THE PROCEEDINGS

OF THE

LOUISIANA ENGINEERING SOCIETY

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Arthur M. Hill, Editor

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President Hermann L. Lehmann

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VOL. XXXV FEBRUARY, 1949 NO. 1

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EDITORIAL NOTES AND COMMENTS

Biographical Sketch of Our President. President Lehmann's industrial background began with his employment at the Sinclair Oil Refinery. Later he worked with the Shell Oil Company (then the New Orleans Refining Co.) in the capacity of Chemist in Charge of Testing.

From such a background, President Lehman went with the Louisiana Highway Commission in 1928 as Chemist in Charge of the Bituminous Laboratory.

He has worked with Professor Bateman at Louisiana State University, doing both research and lecture work.

At present, Mr. Lehmann is Testing and Research Engineer, in complete charge of the Highway Testing Laboratory, a picture of which appears on our front cover.

President Lehman has the following activities to his credit:

Member, American Association of State Highway Officials; Southeastern Association of State Highway Officials, Past Chairman, Committee on Materials and Tests; American Concrete In-

stitute Committee, Structural Design of Concrete Pavement for Highways and Airports; National Research Council, Active on several committees and Chairman of Bituminous Division, Department of Materials and Construction; Representing the Louisiana Department of Highways, American Society for Testing Materials; Past Member, Louisiana State University Science Club while the Highway Laboratory was located on the campus; Past President, Baton Rouge Section of Louisiana Engineering Society; served on the parent society as Director, 2nd Vice-President, 1st Vice-President, until present elevation; helped organize the Baton Rouge and Lake Charles Sections of the Louisiana Engineering Society; his non-engineering activities are: Elder in the First Presbyterian church, has been serving as Sunday School Superintendent for the past seven and one-half years; member of Masonic Order and also the Order of Eastern Stars; A regular solicitor on Community Chest Drive and Y.M.C.A.; Past Committeeman at Large—Boy Scouts of America.

Truly we have a versatile president! He tells us that when he is not "otherwise busy," his time is spent on his hobby, woodworking.

A Message from the President. I consider it a distinct honor and a privilege to have been elected one of the officers for the year 1949. I realize the particular position for which I was elected carries with it a lot of responsibility, but I am satisfied that the rest of the officers elected will share it with me.

I look forward towards attempting to promote those aims set up by my predecessors. The first is to perpetuate the harmony existing between all of the Founder Societies. The second is towards developing the organization to better serve its intended purpose. This can be brought about by increasing the number of state sections and also by following the pattern of the Southwestern Louisiana Institute in promoting student chapters which ultimately are your Louisiana Engineering Society members.

We shall endeavor to keep before us at all times, until finally passed, legislation to license professional engineers. Even though this bill was not made into law, the unaminous acceptance by all of the engineering societies is a major step forward, and I feel in due course of time it shall become a law. The "Canon of Ethics for Engineers" recently sent to the entire membership should be our guiding light, not only to speak it but to practice it.

Our membership, now approximately 1,025, should certainly be double this number, and I would like to ask that each member make it a point to bring in a new member during the coming year. This should not be too difficult considering the potential number of engineers in the state.

In closing, I urge you to attend as many of the meetings as possible because it is through association and contact that you derive

the most good from the organization, and its growth depends upon each individual's interest.

Herman L. Lehmann.

January 20, 1949.

The Lake Charles Section held its Annual Meeting on February 1st; new officers were installed by President Lehmann following a sociable cocktail hour and a banquet which was enjoyed by a nearly complete turn-out of the Lake Charles members and their ladies. Mr. L. E. Fraser, Dean of John McNeese Junior College, was present as a guest of the society and introduced the main speaker, Dr. Harold W. Stoke, President of L.S.U., who addressed the gathering in his excellent and entertaining manner.

Present at the meeting were our First Vice-President, Lionel J. Cucullu, the Secretary-Treasurer and Mrs. Fernandez, and Doctor and Mrs. Leo J. Lassalle, of L.S.U., the former a past president of the society. Some other out-of-towners who journeyed to Lake Charles for the occasion were Messrs. J. E. Jarman, R. T. Brooks and Charles Joubert, interested society members from Lafayette, where potentialities for another state section are developing rapidly.

The new officers installed at the meeting were E. H. Goodloe, president; Harrell R. Smith, vice-president; William M. Larkin, secretary-treasurer. They will take up the reins which were handled so ably during the section's first year of operation by F. Tackett Clarke, retiring president, and Ray E. Burgess, retiring secretary-treasurer, during whose administration the membership has increased from minimum requirement of 25 members to more than 70. Co-chairmen in charge of the meeting were William Wenner and Glendon L. Smith.

Honorary Members of the Louisiana Engineering Society. At the general meeting of the annual meeting in January, Professor Boykin W. Pegues, retired Professor and Head of Civil Engineering at Louisiana State University was presented with an honorary membership in the society. The second recipient was Dean James M. Robert, College of Engineering, Tulane University. Both of these men have made their influence felt on hundreds of engineering students, and in honoring them, the society brings honor and distinction to itself. Prof. Pegues was presented by Dean Lassalle; James M. Todd escorted Dean Robert.

New Members. On of the high spots at the annual meeting was the presenting of a charter for the Student Chapter of the Louisiana Engineering Society at Southwestern Louisiana Institute.

Among the many new members which we welcome to the society, are some sixty-five student engineers from S.L.I.

For Member

GEORGE J. BAILEY, Baton Rouge; age 65. Endorsed: H. L. Lehmann, J. J. Saurage, T. W. Parish, Jr. Pa. State College, Mech. Engr., 1903-04. 1902-10, general practice C.E. 1910-14, charge survey, estimates and construction of irrigation, drainage canal and concrete intake to pumping plant, Washington, La. 1914-16, Asst. to Chief Engr., R.R. construction. 1916-22, Engr. on levee, highway and railroad construction, Camp Beauregard, La. 1922-date, La. Dept. of Highways, now Asst. State Maintenance Engr.

HARRY T. BAILEY, JR., New Orleans; age 32. Endorsed: A. W. Durning, F. P. Fischer, M. E. Kirkpatrick, Jr. Alabama Polytechnic Institute, B.S., M. and E. 1940. La. Power & Light Co., Industrial Sales Engineer, 1946 to date. U.S. Army, 1941-46. Member AIEE, IES.

WILLIAM CRANE BARNWELL, Bogalusa; age 43. Endorsed: M. R. Cuell, C. J. Mayeux, C. H. Hundemer. Miss. A & M College, B.S.M.E., 1930. Miss. State College, B.S.E.E., 1933. American Tel. & Tel. Co., Technical Student, 1931-32. Miss. State College, Student Instructor in Geology, 1933-34. Gaylord Container Corp., 1935 to date, now as Assistant Power Plant Engineer.

RICHARD H. BRETZ, Baton Rouge; age 29. Endorsed: F. A. Hannaman, Jr., A. C. Matthies, T. L. Wilson, Jr. Georgia Tech, B. S. Ch.E., 1940; Graduate work, 1941-42. Sinclair Refining Co., Houston, laboratory work, 1940-41. Pan American Refining Co., Texas City, Technical Asst., Summer 1941. Esso Standard Oil Co., La. Div., Chemical Engineer, 1942-date. Member A.I.Ch.E., Am. Chemical Society.

CECIL S. CAMP, Baton Rouge; age 41. Endorsed: L. J. Lassalle, L. M. Odom, F. F. Pillet. Univ. of Ark., B.S.C.E., 1929. State Univ. of Iowa, M.S. (Mechanics and Hydraulics) 1937. Oregon State College, Instructor in C.E., 1930-31. Miss. State College, Asst. Professor of C. E., 1935-36. Syracuse Univ., Asst. Professor of C.E., 1937-41. Univ. of Tenn., Professor of Hydraulic and Sanitary Engineering, 1941-48. Louisiana State University, Head, Hydraulic Eng. Dept., present position. Licensed Professional Engineer, N.Y. and Tenn., 1948. Members ASCE, AWWA, ASEE, Am. Geophysical Union.

TOM O. DILLON, Sulphur; age 27. Endorsed: F. T. Clarke, F. F. Pillet, W. P. Wallace. Louisiana State University, B.S.C.E., 1946. Union Sulphur Co., Jr. Civil Engineer, 1946 to date. U.S. Army Engineer Battalion, Chief of survey parties, 1½ yrs. Licensed C.E., La.

JOHN A. ELLIS, Baton Rouge; age 39. Endorsed: G. T. de la Matyr, M. H. Elissalde, A. J. Mary. La. State University, B.S.E.E., 1931. Gulf States Utilities, Distribution Elec. Engr., 1933 to date.

WILLIAM S. GALLOWAY, New Orleans; age 41. Endorsed: R. F. A. Benson, M. F. Knost, W. D. Holloway. Texas Technological College, B.S.M.E., 1931. U.S. Engr. Dept., Jr. Mech. Engr., 1931-34. Secured Marine Operating Engr. License, 1933. Gulf Refining Co., 1934-47, now Division Industrial Lubrication Engr. in responsible charge.

ROY GEOGHEGAN, New Orleans; age 42. Endorsed: C. Schneider, L. deSalignac, M. E. Kirkpatrick, Jr. Miss. State College, B.S.C.E., 1929. Illinois Central R.R., Rodman, 1929-30. United Fruit Co., Instrumentman, 1930-31. Miss. State Highway Dept., project Engr., 1931-35. Pan Am Petroleum Corp., Dist. Engr., 1935-42. Civil Engr. Corps, USN, Lieutenant, 1942-46. Pan Am Petroleum Corp., District Engr., 1946-47. Plibrico Sales & Service Co., Manager, 1947-48. Professional Engr. License, Miss. 1931-35; Ala., 1937-48.

ALBERT A. GLODT, New Orleans; age 42. Endorsed: A. T. Dusenbury, B. P. Lyons, M. F. Knost. Sinclair Ref. Co., Chicago, Engr. Draftsman, 1925. Shell Ref. Co., Norco, Engr. Draftsman, 1929-32. U.S. Coast & Geodetic Survey, N. O., Office Engr., 1934-35. La. Highway Comm., Chief of Party, 1935-36. U.S. Engr. Dept., 2nd N.O. Dist., Draftsman, 1936-37. Gulf Refining Co., Gulf Production Div., Resident C.E., 1937-date.

CLARENCE A. JACKSON, Lake Charles; age 43. Endorsed: R. E. Burgess, F. T. Clarke, C. W. Stokes. Univ. of Okla., B.S.M.E., 1935. Drilling Contractor, 1935-42. Lummus Co., Asst. Const. Supt., 1943-44. Gmver Tank & Mfg. Co., Const. Supt., 1945-48.

KENNETH M. KING, New Orleans; age 46. Endorsed: C. E. Cassagne, J. K. Mayer, G. F. Stevenson. La. State University, Sugar Eng., 4 yrs. Partner, construction firm, street and highway, bridges, 1927-35. La. Highway Dept., Chief of Party, Res. Engr., Dist. Supervisor, Asst. Traffic Engr., 1935-42. U.S. Marine Corps., Eng. Bn. Executive Officer, Instructor at OCS, Staff & Command School Corps Engr., 1942-46. Traffic Engineer, City of N. O., 1946-date.

FRANK R. LYMAN, Lake Charles; age 40. Endorsed: R. E. Burgess, E. H. Goodloe, J. P. Fernandez. Southwestern La. Institute, 1925-26. I.C.S. diploma in C.E., 1934. U.S. Engineer Corps., N. O. Dist., C. E. (P-3), 1933-46. Hendry Corp., Rattlesnake, Fla., Supt. of dredging, 1946. Monroe J. Wolfe Const., Supt. charge construction Brushy Bayou drainage structure and highway, 1947. Corps. of Engrs., Lake Charles Field Office, Engr. Civil (P-3) charge construction of Calcasieu Lock, Control Structure and dredging., Dec. 1947 to date.

JOHN E. McADAM, Baton Rouge; age 39. Endorsed: F. R. Adams, C. M. Kerr, A. J. Mary. Texas A & M College, E.E., 3 yrs. 1928 to 1948: S. W. B. Tel. Co., Ft. Worth, Engineer; Trinity Farm Const. Co., Dallas, Engineer Dam Construction; Freese & Nichols, Ft. Worth, Engineer (REA); Cotton Elec. Coop., Walters Okla, Engr.; Dixie Electric Membership Corp., Baton Rouge, Engr. (present position).

KENNETH N. McINTOSH, New Orleans; age 46. Endorsed: M. C. Abraham, K. P. Kammer, F. W. Macdonald. Miss. A & M College, B.S.E.E., 1923. Western Electric Co., Chicago, Student Engr., Test Engr., 1923-25. N.O. Public Service Inc., various engineering positions, now Head of Rate Dept., 1925 to date. Tulane University, College of M.E., part-time instructor, 1943-48.

DAYTON R. TAYLOR, Baton Rouge; age 51. Endorsed: J. S. Burk, L. M. Odom, L. C. Eldridge. Va. Polytechnic Institute, B.S.M.E., 1919. City of Roanoke, Water Dept., 1922-42. Supt. U.S. Corps of Engrs., Major, Chief of Water and Sewerage, 1943-46. City of Roanoke, Asst. City Mgr., 1946-47. Baton Rouge Water Works Co., General Mgr., 1947-date. Licensed M.E., Va. Member ASCE, AWWA, Va. Ind. Wastes & Sewage Works Asso., Fla. Sewage Works Asso., Southwest Va. Engrs. Club, La. Section ASCE.

ARTHUR C. THIGPEN, Ruston; age 26. Endorsed: R. T. Sessums, J. J. Thigpen, F. E. Hogan. La. Polytechnic Institute, B.S.E.E., 1943; B.S. Business Admin., 1947. Bowdoin College, Brunswick, Maine, 4 mos. pre-radar, 1944. Mass. Institute of Technology, 4 mos. Radar, 1944. Electronics Officer, U.S. Navy, 24 mos. La. Polytechnic Institute, Purchasing Agent, 1947-48-resigned Sept. to teach.

GRANVILLE J. WYATT, JR., Maplewood; age 26. Endorsed: R. E. Burgess, S. D. Nolan, G. L. Smith. Southwestern La. Institute, B.S.M.E., 1943. Navy Engineering Officer, 1943-46. E. I. Dupont de Nemours Co., Design Draftsman, 1946-47. Cities Service Refy. Corp., Design Draftsman, 1947 to date. Jr. Mbr. ASME

For Reinstatement to Membership

ARNOLD A. GUSTAFSON, Port Sulphur; age 48. Endorsed: V. H. Brogdon, K. T. Price, Z. W. Bartlett. Minnesota School of Mines, E. M. 1922. Engineering work in various iron mines in Minnesota, 1922-23. Freeport Sulphur Co., Texas and Louisiana, 1934-39; Exploration Supt., western states, 1939-42. Freeport Exploration Co., Canada, Exploration Mgr., 1944-47. Operations Asst., La., 1942-44, 1947-48. Member AIMME, Canadian Inst. M & M E.

EUGENE C. HAWKINS, New Orleans; age 55. Endorsed: B. S. Nelson, J. M. Todd, A. W. Betz. Tulane University, B.E., M & E, 1917. Celotex Corp., Marrero, 1939 to date, now Chief Engineer. Masonite Corp., Laurel, Miss., Engr. and Designer, 1936-39. Federal CWA and ERA, 1933-36., Dist. Engr. Design and Field Engr., Municipal Light and Water Plants, Real Estate Developments, etc., 1924-33. Electric Bond and Share Asst. Field Engr., 1921-24. Licensed C.E., La.

ROBERT P. LINFIELD, New Orleans; age 45. Endorsed: L. V. Cressy, B. M. Dornblatt, F. H. Fox. Tulane University, C.E., 1926. Favrot & Reed, Architects, 1936 to date, in responsible charge of structural design. Occupation prior to 1936 included railroad work, land survey, drainage and irrigation. Licensed C.E., La.

JAMES H. MARTIN, JR., New Orleans; age 27. Endorsed: J. M. Robert, A. M. Hill, P. P. Pareti. Tulane University, B.E. in E.E., 1943. Sperry Gyroscope Co., Brooklyn, N.Y., Service Engineer, 15 months. U.S. Naval Reserve Officer, 22 months. Walter Kidde Co. Agent, New Orleans, 15 months. Woodward Wight Co., New Orleans, Transmission Engineer, Jan. 1948 to date.

For Affiliate Member

HOMER E. MOBLEY, JR., New Orleans; age 28. Endorsed: G. H. Dudley, H. C. Moffit, Jr., J. P. Fernandez. Louisiana State University Night School, Architecture, 1939-40. La. Coast and Geodetic Survey, Party Chief, 1938. W. Horace Williams Co., Asst. Engr., 1939-40. WPA, Project Engineer, 1940-

42. U.S. Engineer Dept., Trinidad, B.W.I., Asst. Engr., 1942. U.S. Air Force, Flight Engr., 1942-45. U.S. Engr. Dept., Asst. Chief Hired Labor Inspection, SP-8, 1945 to date.

For Junior Member

ROBERT F. BLAND, NEW ORLEANS; age 21. Endorsed: W. E. Blessey, F. H. Fox, F. W. Macdonald. Tulane University, B.E. in C.E., 1948: Presently enrolled in the graduate school of Civil Engineering.

JOHN W. BAXTER, Baton Rouge; (JUNIOR MEMBERSHIP AWARD). Graduate of Louisiana State University, June 1948.

WARREN J. BRIGNAC, Baton Rouge; age 25. Endorsed: E. E. Evans, F. H. Fenn, W. P. Wallace. Louisiana State University, B.S.M.E., 1943; presently a candidate for M.S. in Eng. Mechanics. Army Officer during the war. La. State University, Instructor in Engineering Mechanics, 2 years.

SAM L. CALHOUN, JR., New Orleans; age 24. Endorsed: A. W. Durning, F. P. Fischer, M. E. Kirkpatrick. Southwestern La. Institute, B.S.E.E., 1946. Commercial Service Representative, La. Power & Light Co., present position. Member I.E.S.

FREDERIC M. CHATRY, New Orleans; age 25. Endorsed: R. M. Shaw, M. G. Zervigon, J. P. Fernandez. Tulane University, B.E. in E.E., 1945. Ensign, USNR, 1945-46. Corps of Engineers, U.S. Army, Hydraulic Engineer, 1946 to date.

DAVID B. FRIED, JR., New Orleans; age 22. Endorsed: F. L. Alcus, C. W. Ricker, J. P. Fernandez. Tulane University, B. E. in E.E., 1948. Engineering Specialty & Mfg. Co., Engineer, August 1948 to date. Student Member A.I.E.E.

NICHOLAS J. GAGLIANO, New Orleans; age 22. Endorsed: J. K. Mayer, C. W. Ricker, J. P. Fernandez. Tulane University, B.E. in E.E., 1948. Cabirac Plumbing & Heating Contractors, Estimator, June 1948 to date.

ALFRED J. LOUP, JR., Baton Rouge; age 28. Endorsed: Louis Duclos, A. E. Hutchinson, Steve Nasca. Louisiana State University, B.C.C.E., 1948. Licensed C.E., La. La. Dept. of Highways, Senior Detailer, June 1948 to date.

J. HOWELL PEEBLES, JR., New Orleans; age 27. Endorsed: M. C. Abrahm, L. J. Cucullu, A. M. Hill. Tulane University, B.E. in M.E., 1946. Tulane University, Instructor in Mechanical Engineering, two years.

CHESTER A. PEYRONNIN, JR., New Orleans; age 23. Endorsed: A. L. Dunlap, A. M. Hill, O. W. Stephenson, Jr. Tulane University, B.E. in M.E., 1947. Louisiana Power & Light Co., Cadet Engineer, 1947-48. Tulane University, Instructor in M.E., Feb. 1948 to date.

MALCOLM J. TUOHY, New Orleans; age 26. Endorsed: A. R. Boelte, J. E. Boelte, Ward Purdum. Loyola University of the South, B.S. Physics (Cum Laude), 1948. Sperry Gyroscope Co., Sales Engineer, Sept. 1948 to date. Member DES National Honor Society. Author of "Facts of Physics" (Copyright applied for 1947).

WALTER WILLIAM RODY, San Tome, Venezuela; age 22. Endorsed: W. E. Blessey, F. H. Fox, F. W. Macdonald. Tulane University, B.E. in C.E., 1948. Byrd & Bruns Bridge Co., Field Engineer, 3 mos. Presently employed as Structural Steel Designer, Checker, Estimator, City Planner, for Eastern Venezuelan Oil Camps. Licensed C.E., La. Member Sociedad de Petreleo, Geologia & Minas, Caracas, Venezuela.

GEORGE L. YOUSKO, JR., Baton Rouge; age 27. Endorsed: F. S. Houghton, W. A.. Whitaker, E. R. Wilkinson. Onio University, Atomic Physics, 2 yrs.; W. Virginia University, 1 yr. Mech. Eng. Ohio State University, 2 yrs., completing B.M.E. degree. Presently working on Master's Degree at Louisiana State University. Esso Standard Oil Co., Baton Rouge, Mechanical Engineer, 1 yr.

For Student Member

CHARLES W. HOGG, JR., Civil Engineering Student at Louisiana State University.

JAMES FAYARD, FRANK I. KIEFFER, JOHN G. LAUNEY, HOWARD LeLEUX, WILLIAM L. POST, Chemical Engineering Students at Southwestern Louisiana Institute.

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Our Annual Meeting. The total attendance at the 1949 annual meeting was well over 500. The Thursday night gathering, at the Tulane Student Center, was an over-flowing audience. Three hundred dancers and diners made the banquet on Saturday night an outstanding success. The luncheon was also well attended. There is a tremendous amount of work to stage such meetings, and General Chairman Collins and Banquet Chairman Leal McLean with his associates, did a splendid job. Our members have reason to be proud of the convention.

This year the meeting was attended by students from Louisiana Polytechnic Institute. Louisiana State University, Southwestern Louisiana Institute and Tulane University. Faculty members from all these engineering colleges were also present.

Obituary of

NATHANIEL L. MARKS, JR.

The death of Nathaniel L. Marks, Jr., on September 30, 1948 is a severe loss to the engineering profession.

"Nat", as he was known to everyone, loved New Orleans and felt deeply the responsibility of his office as City Engineer. His independence of thought, frankness and sincerity earned him the respect of all with whom he came in contact, both in professional and political circles. He took keen interest in the solution of engineering problems in other localities and their possible application to our difficulties. It was with great pride that he would remark of the feats accomplished by his co-workers under severe natural handicaps and with limited funds.

