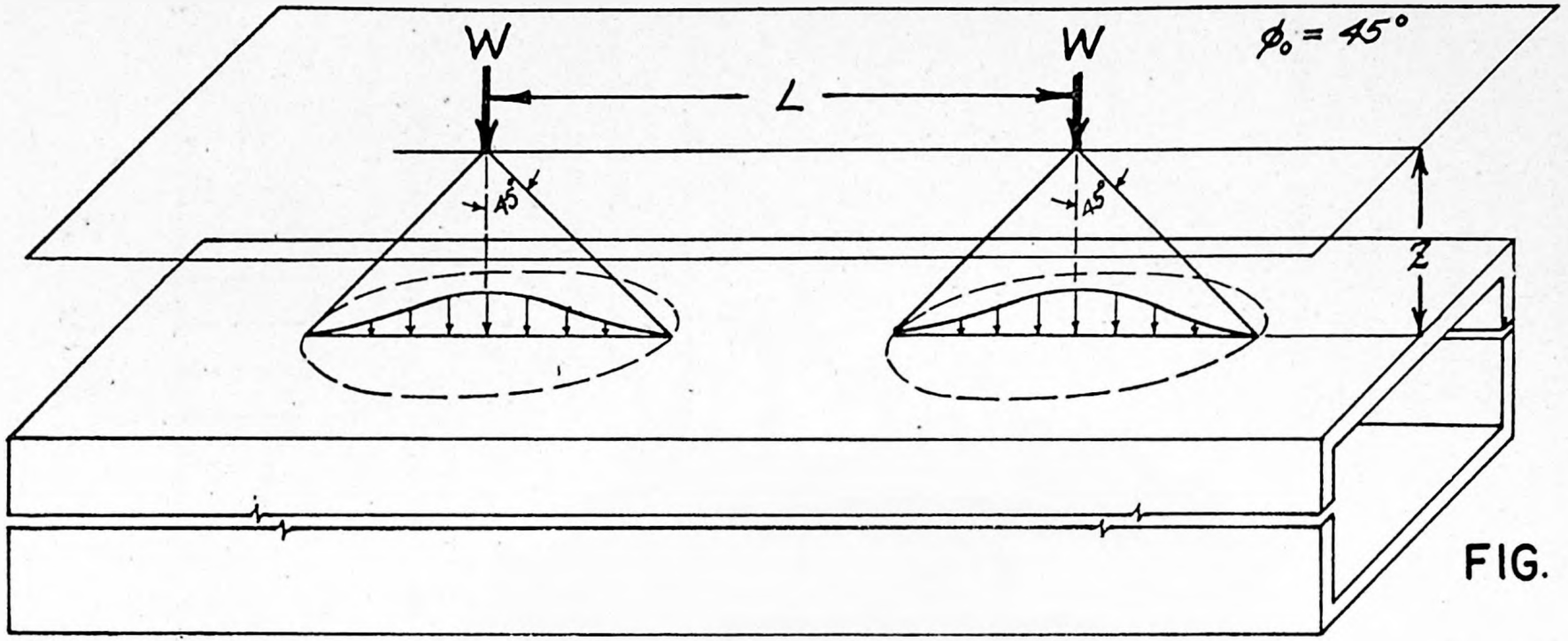


FIG. 8

equal to that under the curved surface, both volumes being equal to the load P. This substitution extends the spread somewhat but only a small amount; the maximum ordinate remains the same, however, in both cases. This is of importance in computations of consolidation since it is the maximum pressure that causes the greatest settlement, for a constant thickness of strata.

To illustrate the use of Formula II, consider the problem of the wheel loads of a large road building machine or the landing gear of one of the enormous new planes rolling over the culvert. This problem is shown in Fig. 8. The pressure spread is assumed as 45° for convenience.

Suppose the wheel loads to be 50 tons each. At a depth of one foot below the surface the pressure under the load is 81.6 t/sq. ft. (Table I, Formula II, $\phi_0 = 45°$, $\phi = 0$, $K = 1.632$, $Z = 1$), while at a depth of 5 feet below the load, the pressure is 32.5 t/sq. ft. and at depth of 10 feet it is .82 t/sq. ft.

We see that as the depth increases the two pressure diagrams will begin to overlap and the pressure ordinates at such points are added together to obtain the total pressure. This is a correct procedure since the pressures were linear functions of the surface load and the law of superposition will apply.

The effect of the addition of the pressure diagrams may readily be seen from the following illustration. Fig 9 shows the column footings for a warehouse where they have been designed to give the same unit pressure under all the footings, known as the sole pressure. The depth of the consolidating strata is more than three times the width of the footing*, hence the footing load may be considered as a concentrated load and

* If the pressure is desired on a plane whose depth below the loaded surface is less than three times the largest dimension of the footing, then it will be necessary to divide the footing into a number of equal parts whose longest dimension is not more than one third the depth to the plane, and compute the pressure at any particular point in the plane by adding the vertical pressures contributed by each of the divisions of the footing. This assumes that the divisions are independent of each other, i. e., that the footing is perfectly flexible, but yields good results. When the depth to the plane is more than three times the longest dimension of the footing, considering the load as concentrated gives nearly the same result as dividing the footing into smaller parts.

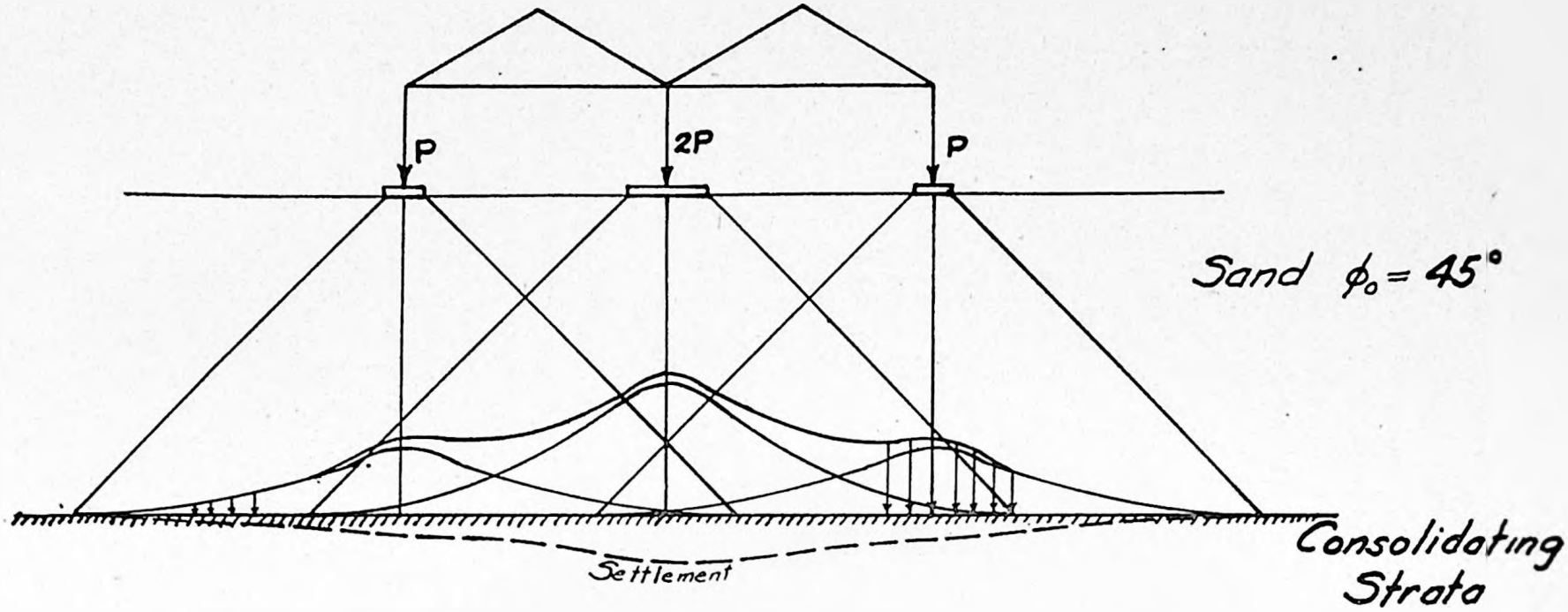


FIG. 9

Formula II applied. The middle footing has twice the vertical load so it will cause a greater settlement to take place under that footing, but at the same time it also receives additional contributions from the other footings. Fig. 9 shows the contributions from the side footings only. This will cause the top of the consolidating strata to take the deflected position shown by the dotted line in Fig. 9.

So far, we have ignored the time rate of settlement and have referred only to the ultimate settlement. The pressure bulbs under the footings vary according to the dimensions of the footings, the larger footings having the deeper pressure bulbs; therefore, even if the footing sizes are designed so as to give equal ultimate settlements, the time rates of these settlements must vary, if the sizes vary, and we find it impossible to prevent settlement with such an arrangement of isolated footings. An excellent paper on this condition has been given (6).

Another illustration of unequal settlement caused by overlapping pressure distributions is two heavy adjacent loads as shown in Fig. 10. The building on the right was built first and has been in existence long enough so that the principal part of its settlement has occurred and for all practical purposes may be considered to have realized its ultimate value. The building on the left is then constructed, causing a pressure spread that reaches under the first building with pressures that are appreciable. These new pressures cause further consolidation under the first building, the consolidation being greater on the left side with a resulting tipping of the building. Even if the buildings are constructed on piling the overall effect is the same since the piling only serve to distribute the load to lower strata. There have been cases in which buildings adjacent to excavations subsided as the excavation progressed and rose as the new building was constructed. This type of fluctuation will vary with the character of the subsurface since consolidation is a function of the ease of escape of water from a consolidating strata in addition to the amount of vertical pressure.

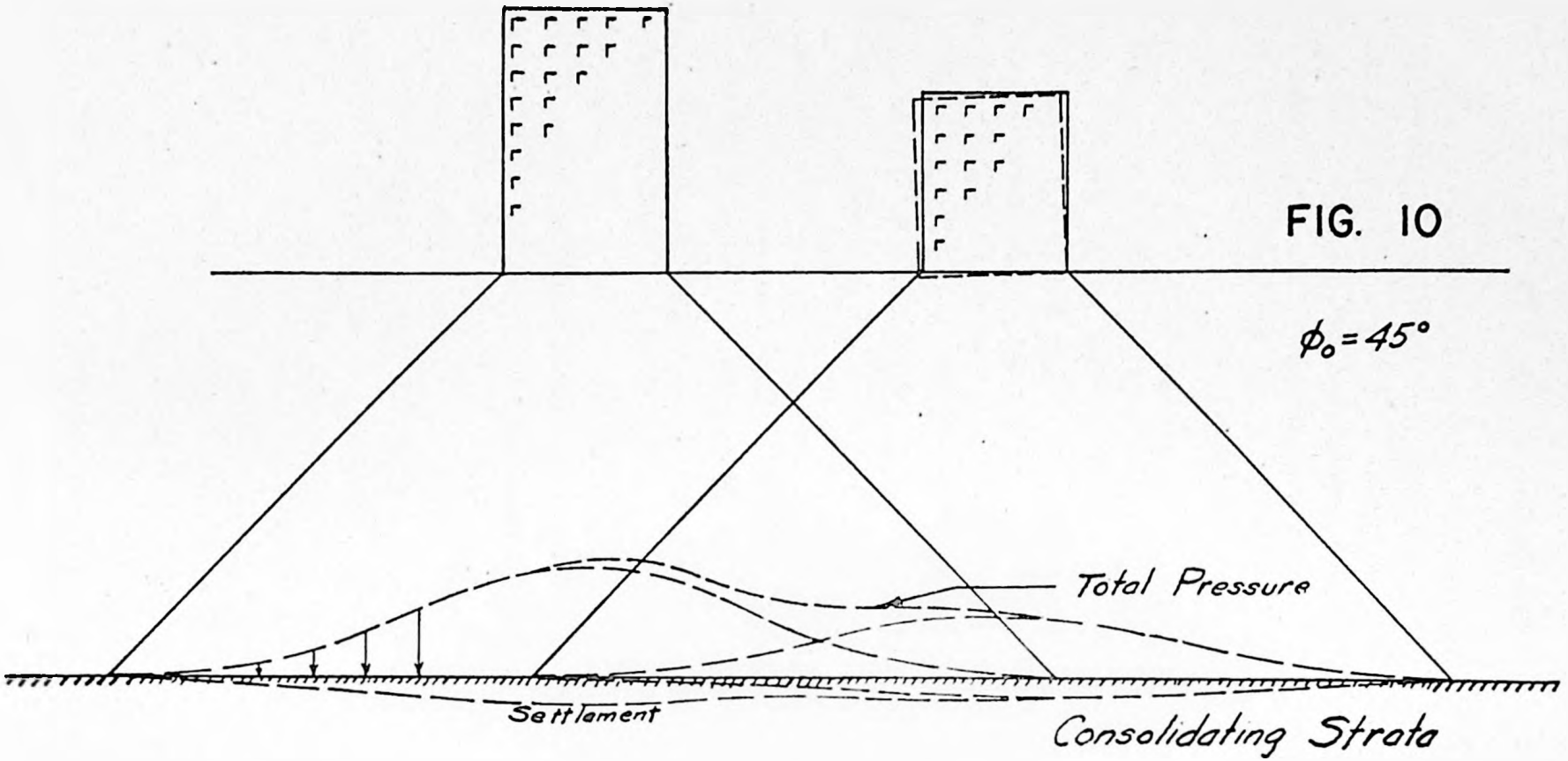
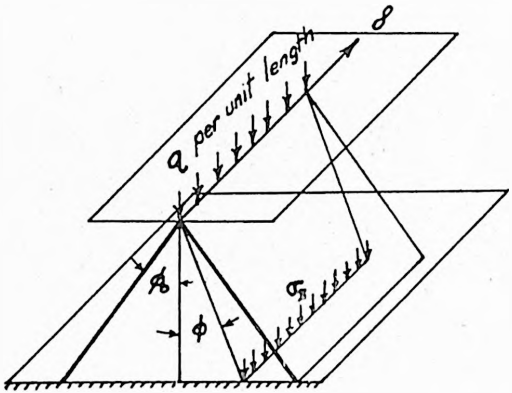


FIG. 10
$\phi_o = 45°$
Total Pressure
Settlement
Consolidating Strata

LINE LOADS



Flamont's Formula

$$\sigma_z = \frac{q}{z} \cdot \frac{2}{\pi} \cdot \cos^4\phi = \frac{q}{z} \cdot n_{40}$$

Kogler's Formula

$$\sigma_z = \frac{q}{z} \cdot \frac{(\cos\phi - \cot\phi_0 \sin\phi)\cos^3\phi}{\phi_0} = \frac{q}{z} \cdot n$$

FIG. 11

Line Loads

The load caused by a wall footing is represented by a line load as shown in Fig. 11.

The solution for this case is obtained by integrating the concentrated load over a small length dx, for a line of infinite extent. Flamont integrated Boussinesq's formula and obtained,

$$\sigma_z = \frac{q}{z} \cdot \frac{2}{\pi} \cos^4 \phi$$

$$= \frac{q}{z} n_{90} \qquad \text{(III)}$$

where q is the load per unit length of the line.

Kögler (7), seeing the need for a limitation on the spread, integrated Strohschneider's formula and obained,

$$\sigma_z = \frac{q}{z} \cdot \frac{(\cos\phi - \cot\phi_0 \sin\phi) \cos^3\phi}{\phi_0}$$

$$= \frac{q}{z} n \qquad \text{(IV)}$$

where q = load per unit length of the line and ϕ_0 is in radians. This is a two-dimensional spread; the common plane stress problem, and values of n may be found for different values of ϕ and ϕ_0 in Table 1. As before, the 90° spread is Flamont's formula.