He was born in New Orleans on January 23, 1899. He received his early education in the public schools and was graduated from Tulane University in 1924 with the degree of Bachelor of Engineering in Civil Engineering. While at Tulane, he was prominently identified with athletic and campus activities. It was there that he met Miss Dorothy Martinez, a student in the Chemical Engineering School and whom he married on June 23, 1927. Their two daughters are Margaret Elizabeth and Dorothy Joan.

In 1925, he was employed by the City of New Orleans as an Assistant City Engineer. In this capacity he supervised the repaving and beautification of Canal street. From 1931 to 1935, he was Principal Assistant City Engineer. He became City Engineer in 1935 and held that post during changes in political administration until his death.

He was President of the American Public Works Association (New Orleans Chapter) 1941-1942, President of Louisiana Institute of Civil Engineering 1945-1946, vice-president of American Road Builder's Association, Municipal Division, was a member of the American Society of Civil Engineers and of this society.

By his death we have lost an associate whose outstanding character as an engineer and public spirited citizen of New Orleans is a worthy inspiration.

It is fitting that we honor the memory of Nathaniel Levin Marks, Jr., by adopting the following resolution:

BE IT RESOLVED, that the Louisiana Engineering Society adopt resolutions embodying the facts as expressed and,

BE IT FURTHER RESOLVED, that this Resolution be included in the minutes and published in its proceedings and that copies be sent to his family.

CLAUDE J. KELLY, Chairman,

CLAIBORNE PERRILLIAT,

C. L. NAIRNE.

PAPERS AND DISCUSSIONS

THE STORY OF THE FISCHER-TROPSCH PROCESS

By V. V. Jacomini *
Hudson Engineering Corp., Houston, Texas

When your Chairman asked that I prepare a paper on the Fischer-Tropsch Process, I agreed most readily as it is a process, the future of which I regard most highly. It is with pleasure that I ask for a few minutes of your time to tell you of the early history of that process, especially as related to the development of the technique of converting the raw synthetic oil into commercial products. The success of this work greatly contributed to the present high regard with which this process is held in the petroleum world, and which work, as President of The TVP Corporation, I had the privilege of directing and of seeing brought to a successful conclusion.

What I have to say here this evening will not be presented as a technical report but more as a human interest story of the early development of a process which I believe is destined to play an important part in the petroleum industry in this country. We on the technical side of the industry usually are so engrossed in our daily problems, especially at this time of unprecedented expansion, that we do not have time to contemplate the romance of the work in which we are involved.

Since the war we have heard much of the synthesis of gas in general and the Fischer-Tropsch Process in particular. I have not heard nor have I found in the many articles written on this subject any reference to the work done here in the United States in the middle thirties, which work helped prove the commercial aspects of the process.

The Fischer-Tropsch Process as a technical reality to the petroleum industry dates back to 1923 when Fischer & Tropsch disclosed their observations that the catalytic reduction of carbon monoxide at pressures below approximately 7 atmospheres gave a liquid product consisting mainly of paraffinic oil, whereas previous high pressure work by others gave a liquid product consisting of a mixture of alcohols, aldehydes, fatty acids and hydrocarbons. This discovery of the effect of pressure lead Fischer & Tropsch to continue their studies in the low pressure field.

In 1933 Ruhrchemie, having obtained control of the Fischer-Tropsch Process, undertook the erection at Oberhausen-Holten,

* Presented at the joint meeting of Louisiana Engineering Society and N. O. Section of American Institute of Chemical Engineers, Oct. 11, 1948.

Rhur, Germany, of a Fischer-Tropsch pilot plant designed to produce approximately 7,000 barrels per year of synthetic oil which they named "Kogasin." This plant demonstrated many of the then weaknesses of the process, some of which were: short catalyst life, necessity for accurate control of catalytic reaction, high cost of catalyst chambers, high cost of removal of sulphur compounds from the synthesis gas and last but not least, the low octane number and the low yield of the straight run motor fuel. Ruhrchemie, when confronted with the fact that the supposedly commercial products had little or no value as a substitute for gasoline produced from crude oil, started a search for a process capable of converting on a commercial scale the highly paraffinic Kogasin into products comparable to those obtained by the processing of natural crude oils.

In 1934 this search became of primary importance to them and it was at that time, while I was living in London, that my parent company was approached to conduct tests to determine if Kogasin could be converted into motor and aviation grades of gasoline. From this initial contact in 1934 negotiations proceeded until in 1936 Guthofnungshutte, the parent company of Ruhrchemie, sent to us at Texas City, Texas, enough Kogasin to permit a 4 day pilot plant run.

The problem presented to us by Guthofnungshutte was to crack the Kogasin to produce motor gasoline and aviation gasoline.

The Kogasin sent was water white and had a boiling range and a gravity about the same as our normal long boiling range gas oils. In fact, the Kogasin was so clear that a glass ful of it looked exactly like a glass full of water. The outstanding characteristic of this oil was its definite pour point. At 65°F it retained its water white color and its comparitively low viscosity. At 60°F it became an opaque white waxy mass.

All of us involved in this initial work were treading on virgin ground. As we look back, the things we did then, now look quite commonplace in the light of our present practices. To us at that time they were far from commonplace. We had heard of a Frenchman named Houdry who was trying with then little success to convince the industry that catalytic cracking was commercially feasible; we had read many of the standard works on catalysts; we knew how to predict the results obtainable when cracking natural petroleum oils in the vapor phase and when cracking them in the liquid phase. But we didn't know what would happen to kogasin when subjected to the high temperature of vapor phase cracking.

Four German scientists were assigned by Guthofnungshutte and Ruhrchemie to witness our work. They were hopeful but not at all

certain that the work would be successful. It had taken them months to produce the few barrels of Kogasin which we had for the test. We had to get results the first time; there could not be a second time for many months; the Kogasin just was not available.

Before starting the actual cracking test we made all the usual distillations to obtain as much knowledge as possible as to what might be the behavior of this material under vapor phase cracking conditions. We never ceased to marvel that this water white oil had only recently been a gas, two parts hydrogen and one part carbon nomoxide and had been converted into this oil at the absurdly low temperature of approximately 380°F and a pressure of only a few pounds above atmosphere.

Because of the high paraffinic quality of the Kogasin we elected to make our test run at temperatures approximating those required for the reforming of paraffinic naphthas. One other factor affecting our decision to make the test run at a high temperature was the Germans' continued expression of their hope that we could make an aviation gasoline. To us this seemed quite impossible as the octane number of the naphtha fraction of Kogasin was close to zero motor method.

The actual cracking test was made on the True Vapor Phase Process Pilot Plant at Texas City, Texas. Sufficient Kogasin was available for a 96 hour run. When the run was once started it had to be carried to a conclusion as the quantity of Kogasin did not permit much starting and stopping of the plant. Equilibrium conditions had to be reached as quickly as possible.

Towards the end of the first 24 hours operation we were confronted with a major decision. Up to that time we had not withdrawn from the plant any fuel oil. Our only products were gas and gasoline. We thought of everything we could to explain the lack of a bottom product. The obvious explanation was that our main fractionator had coked and the bottoms were holding up in the fractionating column. However, this didn't seem quite right as we continued to have in sight in the gauge glass some bottoms, the level of which would rise and fall with changes in speed of the reflux pump.

Not knowing what to do left us only one decision. "Do nothing," so we closed off the bottoms draw-off, ignored the liquid level in the bottom of the fractionator and continued our run for the next three days. At the conclusion of the tests a material balance showed that our production of fuel oil was only about one and one-half percent of the plant feed; the other products were gas and gasoline, about 70% gasoline and 18½% gas. An inspection of the plant showed it to be comparatively free of coke and we heaved a

sigh of relief at this final proof of the correctness of our decision to do nothing.

An inspection of the gasoline produced from this test run showed it to have a reasonably good boiling range, a little on the low side, an excellent coloring, a complete freedom from sulphur and as was expected only a fair octane number, about 65-68 motor method for motor gasoline. The aviation gasoline cut as could be expected was better; approximately 75 motor method.

The problem then confronting us was how would this gasoline react to lead tetraethyl. In those days it was generally understood that the octane number of highly cracked gasolines was improved for straight run gasolines. We had attributed this lack of response to the degree of cracking not to the sulphur compounds more often found in the cracked gasolines than in the straight run gasolines.

Our surprise was only equalled by our pleasure when we read the laboratory reports listing the octane number of the aviation gasoline with 3.6 c.c. of lead at approximately 90 motor method. It was not long after that the industry as a whole began looking to the sulphur content of the gasolines instead of the degree of cracking as the controlling factor of the lead susceptibility of cracked gasolines.

As an aftermath of these successful cracking tests our foreign company, TVP Limited entered into negotiations with Guthofnungshutte for the design and construction of the cracking units for the first commercial Fischer-Tropsch plants ever constructed. These first Fischer-Tropsch plants were constructed by and under the direction of Ruhrchemie with the vapor phase cracking plant and vapor recovery plant under the direction of TVP Limited. The first unit was completed in 1937 at Oberhausen-Holten and was in successful operation about the middle of that year. This was the first of a battery of 12 complete Fischer-Tropsch units to be erected on Ruhrchemie's property at Oberhausen-Holten.

While in Germany on an inspection in early 1937 I was greatly impressed by the magnitude of this particular project. The first Fischer-Tropsch unit was being tested prior to being placed in operation. The second unit was practically complete and the foundations were in place for the third and fourth units. Each unit was rated at 500 barrels per 24 hours capacity, or a total of 6000 barrels per 24 hours for this particular battery of Fischer-Tropsch units. Subsequent operation indicated an actual output in the neighborhood of 10,000 barrels per 24 hours.

That these plants were being built for war purposes, none of us connected with the project doubted. As early as 1935 when discussing the design of the plant, we were told by the Germans that if the reaction chamber was above a certain height we could not

install it in the vertical position. When asked why, they unhesitatingly said: "It will be too good a target." Upon our insistence that the reaction chamber had to be installed in the vertical position it was finally agreed that the smaller plants such as those at Oberhausen-Holten could be constructed in the Rhine area but the larger plants had to be placed in the interior in the general area of Berlin.

The second TVP unit to be constructed to process Kogasin was designed for the Fischer-Tropsch Plant then being built for Kuhlmann in France. As the war started before the design work was completed, this unit was never completed.

We have in the last several years read much of the part played by the Fischer-Tropsch Process in the German war effort. However, to the victor go the spoils and we now have in this country a greatly improved Fischer-Tropsch Process now known as "Hydrocol."

Although the Hydrocol Process has as its basis the German Fischer-Tropsch Process, it differs from the original in many ways. The plants originally constructed at Oberhausen-Holten obtained the synthesis gas by the well known water gas reaction of steam and air with incandescent coke in the conventional Glasgow gas generators. As could be expected the gas so produced was contaminated by sulphur compounds and inerts. From the many articles now being published on the Hydrocol Process it is apparent that great strides have been made in the preparation of the synthesis gas. Instead of air Hydrocol uses pure oxygen and instead of coke it uses natural gas. With these two raw materials a pure synthesis gas of the proper composition is obtained. Of equal importance to the purity of the synthesis gas is the exothermic nature of the reaction of oxygen and natural gas as employed by Hydrocol. It is reported that one of the plants now being designed will produce 750,000 pounds per hour of high pressure steam as a by-product of this reaction.

Another important contribution made by Hydrocol is the use of the fluid catalytic continuous flow principal instead of the stationary catalyst batch principal used by Fischer-Tropsch to convert the synthesis gas to synthetic oil. Along with this development Hydrocol, from available reports, apparently has contributed much to the development of improved catalysts. Instead of producing a gasoline with an octane number in the 40's, they report that the plants now being designed will produce a 10 lb. Reid vapor pressure motor gasoline with a clear octane number of 80 motor method and 88-90 research method, a remarkable improvement over the Fischer-Tropsch gasoline produced at Texas City.

Along with these improvements have gone many improvements in design, resulting in impressive reductions in operating costs. In a recent article by P. C. Keith, President of Hydrocarbon Research, owners of Hydrocol Process, this statement is made in reference to the Carthage Hydrocol Plant which is being built at the (1946) estimated cost of $15,000,000, "Allowing credit for the Diesel oil at 3½¢ per gallon and for the crude alcohol at ½¢ per pound, it is predicted that the out-of-pocket cost of the gasoline will run about 2½¢ per gallon. This cost includes all expenses and charges exclusive of capital costs. When capital costs, including interest, depreciation and amoritization are added, the cost of the gasoline becomes 5.25¢ per gallon."

The actual realization of this prediction will be an important milestone in the history of the petroleum industry and although the process is of German origin, I shall always look back with pride to that small group at Texas City and to the part they played in the production of the first commercial gasoline from Fischer-Tropsch synthetic oil.

ENGINEERING BRIEFS

Bureau of Mines Reports Oil Processed From California Sandstone. According to a recent report by the Bureau of Mines, high recoveries of valuable hydrocarbons suitable for making gasoline, Diesel fuels, and fuel oils have been obtained from surface deposits of bituminous sandstones found near Edna, San Luis Obispo County, California.

Describing a hot-water separation process tested on a laboratory scale by Bureau engineers, the report shows recoveries of bitumen averaging 95% from the Edna sandstones. Bitumen is the tarry substance from which gasoline and ails are extracted. These deposits are estimated to contain about 11% bitumen or about 26 gallons per ton.

Started as a wartime measure when heavy drains were being made on the nation's petroleum resources and a supplementary source of fuels was needed in California, the laboratory research was concentrated on methods for extracting oil from vast deposits of oil-impregnated rocks and bituminous sandstones in that state. On the basis of an investigation made by the Federal Geological Survey in the winter and spring of 1943-44, the Edna, Calif., sandstone deposits are estimated to contain about 282,880,000 tons of bituminous material minable by open-cut methods alone.—Industry and Power.

X-ray Pictures Now Sent by Telephone. X-ray pictures can now be sent by telephone. This new development, with life-saving implications for accident victims, was announced by Dr. J. Gershon-Cohen of Philadelphia and A. G. Cooley, New York City engineer, at a recent meeting of the American Medical Association.

The X-ray telephone service is now operating routinely between Chester County (Pa.) Hospital and Dr. Gershon-Cohen's' office 50 miles away in Philadelphia. The hospital technician takes the picture, puts it on a trainsmitting machine and telephones Dr. Gershon-Cohen's office. The doctor turns on his receiver, looks at the picture, and tells the patient's physician, over the same telephone circuit, what he sees. The procedures take about three minutes.

As the facsimile transmission is similar to that used for transmitting newspaper pictures, it can operate between any two points on the continent. With radio instead of telephone, it could serve ships at sea and patients around the world.—Aminco Laboratory News.

Fresh and Old Eggs Sorted by Ultraviolet Light. Fresh and old eggs can be sorted by means of their color under ultraviolet light,

according to Willett R. Wilson of the Westinghouse Lamp Division, Bloomfield, N. J.

In ultraviolet light, an old egg shows up purple, while a fresh egg glows scarlet. The outer shell of a hen's egg and its protein covering are fluorescent, he explained. Probably the color switch occurs when oxidation causes a chemical change in the shell.

Ordinarily, unrefrigerated eggs kept under average temperature and humidity turn gradually from a scarlet fluorescence to purple in eight to ten days. Properly refrigerated eggs retain their freshness and scarlet fluorescence longer. Brown eggs and white eggs both show scarlet under ultraviolet light if they are fresh. Eggs washed in clean warm water retain normal fluorescent qualities. —Aminco Laboratory News.

Synthetic Mica Developed. Synthetic mica, known as fluorine-phlogopite mica, has the electrical characteristics of natural mica, according to a recent announcement by the U. S. Army and Navy. It is being produced in the United States on a pilot-plant scale and is not as yet available commercially.

Synthetic mica has the desirable characteristics of natural mica, including perfect cleavage into thin sheets, good electrical and mechanical properties, and chemical stability. It is expected to replace the muscovite and phlogopite forms of natural mica.

Considerable work has been done during the past few years looking toward the development of a synthetic mica or a mica substitute. Government-sponsored research on mica synthesis was initiated at the Colorado School of Mines in June, 1946 under an Army Signal Corps contract. Later the U.S. Bureau of Mines began synthetic mica pilot-plant work at Norris, Tenn. Owens-Corning-Fiberglas Corp. furnished accumulated information.—Aminco Laboratory News.

1949

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L. M.: Life Member
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RICHARD R. L. WARD, (1947), Office Engineer, Cit-con Oil Corp.. *Mail*: P. O. Box 2457, Maplewood, La.

CALVIN T. WATTS, (1948), *Civil Engineer*, Associate Professor of C.E., La. Polytechnic Institute. *Mail*: Tech Station, Ruston, La.

MAX P. WATSON, (1944), *Mechanical and Electrical Engineer*, District Engineer, United Gas Pipe Line Co. and Union Producing Co., 707 Canal Bldg. Home: 15 Davis Blvd. *Mail*: P. O. Box 1628, New Orleans 11.

THOMAS A. WATSON, (1942), *Civil Engineer*, Industrial Sales Engineer, Gulf States Utilities Co., 340 Florida St. 541 N. Seventh St. *Mail*: P. O. Box 2431, Baton Rouge 2.

CHARLES H. WEATHERLY, (J), 1945), *Mechanical Engineer*, General Electric Company, River Works, Lynn, Mass. *Mail*: 35 Baltimore St., Lynn, Mass.

JOHN H. F. WEBERT, (1928), *Structural Engineer*, Chief Draftsman, Jones & Laughlin Steel Corp., P. O. Box 66. *Mail*: 4115 Clermont Drive, New Orleans 22.

LEO S. WEIL, (L. M.), (1920), *Consulting Engineer*, Partner, Leo S. Weil and Walter B. Moses. 476 Broadway. *Mail*: 801 Audubon Bldg., New Orleans 16.

ROBERT K. WELLS, (1948), Captain, U.S.N., Industrial Manager, 8th Naval District, USN. *Mail*: U. S. Naval Station, New Orleans 14, La.

LEON C. WEISS, (L. M.), (1918), *Civil Engineer*, Weiss, Dreyfous & Seiferth, Architects. 7425 Dominican St., New Orleans 18.

WILLIAM WENNER, (1947), *Civil Engineer*, Cities Service Refining Corp. *Mail*: 1325 12th St., Lake Chrales, La.

WILLIAM WHIPPLE, (1936), *Mechanical Engineer*, Professor of Steam Engineering, Louisiana State University. 4666 Vanderbilt Drive. *Mail*: P. O. Box 8524, University Station, Baton Rouge 3.

WILL A. WHITAKER, (1945), *Mechanical Engineer*, Asst. Head, Engineering Dept. Standard Oil Co. of N. J., La. Div. *Mail*: 1167 Main St., Baton Rouge, 3, La.

J. LESTER WHITE, (1937), *Civil Engineer*, Asst. to Mgr. Plant and Employee Services, The Ethyl Corp. Home: 1041 Camelia Ave. *Mail*: Box 341, Baton Rouge, La.

ANDREW P. WHITMAN, JR., (J), (1945), *Civil Engineer*, Instructor, College of Engineering, Tulane U., 5243 Constance St., New Orleans 15.

CARL B. WHYTE, (1946), *Civil, Electrical and Mechanical Engineer*, Chief Construction Engineer, Universal Oil Products Co., 310 S. Michigan. Home: 5539 Blackstone. *Mail*: 310 S. Michigan Ave., Chicago, Ill.

CHARLES Q. WIGGINS, JR., (1946), *Mechanical and Electrical Engineer*, Asst. Electrical Engineer, Godat & Heft, Terminal Station Bldg. *Mail*: 2915 Elysian Fields Ave., New Orleans 17.

RICHARD KNOWLES WILKERSON, (1943), *Chief Engineer*, Gulf States Utilities Co. *Mail*: 5912 Robertson St., Baton Rouge, La.

EDWIN R. WILKINSON, (1947), *Electrical Engineer*, Asst. Mgr. of Employee Relations Esso Standard Oil Co. (La. Div.) *Mail*: 306 Richland Ave., Baton Rouge, La.

LAWRENCE V. WILLEY, (1939), *Civil Engineer*, Bridge Construction Engineer, La. Dept. of Highways. *Mail*: 430 Centenary Drive, Baton Rouge, 14, La.

GERALD C. WILLIAMS, (1940), *Mechanical Engineer*, Zone Engineer, Standard Oil Co. of N. J., La. Div. Home: 1882 Cedardale Ave. *Mail*: c/o Standard Oil North Baton Rouge, La.

R. L. WILLIAMS, (1947), *Mechanical Engineer*, Freeport Sulphur Co., Port Sulphur, La.

ROBERT W. WILLIAMS, (1940), *Chemical Engineer*, Process Engineer, Standard Oil Co. of N. J., Louisiana Division. *Mail*: 2123 Cedardale Ave., Baton Rouge 7.

W. HORACE WILLIAMS, (L. M.), (1908), *Civil Engineer and Contractor*, Member of Firm and General Manager, W. Horace Williams Co. Home: 519 Iona St., Metairie. *Mail*: 833 Howard Avenue, New Orleans 13.

W. HORACE WILLIAMS, Jr., (1943), *Civil Engineer*, Member of Firm, W. Horace Williams Company, 833 Howard Ave. *Mail*: 207 Vincent Ave., New Orleans 20.

CHARLES S. WILLIAMSON, (L. M.), (1916), *Chemical Engineer*, Consulting Engineer, 1739 Marengo St., New Orleans 15, La.

GEORGE FREEMAN WILLIAMSON, (1939), *Civil Engineer*, Asst. Chief Engr., Avondale Marine Ways, Inc., Westwego, La. Home: 7830 Burthe St., New Orleans 18.

VICTOR L. WILLOZ, (L. M.), (Jan. 1, 1900), *Electrical Engineer*, N. O. Public Service Inc., 317 Baronne St. *Mail*: 4439 S. Miro St., New Orleans 15.

JAMES NORMAN WILSON, SR., (L. M.), (1911), *Mechanical Engineer*, Sewerage & Water Board of New Orleans, 526 Carondelet St. *Mail*: 2425 Audubon St., New Orleans 18.

TROY L. WILSON, JR., (J), *Civil Engineer*, Asst. to Coordinator of New Projects, Esso Standard Oil Co. (La. Div.) *Mail*: 464 Riveilon St., Baton Rouge, La.

A. R. WINGATE, JR., (1925), *Civil Engineer*, Manager Fabricating Sales Dept. Jones & Laughlin Steel Corp., Home: 1624 Napoleon Ave. *Mail*: P. O. Box 66, New Orleans 6.

WILLIAM A. WINTZ, JR., (1942), *Civil Engineer*, Asst. Prof. of Civil Engineering Louisiana State University. Home: 3029 Highland Road. *Mail*: College of Eng., L.S.U., Baton Rouge, 3.

BURRIS D. WOOD, (1947), *Civil Engineering Aide*, La. Dept. of Public Works. *Mail*: 523 Park Blvd., Baton Rouge, La.

CARROLL L. WOOD, JR., (1946), *Civil Engineer*, Perrilliat-Rickey Construction Co. *Mail*: 4510 S. Prieur St., New Orleans 15.

JOHN WRIGHT WOOD, (1948), *Mechanical Engineer*, General Engineer, Cities Service Refining Corp., Lake Charles. *Mail*: 3 Harman Road, Maplewood, La.

EDWIN R. WOODMAN, (1947), *Highway Engineer*, District Construction Engineer, La. Dept. of Highways. Home: 1418 Glen Oak. *Mail*: P. O. Box 38, Shreveport, La.

A. ALFRED WOODS, (L. M.), (1914), *Civil Engineer*, Retired, 1923 State Street, New Orleans 15.

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

JOHN KING WOOLF, (1943), *Civil Engineer*, Member of firm, W. Horace Williams Co. Home: 298 Walnut St. *Mail*: 833 Howard Ave., New Orleans 12.

GORDON B. WOOSTER, (1948), *Civil Engineer*, Asst. Supt. Butadiene Plant, Cities Service Ref. Co. *Mail*: M.R.H. Box 62, Sulphur, La.

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—Y—

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—Z—

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FRANCIS X. BARRY, Box 86, Sunset, La.
AYLMER P. BATCHELOR, 425 S. 21st St., Baton Rouge, La.
MALCOLM BIENVENU, 514 Voorhies St., Lafayette, La.
DEWEY D. BILLODEAU, R.F.D., Box 248, Jeanerette, La.
LEE J. BLANCHARD, Rte. 1, Box 61, St. Martinsville, La.
FELIX J. BLANCHARD, Box 476, S.L.I., Lafayette, La.
CHARLES R. BRACKIN, 309 Verdun St., Lafayette, La.
VAL D. BREAUX, JR., Box 246, S.L.I., Lafayette, La.
JOHN O'R. BREEDEN, 3716 La. Ave. Parkway, New Orleans
OLIVIER BROUSSARD, III, 307 N. Polk St., Rayne, La.
RALPH CAFFERY, Box 55, S.L.I., Lafayette, La.
ROBERT R. CHAPMAN, Box 235, Lake Arthur, La.
C. J. COUVILLION, 202 Surrey St., Lafayette, La.
JAMES D. CUNNINGHAM, Box 525, S.L.I., Lafayette, La.
SIDNEY A. CURLEY, 112 Smith St., Lafayette, La .
SIDNEY I. DAIGLE, 1022 Washington St., Lafayette, La.
CESIR J. DECAREAUX, 117 E. Convent St., Lafayette, La.
RENE F. DELAHOUSSAYE, 826 E. Main St., New Iberia, La.
EDWARD F. DESFORGES, 120 Amelia St., Lafayette, La.
JOHN F. DIAMOND, 406 Evangeline Drive, Lafayette, La.
EMERY DOMINGUE, 625 St. John St., Lafayette, La.
JULES C. DOMINGUE, General Delivery, S.L.I., Lafayette, La.
KENNEDY J. DUGAS, 516 Lewis St., New Iberia, La.
CLAIBORNE J. DUHON, 331 N. Mouton St., Lafayette, La.
L. M. FALCONER, 638 Charles St., New Iberia, La.
PHIL FALZON, 610 St. John St., Franklin, La.
JAMES FAYARD, Box 432, S.L.I., Lafayette, La.
J. W. FLESHMAN, 626 Harding St., Lafayette, La.
HAROLD N. FORD, 947 June St., New Iberia, La.
MAURICE B. FOURNET, JR., St. Martinsville, La.
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LEO J. GAUDIN, Box 384, S.L.I., Lafayette, La.
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L. A. HOLLIER, Opelousas, La.
WARREN R. HOLLIER, Box 173, Washington, La.
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EMMETT L. MATHEWS, JR., Rte. 2, Alexandria, La.

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JOSEPH C. MEHRHOFF, Box 416, S.L.I., Lafayette, La.
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L. ROYDON SIBILLE, Sunset, La.
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WALLACE L. VALENTINE, Box 374, S.L.I., Lafayette, La.
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ROY J. WASKO, Box 325, S.L.I., Lafayette, La.
RALEIGH L. WYBLE, JR., Box 303, S.L.I., Lafayette, La.

Summary

HONORARY MEMBERS		5
CHARTER MEMBERS		1
LIFE MEMBERS		54
MEMBERS:		
Local	316	
State	297	
Non-Resident	46	
Address Unknown	10	669
AFFILIATE MEMBERS		30
JUNIOR MEMBERS:		
Local	90	
State	58	
Non-Resident	17	
Address Unknown	2	167
STUDENT MEMBERS		97
TOTAL		1023

Past Presidents

*Sidney F. Lewis.....1898
*Thos. L. Raymond.....1899
Henry J. Malochee.....1900
*Frank M. Kerr.....1901
*Alf. F. Theard.....1902
*Alf. Raymond 1903
*J. F. Coleman.....1904
W. B. Wright.....1905
*W. H. Hoffman.....1906
*G. W. Lawes.....1907
*C. W. Wood.....1908
*J. T. Eastwood.....1909
*W. B. Gregory.....1910
*J. C. Haugh.....1911
D. S. Anderson.....1912
*A. M. Shaw.....1913
W. H. Williams.....1914
*L. C. Datz.....1915
*Samuel M. Young.....1916
A. T. Dusenbury.....1917
John Klorer 1918
Ole K. Olsen.....1919
John Riess 1920
R. S. Manley.....1921
Donald Derickson 1922
*J. S. Bareli.....1923
James M. Robert.....1924
Marcel Garsaud 1925
*Farrar P. Hamilton 1926
*Edward S. Lanphier.....1927
John L. Porter.....1928
Frederick H. Fox.....1929
James M. Todd.....1930
*Frank G. Frost.....1931
Frederick N. Billingsley.....1932
John H. O'Neill.....1933
A. L. Dunlap.....1934
Edward S. Bres.....1935
Allen S. Hackett.....1936
C. S. Williamson.....1937
Bernard H. Grehan.....1938
David W. Godat.....1939
William H. Rhodes.....1940
David W. Stewart.....1941
C. Glenn Cappel.....1942
Karl P. Kammer.....1943
Charles M. Kerr.....1944
Reinhard A. Steinmayer.....1945
Leo Jos. Lassalle.....1946
Clayton L. Nairne.....1947
W. Stone Leake.....1948

* Deceased.

MESSAGE OF RETIRING PRESIDENT LEAKE

In my message to you at the beginning of my term of office, as published in the February Proceedings, I stated that our biggest task for the coming year would be to secure the enactment of a State Licensing Law for all engineers. It is of course unnecessary for me to remind you that in this task we failed. Even though the bill passed the senate by a vote of 38 to 2 and passed the House by a vote of 66 to 0, it was vetoed by the Governor. Just why it was vetoed I suppose we will never know but that is beside the point. I truly believe however that our efforts were not entirely lost and that some good was accomplished principally in the fact that it brought about a more coordinated effort by the various engineering groups and organizations and individual engineers than has ever existed in the past. At least this time we can say that the failure was not due to a difference of opinion among engineers for all selfish interests were put aside, many compromises were made, and for once the engineers themselves presented a united front. This united front was brought about to a large extent by the Louisiana Council of Engineers, an organization which was the brainchild of our Past President Glen Cappel. This organization spent many many hours of tedious work writing and rewriting before the final draft of the bill was decided upon. I have mentioned that some individuals and groups put aside selfish interests and sacrificed some special advantages to themselves, and in this catagory I place the Louisiana Institute of Civil Engineers and the Louisiana Highway Engineers Association and yet aside from our own society, these two organizations were the largest donors towards the expense of this project. Before leaving this subject I wish to pay homage to the untiring efforts of our own legislative committee and its chairman, Past President Charles Kerr.

During this year I had hoped to have a new section established in one of our other larger cities. Realization of this aim has not materialized but progress has been made in both Shreveport and Alexandria and I believe will materialize within the term of our incoming president. In this connection, however, I can report one item of real progress, namely the formation of our first student chapter as established at Southwestern Louisiana Institute at Lafayette.

Recently, by your favorable vote, you have accepted and endorsed a new Canon of Ethics for Engineers, a copy of which might well be kept constantly before us all. This Canon of Ethics was prepared by the Engineers Council for Professional Development and has been approved by most of the national engineering organizations,

During the administration of last year's President Nairne, he appointed a committee composed of Past President Kammer as chairman and with Past President Billingsley, Dr. Francis Taylor and Mr. Lyman Reid to make a study of our charter and by-laws and revamp or rewrite it to better fit our present needs. Actually the majority of the work of this committee was done during Past President Nairne's administration but ratification was withheld in the event of possible changes if the licensing bill became law. This was a laborious assignment and the committee is to be commended for its good work. By your favorable vote you recently adopted this new constitution and by-laws.

Recently a committee was appointed with Mr. Lionel J. Cucullu as chairman to investigate the merits of a Group Life Insurance plan for the members of our society. You will hear more on this subject at a later date.

In closing I would like to again thank the society for the honor of serving as your president and I wish to thank all of our committees for their good work during the year and to thank General Chairman Jeff Collins and his committees for making this annual meeting a great success.

I thank you.

W. Stone Leake

REPORT OF THE SECRETARY-TREASURER

At this time I have the pleasure of reporting on two of the Society's activities. I say "pleasure" because reporting success is always pleasant. Your society has made extraordinary progress in recent years. You are now bigger, richer, better known, and I believe have a greater influence than ever in the 51 years of the society's history. I shall leave it to President Leake to tell you more about our progress. This report is confined to membership and finances.

A few years ago during his administration, Dr. Lassalle expressed the desire to see our membership reach the 1,000 mark. Dr. Lassalle, your wish has been realized. Through the able help of Charlie Knost, his membership committee and many cooperative members at large, we have passed that goal in 1948, and each successive ballot breaks the record. This in spite of our strict adherance to the rule of dropping deliquent members; there are no "dead-heads" on the society's roster. The membership report is as follows:

MEMBERSHIP REPORT FOR 1948

Members Elected	
New Members	77
Reinstated Members	9
Affiliate Members	5
Junior Members	46
Student Members	103
	240
Changes in Grade of Membership	
Junior Member to Member	4
Student Member to Junior Member	13
Members Lost	
Resigned	21
Deceased	6
Dropped for Delinquent Dues	28
	55
Net Gain in Membership	185
Membership at beginning of year	838
Total Membership December 31, 1948	1,023

In the capacity of Treasurer I wish to remind you that President Leake's administration has had a rough year financially. This is due not entirely to high prices, but to many unusual expenses, such as publishing the constitution and the canon of ethics, and twice printing the proposed registration act. One item that has increased our expenditures materially is the cost of our attempt to legislate the General Engineering License Act. As the leading member of the Louisiana Council of Engineers, we bore the brunt of that cost.

In spite of these unusual expenses, your board has very wisely seen fit to reduce the dues for non-resident members. This reduc-

tion was thought adviseable because the majority of our members who resign or lose their membership for non-payment of dues are those who leave the state to reside elsewhere. So, in order to induce our old friends not to break ties with the Society, your board reduced their dues to the actual cost of carrying non-resident members. This cost was determined by our 1947 Finance Chairman, Leal McLean. We hope that fruit from this decision will be noticed during 1949 when it becomes operative. Here is our financial report for 1948.

FINANCIAL REPORT OF SECRETARY-TREASURER FOR 1948

RECEIPTS:

Advertising	$ 943.47	
Annual Meeting	1,769.04	
Annual Outing	449.00	
Certificates	32.00	
Dividends	192.24*	
Dues	5,642.75	
Frozen Assets	191.78	
Miscellaneous	.10	
Monthly Meetings	183.70	
Proceedings, Sale of	3.87	
Registration Act	411.50	
Tax Refund	5.84	
Total Operating Income		$9,825.29

EXPENDITURES:

Annual Meeting 1948	$2,252.77	
Annual Meeting 1949	25.24	
Annual Outing 1948	558.97	
Dues Rebates	471.50	
Floral Offerings	30.90	
Library	48.00	
Miscellaneous	405.92	
Monthly Meetings	489.64	
Proceedings	1,807.09	
Registration Act	1,011.24	
Salaries	1,500.00	
Stationery	590.20	
Taxes	35.00	
Certificates	15.25	
Total		$9,241.72
Increase in Tangible Assets		$ 583.57

STATEMENT OF ASSETS

December 31, 1948

Cash, Whitney National Bank Checking Account		$ 5,168.69
Columbia Bldg. & Loan Ass'n.	$ 364.27	
Commonwealth Bldg. & Loan Ass'n.	305.79	
Greater N. O. Homestead Ass'n.	1,603.81	
Security Bldg. & Loan Ass'n.	500.00	
Sixth District Bldg. & Loan Ass'n.	500.00	
Union Homestead Ass'n.	500.00	3,773.87
United States Savings Bonds, Face Value $4,000		3,152.00
Total		$12,094.56
Total Available Assets at Beginning of Year		11,510.99
Increase in Liquid Assets during the Year		$ 583.57

These reports will be published in detail in the next issue of the proceedings so that everyone who wishes to do so may study them carefully.

* Includes increase in book value of stocks and bonds.

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of Meeting of the Board of Direction Held at Arnaud's Restaurant, November 8, 1948

The meeting was called to order by First Vice-President Lehmann, with Messrs. Cucullu, Nairne, Newton and Fernandez present. Minutes of the proceeding meeting were accepted as read.

A letter from Mr. James P. Kemper, referring to the closure of Old River, was read. Mr. Newton moved that this be turned over to the 1949 Civic Affairs Committee. The motion was seconded by Mr. Nairne and carried.

An acknowledgment of the floral tribute sent to our late member, Nat L. Marks, was read.

A discussion concerning group insurance for the Society followed, and the president was authorized to appoint a committee to investigate same.

A communication from Dean Hughes of Southwestern Louisiana Institute regarding a student branch of the L. E. S. at this University was read, and the secretary was instructed to send an outline of the procedure necessary to establish same.

Two petitions requesting the elevation of members to honorary membership were presented. Mr. Cucullu moved that these be referred to the Honorary Membership Committee, seconded by Mr. Newton and passed.

The secretary reported briefly upon the progress of plans for the annual meeting.

The following members, whose adresses have been unknown for some time, were dropped for non-payment of dues:

Wortley Batty, M. G. Communtzis, Marshall B. Ewing, Robert B. Foster, W. Scott Goldman, Robert E. LeBlanc, III, Isham W. Mann, Jr., Hubert P. Oliver, William C. Sage, Hyman Samuelson.

An invitation to attend the annual convention of the National Association of Practical Refrigerating Engineers was read, and the secretary was instructed to acknowledge same.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Sec.-Treasurer

Meeting of the Louisiana Engineering Society held jointly with the New Orleans Chapter, Illuminating Engineering Society, on Monday, November 8, 1948.

The meeting was called to order by First Vice-President Lehmann at 8:00 p. m. in the Jackson Room of the St. Charles Hotel. Approximately 150 members and guests were present. The Chairman welcomed members and guests of the New Orleans Chapter, Illuminating Engineering Society.

Reading of Minutes of the preceding meeting was dispended with. A request for comments on the proposed new construction and by-laws was made, but none were presented.

Section 3 of Article 3 of the Constitution pertaining to the Nominating Committee then was read, and it was announced that the Nominating Committee, consisting of Messrs. C. L. Nairne, chairman; C. M. Kerr and J. M. Todd, would consider suggestions for nominations for a period of ten days following the meeting. Members were urged to send in their selections.

The secretary announced the receipt of an invitation to attend the 39th annual convention of the National Association of Practical Refrigerating Engineers, to be held at the Roosevelt Hotel, November 16 through 19, 1948.

The chair then was relinquished to Mr. R. H. Colcock, Chairman of the New Orleans Chapter, Illuminating Engineering Society, who in turn requested Mr. Harold Salaun to introduce the speaker of the evening, Mr. Samuel G. Hibben, Director of Applied Lighting, Westinghouse Electric Corporation, Bloomfield, New Jersey, who presented a most interesting and demonstrative lecture entitled "What's New in Lighting."

Following the lecture, the chair was returned to Mr. Lehmann, who closed the meeting with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ, Sec.-Treasurer

Minutes of Meeting of the Board of Direction held December 13, 1948

The meeting was called to order by President Leake, with Messrs. Cucullu, Lehmann, Macdonald, Mire, Nairne and Fernandez present. Minutes of the preceding meeting were accepted as read.

Mr. Nairne, Chairman of the Nominating Committee, made the following report of nominees for elective offices for 1949:

For President	Herman L. Lehmann
For First Vice-President	Lionel J. Cucullu
For Second Vice-President	Harry P. Newton
For Secretary-Treasurer	John P. Fernandez
For Director for Two Years	Michael C. Abrahm
For Director for Two Years	Arthur M. Hill

Mr. Macdonald moved that the report be accepted, seconded by Mr. Mire and carried.

President Leake then reported that the Honorary Membership Committee had unanimously approved the petition for elevation of Messrs. James M. Robert and Boykin W. Pegues to honorary membership in the Society. Mr. Lehmann moved that the board accept these nominations and that they be presented to the general membership in accordance with the Society's constitution. The motion was seconded by Mr. Mire and carried.

The proposed constitution and by-laws for the Southwestern Louisiana Institute Student Chapter were read, and the following corrections were made:

Article VI of the Constitution to read: "Any proposed alteration, amendment, or addition to this constitution and by-laws may be adopted by a two-thirds vote of the members present at a regular meeting, provided that any such alteration, amendment or addition to this constitution is approved by the Board of Direction of Louisiana Engineering Society in New Orleans."

Article V of the By-Laws to read: "Section 1. Dues shall be five (5) dollars per year, payable in advance; one (1) dollar of which will be sent to the Louisiana Engineering Society in New Orleans and the remainder shall remain in the treasury as local operating funds. The $1.00 so remitted to the Louisiana Engineering Society in New Orleans shall constitute a Student Membership in said society."

It was moved and passed that the secretary inform the students of these corrections and take the necessary steps to install the chapter at the annual meeting.

The resignations of Messrs. William S. Adams, Henry J. Bultman, Jr., and John Y. Taylor were accepted with regret.

An obituary of the late Nat L. Marks, prepared by a committee under the chairmanship of Mr. Claude Kelly, was read. Mr. Cucullu moved that the obituary be published in the Proceedings and copies sent to the family of the deceased. The motion was seconded by Mr. Nairne and carried.

It was moved that members elected during the year who have not paid any dues be dropped if no remittance is received by the date of the annual meeting. The motion was made by Mr. Lehmann, seconded by Mr. Nairne and carried.

The secretary reported that the cost of banquet tickets for the annual meeting would be $6.00 and those for the annual luncheon, $1.75.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Sec.-Treasurer

Minutes of Meeting of the Louisiana Engineering Society held jointly with the New Orleans Chapter, A. S. M. E. on December 13, 1948.

The meeting was called to order by President Leake in the Jackson Room of the St. Charles Hotel. The president welcomed the members and guests of the New Orleans Chapter, American Society of Mechanical Engineers. Mr. Robert P. Lockett moved that the reading of minutes be dispensed with, seconded by Mr. Vogt and carried.

The third announcement regarding proposed changes in the new constitution was made, and none were presented.

Mr. Nairne, Chairman of the Nominating Committee, reported that the following nominees had been selected by his committee:

For President	Herman L. Lehmann
For First Vice-President	Lionel J. Cucullu
For Second Vice-President	Harry P. Newton
For Secretary-Treasurer	John P. Fernandez
For Director for Two Years	Michael C. Abrahm
For Director for Two Years	Arthur M. Hill

Mr. Claude Kelly moved that the report of the nominating committee be accepted and placed on the ballot, seconded by Mr. Charles P. Knost and carried. The President then called for nominations from the floor, but none were offered.

President Leake then announced that petitions requesting honorary membership for Messrs. James M. Robert and Boykin W. Pegues had been received and that the Honorary Membership Committee and the Board of Direction had accepted both unanimously. He then asked the Society's wishes in the matter and Mr. Sydney Ellis moved that both members be elevated to

honorary membership status, seconded by Mr. Adloe Orr, Jr., and carried unanimously.

The chair then was relinquished to Mr. M. C. Abrahm, Chairman, New Orleans Chapter, A.S.M.E., who introduced the speakers of the evening, Messrs. John F. Vogt, Jr., and Allen H. Jensen, Mechanical Engineers of New Orleans Public Service, Inc., who delivered a lecture jointly on the subject of "Design and Operating Features of the Industrial Canal Steam Electrical Staton of New Orleans Public Service, Inc."

Following their lecture, the chair was returned to President Leake, who thanked the speakers for their interesting and instructive talk, and the meeting closed with a standing round of applause.

JOHN P. FERNANDEZ, Sec.-Treasurer

Note: These Minutes of the Baton Rouge Section were recently received in a group, and are so published.

Minutes of Meeting, April 23, 1948, Baton Rouge Section Louisiana Engineering Society

The following officers were present: J. J. Saurage, president; W. P. Wallace, 1st vice-president; A. J. Mary, 2nd vice-president; F. A. Hannaman, Jr., sec'y.-treasurer; J. T. O'Brien, past president; G. O. Coignet, chairman membership committee; D. F. Latimer, chairman publicity committee; W. P. Evans, chairman Student activity.

Mr. Saurage opened the meeting with the suggestion that the next regular meeting of the section be held on Thursday evening, May 6. No objections were raised and this date stood as the definite date for the next meeting.

It was suggested that this meeting be turned over to the student Group and that Mr. Evans, Chairman of the Student Activity Committee, arrange for the speaker for this meeting.

Mr .Evans stated that tentative arrangements had been made for presentation of the following papers.