If the footing is very wide or the consolidating strata very close to the surface, the given footing may be divided into several parallel line loads and the pressure from each found in a manner similar to the division of the large footing in the concentrated load problem.

The same conditions of unequal settlement will occur under parallel wall footings if they are designed with equal sole pressures as occur with isolated footings.

TABLE I

Values of k and n for eq. I, II, III, and IV
ϕ_o 90° applies to I and III, ϕ_o
other than 90° applies to II and
IV

TABLE I

ϕ \ ϕ_o	=40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°=	ϕ_o / ϕ
0	k=2.042 n=1.433	1.632 1.275	1.337 1.146	1.122 1.042	0.957 0.957	0.828 0.892	0.726 0.817	0.645 0.764	0.579 0.718	0.524 0.676	0.478=k 0.636=n	0
5	k=1.790 n=1.262	1.458 1.140	1.211 1.042	1.033 0.964	0.891 0.894	0.777 0.831	0.688 0.777	0.616 0.733	0.558 0.695	0.509 0.660	0.468=k 0.624=n	5
10	k=1.493 n=1.064	1.244 0.987	1.055 0.918	0.912 0.860	0.798 0.810	0.705 0.763	0.630 0.720	0.569 0.684	0.520 0.655	0.478 0.627	0.443=k 0.598=n	10
15	k=1.169 n=0.850	1.002 0.811	0.871 0.772	0.767 0.738	0.679 0.703	0.608 0.671	0.552 0.643	0.504 0.618	0.463 0.594	0.430 0.575	0.403=k 0.555=n	15
20	k=0.847 n=0.633	0.762 0.633	0.681 0.621	0.614 0.607	0.556 0.602	0.504 0.571	0.464 0.556	0.427 0.538	0.398 0.526	0.372 0.511	0.351=k 0.497=n	20
25	k=0.551 n=0.427	0.531 0.459	0.497 0.466	0.457 0.469	0.427 0.471	0.396 0.466	0.368 0.457	0.344 0.450	0.324 0.444	0.306 0.436	0.292=k 0.428=n	25
30	k=0.310 n=0.252	0.336 0.291	0.330 0.333	0.327 0.351	0.311 0.359	0.294 0.361	0.280 0.364	0.266 0.364	0.254 0.364	0.243 0.363	0.233=k 0.368=n	30
35	k=0.122 n=0.105	0.180 0.172	0.203 0.212	0.211 0.239	0.210 0.256	0.206 0.267	0.199 0.273	0.193 0.280	0.187 0.283	0.181 0.286	0.176=k 0.286=n	35
40	k=0 n=0	0.060 0.071	0.104 0.122	0.122 0.148	0.130 0.170	0.134 0.187	0.134 0.194	0.132 0.204	0.130 0.210	0.128 0.215	0.126=k 0.217=n	40
45		0 0	0.037 0.045	0.060 0.079	0.072 0.102	0.078 0.117	0.082 0.130	0.083 0.139	0.084 0.147	0.085 0.155	0.085=k 0.160=n	45
50			0 0.	0.020 0.029	0.033 0.051	0.041 0.068	0.045 0.079	0.048 0.089	0.050 0.096	0.052 0.104	0.053=k 0.110=n	50
55				0 0	0.011 0.019	0.017 0.031	0.022 0.044	0.025 0.052	0.027 0.059	0.029 0.065	0.030=k 0.070=n	55
60					0 0	0.005 0.010	0.009 0.020	0.011 0.026	0.013 0.032	0.014 0.036	0.015=k 0.040=n	60
65						0 0	0.002 0.005	0.004 0.011	0.005 0.014	0.006 0.019	0.007=k 0.020=n	65.

There are many other conditions of loading that have been tabulated in (8) and (9), and many investigators have published solutions for the different types of sole pressures. These are to be found in the several texts on Soil Mechanics. Any of the sole pressures, however, may be treated as individual concentrated loads over small areas and the pressure on any plane below the footing computed by direct summation, once the sole pressure has been determined or assumed.

It is hoped that Table I will be of value to those who must calculate the pressures on lower strata of lesser bearing value and that at least qualitatively they may think about the unequal settlements that will occur under isolated footings and provide for it in the superstructure.

In conclusion, I would like to state that this paper is largely the result of the work of Professor L. J. Muse, now serving with the Army Air Forces, in collecting and translating the material from the original publications.

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MINUTES OF THE MEETING AND BUSINESS OF THE SOCIETY

Minutes of Special Meeting of the Board of Direction May 14, 1945

The meeting was called to order by President Steinmayer, with Messrs. Kerr, Mayer, McNiven, Nairne, Nelson and Fernandez present. Reading of minutes of the previous meeting was dispensed with.

Mr. Kerr read a resolution concerning legislation on the creation of regional and valley authorities. It was moved and passed that the resolution be presented to the Society as read.

There being no further business, the meeting adjourned.

Secretary-Treasurer.
JOHN P. FERNANDEZ.

Minutes of Meeting of the Louisiana Engineering Society, May 14, 1945

The meeting was called to order by President Steinmayer, with approximately 80 members and guests present. Minutes of the previous meeting were read and accepted.

President Steinmayer announced plans for the June and July meetings. The President also referred to the April issue of the Society's Proceedings, acknowledging the good work of its editor, Professor Arthur M. Hill.

A memorial honoring the late William F. Cooper was read by the Secretary.

Mr. John V. Dugan, Chairman of the Entertainment Committee, announced that the annual golf tournament would be held in July. Mr. Raymond P. Bassich, Chairman of the Employment Committee, reported on his committee's activities to date.

President Steinmayer then announced that a resolution pertaining to legislation on the creation of regional and valley authorities would be presented, and read Section 12 of the by-laws entitled "Motions and Resolutions".

Mr. J. H. O'Neill took the floor, stating that the terms of Section 12 had not been complied with. A motion was made by Mr. C. L. Nairne, seconded by Mr. K. P. Kammer, to suspend the rule outlined in Section 12 in this instance. After some discussion this motion was withdrawn, and the proposed resolution was read by Mr. C. M. Kerr.

Mr. O'Neill then stated that the Society was not in possession of the true facts concerning the anticipated legislation, and that the matter shuold be referred to the legislative Committee for study. He also contended that the second portion of Section 12 had not been fully complied with. At this point the Chair ruled that cards announcing the meeting had carried the sense of the resloution and that a motion was in order.

Mr. Kerr then moved that the resolution be submitted to a vote, seconded by Mr. Nairne. Professor Williamson objected, stating that due notice had not been given. A motion then was made to table the resolution; a vote was taken on this measure, disclosing 13 yea's and 18 no's.

Mr. F. N. Billingsley requested an explanation of the resolution, stating that its terms were too vague, and Mr. Kerr explained. Mr. O'Neill

stated that the Society should study the proposed legislation more fully and made an amended motion that the matter be referred to the Legislative Committee, or to a committee appointed by the President for its investigation. Mr. W. H. Seales suggested that the matter be referred to a special committee of members selected for their ability on the subject.

Messrs. Melville and Kammer maintained the substitute motion was out of order, and the original motion was voted upon, with results of 19 yeas and 19 nos. The motion lost.

Mr. O'Neill moved that the Chair appoint a committee on "Water Use and Control" to study pending legislation on the creation of regional and valley authorities and report its findings to the Society, which motion was seconded by Mr. Billingsley and carried.

President Steinmayer then introduced the speaker of the evening, Mr. C. B. Blair of the Aluminum Company of America, who gave a talk on "Aluminum Cable as a Conductor". Two sound films were shown: "Aluminum—Mine to Metal" and "Aluminum Fabrication Processes". After this presentation, the President thanked the speaker and the meeting adjourned.

Secretary-Treasurer.
JOHN P. FERNANDEZ.

Minutes of Meeting of the Board of Direction, Monday, June 4, 1945

The meeting was called to order by Vice-President Nairne, with Messrs. Gosa, Kerr, Mayer, McNiven, Nelson and Fernandez present. Also present by invitation were Messrs. J. V. Dugan and F. M. Taylor.

Minutes of the two previous meetings were read and accepted. The secretary announced that all candidates listed in the April ballot had been elected to membership.

Mr. Kerr, chairman of the special committee on "Water Use and Control", reported that his committee would meet on Wednesday, June 6. Dr. Francis M. Taylor, representing the special committee on Publications, reported that the suggestions offered by Mr. J. H. Collins for a new type of bi-monthly publication had been received favorably by the commitee. Mr. Kerr moved that the Society appropriate $500.00 to be added to the amount presently budgeted for publications, to be used in the preparation of a new bi-monthly periodical. The motion was seconded by Mr. Nelson and carried unanimously.

Mr. Dugan reported that the Committee on Entertainment and Outings had decided to hold the annual golf tournament on Thursday, July 12 at the Colonial Country Club.

The Secretary read a communication which had been forwarded to Mr. B. A. Fleshman concerning the Board's recommendations for changes in the charter of the proposed Lake Charles Section, and was instructed to inquire what progress was being made in the formation of the section.

Two letters from the chairman of Membership "B" Committee, recommending the following named applicants for election to membership, were read:

For Member: Z. W. Bartlett, Clayton M. Beamer, Louis A. Braud, Grady L. Breece, Ray E. Burgess, Kohlman Campell, A. Watson Chapman, Clifford M. Cockrell, R. H. Earl, A. F. Fritchie, Harvey A. Hall, Irven E. Hanson, Charles P. Hoyt, George E. Millard, Sidney D. Nolan, Paul F. Oswald, Chester A. Stewart, Abijah W. Thompson, Will A. Whitaker.

For Junior Member: Jesse Dean Drake.

It was moved and passed that the action of the Membership Committee be approved and the applicants' names be included in the next ballot.

A list of delinquent members was presented by the Secretary and action on membership delinquency was postponed until the next Board meeting.

A letter from Mrs. M. M. Hanchey of Louisiana State University, requesting a complete file of the Society's Proceedings for the university's library, was read. It was moved and passed that L.S.U. be placed on the mailing list to receive the Society's publication.

A letter from the Argentine Trade Promotion Corporation, requesting a copy of an article on the manufacture of celotex which appeared in the October, 1926 issue of the Proceedings, was read. The Secretary was instructed to write to the Celotex Corporation informing them of the request.

There being no further business, the meeting adjourned.

Secretary-Treasurer.
JOHN P. FERNANDEZ.

Minutes of Special Meeting of the Board of Direction, June 13, 1945

President Steinmayer called the meeting to order. Those present were Messrs. Kerr, Mayer, McNiven, Nairne, and Fernandez. The President read the notice of the meeting explaining its purpose, and stated that in his opinion the Board had acted hastily at its previous meeting, and that he wished to request reconsideration of the motion pertaining to a new bi-monthly publication.

Mr. Kerr then moved that the motion be withdrawn, which carried unanimously. After some discussion on the wording of a new motion, Mr. Nairne took the chair and Mr. Steinmayer moved "that the matter pertaining to the publication of a new bi-monthly periodical should be referred back to the specially appointed Publications Committee with the suggestion that they investigate the matter more thoroughly and submit their findings to the Board in writing as early as possible". The motion was seconded by Mr. McNiven. Mr. Nairne then relinquished the chair to Mr. Steinmayer; motion was put to a vote and was carried unanimously.

Mr. Nairne then moved that the Board receive the report of the special committee on Water Use and Control, seconded by Mr. McNiven. Mr. Kerr, the chairman of the committee, read the report, a copy of which is attached to these minutes. Mr. Nairne moved that the resolution submitted by the Water Use and Control Committee be tabled for further study until the next Board meeting, and that the members of the committee be notified of this action. The motion was seconded by Mr. McNiven and carried unanimously.

There being no further business, the meeting adjourned.

Secretary-Treasurer.
JOHN P. FERNANDEZ.

Minutes of Joint Meeting with the Baton Rouge Section, June 23, 1945

The meeting was held in a dining room of the Istrouma Hotel at Baton Rouge. After a delightful supper, the meeting was called to order by Mr. J. T. O'Brien, President of the Baton Rouge Section, who extended a welcome to the out-of-town members and guests of the Society.

Following the business of the Baton Rouge Section, the meeting was turned over to President Steinmayer, who presented the Secretary, mem-

bers of the Board, and Past Presidents in attendance. The President also called attention to the excellent representation of Freeport Sulphur Company members at the meeting.

Reading of minutes of the previous meeting was dispensed with. The Secretary read a communication from the American Society of Civil Engineers inviting the members of the Louisiana Engineering Society to attend their joint meetings with the Society of American Military Engineers at New Orleans on June 25.

The Secretary reported that a communication had been received from the Social Hygiene Association of New Orleans requesting that a representative be sent to their state-wide convention to be held in Baton Rouge on Wednesday, June 27. Mr. Kerr moved that a member of the Society be appointed to attend this meeting; the motion carried, and Mr. J. T. O'Brien accepted appointment to serve in this capacity.

The chair then was returned to Mr. O'Brien, who introduced the speaker of the evening, Mr. W. Stone Leake of the General Electric Company, who gave a most instructive talk and demonstrated the operation of a wire-recording apparatus, after which two sound films, "Television" and "Frequency Modulation" were presented.

Following these, the meeting adjourned, and Mr. Leake was surrounded by members and guests seeking more information and closer inspection of the wire-recording apparatus, all of which were cheerfully given.

JOHN P. FERNANDEZ.
Secretary-Treasurer.

SEMI-ANNUAL STATEMENT OF RECEIPTS AND DISBURSEMENTS
For the period ending June 30, 1945

Receipts		
Membership Dues	$2,926.62	
Advertising	307.76	
Income from Other Societies for Joint Meetings	104.34	
Sale of Certificates	13.95	
Sale of Proceedings	4.35	
Annual Meeting	869.00	
Interest and Dividends	31.84	
Miscellaneous	.10	
Total Operating Income	$4,258.26	
Income from Frozen Assets	14.63	
Total		$4,272.89

Expenditures:

Cost of Printing Proceedings		$ 681.31	
Cost of Editing Proceedings		11.25	
Cost of Monthly Meetings		168.74	
Library Expenses		24.00	
Cost of Certificates		10.90	
Floral Offerings		17.51	
Secretary's Salary		346.80	
Taxes		11.50	
Bank Charges		10.08	
Rebate to Baton Rouge Section		156.25	
Miscellaneous:			
Gifts to Officers	$79.50		
Ass'n of Commerce Dues	25.00		
President's Gavel	10.61		
Secretary's Bond	10.00		
President's Steno.	6.58		
Other	11.04	142.73	
Stationery, Printing and Postage		299.79	
Annual Meeting		1,219.00	3,099.86
Net Increase in Bank Deposits			$1,173.03
*Cash Balance as of January 1, 1945			2,019.69
Cash Transferred from Savings Acct.			34.13
†Cash Balance as of June 30, 1945			$3,226.85

*See January report to Chairman of Finance Committee.
†See June report to Chairman of Finance Committee.

CARLOS J. GRIMADER
Certified Public Accountant
2341 Bartholomew Street

New Orleans, La.
July 18, 1945

Board of Direction,
Louisiana Engineering Society,
New Orleans, Louisiana.
Dear Sirs:

I have audited the accounts of the Louisiana Engineering Society for the years ended December 31, 1943 and December 31, 1944 and submit the following:

Balance Sheet, December 31, 1944 and 1943 and Comparison (Exhibit A)
Statement of Income and Surplus for the years ended December 31, 1944 and 1943 And Comparison (on cash receipts and disbursements basis) (Exhibit B)

I submit also the following comments:

The cash on deposit at December 31, 1944 in the regular checking account and savings account was confirmed by certifications obtained from the depositaries.