"The Gas Turbine and Its Application in the Oil Industry" by Mr. C. A. Vincent, Senior, M.E., L.S.U.

"Water Supply and Disposal Problems in the Louisiana Sugar Industry" by Mr. P. J. Melancon, Senior M.E., L.S.U.

"What I Expect from Industry" by Mr. C. D. Adams, Senior E.E., L.S.U.

Each talk was to be 15 minutes duration with a question and answer period following each talk.

It was suggested that the Geology Building Auditorium be used for this meeting and Dr. Wallace was to make the necessary arrangements to reserve the place.

It was also decided that soft drinks and sandwiches would be served as refreshments following the meeting.

With no further business the meeting was adjourned.

F. A. HANNAMAN, JR., Sec'y.-Treasurer

Minutes of Meeting, May 6, 1948, Baton Rouge Section, La. Engineering Society

The following officers were present: J. J. Saurage, president; W. P. Wallace, 1st vice-president; F. A. Hannaman, Jr., sec'y.-treasurer.

There were thirty-nine (39) members and guests attending.

Mr. Saurage opened the meeting and requested that members introduce their guests.

The Treasurer's report and the reading of the minutes were dispensed with.

Considerable discussion was raised concerning the proposed Louisiana Engineering License Law with the point of main contention being in regard to the inclusion or spelling out of other branches of engineering such as Agricultural Engineering, etc., in addition to the few branches such as Electrical, Civil, Mechancial, etc., that were included in the bill.

Mr. Lehman, who is a member of the executive council, was to take this up at the meeting of the council scheduled within the next few days.

In the absence of Mr. A. J. Mary, Mr. W. P. Evans introduced the three speakers for the evening.

"The Gas Turbine and Its Application in the Oil Industry" by Mr. C. A. Vincent, Senior, M.E., L.S.U.

"Water Supply and Disposal Problems in the Louisiana Sugar Industry," by Mr. P. J. Melancon, Senior M.E., L.S.U.

"What I Expect from Industry" by Mr. C. D. Adams, Senior EE., L.S.U.

The talks were well received and considerable time for questions and answers was taken after each.

With no further business the meeting was closed, and refreshments, consisting of soft drinks and sandwiches, were enjoyed by all attending.

F. A. HANNAMAN, JR., Sec'y.-Treasurer

Minutes of Meeting, June 11, 1948, Baton Rouge Section, La. Engr. Society

The meeting was held at the Highway Laboratory Building at 5 p. m.

The following officers were present: J. J. Saurage, president; W. P. Wallace, 1st vice-president; A. J. Mary, 2nd vice-president; F. A. Hannaman, Jr., sec'y.-treasurer; T. E. Peak, past president.

President Saurage called the meeting to order.

This meeting was called primarily to discuss the joint summer meeting of the Baton Rouge Section and the parent organization, the appointment of the various committees to handle this important function.

Mr. J. T. O'Brien was selected to handle the Golf Tournament.

Mr. Saurage stated he would make the arrangements for horseshoe pitching. Mr. Mornhinveg was appointed to arrange for a tour of the L.S.U. Campus.

It was decided to dispense with the usual technical talk and/or movie for this meeting. In this connection, Mr. Mary stated that he had arranged for Mr. W. P. Burden to entertain the group with "His Acts of Magic."

The date was set for June 26, 1948.

Based on the results of the last joint meeting, it was decided to have this year's meeting at Harry Cloud's Camp. It was decided to have the cards printed immediately and to request that Mr. Fernandez assist in distributing them.

With no further business the meeting was adjourned.

F. A. HANNAMAN, JR., Sec'y.-Treasurer

Minutes of Meeting, June 26, 1948, Baton Rouge Section, La. Engr. Society

The following officers were present: J. J. Saurage, president; W. P. Wallace, 1st vice-president; A. J. Mary, 2nd vice-president, and F. A. Hannaman, Jr. esc'y.-treasurer.

This was a joint meeting held in conjunction with the Parent Organization of the Louisiana Engineering Society. This business session and dinner was preceded by a full activity which included a tour of the L.S.U. Campus, Golf Club, and horseshoe pitching at Harry Cloud's Camp.

The business session and supper started at 7:30 p. m. A delicious chicken dinner was enjoyed by all attending this meeting. There were 37 members and 7 guests present.

Mr. Saurage called for the reading of the minutes. It was moved and seconded that the reading of the minutes be dispensed with.

Mr. John Kleinpeter, substituting for Mr. W. Pike Burden, presented his "Acts of Magic" show which was well received by the entire group.

After this show the meeting was adjourned.

F. A. HANNAMAN, JR., Sec'y.-Treasurer

Minutes of Meeting, Sept. 28, 1948, Baton Rouge Section, La. Engr. Society

The meeting place was the Highway Laboratory Building.

The following officers were present: J. J. Saurage, president; W. P. Wallace, 1st vice-president; A. J. Mary, 2nd vice-president, and F. A. Hannaman, Jr., sec'y.-treasurer.

There were 37 members and guests present. Mr. Saurage opened the meeting and requested that members introduce their guests.

The treasurer's report and the reading of the minutes were dispensed with.

There was no old business pending and under the heading of new business, Mr. J. C. Hill suggested that the Annual Dinner Meeting be held in conjunction with the Ladies' Auxiliary. This matter was to be taken up at the Executive Committee Meeting held prior to the Annual December Meeting.

Mr. A. J. Mary requested suggestions forthe entertainment for the coming Annual Meeting. Mr. Leo Hough's suggestion of the sound colored movie entitled "Land of the Crimson Cliffs" was to be further considered for this meeting.

Mr. W. P. Wallace brought up the subject of the Baton Rouge Section to underwrite a gift for one of the annual student papers. After considerable discussion on this subject, Mr. Wallace moved that the B.R. Section should underwrite a gift, with a $15 maximum, for one of these student papers. Mr. A. J. Mary seconded the motion and it was passed without any objections.

With no further business, Mr. Saurage requested Mr. A. J. Mary to introduct the speaker of the meeting, Mr. Paul Jones, on the subject "Topographic Mapping by Photogrammatic Methods" after which a motion picture on this subject was shown.

With no further business the meeting adjourned and the usual refreshments were served and enjoyed by all attending.

F. A. HANNAMAN, JR., Sec'y.-Treasurer

Minutes of Tenth Annual Meeting, Baton Rouge Section of La. Engr. Society

The meeting was held in the Venetian Room of the L.S.U. Cafeteria on Dec. 15, 1948.

The following officers were present: J. J. Saurage, president; W. P. Wallace, 1st vice-president; A. J. Mary, 2nd vice-president, and F. A. Hannaman, Jr., sec'y.-treasurer.

There were 108 members and guests present. An excellent supper was served at 7:30, after which President Saurage opened the business meeting.

Since this was a joint meeting with the Ladies' Auxiliary, President Saurage turned the meeting over to Mrs. J. C. Hill, president of the auxiliary, who reviewed the progress of their group since they were organized. Mrs. Hill then introduced the various officers and committee chairmen of the Ladies' Auxiliary.

The meeting was turned back to Mr. Saurage, who requested the members to introduce their guests.

Mr. W. Stone Leake, President of the Parent Organization, gave a short address and announced that Mr. H. L. Lehmann, a member of the Baton Rouge Section, was elected president of the Parent Organization for the coming year.

The reading of the minutes of the last meeting was called for; however, it was moved and seconded to dispense with the reading of the minutes.

The report of the Treasurer was then requested. It was reported that the expenditures for the year amounted to $450.35. The receipts for the year were $488.50. The balance as of December 1, 1947 was $128.03, leaving a balance as of December 1, 1948 of $166.17.

Mr. Coignet, Chairman of the Membership Committee, was absent; however, the Secretary-Treasurer reported that the membership as of December 1, 1947, totaled one hundred and seventy-three (173). This number has increased to one hundred and eighty-four (184) as of December 1, 1948. Of this number, twenty-one (21) are Junior Members; nine (9) are Student Members; and two (2) Affiliated Members. Actually, there were twenty-two (22) new members added to our roll; however, this was offset by eleven (11) members who were removed from the roll due to change in location, non-payment of dues, etc.

Mr. Saurage called for a report of the Nominating Committee. Mr. T. E. Peak, Chairman of this committee, which included Messrs. H. L. Lehmann and J. T. O'brien, submitted the following nominations:

W. P. Wallace, president; A. J. Mary, 1st vice-president; F. A. Hannaman, Jr., 2nd vice-president, and Louis Duclos, secretary-treasurer.

Nominations were then requested from the floor. Since there were none, those named by the Nominating committee were elected by acclamation.

Mr. Wallace then announced that the Section wished to present the retiring president with a gift as a token of appreciation for his work during the past year. President Saurage thanked Mr. Wallace and the entire membership for the gift and since there was no further business, the meeting was turned voer to Mr. A. J. Mary, who gave a brief introduction of the technicolor movie, "Land of the Crimson Cliffs." After the movie, group singing of Christmas Carols was led by Mrs. Hill.

The meeting was then jointly adjourned by Mrs. Hill and Mr. Saurage.

F. A. HANNAMAN, JR., Sec'y.-Treasurer

Minutes of Meeting, Baton Rouge Section, La .Engineering Society
Executive Committee

The following members of the executive committee were present on Jan. 4, 1949 at the home of Prof. W. P. Wallace:

W. P. Wallace, president; A. J. Mary, 1st vice-president; F. A. Hannaman, Jr., 2nd vice-president; Louis Duclos, sec'y.-treasurer; James J. Saurage, past president, and T. Ellis Peak, past president.

President Wallace called the meeting to order and after some discussion the following committee were appointed:

Technical Papers Committee: F. A. Hannaman, Jr., chairman; Joseph T. O'Brien, Fred H. Fenn, Henry L. Landry, and Frank H. Walk.

Entertainment and Arrangement Committee: George T. De La Matyr, chairman; Alfred M. Melancon, and A. M. Rosenthal, Jr.

Membership Committee: Willis Dedric Morris, chairman; T. Ellis Peak, Jr., Emmett T. Craig, L. C. Eldridge, Clarence A. Ibach, Steve A. Nasca, and Maxwell A. Lea.

Publicity Committee: Wiley D. Poole, chairman; Williford J. Evans.

Students Activity Committee: William A. Wintz, Jr., chairman; Frank T. Carroll, Jr., Ambrose K. Ramsey, Jr.

President Wallace stated that he believed that it was desirable to hold more than the required four meetings during the coming year, and this opinion met with general approval. It was tentatively decided that the first meeting should be held in February.

It was decided that the next meeting of the Executive Committee should be a dinner meeting, and that the Chairman of the various Committees would be invited to attend this meeting, since their work and cooperation are necessary in planning the activities of the Section for the coming year. Mr. Austin J. Mary was appointed to make reservations at Mike & Tony's Steak House for the night of Thursday, January 20th, if possible, for this meeting.

There being no further business, the meeting was adjourned and the members of the Committee enjoyed some excellent refreshments provided by Mrs. Wallace. LOUIS DUCLOS, Sec'y.-Treasurer.

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXXV APRIL, 1949 NO. 2

CONTENTS

EDITORIAL NOTES AND COMMENTS

OUR FRONT COVER. The refinery pictured on our April issue was constructed during the war and it set a record in the production of aviation fuel. It has since been converted to peace time operation.

A Message From Our President. The year 1949 has gotten a good start and we of the Louisiana Engineering Society should not let these twelve months overtake us, by our standing idly by. To date we have made definite progress towards expanding the activities of our Society. The Shreveport Section is well underway and should soon be given a charter with a very nice membership. Mr. E. M. Freeman is really "ramrodding" this project. Another section in the early stages of development is at Monroe. Dean Roy Sessums of Louisiana Polytechnic Institute has been most willing to bring together our engineers in Congressional District No. 5. It is the desire of your officers that the Society grow not only in membership but in usefulness. It definitely aims to promote a feeling that the Louisiana Engineering Society is not just another organization but one that is unified in its efforts, diligent in its promotion, sincere in all of its undertakings, and above all, fair and impartial in its decisions.

The Council of Engineers will be called into session very soon to review the Engineers License Law as submitted at the last session of the Legislature and to renew efforts for its enactment into law during the 1950 session.

Yours for a better Society!

H. L. LEHMANN, *President*

New Members. In this issue more than fifty newly elected members are listed. We welcome these engineers, who are undoubtedly known to many. Membership in the Society should broaden their field of acquaintances.

WINFIELD W. ALSUP, Shreveport: age 46. Endorsed: E. M. Freeman, J. P. McCullough, W. F. Standke. University of Texas, B.S., M.S. in C.E., 1925. Mosher Steel Co., 1925-27. J. B. Beaird Co., Shreveport, Draftsman, Checker, Chief Engineer, 1927 to date.

JOHN W. BARTON, Baton Rouge; age 32. Endorsed: J. H. Bateman, L. J. Lassalle, H. L. Lehmann. La. State University, B. S. Sugar Eng., 1939. Esso Standard Oil Co., 1936-46, Sales Dept:. Laboratory Technician. Operating Supervisor Butyl Rubber Div. Anderson-Dunham Co., Vice-Pres. & Gen. Mgr., 1946 to date.

JOHN GOODMAN BLANCHE, Baton Rouge; age 46. Endorsed: Cecil Camp, G. T. De La Matyr, N. E. Lant. U.S. Naval Academy, B.S. 1925. U.S. Navy, engineering duty various times 1925 to 1947, Ensign to Commander. Taught Marine Eng. at U.S. Naval Academy, 2½ yrs. and Mech. Eng. at L.S.U., 2 yrs. Member A.S.E.E.

T. F. CASH, Shreveport; age 49. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough, Oklahoma University, B.S.C.E., 1924. Lone Star Gas Co., Party Chief & Construction Inspector, 1924. Maryland Oil Co., Party Chief, 1925. Roxana Oil Co., Engineer, Geophysical Explorations, 1926. Geophysical Research Corp., Computor, 1927. United Gas Pipe Line Co., 1928 to date, now Office Engr. in charge of specific assignments. Registered Professional Engr., Texas.

STEPHEN H. CORDILL, Sulphur; age 32. Endorsed: F. T. Clarke, J. M. Baker, W. D. Smith. La. State University, B.S. Pet. Eng., 1939. Union Sulphur Co., Inc., 1940 to date, now Gas Transmission Engr.

GAYLORD H. COX, DeRidder; age 43. Endorsed: E. H. Barentine, E. H. Goodloe, W. H. Yawn, Jr. Oregon State College, Mech. Eng., 1926-28; non-eng. course, 1929-31. Montgomery Ward & Co., Sales Engr., 1934-38. Armour & Co., Engr. & Draftsman, 1944-45. Crosby Chemicals, Inc., Engr. & Draftsman, 1945 to date.

SAMUEL G. DAVIS, New Orleans; age 36. Endorsed: M. C. Abrahm, L. V. Cressy, A. J. Harris. Tulane University, 3½ yrs. credit in M.E., B.A. Degree, 1941. Mass. Institute of Technology, Aeronautical Eng. Course, 1942. Mech. Eng. Sales & Service as follows: Calmes Eng. Co., 1936-38; Felix L. Alcus, 1938-40; Allen J. Harris Co., 1940 to date, except 1942-46 as Eng. Officer in U.S.N.

OTWAY B. DENNY, Shreveport; age 30. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. Texas A & M College, B. S. Pet. Eng., 1940. United Gas Pipe Line Co., 1941-42. Interstate Oil Pipe Line Co., Engr., 3 yrs.

JOHN HAMILTON ELLIS, Shreveport; age 54. Endorsed: E. M. Freeman, E. M. Gillen, R. H. Vaughan. 114th Engrs., A.E.F., Master Engr., 1917-19. Pearl River Valley Lbr. Co., Engr. & Surveyor, 1922-24. Gulley-O'Brien, Jackson, Miss., Municipal Engineering, 1924-31. La. Hwy. Comm., Resident Engr., Dist. Engr., 1931-41. Glassel-Taylor, Supt. of Coast Defense Work, 1941-43. Caddo Parish Hwy. Dept., Supt. Mtce. & Const., 1943-date. Licensed C.E., La. and Miss.

JAMES C. FAULKNER, Shreveport; age 33. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. North Texas Agricultural College, 2 yrs. Texas Powder & Lt. Co., Design Draftsman, Party Chief, 1934-39. United Gas Pipe Line Co., Design Draftsman, 1939-41. Koch & Fowler, Office Engr., 1941-43. United Gas Pipe Line Co., Design Draftsman, 1943-45. E. M. Freeman & Associates, Design Engr., 1945-47. Texas Eastern Transmission Corp., Chief Draftsman, 1947 to date.

WILLIAM E. FITZGERALD, Shreveport; age 36. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Texas A & M, B.S.M.E., 1935. Fitzgerald

Plbg. & Heating Co., Engr., Sec.-Treas., President & General Mgr., 1935 to date. Member A.S.H. & V.E.

CHARLES B. FOSTER, JR., Shreveport; age 33. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Texas A & M College, B.S.C.E., 1938. Texas Hwy. Dept., Instrumentman, 1938-39. City of Shreveport, Dept. of Water & Sewerage, 1939 to date, now Asst. Supt. Engr. Licensed C.E., La. Associate Member A.S.C.E.

CLIFTON A. FREY, Shreveport; age 35. Endorsed: R. S. Cooper, E. M. Freeman, R. T. Sessums. La. Polytechnic Inst., B.S. M & E., 1934. U.S. Govt. F.W.A., Field & Office Engr., 1934-42. E. M. Freeman, Design Engr., 1942-43. Ruston P.O.W. Camp, Asst. Post Engr., 1943-44. Sanitary Corps Officer, U.S. Army, 1944-46. E. M. Freeman & Associates, Design Engr., 1946 to date. Licensed C.E., La. Member La. Inst. of C.E., A.S.H. & V.E.

FRANCIS W. GRANT, Shreveport; age 40. Endorsed: E. M. Freeman, R. S. Cooper, H. L. Mitchell. City Engineer's Office, Shreveport, 14 yrs. (10½ yrs. in responsible charge). R. L. Tatum & Associates, Consulting Engrs., Associate, 2/3 yr. E. M. Freeman & Associates, responsible charge and design, 1 1/4 yrs.

JAMES F. HALSEY, Baton Rouge age 28. Endorsed: L. J. Lassalle, L. M. Odom, W. P. Wallace. University of Ill., B.S.C.E., 1947. La. State Univ., M.S. (Hydraulic Eng.) 1948. Registered Engineer in Training, Ill. Jr. Mbr. A.S.C.E. Member Sigma Tau Sigma. Corps of Engrs., Surveyman, 1941-42; Office Engr., 1942-43. Univ. of Ill., Research Asst., 1947. Leo M. Odom, Engr., June-Sept. 1948. La. State University, Asst. Prof. of Hydraulic Eng., 1948 to date.

TRUDEAU J. HOGUE, JR., Baton Rouge; age 31. Endorsed: F. R. Adams, G. T. De La Matyr, A. M. Melancon. La. State University, B.S. (Chem. & Physics) 1940. Southern Bell Tel. & Tel. Co., 1940 to date, except 1942-45 as Signal Corps Officer. Present position, Exchange Engineer. Associate Member A.I.E.E.

ROBIN M. HOOD, Shreveport; age 44. Endorsed: E. M. Freeman, R. T. Sessums, L. M. Odom. La. Polytechnic Institute, engineering graduate 1927. York Ice Machinery Corp., erecting & sales work, 1927-36. York's distributor at Shreveport, 1936-38. Shreveport Industiral School. Instructor Refrigeration & Air Cond., Director, 1938-45. Managing partner, Frigidaire Dealership, 1945 to present.

MORLEY A. HUDSON, Shreveport; age 32. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Ga. Inst. of Technology, B.S.M.E. 1938. Allis-Chalmers Mfg. Co., Test & Service Engr., 1938-40. American Surety Co., Safety & Machinery Engr. in charge Southwest District, 1940-41. U.S. Army, 1941-42. Magnolia Petroleum Co., Maint. Engr., 1942-46. Licensed, Texas. Member A.S.H.V.E., American Chemical Society.

JOHN G. HUFFMAN, Shreveport; age 56. Endorsed: E. M. Freeman, H. L. Mitchell, M. P. Snyder. 1927, Engineer, Reserve Natural Gas Co. & Ark. Fuel Oil Co. 1932, Non-professional. 1936, Instrumentman, La. Geodetic Survey. 1937, Office Engr., La. Dept. Conservation. 1941, Draftsman, Benham Eng. Co., Camp Polk. 1941, Eng. Designer, Silas Mason Co., Ordnance Plant. 1947, Office Engr., Geo. E. Dutton. 1948, Private practice. Surveyor's license, La.

WILLIAM J. LANK, Shreveport ;age 67. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Kansas University, engineering graduate 1908, elected to honorary Sigma Xi. 1906-17, various engineering positions with A. T. & S. F. Ry. Co. 1917 to date, Division Engr. for K.C.S. Ry Co. at various locations and in responsible charge. Registered C.E. in La., Tex., Ark., and in National Council of Engr. Examiners.

A. A. LYONS, Shreveport; age 58. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Alabama Polytechnic Institute, graduate in C.E., 1911. Registered C.E. by Examination in 1915. 38 years in private practice and municipal engineering.

VAL A. LYONS, Shreveport; age 32. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. La. Polytechnic Institute, B.S.C.E., 1938. Surveyor, geophysical exploration party, 1938-40. Map draftsman, 1940-41. Chief of Plane Table Party, 1941. Responsible charge of field work, Feb.-Oct. 1942. Eng. Officer, U.S.A.A.F., 1942-45. General Drafting & Design, 1945 to date.

RICHARD A. McCLENAGHAN, Shreveport; age 56. Endorsed: E. M. Freeman, J. P. McCullough, R. H. Vaughan. La. State University, B.S.C.E., 1914. Over 30 years of experience in C.E. and Surveying, over 10 yrs. in private practice. Licensed, La. and Texas.

JESSIE C. McLEMORE, Shreveport; age 36. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Actual practice in surveying, 14 yrs., 6 yrs.

in private practice. Licensed to practice surveying in State of La. since 1942.

EDWARD C. MISHOU, Shreveport; age 37. Endorsed: E. M. Freeman, J. P. McCullough, R. T. Sessums. University of Kansas, B.S. in P.E., 1943. Univ. of Kansas, AGA, Extension Div., charge Home Study Course in Natural Gas, 1939-43. Ajax Pipe Line Corp., Pipe Line Engr., 1943-45. Interstate Oil Pipe Line Co., Safety Engr., 1945-47; Division Engr., 1947 to date. Member Tau Beta Pi, Sigma Tau, Sigma Gamma Epsilon, Pi Mu Epsilon.