The U. S. Savings bonds and certificates evidencing shares of stock in the various homesteads were inspected by me on May 1, 1945 in the Society's bank box and the amounts to the credit of the Society in the

various homesteads were further verified by certifications obtained from those institutions.

At December 31, 1944 the restricted balances in banks and homesteads in liquidation were as follows:

Canal Bank & Trust Company in Liquidation	$ 72.66
Interstate Trust and Banking Co. in Liquidation, checking and saving account	1,534.25
Columbia Building and Loan Association in Liquidation	130.00
Standard Homestead Association in Liquidation	195.00
Total	$1,931.91

A reserve aggregating $1,927.91 was set up against the total of these balances, thus effecting a nominal balance of $1.00 to the Society's credit in each of the above. Information obtained from Homesteads in Liquidation indicate that a final dividend of $2.50 was paid in April 1945 on Columbia Building and Loan Association in Liquidation shares, thus making a loss of $127.50 sustained on that stock and that the final liquidation of the Standard Homestead will be effected late 1945 or early 1946, with no indication of the resulting loss to be sustained.

An inventory of the Society's property taken by the secretary-treasurer, Mr. J. P. Fernandez, and myself, showed the following articles of equipment, etc., with estimated values places thereon by Mr. Fernandez:

	Estimated Value
13 book cases—two door	$ 260.00
3 book cases—sectional	50.00
2 tables—library	20.00
3 cabinets—filing and utility	45.00
50 pictures	58.00
2 chairs — lounge	20.00
23 chairs—cane bottom	46.00
Public address system	110.00
Easels, signs and Society seal	30.00
1,700 books—various	1,700.00
Total	$2,339.00

It appears that most of this property was purchased some years ago out of the library appropriations and charged to expense, and therefore has not been carried as an asset on the books. Mr. Fernandez is of the opinion that the total sound value of this property is approximately $2,000.00 with a nominal value of $1.00 which was set up.

GENERAL

My audit of the accounts revealed that no general ledger accounts are maintained by the Society. In instances where it was necessary to have an analysis of any account, the information had to be obtained by research. In this connection, I recommend that a simple double entry set of books be maintained so that there will be shown in the accounts, on inspection, the transactions, and resulting changes therein by years.

I noticed in several instances that all cash received from sale of tickets, etc. for entertainment was not deposited intact in the general bank account and that payments for services, etc. for these entertainments were disbursed therefrom. In order to strengthen the internal control of the Society, I recommend that all cash be deposited intact in the bank account and that all disbursements be made by check.

Yours truly,

CARLOS J. GRIMADER

EXHIBIT A

LOUISIANA ENGINEERING SOCIETY
BALANCE SHEET, DECEMBER 31, 1944 AND 1943 AND COMPARISON
(CASH RECEIPTS AND DISBURSEMENTS BASIS)

ASSETS

	DECEMBER 31 1944	1943	Increase Decrease
Cash In Bank:			
Checking account	$2,019.69	$1,717.82	$301.87
Savings account	774.13	764.54	9.59
Total cash in bank	$2,793.82	$2,482.36	$311.46
United States Savings Bonds, Series F (maturity value, $2,000.00)—redemption value	$1,494.00	$1,482.00	$ 12.00
Investments—Homesteads:			
Greater New Orleans Homestead Association	$1,448.55	$1,406.06	$ 42.49
Union Savings and Loan Association	500.00	500.00	
Sixth District Building & Loan Association	500.00	500.00	
Security Building and Loan Association	500.00	500.00	
Columbia Homestead Association	357.93	356.23	1.70
Commonwealth Homestead Association	305.24	305.11	.13
Total investments—homesteads	$3,611.72	$3,567.40	$ 44.32
Property—Furniture, Fixtures, Equipment and Books—nominal value	$ 1.00	$ 1.00	
Funds On Deposit With Banks and Homesteads In Liquidation:			
Interstate Trust & Banking Co. in Liqui- (less reserve for loss—1944, $1,533.25; 1943, $1,725.03)	$ 1.00	1.00	
Canal Bank & Trust Company in Liquidation (less reserve for loss—1944, $71.66; 1943, $180.66)	1.00	1.00	
Columbia Building and Loan Association in Liquidation (less reserve for loss $129.00)	1.00	1.00	
Standard Homestead Association in Liquidation (less reserve for loss $194.00)	1.00	1.00	
Total frozen funds (less reserve for loss)	$ 4.00	$ 4.00	
TOTAL ASSETS	$7,904.54	$7,536.76	$367.78

LIABILITIES

Surplus (Per Exhibit B)	$7,904.54	$7,536.76	$367.78

CERTIFICATE OF AUDIT

Louisiana Engineering Society:

I have audited your accounts for the years ended December 31, 1943 and December 31, 1944, and in my opinion the above balance sheet and accompanying statement of income and surplus fairly present, respectively, your financial condition at December 31, 1943 and 1944, and the results of your operations for the years ended those dates on a basis of cash receipts and disbursements.

CARLOS J. GRIMADER
Certified Public Accountant

LOUISIANA ENGINEERING SOCIETY

EXHIBIT B

STATEMENT OF INCOME AND SURPLUS (ON CASH RECEIPTS AND DISBURSEMENTS BASIS) FOR THE YEARS ENDED DECEMBER 31, 1944 AND 1943 AND COMPARISON

INCOME:

	YEAR ENDING DECEMBER 31 1944	1943	Increase Decrease
Dues collected (in 1944, less refund of $4.00 overpayment	$3,471.28	$3,566.90	$ 95.62
Advertising revenue	345.58	368.74	23.16
Income from investments and savings account	121.41	116.69	4.72
Pro rata receipts from joint meetings held	95.57	94.68	.89
Net profit—sale of certificates, buttons, etc.	.92	6.83	5.91
Sale of proceedings and miscellaneous income	2.80	6.31	3.51
Total income	$4,037.56	$4,160.15	$122.59

EXPENSES:

Salary—secretary-treasurer	$ 900.00	$ 700.00	$200.00
Cost of publishing proceedings	1,120.24	1,138.50	18.26
Cost of annual meeting (less receipts—in 1944, $652.50; in 1943, $534.00)	513.33	475.94	37.39
Expenses paid in advance—next year's meeting	128.00	13.00	115.00
Cost of annual golf tournament (less receipts—in 1944, $638.55; in 1943 $368.75)	108.01	107.26	.75
Refreshments at meetings	342.66	290.34	52.32
Printing, stationery, and postage	315.49	433.07	117.58
Scholarships		290.00	290.00
Payments to Baton Rouge Section	254.75	193.13	61.62
Present to retiring president	33.84	36.35	2.51
Library expenses	11.00	18.00	7.00
Social security tax on salaries of secretary-treasurer and editor	16.00		16.00
General expenses	112.31	149.91	37.60
Total expenses	$3,855.63	$3,845.50	$ 10.13
NET PROFIT FROM OPERATIONS	$ 181.93	$ 314.65	$132.72

SURPLUS CREDITS:			
Liquidating dividends from banks, etc. in liquidation	300.78	216.78	84.00
Nominal value of library equipment		1.00	1.00
Excess of book value of funds in closed banks, etc. over reserve set up		4.00	4.00
GROSS SURPLUS FOR THE YEAR	$ 482.71	$ 536.43	$ 53.72
SURPLUS CHARGE:			
Social security tax, penalty, and interest on salaries for the years 1940-1943	$ 114.93		$114.93
SURPLUS FOR THE YEAR	$ 367.78	$ 536.43	$168.65
SURPLUS AT BEGINNING OF YEAR	7,536.76	7,000.33	536.43
SURPLUS AT THE END OF YEAR	$7,904.54	$7,536.76	$367.78

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXXI | OCTOBER, 1945 | NO. 5

CONTENTS

A MESSAGE FROM THE PRESIDENT

The Engineers' Roles in Communal Affairs. In times of peace as in war, the engineers, by far and large, desire to remain the unsung heroes and prefer to perform their missions without fanfare or public acclaim. Nevertheless, they also resent being shunted into obscurity.

Through their designs and inventions, engineers are motivated by a desire to make life more enjoyable for humanity. Consequently, they should also assert themselves with the planning and the building of sound and efficient educational, political, civic and economic social systems in order that their fellowmen might learn how to better understand and more properly utilize their engineering structures and products.

During periods of national cataclysmic disturbances caused by wars, fires, earthquakes, epidemics, floodwaters, bottlenecks, and breakdowns, engineers have patriotically responded to the calls of duties and generously offered their professional services to their fellowmen, again and again, to help them to bring

order out of chaos. However, when the emergencies are over and the services of the engineers are no longer urgently needed, they, because of their disposition to silence, are relegated by others to subordinate roles in the planning of local, state and national societal affairs.

It, therefore, should behoove engineers, as individuals, and engineering societies, as professional groups, to demand from their fellowmen that they, trained designers and planners, will at all times, be granted the privilege of sharing with them equally important roles in the building of local, state, and national communal affairs to assist man in his attempt to improve his environmental universe.

R. A. STEINMAYER.

EDITORIAL NOTES AND COMMENT

New Members. Again with this issue we list a number of new members. We welcome them into the organization, and look forward to their taking an active part in the affairs of their society.

John W. Germond, Baton Rouge; Age 39. Endorsed: A. H. Douglas, A. G. Mundinger, John E. Quarles; graduate Lowell Institute School (auspices M.I.T.) Building Course, 1930; Rodman, City Engr. Office, Taunton, Mass., 1924-25; Instrumentman & Party Chief, United Fruit Co., Guatemala, C. A., 1925-26; Draftsman, Boston & Albany R. R., 1926-29; Chief Dftsmn, Bemis Industries, Inc., Boston, 1929-38; Chief Housing Engr., Homasote Co., Trenton, N. J., 1938-41; Crawford Co., Baton Rouge, Chief Engr., 1941-date.

J. Gerald Hotard, Baton Rouge; Age 40. Endorsed: M. H. Elissalde, A. M. Melancon, F. B. Stirling; Southwestern, B.S. in E.E., 1929; 6 mos. student engineering, elec. test floor, Allis-Chalmers Mfg., West Allis, Wis., 1929; 5 yrs. Electrical Engineer, Gulf States Utilities Co.

Joseph McLean LeDoux, New Orleans; age 45. Endorsed: C. G. Cappel, A. M. Fromherz, Chas. M. Kerr; L.S.U., B.S. in M.E., 1922; various engineering assignments locally and in South America, 1932-41 ;charge of design & supervision of constr. major drainage structures, 1931-41; Dist. Mgr., Nat'l Electric Prod. Corp. Registered C.E., La. Assoc. Member, ASCE; Member, La. Section, ASCE, and its secretary-treasurer.

Arnold Carl Matthies, Baton Rouge; Age 29. Endorsed: J. H. Gillum, J. T. O'Brien, R. W. Williams. University of Minn., B.E. in M.E., B.E. in Business Admin. 7 yrs. as chem. engr., Standard Oil Co. of N. J. (La. Div.) Member Am. Inst. Chem. Engrs., Tau Beta Pi.

Weston Walter Muse, Jr., Baton Rouge; Age 44. Endorsed: J. E. Jarman, N. E. Lant, H. L. Lehmann. Two yrs. L.S.U. (Arts

& Science); taught school through 1923; salesman, 1923-26; in own business, 1926-28; construction work in West Texas 1930; Rodman, La. Hwy. Comm., 1930-32; transitman and computer, Shell Oil Co., 1932-35; La. Hwy. Comm., instrumentman, 1935-44, Chief of Party, 1944 to present.

Edward B. Rice, Baton Rouge; Age 38. Endorsed: R. M. Craig, Leo M. Odom, John H. O'Neill. Texas A & M, B.S. in C.E., 1929; Employed since graduation by U.S. Geological Survey, Surface Water Div., Water Resources Branch, presently as District Engr. of the La. dist. with general supervision of work in Alabama and Mississippi.

Harluf C. Petersen, New Orleans; Age 35. Endorsed: F. B. Blackstone, K. T. Price, R. A. Steinmayer. University of Minn., School of Mines, Degree of Engr. of Mines, 1933. Positions held with Freeport Sulphur Co. include Field Engr., 1934-36; Asst. Field Supt., 1936-37; Mining Engr. and Geologist, 1937-41; Supt. of Land & Exploration Dept., 1941-date. Member Am. Inst. Mining Engrs., Am. Ass'n Petroleum Geologists, New Orleans Geological Society.

W. Pat Richardson, New Orleans; Age 33. Endorsed: A. Lee Dunlap, A. M. Hill, D. W. Stewart. Tulane University, B.E. in M.&E.E., 1933; employed by Johns-Manville Sales Corp. since 1933. For past six years located in New Orleans handling southern La. & Miss., making engineering recommendations on J-M industrial products.

Horace A. Sawyer, New Orleans; Age 51. Endorsed: Robert E. Gosa, C. L. Nairne, R. A. Steinmayer, Texas A & M, B.S. in C.E. 1916. 1916-17, engineering positions with Gregg County, Texas, G.C. & S.F. Ry., Ill. Hwy. Dept. 1917-19, Engineer Officer, U.S. Army, 1919-21, State Dept. Agent in Rep. of Liberia, Africa. 1922-23, Nagle-Witt, Rollins Eng. Co., highway engineering in Dallas & Stephens Counties, Texas. 1923-25, Field Engr., Lone Star Cement Corp., Dallas. 1926-31, Asst. Sales Mgr., International Cement Corp., N. Y. 1931-date, Vice-President & Mgr., Lone Star Cement Corp, New Orleans. Member ASCE, Concrete Institute, Am. Soc. for Testing Ma-

terials. Has served as Secretary, Director, and President of La. Section, ASCE.

Hugh Worley, Jr., Baton Rouge. Age 42. Endorsed: C. A. Barnard, W. S. Guedry, H. L. Lehmann. University of Miss., B.E. 1924. Associated with M. L. Culley, Consulting Engr., Jackson, Miss., 1924-30; Professor of Civil Engineering, U. of Miss., 1930-31; La. Dept. of Highways, 1931-32; Barber Bros. Co., Engineer & General Supt., 1932-45. Licensed Engr., State of Miss., Associate Member ASCE.

Robert W. Ziifle, Algiers, La. Age 32. Endorsed: J. C. Baine, Jr., Lionell Cucullu, George Richaud. Tulane University, B.E. and B.S., 1933; Research Chemist, Celotex Corp., 1934-36; N. O. Public Service Inc., 1936 to date, present position, Supt. of Equipment.

For Transfer from Affiliate Member to Member

Sebastian V. Massimini, New Orleans. Age 55. Endorsed: K. P. Kammer, James M. Robert, D. W. Stewart, W. O. Turner, Casino Tech School, Turtle Creek, Pa. (operated by Westinghouse) 2 yr. course; 2 yrs. Dressel Inst., Philadelphia, Machine Shop Factory; 2 yrs. Carnegie Tech, Pittsburgh. Worked as fireman on small boilers at 16 yers. of age, later fireman for railroad engines. Operated R.R. construction steam engines and derricks until 1910, when employed by Pittsburgh coal Co. as sub-station engr. 1912, Westinghouse Machine Co. as Asst. Engr., steam station, E. Pittsburgh, Pa. 1915, Westinghouse Elec. & Mfg. Co., various capacities, being transferred to New Orleans in 1919 and promoted to Port Engr. Resigned in 1921 to enter own present business, specializing in repair and installation of steam turbines, gears, condensers, and governor apparatus. Member of Society of Naval Architects and Marine Engineers; member American Society of Refrigerating Engineers.

For Reinstatement as Member

Joseph A. Holland, New Orleans. Age 44. Endorsed: F. N. Billingsley, Cary Gamble, John Riess, Alabama Poly. Inst.,

B.S. in C.E., 1921. Draftsman, La. Hwy. Comm., 1922; Jr. Hwy. Engr., Ill. Hwys., 1923-24; Asst. Engr., Caddo Parish, 1925; Inspector for J. N. Chester Engrs., 1926; Res. Engr. Water & Sewer Installations, J. B. McCrary Engrs. 1927-28; designed & supervised water, sewer and paving for Chas. D. Evans, Cons. Engr. of Shreveport, 1929-30; designed and supervised paving for Fooshee & Hungerford Cons. Engrs. of Paris, Tex., 1931-32; CCC Camp Commander, 1933-37; Bldg. Supervisor for E. F. Neild, Architect, 1938-39; Draftsman, La. Hwy. Comm., 1940; Active duty, Army Air Forces, 1940-44, discharged honorably with rank of Lt. Col. La. Hwy. Comm., Hwy. Engr. Sept, thru Nov. 1944; Asst. Engr., F. N. Billingsley Engr. Co. of N. O., Dec. 1944 to date. Registered C. E. State of Louisiana.

For Transfer from Student to Junior Member

James E. Hassinger, Jr., Albert E. Hotard, Donald E. Nestler, Charles H. Weatherly, Andrew P. Whitman, Jr., all of New Orleans.

For Student Member

Jack Hinrichs, Senior Mechanical Student, Chester G. Lob, Senior Elec. Student, Norvin Leroy Pellerin, Senior Mech. Student, Felicien Perrin, Senior Mech. Student, Christian M. Voelkel, Jr., Junior Mech. Student, all at Tulane University.

Our Employment Committee. Some of the members may not realize or perhaps have forgotten that we have an employment committee, headed by Mr. Ray Bassich, New Orleans Blueprint Co. This committee has beeen active for many years, has placed hundreds in various positions since its formation. At a time like this when the industrial picture is changing so rapidly, you may either want to list your name for change of employment, or perhaps consult Ray as to whom is available. It works both ways, and there is no charge for the service.

Our New Cover. After much deliberation of a committee appointed by President Steinmayer, it was decided to change somewhat the style of the cover. If this change meets with

the approval of the membership, we hope to have various industrial scenes appear in following issues, representing the various activities in our state. President Steinmayer would like to hear from the members as to their reaction to this change.

Our Annual Meeting. Plans are now getting under way for our annual meeting to be held in January. Mr. M. C. Abrahm has been appointed General Chairman. Under his able leadership, and with the cooperation of all of our members, it will undoubtedly be an outstanding program. More details will be announced in the December issue.

PERSONALS

(Note: It would be greatly appreciated if the various members would send in news items about themselves and friends who are members of L.E.S. Editor.)

* * *

Dean L. J. Lassalle addressed the Baton Rouge Section on Wednesday, September 26 on the interesting and timely subject of the Atomic Bomb.

* * *

Our Finance Committee Chairman, Professor W. Fleming Scofield will soon leave us to take up residence on his Alabama farm. Just as he has efficiently planned the expenditures of the Society, so he has carefully mapped out his proposed activities on his five hundred acre estate. We shall miss his smile and quiet dignity. Prof. Scofield has also been serving as the Assistant Secretary of the State Board of Engineering Examiners. Our best wishes go with him, Mrs. Scofield and the two kids.

* * *

Make use of your library! Many of our members have never visited the rooms, 412 St. Charles Hotel. If you are an out-of town member, you will find it a convenient place to relax. Ask at the desk for key to room 422. Sign your name on a card at the desk, and again please sign your name on the book in the room.

PAPERS AND DISCUSSIONS

ROMAN ENGINEERING

By Dr. Russel M. Geer *

FOREWORD

If the Greeks were the greatest artists and architects of the ancient world, the Romans were certainly the greatest engineers. But while the modern architect still studies and draws inspiration from the buildings of Classical Greece, the modern engineer has little to learn from Roman achievements and as a result knows little about them. He would, however, feel quite at home if he could drop back some two thousand years and discuss the problems of Rome's water supply with Frontinus or the building of a military bridge over the Danube with the unknown engineer in Trajan's army to whom the Emperor assigned this task. Without power tools, with no accurate instruments, with metal available in limited quantities and shaped metal only in small sizes, the Roman engineers faced and solved problems not unlike those that face his fellow in the profession today. And he solved these problems well. The largest concrete dome in the world today was built about 100 A.D.; and few modern highway bridges can challenge for grace or utility that which has been carrying traffic over the Tagus River at Alcantara in Spain for about eighteen hundred and fifty years.

CIVIL ENGINEERING

Surveying. We know little of the Roman methods of surveying or of the instruments that were used, but from the results it is clear that the surveyors were competent. They could not only measure angles, calculate distances to inaccessible points, and run levels with accuracy, but could lay out tunnels and dig them from both ends and from central shafts; and to construct a thirty or forty mile aqueduct through rough country with a gradient of less than two feet to the mile calls for field work of no mean skill.

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* Professor of Classical Languages Tulane University, New Orleans.
Presented at the regular meeting of the Society, July 16, 1945.

Roads. The sysem of roads that tied the most distant provinces to the capitol was of great military and economic importance, but we are here interested only in their construction. Naturally the type of construction varied with the expected traffic, the terrain, and the available material. Thus the main roads were paved with stone and were fifteen to twenty feet wide; less important roads were narrower and were surfaced with gravel, and in mountainous country roads might be only five or six feet wide with occasional wider places for passing. When an important road was to be made on level ground, a trench was first dug the full width of the road and four or five feet deep. The roadway was then built up of successive strata of large and small stones and rammed gravel, and sometimes of concrete. The surface was usually made of large stones carefully fitted together, about a foot in thickness and a foot and a half across. Where feasible the roads were straight, going over hills rather than around them. Slopes might be steep; ten percent grades were common and twenty percent not unknown. Many of the Roman roads remained in use for centuries after the fall of Rome. In fact, there were no other made roads in Europe outside the cities until at least the twelfth century, and no roads were built that could compare with the Roman until the work of Telford and McAdam in England in the early nineteenth century.

Bridges. Where streams were crossed stone bridges were usually constructed. The earliest Roman bridges were naturally those across the Tiber at Rome itself. The first was of wood resting on piles, later replaced by masonry piers, but all the others were stone arch bridges so well designed and constructed that some of them are still in use, either in much their original form or built into modern structures. The best preserved is the Fabrician bridge from the bank of the Tiber to the island. It is about one hundred and ninety feet long and consists of two main arches, each with a span of seventy-five feet, resting on abutments on either bank and on a central pier, which itself contains a small arch for relief in time of flood. The Pons Cestius, which crossed from the island to the other bank,

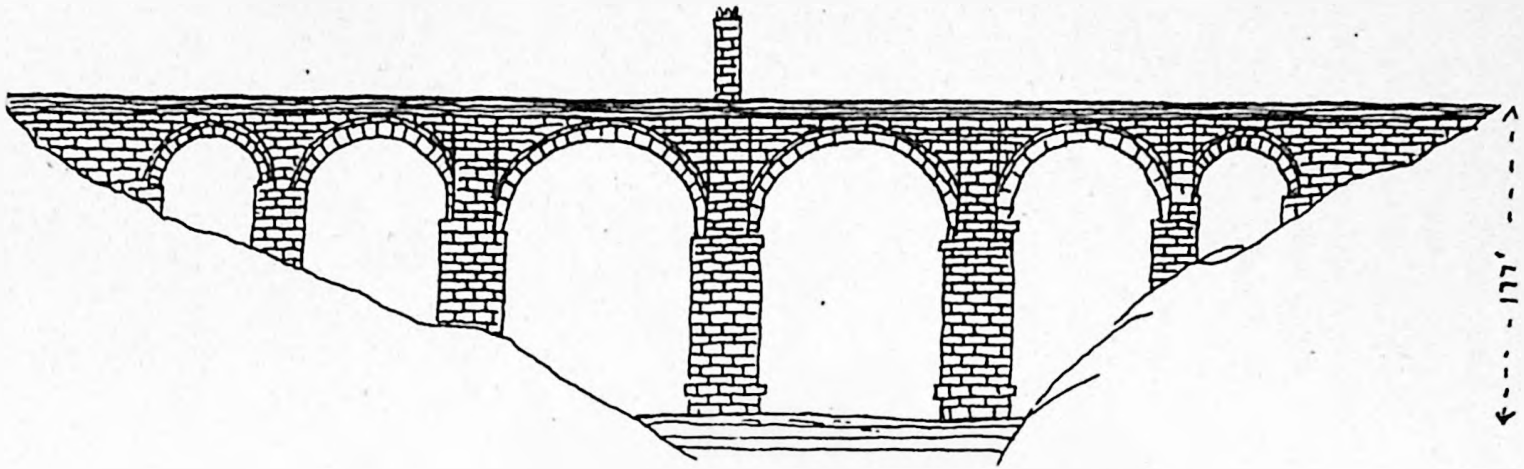

Fig. 1. Bridge over the Tagus River at Alcantara, Spain

was removed in 1888 and a modern bridge was then constructed. Another bridge, in part still in use, is that built by Hadrian as an entrance to his tomb, several arches and piers of which are built into the present Ponte Sant' Angelo. More impressive than these are certain Roman bridges in Spain. That across the Tagus River at Alcantara, built about 100 A.D., has its roadway one hundred and seventy-five feet above the water, carried on six arches of which the two central ones have spans of over one hundred feet each. The bridge has been partially reconstructed at various times and is still in use (Fig. 1).

Tunnels. The Romans dug tunnels for various purposes, but chiefly to carry water. On one of the aqueducts leading to Rome is a tunnel about three miles long finished under Domitian. This was dug from both ends and from several deep shafts. Claudius' tunnel to drain the Fucine Lake was a less difficult problem, since all but a mile, which lay under a mountain, was close to the surface and could be worked from frequent shallow shafts. Of tunnels for roads one, the so-called Grotta Vecchia just north of Naples, can still be seen paralleling the modern tramway tunnel. It remained in use until recent years, but is now closed to traffic.

The city of Rome presented a problem in drainage. The low swampy land between the hills was drained in the days of the monarchy by open channels, which were later vaulted and then served both as surface water drains and as sanitary sewers. Most of these have silted up during centuries of neglect, but the Cloaca Maxima, best known though not the largest, still drains the Forum. Similar systems are known in many Roman cities.

Canals. The Pontine marshes south of the Campagna were drained by a system of canals, some of which have once more been opened as part of the extensive drainage system by which the Italians are today reclaiming that region. Several canals for ships were undertaken by the Romans, and some of them were completed. We know of one some twenty miles long built during the early Empire for military reasons between the

lower Rhine and the Zuider Zee. This was in use for many years, but Nero's more ambitious effort to cut through the Isthmus of Corinth had only been well begun at his death and was never finished. When in recent years a French company undertook the construction of a sea-level ship canal through the Isthmus the several possible routes were carefully surveyed, and that laid out by Nero's engineers was adopted. The modern canal has accordingly obliterated the cut made in Nero's day when some 650,000 cubic yards of earth and rock were removed.

Aqueducts. For about the first two centuries of the Republic Rome was dependent for its water supply on local springs and the muddy Tiber. In 312 B.C., the famous censor, Appius Claudius Caecus, brought water from springs some ten miles from the city by means of an aqueduct constructed for most of its length on or beneath the ground level. Only forty years later a second aqueduct was built, forty miles long and bringing its water to the city at a slightly higher level. The last thousand feet were above ground, and for a short distance it was carried on low arches. The first high level aqueduct was the Aqua Marcia built in 144 B.C., fifty-nine miles long and carried on arches for the last six miles across the level Campagna. The greatest of the aqueducts, the Aqua Claudia built by Claudius, entered the city on arches that carried water channel a hundred feet in the air, the same arches serving also for the Aqua Julia. In all there were eleven aqueducts that, according to a competent hydraulic engineer, brought to the city about 38,000,000 gallons of water a day. Estimates by archaeologists have run as high as 400,000,000 gallons. All the aqueducts in their upper portions were carried on, or just beneath, the surface of the ground where possible, but valleys were bridged and hills were tunnelled where necessary to avoid long detours. The water came from springs or from mountain streams, and the quality was in general good

Within the city the water was led to distributing reservoirs conveniently located, and from them was piped under the streets to public fountains, to baths, and to private houses.

As is shown by the distributing system in the city, the Romans were perfectly familiar with the inverted syphon, that is with the fact that water sent through a pipe will rise to the level of the intake. It may be asked, then, why they built great high level aqueducts to permit the water to flow along an even course under atmospheric pressure. The chief reason probably was that they had only lead pipe. They could and did make lead pipe ten and twelve inches in diameter capable of withstanding a working pressure of seventy-five to a hundred pounds to the square inch, and in some of the provincial aqueducts they used pipe for crossing valleys, but they seem to have felt that it was not practical to build and maintain such a pipe system for the supply of a city as large as Rome.

Wherever the Romans built a city, they built also a water supply. Some parts of these provincial aqueducts are among the most impressive remains of Roman engineering. The best known is the famous Pont du Gard, the bridge which carried the aqueduct for the city of Nîmes in southern France over the Gard River. This bridge, nine hundred feet long and one hundred and sixty feet above the river, consists of three tiers of superimposed arches, those in the upper level being small but the central arches of the two lower levels having spans of eighty feet.

ARCHITECTURAL ENGINEERING

This section will deal with certain technical matters connected with the construction of Roman buildings, leaving to the next chapter the more general discussion of Roman Architecture.

Concrete. The great buildings of the Imperial period were made possible only by the use of concrete. In the earlier period it had been used for foundations,but its use as the chief material for walls and vaults dates from the early Empire. The concrete used by the Romans was practically equivalent to that in use today, its excellence being due to a happy accident. The use of lime mortar made from calcined (burned) limestone and sand was not unknown before the time of Rome, but such

lime mortar deteriorates when exposed to the action of water. If silica be added to the lime, as in modern Portland cement, a mortar is obtained which is not injured by water, and which will even set under salt water. The Romans were fortunate in having easily available in unlimted quantities a certain volcanic sand, pozzolana, containing silica in suitable form. This they used with their lime in making mortar and concrete, and thus without any knowledge of the principle involved they obtained a concrete comparable with that now in use. As a rule Roman concrete was poured into forms as ours is today, but instead of mixing together all ingredients, cement, sand, small stones, and water, as we do, they mixed their lime, poz-

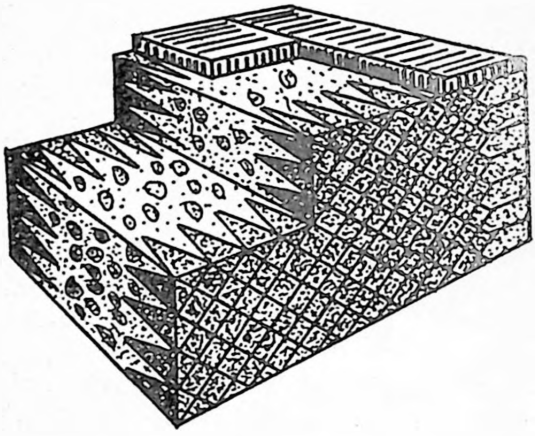

Fig. 2. "Stone Facing"

zolana, and water, and poured that, setting relatively large stones or other material more or less regularly in the mass as the wall was being built. In one other way Roman concrete construction differs from ours. Their concrete walls were regularly faced with stone or brick which seems to have been built up against the inner surface of the forms as the concrete was poured. Where stone was used, it consisted either of irregular pieces, or of pieces shaped like a pyramid set with the base out, the point running into the wall to form a bond (Fig. 2).