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RALPH M. PERSELL, New Orleans; age 40. Endorsed: H. J. Molaison, A. L. Dunlap, W. Guilbeau. Tulane University, B. E. in Ch. E., 1932. Miss. Hwy. Dept., Chem. Engr., 1934-37 and 1938-39. Military service, Lt. Col. CAC, 1940-46. Southern Regional Research Lab., Chemical Engr., 1946 to date. Member A.I.Ch.E., Tau Beta Pi, A.C.S.

ELISHA F. POLLARD, New Orleans; age 51. Endorsed: A. L. Dunlap, H. J. Molaison, F. M. Taylor. Alabama Polytechnic Institute, B.S.Ch.E., 1919; M.S.Ch.E., 1920. Graduate student, Iowa State College, 1923-25. Jeavon fellow, Western Reserve, 1931-32, Ph. D. in Organic Chemistry, 1934. Tulane University, Professor of Chemistry, 1927-42. Southern Regional Research Lab., Chemical Technologist, 1942-46; Chemical Engineer, 1946 to date.

ALBERT F. POOR, JR., Baton Rouge; age 31. Endorsed: R. L. Theaux, H. A. Marcoux, Houston Lester. Ga. Institute of Technology, B.S.M.E. 1940; M.S.M.E., 1947. Ga. Power Co., Draftsman, 1940-42. Blaw-Knox Co., 1942-43. U.S.N., Eng. officer (Lt. j.g.) 1943-45. Blaw-Knox Co., Piping and vessel design, 1945-48. Stone & Webster Eng. Corp-Ethyl Corp., Vessel designer in responsible charge. Registered Prof. Engr., Georgia & Pennsylvania.

LOUIS H. ROEGER, Shreveport; age 54. Endorsed: E. M. Freeman, R. S. Cooper, H. L. Mitchell. E. M. Freeman & Associates, charge of structural design, 1945 to date. Silas Mason Co., Chief Inspector, 1940-41. Horace Williams Co., Chief Draftsman, Camps Claiborne and Polk, 1936-40. Edward F. Nield, Shreveport, Resident Inspector Bldg. Construction, and an additional 20 yrs. experience in architecture, eng. and inspection.

TILLMAN J. RUCKER, Shreveport; age 41. Endorsed: E. M. Freeman, R. S. Cooper, H. L. Mitchell. Caddo Parish Hwy. Dept., Chief of Party, 1926-35. La. Hwy. Commission, Engr., 1935-40. E. M. Freeman, Layout and construction of streets, roads, airports, etc., 1940-43. U.S. Army, Operations Officer for Road Headquarters, 1943-46. E. M. Freeman, Resident Engr. on Airports, 1946 to date.

AUGUST J. RYBERG, Mansfield; age 40. Endorsed: E. M. Freeman, R. T. Sessums, J. P. McCullough. International Correspondence Schools, C.E., 1934-38. Sun Oil Co., Field Engr., 1933-42. Ship Engineer, 1942-43. Dr. Leonard J. Neuman, Houston, Chief of Party and Seismograph Crew, 1943-47. Surveying and Mapping, Private Practice, 1947 to date. Surveyor's License, La.

CHARLES N. SCHWARZ, Sulphur; Endorsed: F. T. Clarke, W. D. Smith, J. Baker. Graduate of Rice Institute. Registered Professional Engr., Texas. Maintenance Engineering Corp., Sales Engr., 1936-42. Union Sulphur Co., Mtce. Engr. and Purchasing Agent, 1942-date.

EUGENE M. SCHWARTZ, Maplewood; age 51. Endorsed: V. M. Brown, R. S. Clark, F. T. Clarke. Loyola University, 1913-16. University of Virginia,

refresher course Ch.E., 1944. Grinnel Co., Inc., Automatic Sprinkler Co., of America, Globe Automatic Sprinkler Co., Solvay Process Co., Dow Chemical Co., Southern Alkali Corp. (present employer). Actively engaged in engineering work with these companies for 29 years.

JAMES M. SMITH, Minden; age 35. Endorsed: R. T. Sessums, J. P. McCullough, E. M. Freeman. La. Polytechnic Institute, B.S.C.E., 1943. Harvard and M.I.T. 9 month Radar-Radio Course Radar, Radio and Electrical Officer, 1944-46. Premier Oil Ref. Co., general engineering work, 1946-47. Interstate Oil Pipe Line Co., District Engineer, 1947 to date.

WENDEL C. SORENSEN, Shreveport; age 39. Endorsed: E. M. Freeman, R. T. Sessums, C. T. Watts. R. F. Rolfe, Dallas, Rraftsman, 9 yrs. City of Austin, Eng. Dept., 1 yr. E. M. Freeman, Draftsman and Designer, 1 yr. Weild and Somdal, Construction Supt. and Designer, 11 yrs. Licensed C.E., La. by examination. Associate member A.S.C.E.

ARCHIBALD D. STRANGE-BOSTON, Shreveport; age 56. Endorsed: E. M. Freeman, J. P. McCullough, R. T. Sessums. Educated in England, B.A. and L.P.W. (equivalent to Structural Engr.) degrees. Meredith Bros. Const. Co., Estimating Engr., 1921-1922. Home Finance & Const. Co., Architect and Supt., 1922-1923. City of Norfolk, Chief Draftsman, 1923-24. Glassel Wilson Co., Estimating Engr., 1924-25. Standard Pipe Line Co., Chief Draftsman, 1925-32. State Highways of Va., Res. Engr., 1933-34. Insterstate Oil Pipe Line Co., Chief Draftsman, 1934-49. Member A.S.C.E., La Chapter A.S.C.E.

JACK S. TOLER, New Orleans; age 36. Endorsed: C. G. Cappel, R. E. Gosa, B. M. Dornblatt. Oklahoma A & M College, B.S.C.E., 1938. Humble Oil & Rfg. Co., 1938 to date, now Asst. Div. C.E. Licensed C.E., La. U.S. Army, 1942-46, Lt. Col. C.E.

WARREN N WHITE, Ruston; age 29. Endorsed: R. T. Sessums, J. J. Thigpen, W. P. Wallace. La. State University, B.S.M.E. 1946. Tulane University, Instructor in M.E., 1946-47. La. Polytechnic Institute, Asst. Prof. C.E., 1947-date.

FRED E. WELCH, Natchitoches; age 54. Endorsed: T. F. Colbert, C. C. Edwards, H. L. Lehmann. 2 yrs. College, Mendelholl, Miss. 2 yrs. correspondence, Univ of Ill., Engineering. Asst. Parish Engr., Winn, Lassalle, Caldwell Parishes, 1919-24. Lassalle Parish Engr., 1924-28. La. Dept. Highways, Dist. Mtce. Engr., Const. Engr., 1928-40. W.P.A., Const. Engr., 1941-43. Private Engineer, Timber Business, 1943-48. La. Dept. Hwys., Commissioner, Asst. Mtce. Engr., 1948 to date. Member American Road Builders Ass'n.

For Affiliate Member

RICHARD F. FITZGERALD, Shreveport; age 31. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Texas A & M, La. Polytechnic, 2½ yrs. Fitzgerald Plumbing & Heating Co., Inc., 12 yrs. Associate Member A.S.H. & V.E.

For Junior Member

JAMES EDWIN ALLEN, Shreveport; age 25. Endorsed: E. M. Freman, R. S. Cooper, H. L. Mitchell. La. State University, graduate C.E., 1948. E. M. Freeman and Associates, Surveyman, June - August 1947; Eng. Draftsman, 1948 to date.

CHRIS DEMOPULOS, Shreveport; age 24. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. Texas A & M College, B.S. Aero Eng., 1941-43; 1946-47. E. M. Freeman and Associates, 1947 to date.

GEORGE J. GROH, New Orleans; age 24. Endorsed: J. H. Collins, Sr. M. R. Guell, C. H. Hundemer. Stevens Institute of Technology, B.S. 1946; M.E. 1947. R. J. Tricon Co., Sales Engr., 1947 to date. Junior Member A.S.M.E.

ALTON M. HENRICKSON, JR., New Orleans; age 24. Endorsed: W. E. Blessey, F. H. Fox, F. W. Macdonald. Tulane University, B.E. in C.E., 1947. City of New Orleans, C.E., 1947. Pan American Petroleum Corp., Draftsman, 1948. Board of Commissioners, Port of N.O., C.E., 1948 to date. Licensed C.E., La.

JAMES F. ILGENFRITZ, Shreveport; age 26. Endorsed: E. M. Freeman, H. L. Mitchell, R. T. Sessums. La. State University, B.S.M.E., 1947. Interstate Oil Pipe Line Co., Mech. Dept., 18 mos.

HARRY E. KELLAR, Shreveport; age 28. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. Ohio State University, B. Industrial Eng., 1948. The J. B. Beaird Co., Inc., Standards Engineer, 2 mos. Jr. Mbr. Am. Inst. Industrial Engineers.

JOHN L. McGEHEE, JR., New Orleans; age 27. Endorsed: M. E. Kirkpatrick, P. M. Lagarde, E. R. Powell. U.S. Naval Academy, B.S., 1943. U.S. Naval Service until January 1948. Mente & Co., Inc., research, development and production, 1948 to date.

FRANCIS P. McNAMARA, Sulphur; age 23. Endorsed: R. E. Burgess, F. T. Clarke, G. L. Smith. La. State University, B.S.C.E., 1948. Licensed C.E., La. Member Sigma Tau Sigma.

RALPH OWEN, Shreveport; age 31. Endorsed: E. M. Freeman, H. L. Mitchell, R. S. Cooper. Centenary College Night School, 1937-41. Arkansas Natural Gas Co., Shreveport, 1937-42. U.S. Coast Guard, Arch and Engr. Drafting, 1942-43. Coast Guard Military Service, Drafting, 1943-46. E. M. Freeman and Associates, Eng. Drafting, 1946 to date.

WARREN M. ROBBINS, Baton Rouge; age 28. Endorsed: L. R. Kirst, B. B. Lyons, J. L. White. Southwestern La. Institute, Civil Engineering, 3¼ yrs. La. State University 1½ yrs., B.S.C.E., 1947; M.S.H.E., 1948. Tennessee Valley Authority, C.E., 1942-43. La. Dept. Public Works, Civil Engr., 1948, also part time during attendance at L.S.U. Junior Member A.S.C.E. Licensed C.E. and Surveyor, La.

ROLAND L. SAUCIER, JR., Shreveport; age 21. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. La. Polytechnic Institute, C.E., 1948. E. M. Freeman and Associates, Engr.-Draftsman, October 1948 to date.

EDMUND O. SEIDEL, Shreveport; age 26. Endorsed: E. M. Freeman, E. M. Gillen, J. P. McCullough. University of Texas, B.S.C.E., 1944; M.S., 1949. University of Texas, Instructor in C.E. Testing Lab., Jan.-June 1948. E. M. Freeman and Associates, Consulting Engineers, Oct. 1948 to present. Jr. member A.S.C.E., Jr. Member Texas Society Professional Engrs.

JOHN D. WILKINSON, Shreveport; age 29. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. La. State University, 3 yrs. Centenary, 2 yrs., B.A. 1941. J. C. McLemore, Instrumentman, 1946-48. Registered Surveyor, partnership with McLemore, 1948-date.

For Transfer from Junior to Full Member

ALONZO A. BALCOM, JR., Baton Rouge; age 30. La. State University, B.S. in C.E. 1940, M.S. in San. Eng'g. 1941. U.S. Army, Commanding Engineers' Battalion, 1941 to 1946. President of wholesale building supply firm, 1946 to date.

JAMES H. DERR, JR., Baton Rouge; age 28. Williamson School of Mechanical Trades, graduate of a three year course in Power Plant Engineering 1940. Gulf State Utilities Co., Student engineer, 1940 to 1941 U.S. Navy, 1941 to 1943. Gulf State Utilities Co., Officer Engineer 1944 to 1948, Assistant Test Engineer, 1948 to date.

WALTER EDWIN DOUGLAS, JR., New Orleans; age 28. Tulane University, B.E. in C.E., 1942. U.S. Engineers, New Orleans District, Design Section, 1942. Geo. G. Sharp, head of Hull Scientific Section, 1943. U.S. Navy, Senior Lt. in Civil Engineer Corp, 1943 to 1947. Eighth Naval District, Project Manager of construction work on $2,600,000 Naval Reserve Training Centers, July 1947 to date. Licensed C.E., La. Member A.S.C.E.

JESSE D. DRAKE, Jackson, Mississippi; age 33. Completed three years Mississippi State in School of Engineering, 1936. Miss. Power & Light Co., Eng. Dept., 1936-41. Chas. T. Main Inc., Architect Engineers of Boston, Mass., head of electrical dept., 1941-43. Todd-Johnson Dry Dock, New Orleans, electrical engineer, 1943-45. Drake Electric Co., Jackson, Miss., owner, 1945 to date. Licensed in Mississippi.

FRANK C. FROMHERZ, New Orleans; age 28. Tulane University, B.S. in C.E. 1943. Goodyear Aircraft Corp, Akron, Ohio, Stress Analyst, 1943-45. U.S. Public Health Service, commissioned J. A. Engineer, 1945-46. Harvard University, Graduate School of Eng'g., 1946-47. La. State Dept. of Health, Public Health Engineer, 1947-48. Alvin M. Fromherz Associates, Civil and Sanitary Engineer, 1948 to date. Licensed C. E., La. Member A.S.C.E.

EDWARD DOMINIC HOGG, New Orleans; age 29. Tulane University, B.S. in C.E., 1941. New Orleans Public Belt R.R., field engineer, 1941-42. U.S. Navy, executive officer and navigator, 1942-45. N.O. Public Belt R.R., 1945-46. George J. Glover Co., engineer, 1946-49. Keller Construction Co., engineer, February 1, 1949 to date.

PAUL M. LAGARDE, New Orleans; age 31. The Citadel, S.C., B.S. in C.E., 1940. Marion Military Institute, instructor 1940-41. U.S. Engineers, New Orleans District, Junior Engineer, 1941. U.S. Army, specialized in radar, 1942-46. U.S. Engineers, hydraulic engineer, 1946. New Orleans Public Belt Railroad, Assistant Civil Engineer, 1946 to date. Licensed C.E., La. Junior Member A.S.C.E.

JOSEPH HUGH LEBLANC, JR., New Orleans; age 30. Tulane University, B.E. in M.E., 1941. Tenn. Coal, Iron and R.R. Co., Jr. Steam Engineer, 1941-42.

Welding & Mfg. Co., Shop Foreman 1942-45, Engineer 1945-48. Dixie Machine, Welding & Metal Wks., Inc., 1948 to date.

WALLACE RAY MACK, Oberlin; age 46. Instrumentman, La. Dept. of Highways, 1927-32 and 1934-42. Resident Engineer in charge road and bridge construction and some designing of small structures, 1942-date.

STENNING C. MURPHY, New Orleans; age 30. Tulane University, B.E. in Ch.E., 1941. U.S. Navy 1941-45. Blue Plate Foods, Inc., Chief Chemist 1945 to date. Licensed Ch.E.

SPALDING KENAN MANSON, JR., New Orleans; age 27. Tulane University, B.E. in C.E. 1942. U.S. Navy, Engineering Division Officer, 1942-45. R. P. Farnsworth Co., Inc., Engineer, 1946-48. Clifford A. King, 1948 to date. C.E. in La.

LUTHER D. McCORQUODALE, Lake Charles; age 42. Calcasieu Parish Engr. Dept., Instrumentman, 1925-27. La. Hwy. Commission, Instrumentman, 1927-32. F. Shutts & Sons, Engr. Firm, Instrumentman, 1932-34. G. M. Oil Co., Houston, Chief of Party, 1934-35. La. Hwy. Commission, Chief of Party, 1935-40. La. Hwy. Commission, Project Engineer, 1940 to date.

FRANCIS JOSEPH ORY, New Orleans; age 29. Tulane University, B.E. in C.E. 1941. U.S. Army Engineers, construction inspector, 1941-42. U.S. Navy, Civil Engineer Corps, Officer in construction and maintenance of naval bases, 1942-46. U.S. Engineers, Waterways Station, Engineer, 1946-47. Keller Construction Co., estimator (construction), 1947 to date. Licensed C.E. in La.

WARD C. PURDUM, New Orleans; age 26. Tulane University, B.E. in M.E., 1944. U.S. Navy, Engineering officer, 1944-46. Construction engineer, 1946-47. Equitable Equipment Co., Inc., sales engineer. 1947 to date.

IRWIN A. RABEN, Lake Charles; age 26. Tulane University B.E. in Ch.E., 1942. Yale University, 1942-43. U.S. Army, Aircraft Engineering Officer (Captain, 1943-46). La. State University, M.S. in Ch.E., 1947. Cities Service Refining Corp., process engineer, 1947 to date.

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ROBERT WILLIAM SCHUPP, New Orleans; age 28. Tulane University B.E. in M.E., 1943. U.S. Navy, Lieut., 1943-46. Jordy Engineering Co., Inc., specialized in Air Conditioning, Heating and Ventilation, production manager, 1946 to date. Member of A.S.M.E.

WILLIAM F. STANDKE, Shreveport; age 31. Tulane University B.E. in C.E., 1940. Texas Co. and United Gas Co., Engineering draftsman, 1940-41. U.S. Engineers, structural engineer, 1941-42. U.S. Navy, Engineering Officer, 1942-46. Neild & Somdal, Arch., Shreveport, Structural Engineer, 1946 to date. Licensed C.E. in La.

PAPERS AND DISCUSSIONS

APPLICATIONS OF THE FLUID CATALYST TECHNIQUE TO CATALYTIC CRACKING AND HYDROCARBON SYNTHESIS*

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I should like to speak to you about a new technique in chemical engineering, fluidization. This technique is not only a method of handling finely divided solids, but an excellent means of contacting gases with solids for use in such of well-established unit operations as heat or mass transfer, and gas-solids mixing. It seems logical, therefore, to consider fluidization as a technique worthy of careful study. Very rapidly, new and different applications of modifications of this technique are being discovered, not only in the catalytic field but in purely physical processes as well.

Probably the two most important properties of a fluidized solids mass are the rapid transfer of heat which can be obtained and the intimate contact of gases with solids which is possible. To illustrate the applications of fluidization, we are to discuss today two widely different processes in which most of the properties of fluidized solids are utilized. The first, fluid catalytic cracking, now well known, is the process in which the fluidized solids technique was proved commercially feasible. The second, hydrocarbon synthesis, is a process of the near future, made commercially attractive by the development of that technique.

This new "unit operation" is based on two properties or characteristics of finely divided solids described as follows: (1) Solids of a proper particle size range when intimately mixed with a gas will form a homogeneous solids-gas mixture with properties of a fluid. This fluid resembles a liquid except that its density can be varied either by changing the ratio of solids to gases or by adjusting the flow conditions. (2) A finely divided solid when suspended in a gas stream flowing upwards at relatively low velocities will form, contrary to Stokes' law, a continuous dense phase closely resembling a boiling liquid with a relatively well defined level or meniscus.

Fluid Catalytic Cracking

Although most of you are well familiar with the fluid catalytic cracking process, I should like to use this process as an example of fluidized solids technique because it illustrates most of the prin-

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ciples of this "unit operation." Basically, of course, we are considering here two chemical reactions. The first, the cracking reaction, is an endothermic process absorbing large quantities of heat and at the same time depositing carbon on the catalyst surface. The carbon is removed by a second chemical reaction, namely, simple oxidation of carbon by air and known in catalytic cracking as regeneration of the catalyst. This regeneration, of course, is highly exothermic. The combination of these two reactions is ideal for application of the fluid process, for by circulation of fluidized catalyst from the zone of one reaction to the other, the heat liberated by the oxidation step can be utilized by the cracking reaction with high heat economy. The principle of the catalyst in catalytic cracking is, of course, the acceleration of the chemical processes of cracking to such a degree that the reaction may be carried out at relatively low temperatures and to guide the reaction in the preferred direction. At these temperatures, which are 100-200°F. below those used in thermal cracking, the losses of oil through gas, coke and tar formation are greatly reduced and high yields of liquid products are obtained. Furthermore, at low temperatures the quality of these products is greatly improved so that the octane number and stability of the gasoline is exceptional. In the fluid cracking process however, the catalyst has other functions resulting largely from its efficiency as a heat transfer medium. In the cracking zone the violent turbulence of the circulating catalyst effects a remarkable uniformity of temperatures in that zone which permits close control of the cracking reaction. The same is true in the regenerator. Furthermore, the high heat capacity of the tremendous circulating stream, 40 to 50 tons of catalyst per minute, results in the transfer of the heat of burning to the cracking zone to sustain the cracking reaction.

A typical plant, is of course, a highly complicated affair . . . but the process which goes on within it is comparatively simple . . . As far as the transformation from crude oil is concerned, the essential elements are the reactor and the fractionator. . . .

As in other cracking plants, the feed stock is heated before entering the reactor. It is cracked within the reactor—and passes on to the fractionator where it is separated into gas, high octane gasoline, heating oil, and gas oil.

It is in the reactor, in the presence of a fluidized catalyst, that the conversion of oil to high yield of high quality products takes place.

A rapid transfer of heat takes place when hot catalyst joins the preheated oil. Flash vaporization produces the oil vapors which transports the catalyst into the reactor. In the dense bed of seething catalyst, heavy oil is converted into high yields of high quality products. In the process carbon is deposited on the catalyst.

A small part of the catalyst, carried overhead with escaping cracked vapors is almost completely recovered in cyclone separators and returned to the catalyst bed.

A still smaller fraction of the catalyst escapes from the cyclone and is recovered as a heavy oil slurry at the bottom of the fractionator. This recovered oil and catalyst are pumped back to the reactor.

As the cracking proceeds, the catalyst becomes contaminated with carbon, which lowers its activity. The carbonized catalyst, accumulated at the bottom of the reactor, after stripping of entrained oil vapors is withdrawn continuously through a slide valve, picked up with compressed air, and, as in an air lift, is blown upward into a regenerator where the accumulated carbon is burned off. The regenerator operates at 1100°F—a dull red heat. The violent action in the fluid bed gives some remarkable results. In a plant scale regenerator, as much as 200,000,000 BTU's per hour may be liberated; yet the temperature in the regenerator seldom varies more than 50°F. from top to bottom even though the catalyst bed may be 20 ft. deep and up to 45 ft. in diameter.