The brick facing consisted of thin triangular bricks laid with one face out (Fig. 3). The object of the stone or brick facing is not known. It cannot have been to improve the appearance since exposed surfaces were regularly covered with stucco or with a thin veneer of stone slabs. Still less clear is the purpose of the bonding courses of large thin brick extending from side to side of the wall. It seems probable that the Romans distrusted the strength of the concrete and thought to strengthen it in his way, but if so their efforts were useless, since such a wall usually fails on the line of the bonding course.

Arch, Vault, and Dome. In concrete the Romans developed a new material; in the arch they found a new form. These are the chief elements that made possible the great achievements of Roman architecture. The arch was not an invention of the

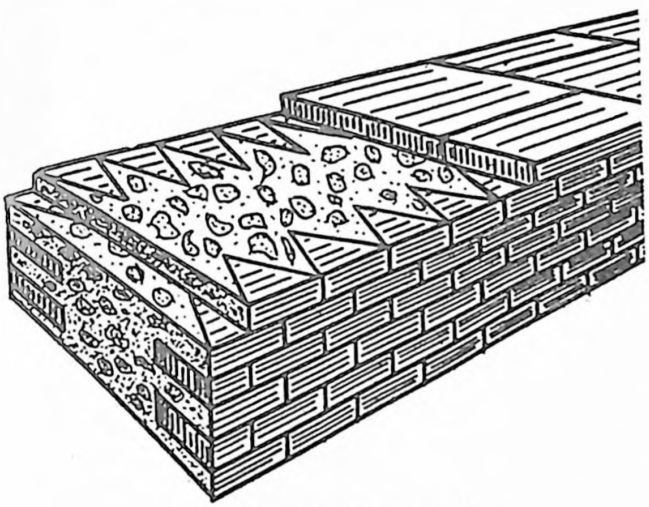

Fig. 3. "Brick Facing"

Romans. They probably learned it from the Etruscans who had brought it with them from the East, where vaulted tombs were made at least a thousand years before the foundation of Rome. But eastern and Etruscan vaults were small and were used only below ground; the Romans were the first to bring

the arch and vault up into the air and make them an important element in their building.

Old Greek construction was based on the use of vertical and horizontal members—columns and walls connected by beams of wood or stone. The distance which can be spanned in this way is limited, especially in the case of a stone beam or architrave, which if of any considerable length will break of its own weight. With the arch the downward thrust of the mass above the arch and of the arch itself is largely changed into an outward thrust at the two ends of the arch. If this thrust is taken care of by abutments, or balanced by the opposite thrust of adjacent arches, the arch can fail only through the crushing of the stones of which it is composed. The arch, and the vault and dome which are constructed on the same principle, can therefore be used to span a much greater space and to carry a much greater load than can a beam either of stone or wood. We find Roman bridges with arches over a hundred feet between piers, and the dome of the Pantheon with a diameter of one hundred forty-two feet is the largest solid dome ever constructed.

Forms of Arch and Vault. The Romans most frequently used the arch in its simplest form, the semi-circular arch with the joints between the stones lying on the radii of the semicircle, but they also used other forms, including, for small openings such as doors and windows, the flat arch. This flat arch was sometimes even substituted for the solid architrave blocks of temples built on the Greek plan. During the Republic the barrel vault seems to have been the only form of vault in use, but during the early Empire the cross-vault was developed. Since light could be admitted through windows at the ends of the cross-vaults, this type of roof was especially useful for covering large central halls surrounded by lower rooms, as, for example, the central hall of one of the great imperial thermae. Moreover, the weight of a cross-vaulted roof is concentrated on a few points; piers may therefore be substituted for walls, and the side rooms be made practically parts of the central hall. The Romans made much use of the dome,

but always as the roof of a circular building or room. Toward the end of the Empire some progress was made toward solving the problem of placing a dome on a square room, but the final solution was found, not at Rome, but at Constantinople after the fall of the Western Empire.

Concrete Vaults. We must distinguish between the true masonry arch or vault and the pseudo-arch made from a single mass of concrete poured in place. This solid block, as long as it is unbroken, acts like a beam, and there is no outward thrust on the piers or walls, but such an arch is subject to the same danger of breaking as is a beam. If a solid arch cracks on lines that follow the radii of the circle, it becomes in effect a true arch. We find that the Romans often inserted flat bricks or tile in their concrete arches and vaults in such a way that cracks, if they occurred, would tend to lie along these lines and so convert the solid mass into an arch (Fig. 4). In other concrete

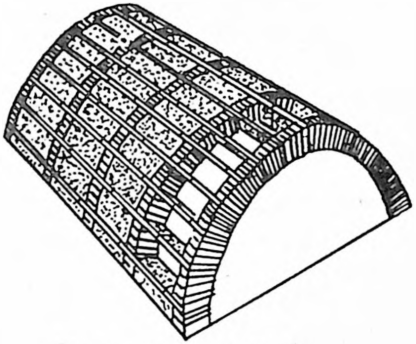

Fig. 4. "Arched Vaults

vaults and domes we find elaborate systems of brick ribs and arches probably intended to limit the effect of cracking and to concentrate the weight of the mass on the strongest part of the walls and foundations.

Continued Progress of Architecture in Late Empire. In practically every field of endeavor the ancient world had produced

its best work before the end of the second century and the decline had begun. This was not true with the development of Roman Law. Another great exception is architecture. While the ornament became tasteless and the sculptures with which buildings were adorned had to be pillaged from earlier structures, in general design, in the skill with which new problems were faced and mastered, and in boldness of conception progress still went on. The great Baths of Caracalla and of Diocletian surpassed any that had gone before, and the Basilica of Maxentius was the crowning achievement of Roman engineering. Even the transfer of the center of power to Constantinople does not mark the end. When the architects built the church of Saint Sophia they were still carrying on the spirit of the engineers of Rome.

MINUTES OF THE MEETING AND BUSINESS OF THE SOCIETY

Minutes of Meeting—Executive Committee, Baton Rouge Section

After a delicious supper at Mike and Tony's on September 5, 1945, the meeting was called to order. Among those present were J. T. O'Brein, president; P. J. Guelfi, 1st vice-president; H. L. Lehmann, past president; James J. Saurage, secretary-treasurer. Wm. Whipple and F. F. Pillet were out of town and therefore could not attend.

The first business discussed was our coming quarterly meeting. It was decided to have this meeting on Wednesday, September 26th. Dr. Leo J. LaSalle will be our speaker and will talk on "Atomic Power and the Atomic Bomb". It was through the efforts of President O'Brien that we are able to get Dr. LaSalle to address our group.

It was decided that the L.S.U. Golf Club House would be an ideal place to meet and Saurage is to investigate and make the necessary arrangements if it is available.

We next discussed in general the next Annual Meeting and Mr. Lehmann will make arrangements to hold it at the L.S.U. Venetian Room if it is available.

Meeting adjourned.

Secretary-Treasurer,
JAMES J. SAURAGE.
Baton Rouge Section

Minutes of Meeting of the Board of Direction, July 9, 1945

The meeting was called to order by President Steinmayer with Messrs. Gosa, Kerr, Mayer, McNiven, Nairne and Fernandez present. Also present by invitation were Dr. H. M. Shilstone and Mr. J. H. O'Neill. The regular order of business was postponed for convenience.

Dr. Shilstone stated that he intended to purchase the Howard Memorial Library building located at Lee Circle and Howard Street and, since the structure is much too large for his own offices, he would offer the rotunda and the mezzenine to the various engineering groups of New Orleans for use as a library and meeting place, provided they would assume the operating expenses for that portion of the building. Dr. Shilstone estimated that such expenses, including porter service, lighting and heating, would run between $3000 and and $3500 per annum.

During the discussion it was brought out that the premises are to be made available to all engineering societies having a common meeting place and access to their libraries. The libraries could be located on the mezzanine floor, and the rotunda would make a very satisfactory reading room when not in use as an auditorium. The estimated seating capacity of

the rotunda is 200. However, the annual convention still would be required to be held elsewhere, no bar service would be permitted, and there would be no showers or other accommodations available.

Dr. Shilstone stated that it was not his intention to attempt to form an engineers' club, but rather to provide a common meeting place for all local engineering groups. He stated further that his offices would be open from 9:00 a. m. to 5:00 p. m., and the rotunda and mezzanine always would be available between those hours without the necessity for providing a full time attendant.

President Steinmayer thanked Dr. Shilstone for his offer and announced that he would appoint a committee to look into the matter, whereupon Dr. Shilstone requested that he no be appointed a member of such committee, although he would be glad to assist in furnishing any information that might be desired.

A motion then was passed that the President appoint a committee consisting of five past presidents of the Society to investigate the matter, whereupon the following were appointed: Messrs. D. W. Stewart, chairman, Charles M. Kerr, John Riess, Ole K. Olsen, Allen T. Dusenbury.

Minutes of the last regular meeting were read by the secretary and accepted.

Mr. Kerr presented the resolution prepared by the Water Use and Control Committee; Mr. O'Neill, a member of the committee, stated that in his opinion the resolution was not purely a criticism of the proposed Senate Bill No. 555, but represented constructive criticism as well, saying further that the citizen should be on guard against too much centralization of power, and that the Society should go on record not as objecting to regional and valley authorities but as opposing the creation of federal corporations such as that proposed in Senate Bill No. 555 for the Missouri River Basin.

Mr. Nairne moved that the Board adopt the resolution as written and submit it to the membership for approval, seconded by Mr. Mayer, and the motion carried.

A list of delinquent members was read by the Secretary and, after some discussion, action was deferred.

The Secretary presented a report of the Finance Committee. Mr. McNiven moved that the report be accepted, seconded by Mr. Mayer.

The Secretary presented his semi-annual report, which also was accepted and a copy of which is attached to these minutes.

The matter of invitations to attend meetings of other engineering groups was discussed, and Mr. Gosa moved that the Louisiana Engineering Society send cards to local members advising of any invitations extended by other groups to the Society's membership. The motion was carried.

Mr. Nairne proposed an amendment to the constitution or by-laws which would create an advisory committee consisting of all past presidents of the Society. President Steinmayer then appointed Mr. Nairne to con-

tact all past presidents and seek their opinions on the advisability of such an amendment.

President Steinmayer submitted to Mr. McNiven for study a copy of the Code of Ethics for Engineers prepared by the Engineers' Council for Professional Development, as well as a rearranged version of the same.

The minutes of a special meeting of June 13 were read by the Secretary and accepted. President Steinmayer stated that the Publications Committee has not yet reported on the matter of the proposed new form of bi-monthly publication.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ,
Secretary-Treasurer.

Minutes of Meeting of the Louisiana Engineering Society, July 16, 1945

The meeting was called to order by President Steinmayer, with approximately 60 members and guests present. Minutes of the preceding meeting were read and accepted.

Mr. Kerr read a resolution prepared by the Special Committee on Water Use and Control (copy of which is attached to these minutes), after which he moved that the Society accept the resolution as read; he motion was seconded by Mr. John L. Porter. Mr. John Klorer took the floor, stating that, since copies of Senate Bill No. 555 were not mailed to members with the resolution, the membership was not fully qualified to vote on the measure. Mr. Porter replied that the committee had studied the bill carefully before drafting the resolution, and that the resolution favored the development of river basins in their entirety, whether such basins were in one or more states. Mr. Klorer stated he was in full accord with the resolution where basins were located within a single state, but was not prepared to decide in cases where such basins covered several states. After a brief explanation by Mr. Porter, Mr. Klorer thanked the Chair for having been elucidated on his point of inquiry.

Mr. Rudolf Hertzberg offered the suggestion that the resolution should read "a majority of the members of the Louisiana Engineering Society" instead of "The Louisiana Engineering Society".

There being no further discussion, the resolution was put to vote with the result of 41 yeas, 2 nos.

Mr. W. H. Rhodes inquired why, since the resolution had passed, the Louisiana Engineering Society was concerned in a matter of policy and not of technical engineering. Mr. Porter replied that this policy was closely related to engineering and that the Society, as well as the profession as a whole, has not interested itself enough in civic matters, to its own detriment.

President Steinmayer then stated that in his opinion the passing of this resolution was one of the most progressive, if not the most outstandnig accomplishment of hsi administration. He pointed out that the Society objected in prineiple to the proposed act of Congress, but gave constructive criticism to guide future legislation on the subject. He thanked the Committee on Water Use and Control for its good work.

Mr. John V. Dugan, chairman of the Entertainment Committee, reported on the golf tournament held July 12 and thanked his sub-committees for their good work. Mr. Charles Rogers then moved that a rising vote of thanks be given to Mr. Dugan for his excellent work in behalf of the tournament.

President Steinmayer then introduced the speaker, Dr. Russel M. Geer, who gave a very interesting illustrated talk on "Roman Engineering". A lively discussion followed, during which the President noted that, for a professor of classical languages, Dr. Geer's knowledge of engineering was surprising. The meeting then adjourned with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ,
Secretary-Treasurer.

Minutes of Meeting of the Board of Direction, August 6, 1945

The meeting was called to order by President Steinmayer, with Messrs. Gosa, Kerr, Mayer, McNiven, and Fernandez present. Also present by invitation was Mr. J. H. Collins, Sr., a member of the Special Publications Committee. The order of business was dipensed with for convenience.

Mr. Collins reported that his committee had secured several estimates on the cost of printing a publication similar to "The Slide Rule", published by the Houston Engineering Society, and the conclusion was reached that such a publication would cost approximately $2100 which, added to the cost of printing 700 copies of the Proceedings ($1100), would make a total cost for publications of $3200 per annum.

It was brought out that the new publication would contain approximately 16 pages, about one-third of which would be devoted to advertising; and that aadvertising rates would be $60.00 per page for a single issue or $45.00 per issue on yearly contract. On this basis a gross revenue of $2700 per annual could be realized.

The committee recommended that, should the present Proceedings be continued as a bi-monthly publication of the Society, the cover might be improved by a two-color design and appropriate cut, and that the advertising rates be increased to conform with standard prevailing rates such as outlined in the preceding paragraph.

Mr. Kerr moved that effort be made to improve the present Proceedings by changing its form, expanding, modifying, and changing its cover to a two-color arrangement with appropriate cuts, in order to make the

current publication more appealing to its readers. The motion was seconded by Mr. Mayer and carried unanimously.

Minutes of the previous meeting were read by the Secretary and accepted.

The Secretary enumerated a list of communications acknowledging receipt of the Society's resolution on Water Use and Control which was sent to all Louisiana Congressional delegates, as well as a number of other public officials and editors of engineering publications.

President Steinmayer read a communication from the Louisiana Social Protection Council soliciting a contribution.

Mr. McNiven reported on the "Code of Ethics for Engineers of the Engineers' Council for Professional Development" and was instructed to advise Mr. Dugal C. Jackson, chairman of the Council's Committee on Engineering Ethics, of his findings.

The Secretary presented the auditor's report for the years 1943 and 1944. Mr. Mayer moved that same be published, seconded by Mr. Kerr, and carried unanimously.

The following members were dropped for non-payment of dues:

H. C. Becker, Jr., W. K. Beenel, Harwood I. Brown, Earl C. Coburn, W. Lester Corley, Elmo J. Edwards, Lloyd A. Ellis, Chas. D. Foley, Albert J. Fransen, Melvin C. Hudgins, Harry Jacobs, A. G. Jarreau, Arch B. Kennedy, Henry F. Lewis, Paul E. Lirette, Wm. O. Martin, Jr., Arthur W. McWhorter, Arthur deR. Remanjon, W. E. Sharp, Geo. A. Thompson.

The Secretary reported upon the progress being made towards the formation of the Alexandria section.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ,
Secretary-Treasurer.