The heat of combustion is stored in the catalyst and is imparted to the oil at the point of catalyst injection.

The products of carbon combustion pass out of the regenerator into cyclone spearators from which most of the entrained catalyst is returned to the fluid bed.

The off-going gases go to a waste heat boiler and pass on to a Cottrell electrical precipitator which removes most of the last traces of catalyst. The gas is vented from the stack.

The final recovered catalyst is repressured in a standpipe and passed by airlift to the generator.

The completely regenerated hot catalyst passes down a standpipe to be picked up by the incoming oil.

The scenes which follow summarize the major cyclic path over which the catalyst flows continuously.

Because of its fluid condition, a pressure head is developed by the catalyst in the regenerator standpipe. This pressure is sufficient for the catalyst to flow from the regenerator—a zone of relatively high pressure.

Here the catalyst promotes the cracking reaction, after which it is discharged continuously from the bottom of the reactor.

After leaving the reactor slide valve, it is carried by air stream back to the regenerator. In this vessel its carbon is burned off, and it is returned to the start of the cycle, all without a single moving mechanical part in the system. The major transformation of the entering oil molecules takes place in about 20 seconds. The average catalyst particle makes its way around the circuit every

ten minutes; yet the process runs continuously for months on end.

These units are each capable of handling over a million and a quarter tons of feed stock per year. They are about 250 feet high—the height of a 20 story building—and contain 24 miles or more of piping.

One section of pipe is about 8 feet in diameter. About 40 tons of catalyst is circulated through a unit every minute—with a volume equal to 4 tank cars. Catalyst recovery is so complete that only about 0.005 per cent of the 60,000 tons circulated daily is lost to the air, namely 2 to 4 tons per day.

Hydrocarbon Synthesis

Before the war, U.S. oil consumption was 3.8 million barrels per day compared to a production capacity of 5 million. The present consumption is 5.7 million barrels per day or 2 billion per year, and there is every indication that the demand will continue to increase rapidly. It is predicted (1) that by 1949 the world demand will be 10 million barrels per day and that foreign consumption should increase even more rapidly than U.S. through rapid mechanization. It is not strange that the petroleum industry has been actively looking, since before the war at other sources of liquid fuels. The recent proposal in the Wolverton Bill that plants be built under a government guarantee to produce synthetic fuel from coal and shale is undoubtedly largely in the interests or national defense, but the suggestion is certainly of interest in this connection. The most concrete interest is, of course, in the fact that a commercial plant for the synthesis of gasoline from natural gas is now under construction in Texas and Kansas.

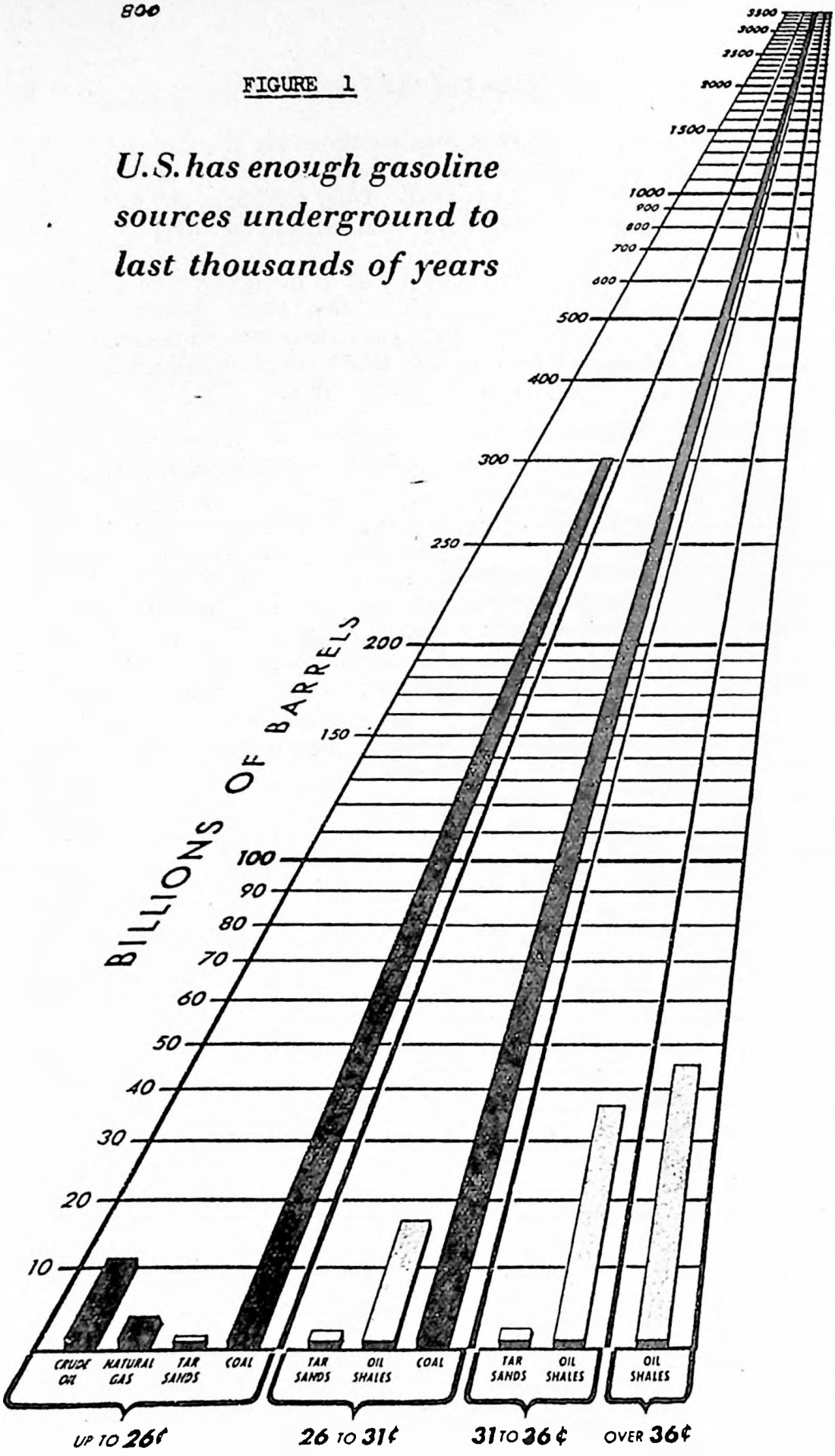
Fortunately for us, our reserves of other sources of liquid fuels are vast. In addition to the natural gas already mentioned, we have shale oil, tar sands and coal. To illustrate the magnitude of these reserves, Figure 1 is presented. Also shown in Figure 1 are the filling station prices (based on 1946 prices and cost estimates.) which we might expect to pay before some of these sources could be tapped economically. It will be noted that, assuming about one quarter of the natural gas reserves might be available for conversion to liquid fuels, petroleum reserves could be extended 30-40 percent by conversion of this natural gas to oil. When prices are increased sufficiently for coal conversion to be economical, however, we can count on reserves so vast that one-half of them would supply the present oil demand for 1000 years. This figure is of course limited in accuracy to that of the coal reserve estimates. Large additional reserves of shale and tar sands may also come into the picture.

To manufacture liquid fuels from these three raw materials several precesses may be used. With natural gas the fluid catalyst adaptation of the Fischer-Tropsch synthesis is the most likely.

800

FIGURE 1

U.S. has enough gasoline sources underground to last thousands of years



Filling Station Prices (1946)

To use this process the natural gas must first be converted to hydrogen and carbon monoxide by an oxidation step. Direct oxidation with pure oxygen is to be used in the plants now being built. Synthesis of oil from coal may also take the Fischer-Tropsch route. Coal will first be converted to hydrogen and carbon monoxide and it is quite possible that a fluidized solids technique will be used for this step. The hydrogenation of coal to liquid fuels is also being investigated by the Bureau of Mines. It is this process which furnished the Germans with most of their synthetic fuel during World War II. Shale distillation has been developed satisfactorily through a small pilot plant stage as a fluidized solids process.

Let us look more closely at the hydrocarbon synthesis process. Technically speaking the basic raw material can be any carbonaceous matter, natural gas, coal, saw dust, agricultural wastes or even low grade oils. Any of these materials however, must first be converted to hydrogen and carbon monoxide by combination with oxygen, steam, or carbon dioxide. After these gases are manufactured, the treatment to form liquid fuels is the same regardless of the primary raw material. Inasmuch as the simplest and cheapest starting material is natural gas, the petroleum industry has started its development of hydrocarbon synthesis with that raw material. Fortunately, some of the knowledge gained through this development can be almost directly applied to the more complicated process starting with coal.

There are two important methods of converting natural gas to hydrogen and carbon monoxide. The first, used for many years in the ammonia synthesis industry, consists of reforming the methane with steam over a nickel catalyst at temperatures in the region of 1500°F. To adjust the ratio of hydrogen to carbon monoxide to that desired for synthesis, carbon dioxide is added. To give a 2/1 ratio the proportions are as shown in the following equation:

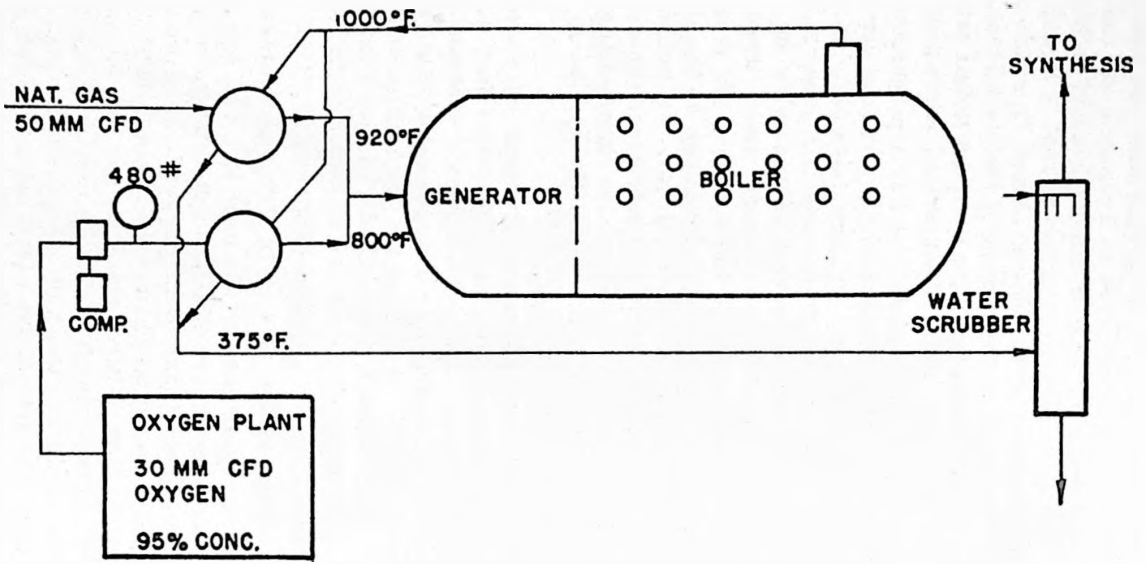
$$3CH_4 + 2H_2O + CO_2 = 8H_2 = 4CO$$

3 Volumes Nat. Gas = 12 Volumes Synthesis Gas

The development of the new low cost oxygen has made possible a more simple method of generating synthesis gas, the direct oxidation of methane with oxygen. This process takes place in a simple combustion chamber without benefit of catalyst and has the big advantage that synthesis gas can be manufactured under the pressure at which it will be used in the synthesis reaction itself thus reducing the high compression costs. A flow sheet for a synthesis gas generation plant using natural gas and oxygen is shown in Figure 2. It has been reported that a 50,000,000 CFD flow of natural gas is preheated by heat exchange to 920°F. where it is mixed with a similarly preheated steam of 30,000,000 CFD of oxygen. These gases burn in a refractory lined generator at about 2500°F. and under synthesis pressure, in the range of 300-600 psig.

FIGURE 2

SYNTHESIS GAS PLANT — DIRECT METHANE OXIDATION



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The gases are quickly cooled by a bank of boiler tubes to 1000°F. thereby generating high pressure steam. Further cooling is effected by heat exchange with the incoming gases. The quantities of gas involved in this generator should be sufficient to produce almost 5000 bbls./D of oil. The details of the manufacture of synthesis gas from coal are not so well worked out although pilot plant work is underway. The Standard Oil Development Company, together with the Pittsburgh Consolidated Coal Company, are erecting a complete gasification pilot plant at Library, Pennsylvania, which will also use the Fluidized solids technique. As with natural gas, it is necessary to convert the coal to hydrogen and carbon monoxide ratio. It is the belief that almost any grade coal may be used and that mechanical mining methods will be improved which will bring the coal out of the earth at a low cost. Of course, the possibilities of gasifying coal underground are also being explored as another source of synthesis gas.

Synthetic hydrocarbons may be produced either from natural gas or from coal. These basic raw materials must first be converted into synthesis gas.

When coal is used, it may be reacted with oxygen and steam in a generator to form a mixture of carbon monoxide and hydrogen which we call synthesis gas. Natural gas is also used as a basic raw material. It may be combined with oxygen in a generator to form synthesis gas. Once the synthesis gas has been formed and purified, the remainder of the process is the same for both coal and natural gas.

From a generator, the synthesis gas is fed into a reactor, the synthesis gas is converted into synthesis products; gasoline, Diesel oil and chemicals.

Here is one technique for the production of synthetic hydrocarbons. At the present time in the United States, synthesis from natural gas is closer to plant scale application than synthesis from coal.

Natural gas, which is principally methane (CH_4), is used as a feed material. It is preheated in a heat exchanger to about 930°F. Oxygen, which has been separated from air in an oxygen plant, is similiarly preheated. Togther they are fed into a synthesis gas generator. The burning zone of the generator is an open chamber lined with refractory insulation. Here the methane is converted by partial oxidation to carbon monoxide and hydrogen. The temperature level in this combustion zone is about 2500°F. and the pressure 2- to 30 atmosphere, the hot products of combustion leaving the combustion zone, are cooled in the waste heat boiler of the generator.

The gas leaving the generator is further cooled by heat exchange with the methane and oxygen. The gas now enters the bottom of a fluid type reactor.

The reactor operates at 600-700°F. and at a pressure of 20 to 30 atmospheres. In the presence of an iron catalyst which is in constant and violent motion, the synthesis gas reacts to form synthetic hydrocarbons and water. The reaction liberates a very large amount of heat, amounting to over 14,000,000 BTU's per ton of liquid product produced. Cooling tubes immersed in the fluidized catalyst make possible high rates of heat transfer, which still maintaining uniform temperature throughout the catalyst. The heat of reaction is absorbed in the vaporization of water to form high pressure steam which is a source of heat and power throughout the plant. The maintenance of an even catalyst temperature with this large heat evolution has been in the past the major difficulty in applying the synthesis operation to large scale production.

A relatively deep bed of catalyst is employed in the synthesis reactor. Most of the small amount of entrained catalyst leaving the fluid bed is recovered in a cyclone and returned through a dip pipe to the catalyst bed. The synthesis product leaving the reactor is passed to a condenser. From the condenser it is passed to a receiver where the gases are separated from the liquids. A portion of the gas is recycled for further processing. From the remainder of the gas, light hydrocarbons are recovered. The residual tail gas is used to furnish plant heat and power requirements, or part of it may be sold as fuel. The liquid hydrocarbon products are primarily high octane gasoline and Diesel oil which require only normal finishing treatment. By products of the process include a variety of useful chemicals.

The plant shown in Baton Rouge is the largest of the 13 pilot plants which my company is now operating in this important field of hydrocarbon synthesis. One of the company directors, when seeing this pilot plant for the first time, said that if it were only the pilot plant, he was convinced that all commercial plants embodying the final process would have to be lodged in the State of Texas since otherwise the operators of the plants would find themselves in interstate commerce.

The hydrocarbon synthesis process began in Germany in 1923 with the discoveries of Fischer and Tropsch, and it was upon their discoveries that the German synthetic oil process was founded. Their process consisted of converting hydrogen and carbon monoxide in a ratio of 2 to 1 to heavy straight-chain paraffin hydrocarbons over beds of cobalt catalyst. Temperatures were low, around 400°F., and the pressure was atmospheric. The straight-chain paraffins resulting from this operation were, as you know, of very low octane number, on the order of 10 to 40 ASTM. In fact, the Germans used this synthetic product largely for other uses, such as lubricating and Diesel oil manufacture. It was, nevertheless, a large industry. Work started in the United States about 1938 and, of course, the first investigations closely paralleled the German work.

Despite the stoppage of much of the U.S. research in that field during the war, it was not long before the search after higher octane gasoline led the U.S. workers to a different catalyst and an entirely different mechanical approach to the problem. By changing over to an iron catalyst it was possible to increase the reaction temperature to a range of 600-700°F. This meant that the pressure also had to be increased to 20-30 atmospheres, but the resulting product was now highly olefinic with more branched-chain molecules—in other words, higher octane number. The mechanical design of the plant usually centers around the removal of the high heat of reaction. The Bureau of Mines has developed a slurry process in which that heat is removed by the circulation of oil products. The industrial developments, however, are based on the fluidized solids technique. The simplification of equipment resulting from the use of fluidized catalyst is amazing. The Germans, in order to remove the heat of reaction and protect their sensitive catalyst from high temperatures, arranged the catalyst in very thin beds between cooling surfaces. For a plant producing 10,000 B/D, six million square feet of cooling surface would have been required. The American fluid processes are planned with only 1/2 to 1 per cent of that area per barrel per day capacity. As in most catalytic processes, close temperature control is still required both to protect the catalyst and to insure the proper yields of product. It is contemplated (2) that the catalyst to be used will be essentially pure iron derived from an oxide with some alkali promoter added. It has been reported that the source of oxide may be iron ores, mill scale, ammonia synthesis catalyst, the sinter from roasting sulfide ores, etc.

The mechanism of the synthesis reaction is not too well understood. The chemist would represent the reaction simply by the following equations:

$$2H_2 + CO = \frac{1}{n}(CH_2)^n + H_2O \qquad (1)$$

$$H_2O + CO = H_2 + CO_2 \qquad (2)$$

$$3H_2 + 3CO = \frac{2}{n}(CH_2)^n + H_2O + CO_2 \qquad (3)\ \text{Addition of (1) and (2)}$$

The first two reactions shown above, the synthesis step and the water-gas shift reaction, can be added together in varying proportions. The third equation given above is a typical example. The ratio of consumption of hydrogen to carbon monoxide can be changed from two down to 1/2, but the yields of oil represented above by $(CH_2)n$ from a given volume of the hydrogen and carbon monoxide mixture are not basically changed. Normally, the prod-

ucts from synthesis will include a mixture of paraffins and olefins varying from the lightest gases, methane, ethane, ethylene, etc., up to heavy oils and wax. Also dissolved in the oil in the water layer are a host of chemicals, differentiated from hydrocarbons by the presence of one or two oxygen atoms per molecule. These oxygenated compounds include alcohols, aldehydes, ketones, and acids. At the conditions at which the Standolind Oil and Gas Company propose to operate their hydrocarbon synthesis plant, they estimate their synthetic oil products, after treating to convert oxygenated compounds into olefins and to polymerize light olefins, to be 84 percent gasoline, 11 percent distillate fuel and 5 percent heavy fuel. The finished gasoline will have a clear ASTM octane number of about 80. The Standard Oil Development Company has quoted the same ASTM octane number and a clear research octane number of about 93 which 2 cc. TEL will increase to 93. Of course, there will be some lighter hydrocarbons formed as by-products.

Sullivan has given us some interesting figures on the production of chemicals from 10 hydrocarbon synthesis plants of a nominal capacity of 7000 B/D each. These figures are compared in Table I with the present total U. S. production of these chemicals. The figures for hydrocarbon synthesis plants are calculated from the estimated production of organic chemicals from the Carthage-Hydrocol Plant at Brownsville, Texas. You will note that the chemicals from these 10 synthesis plants amount to an average of 68 percent of the product now produced by the present U. S. organic chemical industry, varying from 26 percent for acetaldehyde to 87 percent of the present acetic acid production. It is evident that if the petroleum industry starts producing oil synthetically, it will immediately become also the major producer of basic organic chemicals.

No discussion of hydrocarbon synthesis would be complete without mention of costs. At the present stage of development of the process, however, and with the current uncertainty of construction cost estimates, the presentation of an accurate cost picture is difficult. Some reasonable estimates are given in the next slide (slide 5). Based on natural gas at 10 cents per thousand cubic feet, Murphree, President of the Standard Oil Development Company, has quoted a cost of gasoline from natural gas at 13 cents per gallon including amortization and return of investment. This can be compared roughly to a 14 cents per gallon price for gasoline from crude oil when produced in newly constructed equipment and when operating for maximum yield of gasoline. A similar price of gasoline from coal might be 16-17 cents per gallon and from shale, 16 cents per gallon. The investment per barrel/day of oil products capacity for crude oil production, transportation to consuming area and refining is about $4300 for maximum distillate yield and $6500 for maximum gasoline yield and for oil synthesis from natural gas,

$7400 and $8200 on the same basis. For synthesis starting with coal, $7600 and $8500 is estimated and from shale $6100 and $8400. With coal and shale product transportation is not included which may be required in areas west of the Mississippi. High housing costs, also must be added for such a location. It is evident from these figures that construction costs play a large part in determining the price of synthetic gasoline. Despite these high costs, however, the average motorist need feel little concern over the future supply of gasoline for his automobile for even at the present stage of development of the gasoline from coal process, estimates show that it will cost him only 10-15 cents per day more to operate his car on gasoline from coal than he now pays for petroleum gasoline.

Estimates for NEW Liquid Fuel Capacity

BASIS: SOURCE TO MARKETING AREA
MAXIMUM GASOLINE PRODUCTION

	Crude Oil $2.78/B	Nat. Gas 10c/MCF	Coal $3.20/T	Oil Shale $1.00/T
Investment, $/B/D Gaso.	$6,500	$8,200	$8,500**	$8,400**
Steel Req't, T/B/D Gaso.	7.8	7.9	5.2	7.4
Gaso. Cost Incl. 15% Cap. Charges*, ¢/Gal.	14	13	17**	16**

*5% AMORTIZATION + 10% RETURN.
**COST OF ADDITIONAL HOUSING NOT INCLUDED

NEW SOCIAL CONCEPTS FOR THE ENGINEER

S. B. WILLIAMS*

In spite of all of our generosity to people in distress wherever they are, in spite of our ideals and principles in international diplomacy, we are regarded as being essentially a very materialistic nation. The yardstick of progress in this country is material, not spiritual. A man, as a rule, is a success if he has made a lot of money or built up a big business regardless of how deficient he may be in his human or social concepts. The last twenty years, however, have shown us that technological development cannot be the sole criteria of progress. There is a social side of man which is equally, if not more important, the understanding of which may command mental skills of higher quality than those devoted to technical problems. I say this because scientists and engineers have been able to pry open nature's secrets one by one and harness them but we have made little progress in opening the secrets of personality and so controlling them that man will be happy and willing to live at peace with his neighbor.

And when I say control, I don't mean regiment but rather guide and help so that mass thinking and behaviour will better reflect the thoughts of the individual and so that individual liberty will be preserved. Every time we permit government to impose a control on the freedom of the individual, no matter how worthy the end result might appear to be, we lose something that to our forefathers, who won this country for us, was more precious than life itself.

Science and technology have placed so many new tools in man's hands, that many fall into the habit of giving credit to the machine for our progress. We credit the railroad, for instance, with the opening of the west. We speak of the machine age.

We can lift a telephone and in a few minutes talk to almost any part of the world. We can have breakfast in New York and dinner in San Francisco. We can sit in our home and see a baseball game at the time it is being played. We can flip a switch and have light instantaneously. We can break the atom and change the characteristics of materials. We have in our modern Aladdin's Lamp miracles more marvelous than the genii ever dreamed—all the product of technological genius.

These and other technological contributions have increased our national wealth and our standard of living. We are constantly telling ourselves that Americans enjoy the greatest prosperity of all the peoples on this earth. We have more telephones, auto-

* Manager, Customer Relations, Sylvania Electric Products, Inc. Presented Jan. 14, 1949 at the Annual Meeting of the Louisiana Engineering Society.

mobiles, radios, washing machines, etc. per capita than any other country. Our man hour of labor brings the worker a greater purchasing power in terms of material needs—and all this is ours because we have developed the machine to a point where the worker with all this power behind him can turn out more products in less time.

With such an economy you would think that the people of the United States would be extremely happy and contented with their lot. If discontent were to arise you would think that just a moment of reflection on the lot of the worker in England or France or Russia would cause his unhappiness to vanish—well, has it?

Why in this land of plenty, in this land of great personal liberty are some people asking for a change in our system? Why is there so much dissatisfaction?

Somewhere in the Bible it asks, "What does it profit a man that he gain the world and lose his soul?"

History is replete with the rise and fall of nations that developed a civilization in which social values were subjected to material acquisition.

When people feel that they are in a position where they can't do much for themselves, they turn either to government or to mass action. What they lose in individual liberty they feel is compensated for in the greater liberty and strength of the mass.

In this country, workers sense that in mass production they have lost diginity and security. Because the average worker works not for himself but, as an old German, I knew, used to say, "for Mamma and the kiddies," security is a very important thing in the desires of the individual.

Desire for security has lead directly to government interference with the natural laws of economics through the imposition of controls, government spending to make work, social security and unemployment funds, minimum wages, parity prices for foodstuffs, price and wage control,—all of which in peace-time add up more and more to socialism. These are not the temporary controls of a national emergency but are permanent loss of individual liberty, Nevertheless, the majority, judged from their votes at the polls for the past two decades, have been willing to sacrifice individual liberty for security.

We have fallen down somewhere when workers feel it necessary to go to government for assistance. Our vaunted civilization and technological progress are weakened and became vulnerable when the social needs of man are neglected.

In addition to asking government for help, organized labor is taking steps to bring added security either through shorter hours or through a guaranteed annual wage. Here are problems

that need solving. Shorter hours may bring social repercussions that are unwholesome, particularly in large cities. The annual wage challenges management and engineering to find ways to distribute the work load so that people can be kept employed regularly without a feast or famine work system.

Why should it be necessary for workers to turn to government for work? Isn't it possible for industry to provide a balanced job opportunity? What do we know about deferred work that can be turned off and on to iron out the valleys of demand? What programs of sales have we developed to maintain market stability?

In the lighting industry we have such an opportunity in relighting. New devices and new knowledge mark relighting a never ending job. A Planned Lighting Program has been started to accomplish this job. I would like to point out to the lighting engineers that this program properly pursued can provide social values of greater importance than economic values. Dependent upon its success are the thousands of workers in the factories. Their security is not in their own hands but in yours.

What I am trying to say is this—the social concept of employment security is a responsibility that engineers cannot evade unless they are willing to let government take over and lead us further into a controlled socialistic state. Technology has so dominated the economic progress of this country that it cannot default on this phase of our economy without accepting the responsibility for the consequences.

The most simple truths are the most difficult sometimes to comprehend and to accept. For instance, how much better off would we be in our international dealings, and in fact in our every day efforts, if we all adhered to the Golden Rule? Or take the simple truth that Honesty is the Best Policy? What is more fundamental than the Ten Commandments yet how many of them do all of us break more or less regularly?

There is one fundamental social concept that we have neglected too long in our search for efficiency and better methods and machinery, namely, that only people count.

Who is attending these three days of conference? There will be no turbine or insulator or lighting fixture listening to the speakers. Only people are here.

No machine, all by itself, ever made anything! The machine is but a tool to help some person or persons make things. The machine can't think! It can't decide to go on strike or to quit at 12 o'clock or to speed up or slow down! It can't decide to do something different tomorrow! It can do only what some human mind decides it shall do.

No machine ever purchased anything! You can't sell oil to a turbine—even if it were smoking. You sell oil to an operator or an engineer.

No machine ever sells anything! As a tool it may be helpful in making a sale but it still takes a salesman to get the business.

We sometimes think corporations do things but upon analysis we always find that the decisions are made by human beings. We talk about selling an order to a company but we find that what we have done is to sell the purchasing agent or engineer or some one in a position to make a decision to buy.

Our present social troubles started when we began to think that inanimate objects did things, when we forgot the transcendant importance of people.

One of the things the engineer has been responsible for is the concept of labor-saving machinery. What are we saving that labor for? Can we store up the labor we save today as we would store up coal and use it some other day when we have need for it?

The concept of labor-saving is anti-social unless we have some other or better way of utilizing that labor. Like any other engineer I deplore waste. As a nation we have been very wasteful of many things that can never be recovered. Efficiency is essential but when we save labor and do not use it we are wasteful of our most important resource—human occupation.

Our social concept of better tools should not be labor-saving but a more productive employment of human energy. If we take this approach to technological efficiency we will be truly efficient. If we don't we will open the door still further to feather-bedding. Organized labor is not without some efficient tools through higher wages, shorter hours, reduced work load, severance pay, or non-productive employment. Management and engineers have a social responsibility for creating employment. Our whole economy and well being is dependent upon keeping people employed—not on saving labor. It is wasteful to save labor if labor-saving means unemployment.

Technological progress has changed the character of employment in the United States. In our four primary occupation groups —agriculture, forestry, fishing and mining—we dropped in the period from 1910 to 1940 from around 35% of the total to around 20%. In other words, in 1910 one worker in three was employed in primary occupations whereas in 1940 only one in five was so employed. By 1950 the number will be even smaller. This came about in spite of the fact that our consumption of primary produce was greater. The reason, of course, is attributed to better tools.

Most people, I imagine, would assume that the workers so dislocated were absorbed in manufacturing and the mechanical

industries but the figures for the same period show a percentage drop in those occupational fields. In fact the data indicates that the workers who were gainfully employed went into the trade, service and clerical fields—the occupations that are largely non-creative.

The introduction of electricity to agriculture will see this trend greatly accentuated in the next generation and long before this century is over, the primary occupations which were dominatly personal enterprises at the beginning of the century, will have become large corporate enterprises with a diminished occupational opportunity for individual workers. Changing from more than a third of our gainfully employed people in primary industries, where there was a strong feeling of personal liberty and independence, to a fifth or less has had an effect upon our entire social and political structure, which will be more marked in the next two or three decades.

Probably no single technological achievement has done more to give real purchasing power to the workers' wages and thereby improve the standard of living, than the technique of mass production. But the positive economic gains have the opposite reaction socially. Before the era of mass production we had skilled factory workmen who had spent years learning their trade. Back where I came from in New England a machinist spent seven years as an apprentice and helper before he became a journeyman. In that time he knew how to operate every kind of a shop machine and to keep it in good working order. He could read drawings and he could lay out work. Today we train men for some machine operations in just a few weeks.

For the majority of factory operators in mass production all around skills are no longer required. They work at the same thing day in and day out. Thier work is repetitive, monotonous and for the most part so far removed from the finished product that they frequently have little idea of its value. In mass production the individual has little opportunity to feel he is doing something creative. In fact, the average worker cannot see that he has added one iota of his individuality to the parts he is turning out. Obviously under such conditions there is little incentive for the average worker.

We cannot return to the days of craftsmanship and hope to produce enough goods at sufficiently low prices to maintain our standard of living. There aren't enough workers to turn out all we need on a craftsmanship basis. Accepting that situation we should make a more concerted effort to find ways whereby pride of performance can be reestablished. Obviously there is little that can be done to make a screw machine operator swell up with pride

over the output from the bank of automatic machines he is operating. There must be some other pride, such as group achievement. For instance, I would imagine that men working on a Cadillac would have more pride of work than those working on a Chevrolet. The problem is to get those working on a Chevrolet to take pride in turning out a better car than the Ford. It's the old team spirit.

Pride is one of the strongest human motives. It provides more incentive than money for a great many people.

Another unhealthy social condition that has arisen from mass production is the loss of human dignity. People at long benches or at machines producing or assembling the same things all day long, each doing the same thing as his neighbor, soon lose the feeling of individuality and acquire the frustration that comes from being a mere economic abstraction. The essence of mass production is repetitive sameness but the human being is not a machine and when we try to make him act like a machine we run into social inertia.

Man does not live by bread alone. His personality must be nourished or his whole self is lost. We make a mistake when we treat labor as a mass commodity, as so much steel or coal. The moment we do, we get away from people as persons and then we find ourselves faced with mass organizations with a collective personality and with enormous strength.

Sometimes we are fooled by the demands of organized labor for more and more wages. Higher wages, however, are merely a tangible, measurable way of expressing dissatisfaction. The workers don't know how to bargain collectively for dignity, individuality, pride of workmanship and general spiritual well-being. They do know how to bargain for income and security.

Management must find a way to restore these social values that were lost with large scale production processes. We think in Sylvania, we have found part of the answer through decentralization. We now have some 21 or 22 plants in operation with two more to go into production this year. For the most part they are located in small communities and seldom employ more than 500 operators each.

Each plant manager runs his plant within the general policy rules of the Company pretty much as though it was his own business. He is responsible not only for the plant earnings record and cost of operation but also for the morale of his people and for the local standing of the Company.

Being in small towns, management and people live close together without class distinction. They belong to the same social groups, go to the same churches and their children to the same schools.

Operators know what is going on in the plant. They know more about the objectives of the local manager and liking him and feeling a part of something they have a pride of performance.

With small compact operations such as decentralized plants there is a Jim and Bill attitude—not that guy over in the next aisle. The manager is Jim and says, "Hello, Bill" to the fellow running a lathe. In one of our plant towns an operator happens to be mayor. Many of our people are engaged in community enterprises and have a social standing in their community. Under such conditions people feel and act like individual human beings.

Let me tell you about one of our small plants in Pennsylvania where radio reciving tubes are made. The girls wanted bright dimity curtains and asked for permission to buy them. Those curtains were merely a way of expressing certain social desires. The girls wanted to work in surroundings that didn't say factory quite so plainly. Of course, we purchased the curtains and if you ever go to Brookville you will see a factory with dimity curtains at the windows.

We have found that decentralization, which takes work to people in areas where they live rather than uprooting people and bringing them to some large industrial center, is a potent means for restoring diginity and individuality to the workers. The social aspects of such a program have tremendous values for the human beings employed in such plants.

One manifestation of social dissatisfaction is the increasing tempo to the questioning of the right to individual wealth. This, of course, is found principally in communist propaganda. Capitalism is criticized as the root of all social evil.

A second manifestation of the same unrest is the questioning of the size of the profit and the right of the owners' of the business to retain that profit. Wage demands are based not on merit but on the ability to pay. Labor leaders are urging higher taxes on the profits of industry.

A good diagnostician might discover several causes of this unrest but none more important than the feeling of frustration. When people work for small outfits you don't find as much of this kind of dissatisfaction although their wages, in a great many instances, will be less than those paid by the larger companies.

The reason is not hard to find. In the small operations the workers know what is going on. They know that capital has a meaning and that when there isn't enough, work is held up. They know that profits are plowed back making for more jobs opportunities and greater security and stability to employment.

What they know in the small operations, the workers in the large operations want to know. By taking them into management's

confidence there should be less unrest and more conscious effort to improve productivity.

Just because people work with their hands and have not had the advantage of formal college education and frequently of high school even, is no reason for attributing radical ideas to them. Workers in general have a pretty good sense of values. If they follow certain leaders it is because they feel they will gain more advantages. Workers still look up to the boss. They look to him for leadership. Too often he is to buy with economic matters to give human considerations the time and attention they must have.

When workers feel neglected and turn to less conservative leaders, management should not berate them but should take steps to mend its own ways. We may win the battle of economics but if in so doing we lost the battle of social accomplishments, we have lost all. It alone is enduring.

ENGINEERING BRIEFS

Birth of a Fiber. Plans for large-scale production of the new synthetic fiber, "Orlon," long known as the experimental "Fiber A," have been announced by duPont. Construction of a new plant to make the fiber in Camden, S. C., will start in March, 1949, and be completed within 18 months. Orlon is expected to be more expensive than nylon, and to be used at first in specialized applications which require its exceptional durability. General use, in the hundreds of millions of pounds, may be attained ultimately, but little immediate effect on established fibers is expected. Repercussions will more likely be felt in the synthetic-rubber industry, for Orlon production may make the raw material for oil-resistant synthetic subber less expensive.

Unlike wool, cotton, or rayon, the all-synthetic fibers generally absorb little or no moisture, and therefore are nearly as strong when wet as when dry. Orlon is similar to nylon in its strength and lightness, and is outstanding in its resistance to sunlight, mineral acids, and exposure to elevated temperature. These properties, as well as resistance to attack by insects and fungi, show promise for such products as awnings, automobile tops, sails, filtration fabrics, and household curtains.

Even though these applications are interesting and essential, the total volume of Orlon absorbed by such specialized uses would be relatively small. The biggest obstacle to widespread use is the difficulty in dyeing the fabric with colors that are lightfast. Appreciable amounts of Orlon will probably not be available until 1951, however, and technological developments during that time may have overcome this problem.

Effect of new fiber. All-synthetic fibers, now almost entirely nylon, account for only one per cent of the over-all textile usage, which last year consumed over seven billion pounds of fibers in the United States. Although Orlon will not have an immedate effect on cotton, which supplies fiber for 70 per cent of the total textile and cordage products, several of the new fiber's advantages make it a potential threat. Its non-absorbent quality facilitates cleaning, since dirt does not become embedded in the fiber. Unlike nylon, which is cold when dry and slippery when wet, Orlon is warm to the touch. It drapes well and does not retain wrinkles, both important to apparel and household applications.

Besides its effect on the textile industry, the advent of Orlon may be important to developments in synthetic-rubber production. Orlon's raw materials, a class of compounds known as acrylonitriles which are derived from natural gas, petroleum, or acetylene, are also used in the oil-resistant synthetic rubber popularly called

Hycar, Perbunan, Butaprene, or Chemigum. Because oil-resistant rubber cost more than the plentiful general-purpose synthetic, GR-S, it has been limited largely to applications requiring its special properties, as in self-ealing gasoline tanks. Large-scale production of Orlon may imply a cheaper process for acrylonitrile, which could lead to more general use of acrylonitrile rubbers.—Industrial Bulletin of Arthur D. Little, Inc.

Exploration Today. New prospecting methods are helping to alleviate the war's inroads on the mineral resources of the United States and nearby areas. Most used of the new prospecting tools is the airborne magnetometer, which can cheaply survey a vast area for geologic conditions necessary for concentrations of some minerals or petroleum. In other ways, too, the airplane itself is a valuable prospecting tool. Geochemistry offers a promising new approach to future prospecting, and today's uranium bonanzas are found with instruments previously confined to the physics laboratory.

Use of these new techniques is part of a general effort by Government and industry to prvoide for future minerals demands; other parts are intensified conventional geologic search and development of more efficient recovery methods, which permit use of lower-grade ores. Considerable success has already been attained. New finds in the Caribbean have outstripped wartime consumption of aluminum ore. That part of the Labrador deposits already proved replaces all of the iron ore taken from the Lake Superior region during the war, while new beneficiation techniques extend present reserves. Iron ore from both these sources will cost more, but not prohibitively. New finds of copper ore plus extensions of previous reserves have kept ahead of consumption, although a third of our copper is imported. Zinc resources have stayed about even, while new discoveries of lead have hardly offset the depletion of known districts. The United States is still short of manganese, chromite, and tin, but well supplied with nickel, titanium, molybdenum, mercury, and silver.

Most of the last decade's finds were made by traditional methods, and these will continue important, but the newer tools will greatly improve the prospectors' lot. The airborne magnetometer grew out of wartime research in submarine detection. It measures local changes in the earth's magnetic field caused by a submarine, or, for geologists, by magnetite, which is an indicator mineral for specific conditions that are necessary for the formation of other, more valuable, minerals. The instrument is used for broad surveys which direct prospectors to likely areas. Prewar surveys were made with the magnetometer on the ground, but making the instrument sensitive enough for airplane use cuts the survey cost, formerly up to $200 or more per linear mile, to $10 to $15. In the

Americas and Africa, 500,000 square miles have already been surveyed by airborne magnetometer; finds include the world's greatest titanium deposit, located in eastern Quebec.

The most important use of the airborne magetometer is in petroleum exploration, where pools are often thousands of feet underground. A recent survey of 85,000 square miles over the sea near the Bahamas used Shoran radar to record the path of the survey plane.

The use of the airplane in exploration has been extended, not only for access to remote areas, but also for use in topographic mapping and in actual search. When the reserves of aluminum ore in this country began to look critically low during the war, an exploration party started out to find bauxite by airplane after geologic reasoning had suggested searching for an elevated plateau with a topography indicating limestone, in a tropical climate, and with red soil. The right combination was found in Haiti and the reserves of bauxite subsequently located restored this country's aluminum resources to a strong position.

Promising results have come from "biogeochemical" prospecting. Some plants concentrate trace metals in their leaves, and thus may indicate mineral deposits beneath their soil. Plants in a British Columbia copper mining district carry an average of ten times as much copper as those in a neighboring district with no copper deposits; in some species, such as green alder and devil's club, the increase was 50 to 100 times. A similar, but less marked, relation to zinc deposits has been noted. An investigation of traces of metals in plants, waters, and soils, as a means of prospecting, is now in progress under the direction of the U.S. Geological Survey. This program includes development of simple analytical tests with which a prospector can follow increasing metal concentrations in his search for buried ore deposits.

The most intensive use of new exploration technology is in seeking uranium. The Atomic Energy Commission's bonus of $10,000 for discovery of a new uranium deposit and the increased value of uranium encourage extensive prospecting, especially in Utah and Colorado. Gamma-ray counters to locate deposits may be carried by a man or in jeeps, or even in helicopters. Although gamma radiation is cut in half by passing through two inches of rock, it is often possible to locate uranium several feet under the surface. When the radio-active material is exposed, the radiation may be picked up from several hundred feet above. Specially designd counters are lowered into drill holes to locate underlying strata.

With xploration at a high pitch and a number of companies supporting basic research in this field for the first time, many geologists see a reasonable hope of providing, in the long run, for the nation's enlarged appetite.

MINUTES OF MEETING OF THE BOARD OF DIRECTION HELD AT TULANE UNIVERSITY JANUARY 20, 1949

The meeting was called to order by President Lehmann, with Messrs. Abrahm, Cucullu, Hill, Mire and Fernandez present. Minutes of the preceding meeting was accepted as read.

The secretary announced that all applicants for membership named in the December ballot had been elected.

A communication from the New Orleans Section, A.S.C.E., concerning the cost of the registration act, was read and the secretary was instructed to reply to same.

An application for reinstatement submitted by Mr. B. L. Kiernan was accepted.

Resignations of the following were accepted with regret: Elmer W. Ruhnow, A. W. McDougall, Walter C. Young, J. M. McQueen, Glenn N. Cox, H. A. Marcoux, F. T. Carroll.

A letter from Mr. Clayton M. Beamer, a member of the society residing in New Jersey, in which he expressed appreciation of his membership, was read.

The following members were dropped for non-payment of dues: Raymond I. Allen, Carlisle Davidson, Salvador Maffei, Olney R. Neal, C. A. Richards, Harold A. Rosen, C. Morrell Supplee, Jr., Rodney M. Vincent, Frederick W. Weissborn.

Mr. E. M. Freeman was appointed chairman of a committee of his own choice to prepare the obituary of our late member, Algeron F. Flournoy.

Mr. Mire moved that the President and Secretary be authorized to sign checks drawn in 1949; seconded by Mr. Abrahm and carried.

Mr. Hill moved that the Secretary be authorized to have access to the safety deposit box in the Whitney National Bank; seconded by Mr. Cucullu and carried.

Mr. Mire moved that Mr. Arthur M. Hill be appointed Editor of the Proceedings for 1949; seconded by Mr. Abrahm and carried.

The following State Contact Representatives were appointed: Hiram R. Mason, 3rd Congressional District; Ernest M. Freeman, 4th Congressional District; Roy T. Sessums, 5th Congressional District; Leo M. Odom, 6th Congressional District; Ray E. Burgess, 7th Congressional District, and Soule Butler, 8th Congressional District.

The following standing committee chairman were appointed for 1949:

Technical Papers, James S. Janssen; Annual Outing, Robert P. Lockett, Jr.; Finance, Frank W. Macdonald; Membership, Lewis B. Gay; Professional, Civic and Industrial Affairs, R. A. Steinmayer; Publications, J. M. Guillory; Publicity, Allen W. Betz; Legislative, C. Glenn Cappel! Housing, David W. Stewart; Employment, Raymond P. Bassich; Student and Jr. Activities, O. W. Stephenson, Jr.