Minutes of Meeting of the Louisiana Engineering Society, August 13, 1945

The meeting was called to order by President Steinmayer. Present were Messrs. Gosa, Kerr, Mayer, McNiven, Nelson and Fernandez, members of the Board, and Messrs. Ole K. Olsen and John Riess, members of the special committee appointed to investigate the Shilstone offer.

In behalf of Mr. David W. Stewart, chairman of the committee, Mr. Riess read the committee's report, which stated that Dr. Shilstone's proposition appeared to be unsatisfactory.

Mr. Mayer moved to accept the committee's report, seconded by Mr. Gosa and carried.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ,
Secretary-Treasurer.

Minutes of Special Meeting of the Board of Direction, August 13, 1945

President Steinmayer called the meeting to order, with approximately 120 members and guests present. Minutes of the previous meeting were read by the Secretary and accepted.

It was announced that copies of the resolution prepared by the Special Committee on Water Use and Control has been mailed to all congressmen, state and city officials, and various other organizations interested in the proposed bill, and that numerous replies had been received. It was moved and passed that the Special Committee on Water Use and Control be discharged with thanks for its excellent work.

President Steinmayer appealed for assistance in increasing the Society's membership with fully qualified members. He also announced that future issuse of the Proceedings would include items of personal interest, and requested that any suitable material be mailed to the editor.

The meeting then was turned over to the Louisiana Post, Society of American Military Engineers. Following the transaction of their business, Mr. William H. Rhodes introduced Lieutenant Moreland Hogan who, after a brief discussion on testing dry docks, presented the main speaker of the evening, Lieutenant Commander Ammann, who gave a very interesting illustrated lecture on "U. S. Navy Advanced Base 100,000-ton Sectional Dry Dock". Following the film, the meeting was returned to President Steinmayer, who thanked the Society of American Military Engineers for their splendid program, and the meeting adjourned with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ,
Secretary-Treasurer.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXXI | DECEMBER, 1945 | No. 6

CONTENTS

EDITORIAL NOTES AND COMMENT

The Big Event. Within a few days after the publication of this issue of the Proceedings, our annual meeting will be underway. It represents the efforts of many of our members. It is a medium of exchange of ideas, of making new acquaintances of fellow engineers. Let's all support it; attend as many sessions as you can, and by all means register! Our front cover carries the aerial view of Market Street Power Station, the location of our plant visit. The committee personnel is as follows:

Michael C. Abrahm ..... General Chairman
R. M. Seago ..... General Vice Chairman
John P. Fernandez ..... Secretary
Reinhard A. Steinmayer ..... Chairman, Ex-Officio

Banquet Committee:

John V. Dugan, Jr., chairman
B. P. Babin, Vice-Chairman
Ben H. Bell
J. H. Collins, Sr.
Sidney Ellis, Jr.
Claude J. Kelly
Ole K. Olsen

Industrial Plant Inspection Committee:

Edw. M. Naberschnig, Chariman
David Moodie, Vice-Chairman
R. F. A. Benson
F. B. Blackstone
Frank P. Fischer
J. M. Gondron
C. L. Rittenberg
W. Horace Williams, Jr.

Program Committee:

James S. Janssen, Chairman
A. W. Durning, Vice-Chairman
Cornelius C. Crusel
Albert J. Fransen
W. J. Guilbeau
Rudolf Hertzberg
C. Harold Louree
William P. Oster
Harluf C. Petersen

Publicity Committee:

Claiborne Perrilliat, Chairman
John C. Baine, Jr., Vice-Chairman
W. J. Amoss
Albert R. Boelte
William H. Bohne
Horace E. Crump
C. Leonard Jones
Ernest L. Mire

Reception Committee:

Charles M. Kerr, Chairman
Karl P. Kammer, Vice-Chairman
H. J. Melochee
D. S. Anderson
W. Horace Williams
A. T. Dusenbury
John Klorer
Ole K. Olsen
John Riess
Donald Derickson
James M. Robert
Farrar P. Hamilton
John L. Porter
Frederick H. Fox
James M. Todd
F. N. Billingsley
J. H. O'Neill
A. L. Dunlap
Edward S. Bres
Allen S. Hackett
C. S. Williamson, Jr.
Bernard H. Grehan
David W. Godat
Wm. H. Rhodes
D. W. Stewart
C. Glenn Cappel
R. A. Steinmayer
Leo J. Lassalle
Clayton L. Nairne
J. T. O'Brien
P. J. Guelfi

Registration Committee:

J. J. Bulliung, Chairman
Allen W. Betz, Vice-Chairman
H. M. Blain, Jr.
J. Edwin Boelte
Geo. R. Hammett
Geo. Wm. Hill
Wilday Tudury

Student Conference Committee:

Wm. H. Johnston, Chairman
E. A. McLellan, Vice-Chairman
E. J. Angelo, Jr.
F. J. Germano
J. E. Morehiser
W. P. Wallace

Technical Papers Committee:

Harold A. Levey, Chairman
L. V. Cressy, Vice-Chairman
Thos. H. Bean, Jr.
Charles M. Kerr
A. Watson Chapman
W. J. Drawe, Jr.
R. Frischhertz
R. M. Seago

Technical Exhibits Committee:

Arthur M. Hill, Chairman
J. A. Cronvich, Vice-Chairman
W. E. Owen
A. K. Ramsey
M. G. Zervigon

Colonel Fox Returns. After an absence of almost five years, Col. F. H. Fox has returned to the civil engineering department of Tulane University. He saw action in Africa, and has had important assignments in the training of troops in anti aircraft operations. He also directed the testing of troops after completion of training, to ascertain whether or not they were ready for duty abroad. It is Professor Fox's "second war" as he served for two and one half years in World War I with combat engineers.

OBITUARY OF
ANDREW MOORE LOCKETT

In the death of Andrew M. Lockett on October 11, 1945, the Louisiana Engineering Society has lost a distinguished member and his many friends and business associates have lost a valuable and much beloved friend and will miss his keen wit and kindly disposition.

Born in Marion, Alabama, September 4, 1865, he came of a family distinguished in Civil War history. His grandfather, Governor Moore, was the War governor of Alabama and his uncle, Colonel Samuel Lockett, made military history as the engineer who planned the defenses during the siege of Vicksburg, Miss. Mr. Lockett, whose family was impoverished by the ravages of Reconstruction Days, set out courageously to make a career on his own and his success may well serve as an inspiration to any young and ambitious engineer. He attended the Stevens Institute of Technology but for financial reasons he was unable to complete his studies and it is a tribute to his success that 50 years later, in 1938, Stevens Institute awarded him an honorary degree

He lived a remarkably full life, as in addition to founding and building up a large business of his own, he took a prominent part in all the important civic and social activities of his adopted city.

He founded the firm of A. M. Lockett and Co. Ltd., Contracting Mechanical Engineers, in 1899 and was President until ill health forced his retirement in 1944 when he became Chairman of the Board until the time of his death.

He was a Director of the Association of Commerce for 13 years and served as President for two years, 1930 and 1931. While serving as Vice-President of the Board of Port Commissioners, of which he was a member for several years, he made an extensive tour of Europe inspecting port facilities of large seaports in England and on the Continent. One of the original members of the Intra-Coastal Canal Association, he was serving on its executive committee at the time of his death. He was a former member of the Board of Directors of the New Orleans Public Service Inc., a former Director of

the Whitney National Bank and a member of the Industrial Advisory Committee of the 6th District Federal Reserve Bank.

Mr. Lockett was a life member of the Louisiana Engineering Society, a Fellow of the American Society of Mechanical Engineers, a member of the Newcomen Society, of the Boston Club and several Carnival and other local organizations.

His chief diversion from his business and civic duties was his home work shop where his mechanical skill enabled him to develop a number of inventions covering a wide field such as an automatic bicycle pump, a valve facing tool, a pneumatic auto shock absorber, a gravel washer, a sand separator, an oil burner, a coffee dripper, a human blood pump, a table baseball game, a creosote plant condenser and several others. Several of these devices are in wide commercial use.

Your Committee feels that the Louisiana Engineering Society should pay tribute to our late fellow member and friend Andrew M. Lockett by adopting this resolution:

Therefore: BE IT RESOLVED, that the Louisiana Engineering Society adopt resolutions embodying the facts as above expressed and that these resolutions be spread upon the minutes of the Society and published in its Proceedings, and that a copy be sent to Mrs. Lockett and his other close relatives, together with an expression of our heartfelt sympathy and sincere condolences.

Respectfully submitted,
B. Stanley Nelson, *Chairman*
A. Lee Dunlap

OBITUARY OF
TAINTOR PARKINSON

The sudden death of Taintor Parkinson, Professor of Electrical Engineering at the Louisiana State University, has brought a keen sense of loss to his large circle of friends.

Death came at Southbridge, Massachusetts, after an illness of about two weeks which followed the extraction of an impacted tooth. The condition causing death was diagnosed as inflammation of the nerves of the spinal column, caused or contributed to by infection over a long period.

Professor Parkinson came to L.S.U. from the University of Michigan in 1934 on completion of four years of graduate study and research in electrical engineering and physics. He was a graduate of Dartmouth, 1909, and received the master of pedagogy degree from New York University in 1911.

He rose from the ranks to second lieutenant in the Signal Corps in World War I and immediately following the armistice was assigned to teach radio at the Second Aviation Instruction Center, Tours, France, for the 1918-19 Winter term. He was a public school principal in Greenwich, Connecticut, 1919-23. He was associate Physicist with the U. S. Bureau of Standards July, 1928 to February, 1930, in charge of a project on investigation of radio wave phenomena, and had for a little more than four

years previously been a research associate with the Bureau in the same field.

As a delegate from the National Academy of Sciences and the National Research Council, he presented a paper at the meeting of the International Union of Scientific Radio in Brussels, Belgium in 1928 and while in Europe did special study on radio research then being conducted at various laboratories in France, England and Belgium. At the time of his death he was carrying on at the University two confidential research projects for the Federal Government.

Professor Parkinson had a fine, gentle and friendly disposition. His influence for good will reach on through the years and his closest personal friends will long remember him as a fine Christian gentleman whose life was exemplified by the "Golden Rule" in principle and practice and who literally inspired his students to the nobler way of life.

Be It Resolved, That in behalf of the entire membership of the Louisiana Engineering Society this memorial be adopted in tribute to the memory of our late fellow member Taintor Parkinson.

By his death we have lost a beloved associate whose outstanding character as an engineer and teacher reflected high honor upon our profession and whose memory is a fitting inspiration for all time.

Be It Further Resolved, That this memorial be spread upon the minutes of the society, and that a copy be sent to his father, Mr. William D. Parkinson, with an expression of our sympathy and heartfelt condolence.

L. J. LASSALLE, *Chairman*
W. D. MORRIS
B. W. PEGUES
H. WATERFALL

OBITUARY OF

LESTER CHAUNCEY SMITH

Lester Chauncey Smith, a former member of this Society, died on November 17, 1944, at Mobile, Alabama.

Mr. Smith was a native of Montgomery, Alabama, having been born in that city on February 9, 1889. He was the son of Mr. and Mrs. Lester C. Smith, his mother having been, prior to her marriage, Miss Annie Jackson of Montgomery.

Lester C. Smith was educated in the primary schools of Montgomery and was graduated from the Alabama Polytechnic Institute of Auburn in Civil Engineering in the Class of 1909.

Subsequent to his graduation he spent approximately one year in railroad surveying and construction, approximately one year with the Alabama Power Company on hydroelectric development on the Coosa and Tallapoosa Rivers in Alabama, approximately six years as a Junior Engineer with the U. S. Engi-

neer Department on various surveys and construction projects for river improvement.

During the first World War he was a First Lieutenant and subsequently a Captain in the Second Division, Second Engineers of the regular army. His Company participated in eight major battles during the war, the principal ones being the First and Second Battles of the Marne, Soissons, Chateau Thierry, and Belleau Wods. He received the Croix de Guerre for gallantry in action.

In 1919 Mr. Smith was married to Miss Mary Baldwin Williams of Montgomery, Alabama.

After the war Mr. Smith returned to the practice of engineering and went to work as a Construction Engineer for the firm of Doullut & Williams, Inc. in 1920. He remained with this firm until 1925. During that time he was principally engaged in the construction of piers and other river terminals, the principal one of which was a wharf for the Standard Oil Company at Baton Rouge. Subsequent to that engagement, and up until a short time prior to his death, Mr. Smith was a member of the firm of Doullut & Ewin. During approximately twenty years with this firm, he had charge of design and construction of many projects, including piers, bulkheads, shipbuilding ways, bridges and other similar structures. He was in charge of the field work on the construction of the Sugar Bowl Stadium in the City of New Orleans.

He was a member of the Louisiana Engineering Society and an Associate Member of the American Society of Civil Engineers for many years.

In addition to his many friends he is survived by his widow and four children, Lester Chauncey Smith, Jr., Mary Baldwin Williams Smith, Etheldra Graham Smith and Martin Baldwin Smith. His oldest son, Lester C. Smith, Jr., is at present in the United States Army, having served as a gunner and engineer on a B-17 in flights over Germany, and being in training for service on a B-29 at the time of the Japanese surrender.

J. P. Ewin

Engineering Briefs—Heat and Power by Liquid Heat. The John B. Pierce Foundation, important housing research organization, will soon announce details of a revolutionary system for furnishing heat and power to homes. It is called liquid heat.

Basis of the development is a secret chemical, a liquid which will convey temperatures up to 817 F. before boiling. This liquid is piped to different appliances in the home. It will operate them all from a single unit on the premises, according to the inventors, just as they are now operated from electric and gas connections.

It is claimed that liquid heat will run the cooking range,

refrigerator, water heater, washing machine, lights, and all the other household gadgets at a fuel saving of 48% under conventional systems (on the basis of a test using No. 1 buckwheat anthracite costing $7.50 a ton.) The liquid which does the multifarious jobs is heated in the first instance in a boiler burning coal, oil, or other fuels. Since it is independent of gas mains or power lines, liquid heat is adaptable to remote regions as well as settled communities.—From "Power Notes."

Concrete with Coral Aggregate. After a series of experiments in Bermuda, a concrete has been developed using coral as an aggregate and sea water for the moistening agent. Lack of fresh water on the island necessitated extensive experimenting with sea water.

New Hydro Plant. Plans have been drawn for a hydro-electric plant on the Colorado river, about one hundred eighteen miles above Boulder Dam. The proposed height is seven hundred thirty six feet, with a planned generating capacity of seven hundred fifty thousand kilowatts.

Gas Turbine for Marine Use. Recently a twenty five hundred horsepower gas turbine unit has been completed and tested. It was designed especially for marine use. Test figures show a thermal efficiency of 29%. Efficient part load operation is also claimed. At present fuel oil is being burned, but plans are being made for a combustion chamber using coal as a fuel.

You have a financial interest in the L.E.S. library; use the facilities at 422 St. Charles Hotel.

PAPERS AND DISCUSSIONS

NAVY'S FLOATING DRYDOCKS*

By Comdr. Ammann Werner

The Bureau of Yards and Docks, since its inception in 1842 by Act of Congress, has been charged with the design, construction, operation and maintenance of the U. S. Navy's shore establishments. One of the Bureau's major phases has been, and is, the construction and maintenance of facilities for docking of ships. These facilities include marine railways, graving dry docks and floating dry docks.

During peacetime, docking facilities are required mainly for routine underwater maintenance of ships, such as cleaning, painting, checking shafts and propellers, sea chests and intakes, with occasional underwater damage repair. During the present war the tremendous increase in number of ships, not only in the Navy but also in the Army and the Merchant Fleet, has been evident. In order to be prepared for repairing war-damaged ships the rate of increase of docking facilities, however, had to be on an even greater scale. Time required in docking for scraping and painting a battleship's bottom is only two days, whereas repair of moderate hull damage runs into weeks or months. The Chief of the Bureau of Yards and Docks, Vice Admiral Moreell, foresaw, even long before our entry into the war, this huge increasingly urgent need of docking facilities and he took action. Plans were prepared, funds allocated, contracts awarded, and construction started on additional drydocking facilities.

In addition to graving docks, floating dry docks were constructed for use at commercial yards, using Navy funds. These floating docks gave flexibility to the program. If, as it later developed, more docking facilities were needed on the west coast or in the Pacific, these floating docks could be readily moved to new locations to meet the changing circumstances.

After our entry into the war, an unprecedented increase in

* Presented at the regular meeting of the Society on August 13, 1945 by Commander Werner Ammann, Civil Engineer Corps, U.S.N.R.

docking facilities had to be provided, not only within the continental limits of the United States, but at advanced bases. Emphasis was therefore shifted to, and construction further accelerated, on the floating dry dock program. In addition to the advantage of mobility, the floating dry dock as compared with the graving dock can be constructed in less time and can be operated at locations where foundation conditions preclude construction of a graving dock.

For those not familiar with a floating dry dock a brief description of its general principles is presented. Basically, it consists of a pontoon into which water is admitted for submergence under a ship. The water is then pumped out, its buoyancy lifting the ship clear of the water. Sidewalls are required to prevent pontoon from sinking out of control once it is completely submerged. The most usual design today is a "U" or trough shaped dock.

Floating dry docks are not new structures. A number of them were constructed and placed in operation in Germany, Great Britain and other countries in the last century. The U. S. Navy started using them about 1850, but they have never played the significant or strategic role that they have during this war. In that respect they can be considered one of this war's new weapons, as it enabled our fleet to be maintained and repaired at mobile advance bases close to the scene of action.

The AFD, Auxiliary Floating Dock, is a small single piece steel "U" dock with lifting capacity of 1000 to 1900 long tons, generally constructed as a military type. It is designed for docking mine, patrol and smaller landing craft and destroyer escorts (See Fig. 1). The pontoon is constructed with faired bow and stern to facilitate towing. It is a mobile type dock since it can be placed in operation shortly after arrival at its base. Its power plant, pumps and other operating machinery are located in the upper portion of the wing walls in the so-called safety compartments. The dock's ballast tanks are in the lower portion of the wing walls and in the pontoon. The primary function of the safety compartments is to prevent

complete sinkage of the dock when the dock's ballast tanks are completely flooded.

The ARD, Auxiliary Repair Dock, is a single piece steel dock with a lifting capacity of 4,000 tons. It has a ship-like

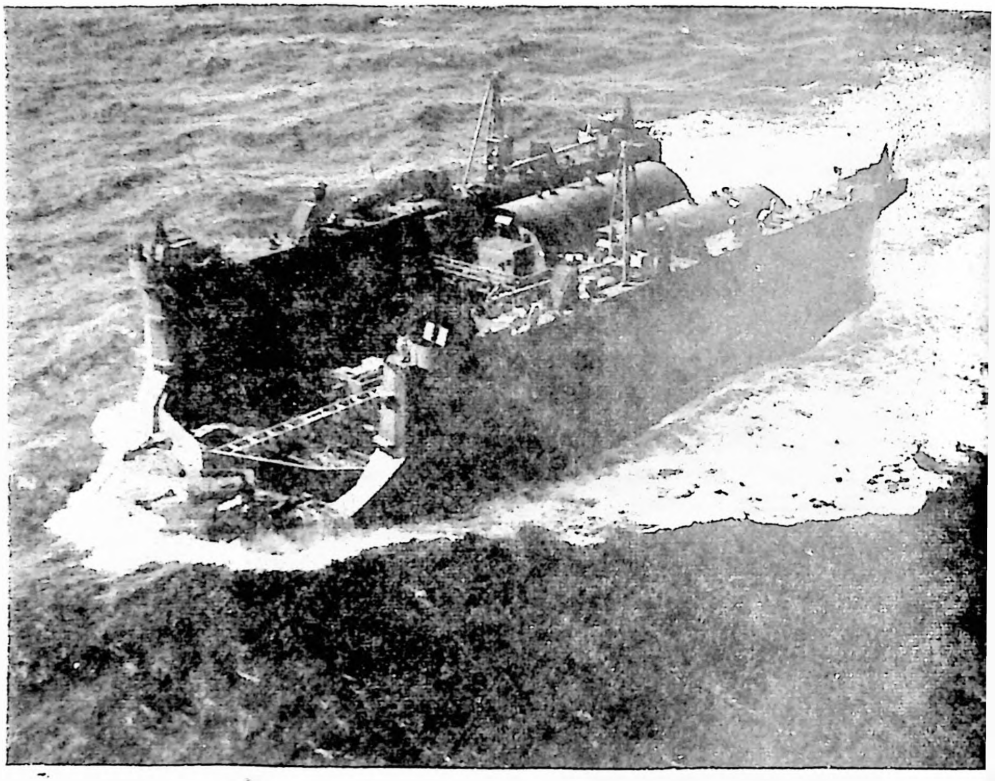

FIGURE 1. *1,000 ton AFD under tow to an advanced base. The Quonset huts in the dock basin are utilized for crew berthing and messing under way. At location these huts will be placed ashore or onto barges alongside and utilized as shops and crew's living facilities.*

hull with closed bow and stern gate to form a closed docking basin. It docks destroyers, submarines and LSTs. The ARD is a very mobile type dock and practically all of them have been constructed as military docks. Due to its mobility and general usefulness in docking all ships up to and including

destroyers it is usually the first type to reach advanced bases, and consequently it has had its share of bombing and strafing. On its initial outward trip it is used as a freight and small ship carrier. The dock is equipped with two 10 ton revolving gantry cranes for servicing the dock and ship in dock. Experiments have been made with the ARD for performing dockings at sea. Ordinarily a floating dry dock is designed for operation in a protected harbor where seas and ground swells are small. At sea the roll and pitch of the ship are not the same as those of the dock and the problem is to dampen any relative motion between them at the time the ship's keel is ready to land on the dock's blocking.

The ARDC, Auxiliary Repair Dock Concrete, is a 2800 ton capacity single piece concrete dock designed for both home and overseas use. It is similar in outline, though larger than the AFD steel docks. Its hull walls and bulkheads are made of approximately 6″ thick normal aggregate concrete. It is less efficient than a steel or timber dock as regards its lifting capacity ratio to its dead weight. However, it was designed to save critical steel, and has proven a successful small dock, requiring a minimum of hull maintenance work, and able to stand the pounding and stresses of heavy seas during towing.

The YFD, Yard Floating Dock, includes a wide variety of types, as follows:

(a) The 1000 ton to 5000 ton single piece timber docks.

(b) The 6500 to 20,000 ton sectional timber docks. This brings up the self-docking feature in floating dry docks, that is, a dock so designed that parts or sections of it can be docked in the remaining portion of the dock. For docking of a section, locking logs are removed, the section turned 90 degrees and brought into the submerged portion of remainder of dock.

(c) The 16,000 ton special Rennie type dock, "U" shaped, with steel wing walls and timber pontoons bolt-connected to the wing walls. It has the advantage of longitudinal strength and ease in self-docking. For self-docking a pontoon, the connections to wing wall

are removed, the pontoon lowered, slipped out endwise and brought into submerged remainder of dock.

(d) The 14,000 to 18,000 ton three-sectional steel docks for docking light cruisers, transports, cargo ships, tankers, hospital and similar type ships. It is a trough shaped dock with long center section and 2 short end sections. The end sections are capable of docking the center section and in turn can themselves be docked in the center section. For towing to forward areas the end sections are cradled and secured within the the center section. A new feature is incorporated in this dock, a so-called buoyancy compartment in the center of the pontoon, directly under the keel blocks. Its purpose is to provide greatest buoyant force at the location of greatest ship load, thus producing less transverse bending movement in pontoon and lesser differential water pressure on wing wall plating and framing.

Finally, the ABSDs, the Advanced Base Sectional Docks, in two sizes; a ten section steel dock with a total lifting capacity of 100,000 tons for docking of battleships or the large liners like the Queen Mary or the Queen Elizabeth, and a seven section steel dock with a total lifting capacity of 56,000 tons for docking heavy cruisers, including the new Alaska type battle cruiser, aircraft carriers, and the smaller, older class battleships. Each section of these sectional docks is complete in itself as far as electric power, salt water, compressed air, crew's messing and bunking and other facilities are concerned, so that it can be towed to an advanced base as an independent unit. Furthermore, the sections being practically alike, are interchangeable. Thus, in case of loss or serious damage to any sections, the dock can operate with less than the requisite number of sections. The pontoon ends of each section are faired for ease in towing. The wing walls are built in, or jacked down to the lowered position to give greater stability and lesser wind area presentment during tow.

The cost of the sectional docks runs in the neighborhood of about $3,000,000 per section complete, or a total of about $30,000,000 for the battleship dock. But, if they can save or

help save a $100,000,000 ship, not to mention repairing and maintaining hundreds of ships close to the fighting front, getting them back into action weeks and months sooner than if they had to make a trip back to Pearl Harbor or the West Coast, thus materially shortening the war, their cost is justified. Furthermore, they will all have peacetime usefulness in docking merchant and passenger ships. The Bureau's total investment in floating dry docks is about $450,000,000. Great credit is due to the designers of these docks. The Bureau laid down the basic design requirements for all types of docks and, further, it completely designed some types. The consulting engineering firm of F. R. Harris, Inc. at New York was the designer of the ABSDs, the three-sectional steel YFD docks, timber docks and other types. Great credit is also due the contractors and their workmen, to their know-how and will to push to completion in the face of difficulties.

Since I was directly attached to the U.S.S. ABSD-1, the first of the large sectional battleship docks, during its towing, assembling and operation period for about two years, I would like to describe in narrative form and in greater detail the work involved in assembling the dock and to mention a few of the incidents that occurred during that time.

After completion of construction, the floating dry docks that are destined for forward areas, are turned over to the fleet as a commissioned ship of the Navy. They are commanded by a Naval Line Officer and operated by officers and enlisted personnel of the Navy. I was assigned to the U.S.S. ABSD-1 as Maintenance and Dock Control Officer. During the early days of getting the ABSD-1 ready to put to sea, the following were some of he jobs that had to be performed by the officers then assigned to the ABSD-1:

(1) Study the plans and specifications at the designer's office and make recommendations for any necessary changes that could be performed without delaying construction.

(2) Make list of and check on procurement of auxiliary equipment, tools and materials required for outfitting,

assembling and operation of the dock. This included such items as binoculars, weld rods, barges, tugs, bolts, nuts, crawler cranes, and thousands of other items too numerous to mention.

(3) Organize the ship's officers and crew into departments and divisions. The enlisted men were procured from the Floating Dry Dock Training Center at Tiburon, near San Francisco. This training center was set up for the purpose of training floating dry dock personnel. However, further instructions and training were given them in connection with their particular duties on the ABSD-1. The battleship sectional docks have a complement of about 30 officers and 750 enlisted men.

(4) Make submergence, wing wall raising and machinery and equipment tests.

In June of 1943 I was sent to Morgan City, Louisiana to take charge of the two sections of the ABSD-1 leaving from there. The other eight sections were to proceed separately from San Francisco. Then came our final frantic efforts to complete construction of the sections, stow all necessary gear and equipment, secure them for sailing, provision them for three months at sea and make final convoy, towing and signaling arrangements.

One of our first worries was getting over the mud flats of the lower Atchafalaya River to deep water in the Gulf of Mexico. The channel at its narrowest and shallowest section was only 100 feet wide by 8 feet deep at mean low water. Since our sections drew more water than that it was necessary to get over the shallow section quickly at high tide. Even so, the small inland tugs that towed us to the Gulf churned up mud continually and got partially stuck several times. At deep water in the Gulf we were met by the ocean-going tugs and escort vessels. Our new tow was made up and we got under way on our long trip.

Upon arrival at Panama our queer looking ship apparently caused considerable speculation. We received a signal from

one of the patrol crafts asking "What is it", to which we replied "New secret weapon".

In the Pacific our trip was fortunately practically without incident. For a period of thirty days we saw neither land, plane or ship other than those in our convoy, which is believed to be quite a record in these days of fast travel. Some storms, though none of great severity, were encountered. In moderately heavy seas we rolled about 30 degrees, and since the sections are flat bottomed and very stable the roll was stiff and quite rapid.

Our final destination proved to be one of those beautiful coral lagoons in the South Pacific that one reads about. The waters in the bay were a deep blue and clear enough so one could see bottom in 40 to 50 feet. The waters contained thousands of multi-colored tropical fish and coral formations, and the bay was surrounded by sandy beaches and cocoanut groves. However, this beauty palled on us the longer we had to stay there.

Our first job out there was to remove all topside equipment and make other preparations for wing wall raising. The wing walls were then raised, section by section, into the upright position by means of two long steel jacking columns with 500-ton hydraulic jacks at their base. Fig. 2 shows details of this jacking equipment. Raising was accomplished by jacking one column the length of the distance between pin holes, lowering the second column, pinning off second column at its connection to the wing wall, and the jacking with second column. This cycle was continued until the center of gravity of the wing wall passed over the base hinge. From there on the wing wall moved into its upright position by a second set of smaller jacks engaging a tension harness. The wing wall was then secured to the pontoon by 2-inch diameter bolts spaced at 12-inch centers around the periphery of the wing wall.

After the first section's wing walls were raised, it was moved to its final location and secured to the mooring anchors and chains. Thereafter, as the wing walls on each subsequent section were raised, it was brought alongside the assembly,

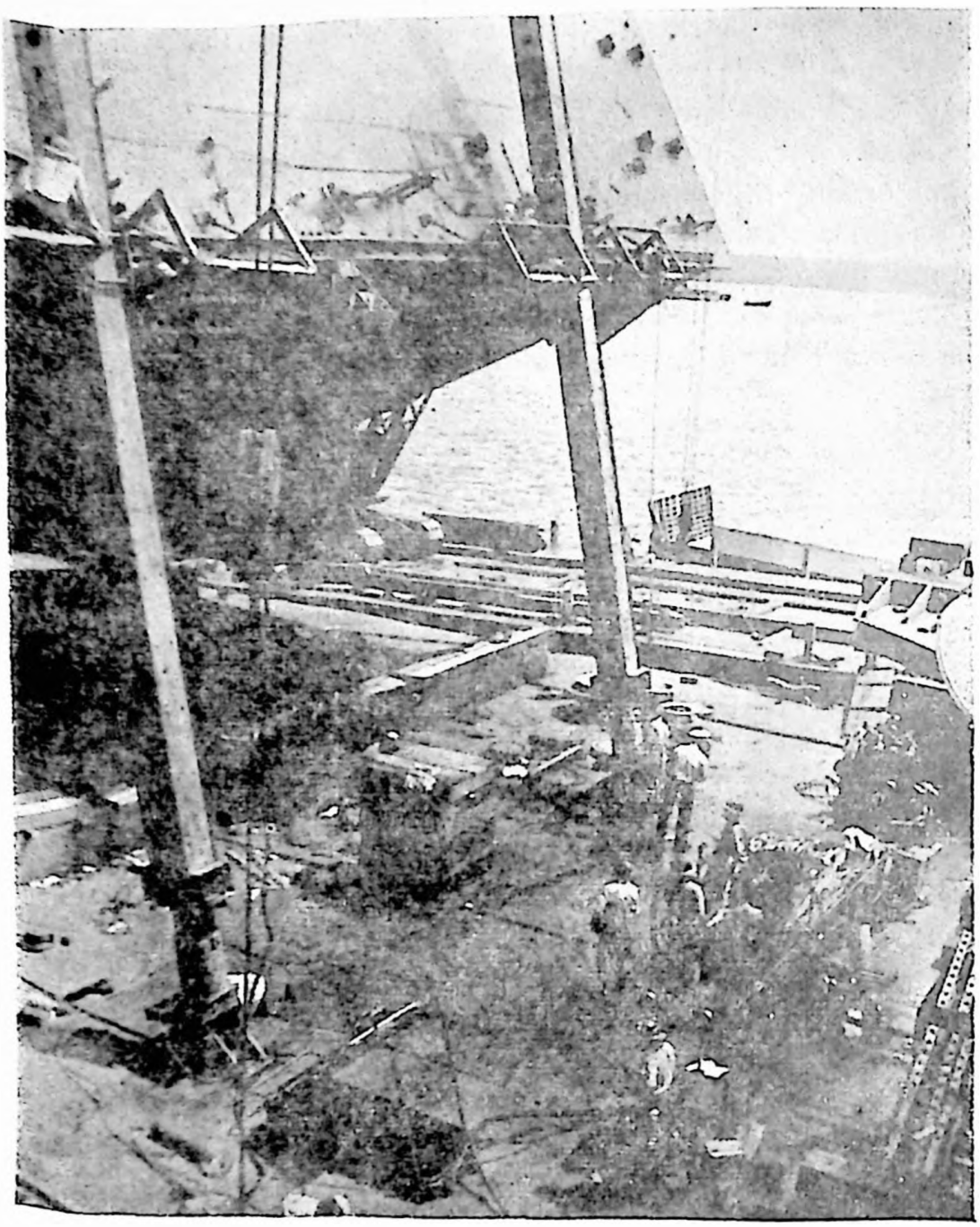

FIGURE 2. *Wing wall raising operation on section of battleship dock. Note compressed air operated hydraulic pump in right foreground. This pump actuates the hydraulic jacks at base of jacking columns.*

flooded or pumped to correct alignment and splices made. The connections between sections consist of 1¼" splice plates engaging 2" keeper plates at the tops and bottoms of the wing walls.

As assembly of the dock proceeded, additional moorings were laid. The completed dock was moored with thirty-two 15-ton anchors and 3" cast steel chain. It was moored in approximately 30 fathoms of water with its longitudinal axis in the direction of the prevailing wind.

The crane transfer operation incident to dock assembling was interesting and fraught with some hazard. During sailing the two cranes were secured on the pontoon deck of two of the sections. Upon arrival at location these cranes were operated while in this position on the pontoon deck of their respective sections, thus greatly aiding in all the multitudinous weight-handling jobs. After several sections were assembled with their wing walls in the upright position the cranes were transferred to the wing wall decks. This was accomplished by the following steps: (a) Flooding the partial assembly until its wing walls reached same elevation as pontoon of crane sections, (b) bringing crane section alongside submerged assembly and securing it there by special prestressed cables, (c) installing special rail links across gap, (d) transferring crane using its own travel power, (e) disconnecting previous crane section and, finally, (f) pumping up partial assembly.

Total time to assemble our dock was about three months. Later docks, due to experience attained with the first one, took from two to two and a half months.

In these sectional docks there is a buoyancy compartment in the center of the pontoon that has the same purpose as the buoyancy compartment previously described in the three piece steel YFD type dock. However, in the section docks this space is utilized for fuel oil and water storage, for housing the dock's machinery including diesel engines, generators, pumps, boilers, evaporators and auxiliary equipment, and for the crew's living and messing quarters. Normally, when the dock is in the up position, access to the buoyancy compartment is through hatches and scuttles on the pontoon deck. During submergence these hatches and scuttles are closed and access to the buoyancy compartment spaces from the wing wall deck is had down vertical circular stairwells within the wing walls

and through passageways within the pontoons. The safety compartment spaces in the tops of the wing walls are utilized for the ship's officers' wardroom and quarters, sick bay, crew's recreation facilities, refrigeration and storage compartments, machine, shipfitters, sheet metal and carpenter shops and other facilities. Due to the fact that the wing walls were in the down position during sailing, practically all of the facilities in the wing wall spaces had to be constructed and installed by our ship's force. This took a long while since the work was made secondary to ship repair work.

As previously mentioned the dock is comparatively flexible, and since extremely heavy ship loads and buoyant forces had to be dealt with, measures had to be taken to prevent excessive dock distortions during operation, that might be injurious to either the dock or the ship in dock. Fundamentally the problem is simply to pump each section, such that the upward buoyant force of that section equals the portion of the ship load on the section, during all stages of pumping. If that is done there will be no shear or moment transfer between sections of the dock, or parts of the ship. Previous to docking a ship, pumping calculations are made based on the principles stated above. However, as a secondary check to insure prevention of large deflections, particularly since at first the tank water level indicating system was not completely reliable, a deflection control system was installed on the dock. Vertical and horizontal sighting battens or targets were installed on each section of both wing walls, and an engineer's level was set up on the top of both wing walls at the head of the dock. By setting the cross hairs of the level on the target at the after end of the dock, vertical and horizontal deflections of the intermediate sections were continuously read through the telescope of the level. Sensitive list and trim indicators in the control house gave information as to changes in list and trim during pumping. Two cruisers or two cargo ships whose combined overall length is so great as to prevent them from being docked on the longitudinal centerline of the dock, could be docked by offsetting the forward ship to port and the after ship to star-

board, or vice versa. This, however, required differential pumping between port and starbord sides of the dock. Since the dock had very little strength for resisting torsion about its longitudinal axis, a system for detecting any undue torsion had to be developed. This was done by installing a list indicator on the after end of the dock, and by taking simultaneous readings on forward and after list indicators; any difference between the two gave a measure of the overall dock torsion. Intermediate torsion was detected by readings on the horizontal and vertical deflection battens. Offset docking of two cruisers and other ship combinations has been successfully performed, by use of the above control system.

In conclusion I would also like to acknowledge the deserving credit due the enlisted men of the Navy who were attached to the dry docks, for their part in the assembling and operation of these docks. Due to their persevering and enthusiastic work at all times of day or night in the face of adverse weather and other conditions, they made it possible to get battle-damaged ships back into fighting condition quickly. Thus, the all important part played by these dry docks in the present war is due to the cooperative efforts of their designers, constructors and operators.

MINUTES OF THE MEETING AND BUSINESS OF THE SOCIETY

Minutes of Meeting of the Board of Direction, September 10, 1945

President Steinmayer called the meeting to order with Messrs. Gosa, Kerr, Lassalle, Mayer, McNiven, Nairne, Nelson and Fernandez present. Minutes of the meeting of August 6 were read by the Secretary and accepted.

Mr. Nairne announced that he had communicated with all past presidents of the Society concerning the proposed Advisory Committee.

The Secretary read a letter from the Publication Manager of the American Society of Civil Engineers requesting permission to publish in part the Society's resolution on Water Use and Control. It was moved and passed that the resolution must be published in its entirety.

A communication from the Engineers' Council for Professional Development acknowledging Mr. McNiven's letter regarding the Engineers' Code of Ethics was read.

The Secretary reported the death of an out-of-town mmeber, Mr. Lester C. Smith, whereupon the President appointed Mr. James P. Ewin to conduct the preparation of a memorial to the later member with authority to name his own committee for assisting in this work.

Minutes of the special meeting of August 13 were read and accepted.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ
Secretary-Treasurer

Minutes of Joint Meeting of the Louuisiana Engineering Society with American Institute of Electrical Engineers, September 10, 1945

The meeting was called to order by President Steinmayer with approximately 160 members and guests present. Minutes of the previous meeting were read by the Secretary and accepted.

Mr. D. E. Drufner, a spokesman for the United Community and War Chest, gave a short talk appealing for support in the coming campaign.

President Steinmayer announced that Dean Leo J. Lassalle of Louisiana State University would speak at a meeting of the Baton Rouge Section of the Louisiana Engineering Society on September 26, his subject to be "Atomic Power and the Atomic Bomb".

The chair then was reliquished to Mr. W. Stone Leake, local chairman of the American Institute of Electrical Engineers. Following the business of that organization, Mr. R. F. Wright presented the speaker of the evening, Mr. L. W. Ballard, Jr., who spoke on "Industrial Electronics".

Following Mr. Ballard's lecture, the meeting was returned to President Steinmayer, who thanked the American Institute of Electrical Engineers for the splendid program and the meeting adjourned with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ
Secretary-Treasurer

Minutes of Meeting of the Board of Direction, Louisiana Engineering Society, October 1, 1945

The meeting was called to order by President Steinmayer, with Messrs. Gosa, Kerr, Mayer, Nairne and Fernandez present. Minutes of the preceding meeting were read and accepted with a correction.

Mr. Nairne reported that he had received a number of replies from

past presidents of the Society regarding the Advisory Committee Amendment to the Constitution, and that a summary of their opinions would be prepared for the Board's next meeting.

The Secretary read a financial report on the annual outing which was accepted. Mr. Nairne moved that the Society express its thanks to the general chairmen of the outing. Mr. John V. Dugan, Jr., for the splendid work performed by himself and his co-workers in making the occasion an outstanding success. The motion was seconded by Mr. Kerr and carried.

The following members were selected to serve on the Nominating Committee for the forthcoming election of officers and board members:

Charles M. Kerr, Chairman
David W. Godat
John Riess

The Treasurer presented a financial statement for the third quarter of the year.

The Secretary announced that all candidates for membership on the September ballot had been elected.

The Secretary read a resolution presented by Mr. Legendre in favor of a veterans' hospital for New Orleans.

A letter from Mr. W. H. Scales, Chairman of the Legislative Committee, was read by the President.

The Secretary announced that Mr. W. F. Scofield had submitted his resignation as Chairman of the Finance Committee, effective November 1st, whereupon Mr. Noel P. Kammer, Vice-Chairman, was appointed by the President to serve as Chairman for the remainder of the year.

The Secretary announced that word of the death of Professor Tainter Parkinson of Louisiana State University, a member of the Society, had just been received; the President appointed a committee consisting of Dr. Leo J. Lassalle, Chairman, and Professors B. W. Pegues, Willis D. Morris and Harry Waterfall to compose a memorial letter in honor of the departed member. There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ
Secretary-Treasurer

Minutes of Special Meeting of the Board of Direction, Louisiana Engineering Society, October 8, 1945

The meeting was called to order by President Steinmayer. Members present were Messrs. Gossa, Kerr, Lassalle, McNiven, Nairne and Fernandez. Also present by invitation was Mr. M. C. Abrahm.

President Steinmayer announced that the dates for the annual meeting would be January 10-11-12, 1946. It was moved and passed that the sum of one thousand dollars be underwritten for expenses of the meeting. The President then appointed Mr. Michael C. Abrahm as General Chairman of the meeting.

Mr. Abrahm in turn named the following gentleman to serve as chairmen of the various committees to function in connection with the annual meeting:

Mr. R. M. Seago, General Vice-Chairman
Mr. Harold A. Levey, Technical Papers
Mr. J. J. Bulliung, Registration
Mr. A. M. Hill, Technical Exhibits

Mr. John V. Dugan, Jr., Banquet
Mr. W. H. Johnston, Student Papers
Mr. Claiborne Perrillat, Publicity
Mr. James S. Janssen, Program
Mr. Edward M. Naberschnig, Visitation

It was moved and passed unanimously that consideration be given to the mator of increasing the price of banquet tickets and that some difference be made in prices of tickets for members and their families and those of outside guests.

The Secretary announced the death of Mr. B. N. Davis, a member of the Society, which occurred on July 1st, and Messrs. Charles M. Kerr, Chairman, and J. A. McNiven were appointed to prepare a memorial letter in his honor.

There being no further businesss, the meeting adjourned.

JOHN P. FERNANDEZ
Secretary-Treasurer

Minutes of Joint Meeting of the Louisiana Engineering Society With N. O. Section, American Institute of Chemical Engineers, October 8, 1945

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

President Steinmayer announced the appointment of the Nominating Committee to consider candidates for the January election, members of the committee being Messrs. Charles M. Kerr, Chairman, David W. Godat and John Riess. It was also announced that the annual meeting would be held January 10-11-12, 1946, and that Mr. M. C. Abrahm would serve as Genreal Chairman for the meeting. Mr. Abrahm then was introduced and gave a brief outline of plans for the meeting, after which he gave the names of sub-chairmen of the various committees who would work with him for the success of the annual meeting.

Mr. Charles M. Kerr announced that a meeting of the Louisiana Section, American Society of Civil Engineers, would be addressed by Mr. J. A. Elliot, Division Engineer of the Public Roads Administration, Federal Works Ageney, on Monday, October 29 in the Jackson Room of the St. Charles Hotel.

A brief talk on the civil service laws of the city and state was given by Mr. Shaw.

The meeting then was turned over to Mr. A. Watson Chapman, Vice Chairman of the local section of the American Institute of Chemical Engineers, who introduced the speaker of the evening, Professor Harry McCormack, Head of the Department of Chemical Engineering, Illinois Institute of Technology. Following the professor's very interesting lecture entitled "Our Future Engineers", the meeting was returned to President Steinmayer, who thanked the speaker, and the meeting adjourned with a rising vote of thanks to Professor McCormack.

JOHN P. FERNANDEZ
Secretary-Treasurer

Minutes of Meeting of Baton Rouge Section Louisiana Engr. Society

Third quarterly meeting, September 26, 1945, L.S.U. Golf Club Clubhouse. Officers present: J. T. O'Brien, President; P. J. Guelfi, 1st Vice President; Wm. Whipple, 2nd Vice-President; James J. Saurage, Secretary-Treasurer. Attendance: Approximately 70.

President J. T. O'Brien opened the meeting at 8:15. Members introduced their guests among whom were several members of the L.S.U. Physics Department, including Dr. Guthrie, head of that department.

President J. T. O'Brien then asked for committee reports.

Wm. Whipple, Chairman of Technical Papers Committee, who has just returned from a three months vacation, extended thanks to those who arranged for the speaker for to-night's meeting.

Henry Landry, Chairman of Entertainment Committee, said he had nothing to report but expressed appreciation to those who helped him in carrying out the duties of his committee.

T. E. Peak, Chairman of the Membership Committee, reported he was about out of Membership Application Blanks.

W. M. Larkin, Chairman of the Publicity Committee, reported that he had present, as his guest, a member of the States Times Newspaper—who would write up an account of the meeting for publication.

The reading of the minutes of the last meeting was dispensed with. The report of the Secretary-Treasurer brought out the fact that the Baton Rouge Section has a credit balance of $145.04.

A standing vote of thanks was then given to those who helped organize and conduct the tour of that section of the Standard Oil Company which was enjoyed by many of the members at our June meeting.

Discussion was then opened on a speaker for our December meeting. Mr. Guelfi stated that we could probably get Mr. Sam Hibben of Westinghouse Electric Corporation, whom he had previously heard deliver a lecture which was most interesting. It was agreed that Mr. Guelfi should contact Mr. Hibben and if possible, arrange to have him as our speaker at the December meeting.

President O'Brien then appointed a Nominating Commitee. This committee is to present, at our Annual Meeting in December—its recommended candidates for the several elective offices of the Baton Rouge Section. Mr. H. L. Lehmann, Mr. F. F. Pillet and Mr. N. E. Lant were appointed to this committee and Mr. Lehmann is to be chairman.

President O'Brien introduced Dr. Leo Lassalle who proceeded to give a very interesting lecture on "Atomic Power and the Atomic Bomb".

Dr. Lassalle's talk was followed by a period of informal discussion. Questions from the floor were answered by Dr. Lassalle.

The meeting was then adjourned and sandwiches and cold drinks, provided by the Entertainment Committee were served.

James J. Saurage
Secretary-Treasurer
Baton Rouge Section I.E.S.