The Secretary was instructed to thank the Membership Qualifications Committee of 1948 for its splendid service to the Society.

The matter of entertainment at the annual outing was discussed, and it was the opinion of a majority of the board that this should be eliminated.

Mr. Cucullu moved that the secretary be authorized to employ a Certified Public Accountant to audit the Society's books for 1948, seconded by Mr. Hill and carried.

The secretary announced that the Lake Charles Section would hold its annual meeting on Tuesday, February 1 and that members of the board were invited to attend. It was also reported that the establishment of a section of the Society at Shreveport was well under way through the efforts of Mr. Ernest M. Freeman of that city.

The secretary reported that there also was the prospect that a student chapter would be formed at Louisiana Polytechnic Institute.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Sec.-Treasurer

Minutes of Annual Meeting of the Louisiana Engineering Society held January 13, 1949 at the St. Charles Hotel

The meeting was called to order by President Leake, with approximately 130 members and guests present. Reading of minutes of the preceding meeting was dispensed with. President Leake welcomed all those present and introduced officers of the various engineering groups participating in the annual meeting.

Mr. Jeffrey H. Collins, Sr., General Chairman of the Annual Meeting, introduced the kepnote speaker, Mr. Mike M. Mora, Director, World Trade Development Committee, International House, who gave a most interesting and instructive address on "World Trade and Its Impact on Louisiana."

Annual reports on membership and finance for the year 1948 were presented by the secretary-treasurer, and these were followed by the annual report of the retiring president (published in February issue of Proceedings).

Mr. Lionel J. Cucullu introduced resolutions thanking the St. Charles Hotel, Johns-Manville Corporation, and the Board of Port Commissioners for their generous cooperation in behalf of the annual meeting, and moved that these resolutions be adopted. The motion was seconded by Mr. James M. Todd and carried.

Merit certificates were presented to the following students who delivered papers at the Student Conference Committee:

Lynton B. Irish, Louisiana State University; John O'R. Breeden, Southwestern Louisiana Institute; George C. Briley, Louisiana Polytechnic Institue, and Tulane University.

It was announced that Student Membership Awards had been presented during the year to the following for having completed their Bachelor's Degree in Engineering with highest scholastic honors in their respective schools:

John W. Baxter, Louisiana State University; Surey R. Slovenko, Tulane University; William T. Turner, Jr., Louisiana Polytechnic Institute.

Life Membership Certificates were awarded to the following:

John H. Bernhard, Shirley C. Braselman, Charles J. Wyler, William F. Oakes and T. Baker Smith.

Dean Leo J. Lassalle then presented a certificate of Honorary Membership in the Society to Professor Boykin W. Pegues, and President James M. Todd of A.S.M.E. presented a similar award to Dean James M. Robert.

President Leake presented a charter to the newly organized Southwestern Louisiana Institute Student Section of the Society, which was accepted by its president, Val D. Breaux.

Announcement of other highlights of the meeting were made by the secretary.

Mr. Clayton L. Nairne then gave the Teller's Report, requesting the following gentlemen to escort the newly elected officers to the rostrum:

Prof. R. A. Steinmayer, escorting Ernest L. Mire, standing member of the Board of Direction with one more year to serve;

Mr. Charles M. Kerr, escorting F. Tackett Clarke, standing member of the Board of Direction with one more year to serve;

Prof. A. L. Dunlap, escorting Arthur M. Hill, Board member elected for 2 years;

Mr. David W. Stewart, escorting Michael C. Abrahm, Board member elected for 2 years;

Prof. Frank W. Macdonald, escorting John P. Fernandez, Secretary-Treasurer;

Dean L. J. Lassalle, escorting Harry P. Newton, Second Vice-President;

Mr. Karl P. Kammer, escorting Lionel J. Cucullu, First Vice-President;

Mr. Norman E. Lant, escorting Herman L. Lehmann, President.

Retiring President Leake then handed the gavel to President-elect Lehmann, who accepted the office.

Mr. Todd announced that he would like to see an annual award made to the engineer whose efforts in behalf of civic progress were most noteworthy during the year.

Following this, the meeting adjourned.

JOHN P. FERNANDEZ, Sec.-Treasurer

Minutes of Meeting, Baton Rouge Section, Louisiana Engineering Society, Wednesday, February 23, 1949.

The meeting was called to order by President Wallace in the Biology auditorium with 1st vice-president, A. J. Mary, and sec'y-treasurer Louis Duclos, and approximately 100 members and guests present. Members were called on to introduce their guests. Members of the Senior Civil Engineering class of Louisiana State University were the special guests of the Section. Mr. H. L. Lehman, President of the Louisiana Engineering Society was present and spoke briefly.

A motion to dispense with the reading of the minutes and the treasurer's report was carried unanimously.

President Wallace requested the secretary to read a letter from the Gulf States Utilities Co., inviting the members to attend the "House of Magic Show" to be given February 25, 1949 by the General Electric Co. at the Baton Rouge High School Auditorium.

There being no new or old business to come before the Section, President Wallace introduced the speaker of the evening, Lieut-Col. Alvin R. Moore, Asst. District Engineer, U. S. Corps of Engineers, New Orleans District. Lieut.-Col. Moore gave an illustrated lecture on "Foundation Investigations of the Veterans Administration Hospital in New Orleans."

There being no further business the meeting was adjourned with a rising vote of thanks to the speaker.

LOUIS DUCLOS, Sec.-Treasurer,
Baton Rouge Section, La. Engineering Society

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

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CONTENTS

EDITORIAL NOTES AND COMMENTS

Our Front Cover. The ten-million-dollar Veterans' Hospital, now under construction in Shreveport, Louisiana is expected to be completed early in 1950.

Located on the Fort Humbug Bluff overlooking the Red river, the 450-room hospital will be visible for miles and will offer its veteran patients a spectacular view.

In addition to the main building, which will reach ten stories above Fort Humbug, there will be a boiler house and garage building, male attendants' quarters, nurses' quarters, two resident doctors' duplexes, a manager's residence and related roads, walks, parking areas, fences and utilities, including a 300,000-gallon water storage reservoir.

Groundbreaking ceremonies for the structure—the largest construction project in Shreveport's history—were conducted on December 10, 1948.

—"The Shreveport Magazine"

Architects, Neil and Somdal; Structural Engineers, E. M. Freeman and Associates; Mechanical Engineers, Reg. F. Taylor. Construction is under the direction of the Corps of Engineers, U. S. Army.

The Shreveport Section. Mr. E. M. Freeman, 4th Congressional District Contact Representative met with the Board of Direction of L. E. S. on May 9. He presented such documents and signatures as were necessary to establish a section of the Society in Shreveport.

The formation of these branches signifies an ever widening interest in the activities of the Society, and increases the prestige of the organization in strategic areas of the state.

Our Shreveport section is the third to be formed; Mr. Freeman and the engineers working with him on this project are to be complimented in their endeavor. The other two sections are at Baton Rouge, and Lake Charles.

Industrial Development in Louisiana. The audience at the May 9 meeting displayed keen interest in the able presentation of the industrial picture in Louisiana. Mr. R. A. Cuyler, Industrial Sales Manager of the Louisiana Power and Light Co. spoke from personal experiences and observations gained by travelling the length and breadth of the state. The prospects for continued industrial expansion in the state seem most encouraging.

Our New Crop of Engineering Graduates. Engineering schools throughout our state are graduating a bumper crop of engineers this June. It is to the advantage of the south to keep these boys in the south. In most cases they are our native sons, and their education has been paid for with southern funds. This is one "crop" we should not export.

State Board Registers Record Group of Civil Engineers. At the May meeting of the Louisiana State Board of Engineering Examiners a new record was established in the number of Civil Engineers registered at a single meeting. At this meeting 95 applicants for registration in civil engineering were considered. Included in this group were 44 from the graduating class at Louisiana State University and 27 from Tulane University.

L. E. S. Student Chapter at S. L. I. The eighth annual "Engineers' Ball" was held on April 22, 1949. The Ball, given for the student body, was sponsored this year by the L. E. S. Student Chapter of S. L. I. In the past this event was sponsored by the Engineers' Club which the L. E. S. Student Chapter has replaced.

The "Engineers' Ball," this year as in previous years was unique in that it provided not only dancing but also a display of interesting and entertaining gadgets such as, an "oomph machine" for the ladies, strength and torque machines for the men, a con-

tinually flowing faucet with seemingly no supply pipe, a working model of an oil drilling rig, a model suspension bridge over which all guests passed, plus many other exhibits. The purpose of the gadgets and exhibits was twofold; first, to demonstrate the foolishness and inventiveness which can be produced when a group of engineering students get together, and second, to provide entertainment for the guests while they were not dancing.

During the intermission the following newly elected officers, to serve during the forthcoming school year, were introduced to the audience; President, Charles Negley; Vice-President, Dewey Billodeau; Secretary, Richard Johnson; Treasurer, John Pere, and Reporter, Elmo Russell.

The highlight of the evening was the presentation of the Engineer's Sweetheart to the student body. The members of the chapter chose Miss Marjorie McKay of Bogalusa, a senior in the College of Education, as their sweetheart. She was presented to the student body by Dean G. G. Hughes of the College of Engineering. A miniature locomotive, christened "The L. E. S. Unlimited, No. 13", pulling a green and white float, on which Miss McKay was riding, circled the floor twice before stopping in front of the band stand, where the "Sweetheart" was met and presented to the audience by the Dean.

At one moment of the evening a large mass of balloons was released from the ceiling to float down on the dancers. These balloons were suspended from strings stretched across the ceiling, in such a fashion that they fell singularly and precisely in their designated areas.

The response received from the large appreciative audience was indicative of the wonderful time enjoyed by all.

PAPERS AND DISCUSSIONS

CONSTRUCTION OF FACILITIES FOR OFFSHORE DRILLING

BY JACK S. TOLER*

During the past three years the petroleum industry has shown an increased interest in the exploration and development of the potential oil producing structures underlying the Continental Shelf off the coast of Louisiana and Texas. With this development, many new and unusual problems of design and construction have been presented to the engineering profession and the solution of these problems has required the knowledge and skill of many of our most capable engineers in the fields of research, design and construction.

For many years, marine operations have been conducted in the inland bays and waters of the Gulf Coast. However, these operations have been in comparatively shallow and protected waters and the conventional piling and barge type foundations have sufficed. The present area of offshore development in the Gulf lies generally along the coasts of Louisiana and Texas from the Mississippi Delta, west of Freeport, Texas, and extends as far as 30 miles from shore in water depths up to 65 feet. The depth of water, soft soils underlying a great portion of this area and exposure to tropical storms and hurricanes has required that greater consideration be given to longer unsupported pile lengths, deeper penetrations of pile and greater horizontal loads from wind and wave forces than previously used in marine drilling foundations.

In 1946 the Humble Oil & Refining Company's interest in offshore drilling was intensified and plans made to develop a number of prospective areas on the Continental Shelf. During the past 13 months marine drilling platforms have been erected at ten locations and contracts have been awarded for three additional platforms, one of which is nearing completion. These platforms vary in size from a 46 x 70 foot single deck, one well island used in conjunction with a converted LST vessel to the 110 x 206 foot double deck platform erected eight miles southeast of Grand Isle, Louisiana, designed to accommodate all facilities required to drill seven wells.

During preliminary planning, exhaustive studies were made to determine safe criterion for design of platforms to withstand the large lateral loads imposted by wind and wave forces and to support the heavy drilling loads.

Dr. W. H. Munk and C. J. Burke of the Scripps Institute of Oceanography were engaged to advise on the possible forces to be

* Assistant Division Civil Engineer, Humble Oil and Refining Co., Louisiana Division. Presented at Annual Meeting of the Society, January 15, 1949. Session sponsored by Louisiana Section, A. S. C. E. and Louisiana Post, S. A. M. E.

expected from hurricane waves and winds. Their studies indicated that a maximum wave height of 32 feet with a five foot storm tide could reasonably be expected at our various locations. For this wave height, they have estimated that the total force on a one foot diameter cylindrical pile would be 12,400 pounds. This is four to six times as large as the force that would be exerted by waves in water less than 30 feet or more than 60 feet deep, the range of depth within which our platforms are being erected.

At the beginning of Humble's offshore operations there were no reliable data available concerning the character of the soil below the floor of the Gulf. Therefore, it was necessary to conduct extensive foundation studies throughout the area to determine the most economical and practical type of foundations to use for support of the heavy drilling loads.

During the winter of 1946 and summer of 1947, 23 inch and 24 inch OD tubular steel test piles were driven in the Gulf at ten prospective platform locations. Seven core test holes were drilled at various points on land extending from Tiger Pass, west to Timbalier Island. Another core test was drilled from a platform constructed on the 24 inch test pile driven near the site of the large drilling platform erected off Grand Isle. The test piles were driven to penetrations up to 165 feet and core tests drilled to depths up to 400 feet. Undisturbed soil samples were extracted from the core holes for testing in the laboratory to determine the shear strength and other characteristics of the foundation bed at the locations.

Laboratory tests and analysis were made under the direction of Prof. Raymond F. Dawson of the Engineering Research Section of the University of Texas. Unconfined compression tests were used to measure the shear strength of the soils and consolidation tests were run to aid in determining the probable maximum settlement that could be expected. Other tests to identify and catalogue the soils were also made. The results of these tests correlated with the test pile data gave a fairly reliable average picture of the character of the soil below the Gulf floor over the wide area. These investigations revealed that no firm bearing stratum is located near the surface; that the soil formation, except for surface variations, consists of a soft silty clay having a comparatively low shear strength and extending down to depths of 200 feet or more. This data indicated that the most suitable type of foundation would be of friction piles which would have to be driven to unusually deep penetrations to support the heavy loads. An average shear strength based on the soils test data was used as a criterion in determining the penetration required for the friction piles under the design loads.

Many different designs proposed by various engineers and contractors have been considered and several designs have been developed by the Civil Engineering Division of the Humble Com-

pany. A design developed by the W. Horace Williams Company, engineers and contractors of New Orleans, was selected. This design has been planned to permit the maximum amount of prefabrication on land and to hold erection time off shore to a minimum. The substructure or foundation consists of a number of prefabricated tubular steel jackets or templets through which steel H-bearing pile are driven to support the superstructure and drilling loads. The templets, which furnish lateral support for the piles, are fabricated with four 16 inch pipe legs braced together with 6 inch pipe diagonal and horizontal members. They are made 10 feet square and of length to extend from 10 feet above Mean Gulf Level to well below the mud line.

The templets, spaced on 30 feet 2 inch centers to match derrick substructure dimensions are braced to each other at their tops by pin connected 8 inch pipe struts. The poles, with cut-off elevation of approximately 29 feet M. G. L., are cross-braced to each other by diagonal tension rods extending from the top of the templet to the top of the pile so that the four pile of each tower act as a unit. Design of the pile caps and deck beams with the 8 inch pipe struts and tension rods provide for portal action of the pile and templet units.

The 10 inch 57 lb. steel H-bearing pile are made up in three sections to make a total length of 280 feet and as a general practice are driven to a penetration of 185 feet to develop an ultimate bearing capacity of 200 tons per pile. In the large platform off Grand Isle, the piles were driven to penetrations ranging from 154 feet to 196 feet depending upon the design pile loads. The pile sections consist of one 120 foot lead section followed by three 53 feet 4 inch sections. Early design made use of a bolted splice connection with splice plates and bolt holes pre-matched in fabrication. However, difficulty was encountered in making the bolted field splice due to slight deformation of the top of the pile sections in driving. A welded connection is now being made to develop the full strength of the pile and bolted splice plates are used as construction aids only.

The superstructure is very simple in its detail and consists of a treated timber deck on rolled cap and deck beams. All members are cut to exact lengths in the fabrication yard reducing cutting work at the job site to a minimum. The caps are made up of 24 inch 76 lb. WF beams with portals of the same size beams between each pair of caps on piles in the same templet. As a general practice, cap sections consisting of two cap beams and connecting portal beams are prefabricated on land to the required length and set in place in one lift. Deck beams of 12 inches by 36 lb. WF beams extend across the caps and are spaced as required to support the deck loads. Except for pin connected pipe and rod braces between the templets, the design provides for all welded construction.

The basic features of design and construction outlined above are readily adaptable to varying types of rig layouts and well platforms and provide standardized, salvageable structural units which can be used to provide a foundation of any desired size or loading capacity. The same basic detail of foundation and superstructure has been used by Humble in platforms varying in size from a large double deck platform built to accommodate seven wells to single deck islands designed to accommodate a single well.

The largest marine drilling platform constructed to date in the Gulf is the 110 x 206 foot double deck drilling platform constructed by the Humble in the Gulf of Mexico about eight miles southeast of Grand Isle, Louisiana. Construction was performed during the winter months with unfavorable weather prevailing during a great portion of the construction period. A total erection time of 107 days was required of which 17 were lost due to rough seas.

Approximately one acre of floor space accommodates all facilities required for the operation of the largest and most powerful drilling rig assembled by Humble. Significant design features include: Total dead and live load of 10,000,000 pounds; combined wind and wave loads totaling 1, 500,000 pounds; 100 steel piles in lengths up to 270 feet to carry loads up to 126 tons. Uniformly distributed deck loads vary from 100 pounds per square foot in parts of the living quarters to 1,000 pounds per square foot in mud storage areas. As constructed, seven wells can be drilled to depths of 15,000 feet and modifications have been planned to drill four additional wells. Living quarters and mess facilities are provided for 54 men.

Because of the high cost involved in construction of large drilling platforms with complete accommodations for wildcat operations, smaller single deck platforms have been adopted for use in conjunction with converted Navy surplus LST's. Three different size platforms, all of the same basic design and construction as previously described, are being used with success in our operations. These include 46 x 70 foot single well platforms, 50x 100 foot three well platforms, and 50 x 150 foot three well platforms. Pipe storage space has been eliminated on the first two size platforms listed. These platforms support the derrick, engines and drawwork, one mud pump and storage tank, 250 barrels of fresh water storage and a 14 x 20 foot emergency crew quarters.

For economy in construction, careful consideration should be given by offshore operators to the type of construction equipment selected by the contractors on their work as well as to the contractor's ability to maintain the highest possible efficiency in operations. Construction equipment must be stable and seaworthy, and able to operate under all weather and sea conditions except severe

storms and gales. The work must be planned with skill; executed by qualified supervisors and workmen, and the flow of supplies and materials well coordinated to prevent costs delays in construction. High rental costs of sea going construction equipment, tugs and barges make delays extremely costly whether due to bad weather, poor job planning or inefficiency, and these high costs will be borne eventually by the operator under any type of contract arrangement. It has been our experience that it is poor economy to engage at a low rental rate, construction equipment that would operate under normal sea conditions to perform a seemingly simple operation. Unexpected adverse weather and seas frequently prevail in the Gulf and we have found that job costs might be several times to cost had more seaworthy equipment been used, at a higher rental rate.

A converted LST vessel used by one contractor in construction of drilling platforms for Humble has proved to be particularly adaptable for this type of work. Because of its size and stability, work has been carried on in much rougher water than would have been possible with a smaller vessel. The use of two cranes, one of 50 ton capacity and the other of 25 ton capacity, both mounted on the LST, increases the efficiency of construction operations considerably. LSM vessels, stripped and converted to sea going barges, have been used to transfer material, equipment and supplies from the contractor's yard in New Orleans to the job site as needed.

Combination lump sum and cost plus fixed free contracts have been used to relieve contractors of the risk and cost of the marine construction operations. The lump sum price for material, fabrication and loading has converted conventional construction work on land and permitted competitive bidding. The fixed fee covers the contractor's fee and equipment rental for the erection of the platform offshore. Direct cost of labor, transportation and supplies for field erection are borne by Humble. This type of contract arrangement has worked decidedly in favor of the operator as he assumes the risks of increased costs due to unavoidable delays eliminating this element of cost from the contractor's fee.

Another problem which confronts the engineer in connection with offshore drilling is that of accurately locating the drilling or platform location. Unlike most areas on land which have been subdivided, the leased tracts in the Gulf of Mexico have not been marked by corners or monuments but are described by their State Lambert Grid Coordinate values. The coordinate values can be correlated with know geodetic positions established by the U. S. C. & G. S. stations along the coast of Louisiana in 1935.

Many of the U. S. C & G. S. Stations have been obliterated by storms, high tides and shifting islands and in many instances it has been necessary to relocate these stations before platform loca-

tions can be projected offshore. The relocation work is done by conventional land transit parties using three-point method.

Both conventional land methods and Shoran survey methods are used. We have found that during the greater part of the year the transit surveys are costly and time consuming because of bad weather, poor visibility and rough seas. As an example, during the winter of 1947 and 1948 the cost of making two locations by this method was $15,000 and required the use of a survey party for a period of approximately three months. On many days, the weather would be clear, but by the time the crew arrived at the site of their location, have or rough water would prevent their working. Contract Shoran survey equipment was then engaged and in approximately three weeks time, at a cost of $15,000 with the same weather conditions prevailing, fifteen buoys and rig positions were located. The cost of this type of equipment ranges from $650 to $700 a day for the necessary boats, personnel and equipment, as compared to the cost for a transit survey party with boats of approximately $200. The accuracy of the Shoran method is well within that required in this type of operation.

The design of suitable moorings for the drilling ST's presents a problem of major proportions to offshore operations. Several different types of conventional anchors including the Navy Stockless and Danforth anchors have been considered by the Petroleum Engineering Division of Humble. A fixed mooring system designed to hold the ST in position broadside to an 80 mile per hour wind with a 5 knot current has been developed and has proven very satisfactory. This consists of two inch Di-Lok anchor chain connected to seven spud piles or dead men driven in positions varying from 295 to 667 yards from the vessel. A Danforth anchor is connected to the starboard bow line at a distance of 667 yards from the vessel to provide an emergency storm anchorage. The spud piles are built up of 10 inch, 57 lb. H-bearing pile sections 80 feet in length and are driven to a penetration of 110 feet. The pile to chain connection is made at a point 30 feet below the top of the pile, thus providing a dead man type anchor. All connections are designed to withstand an ultimate load of 450,800 pounds, the breaking strength of the chains.

Each phase of operations of the petroleum industry presents new problems in the field of engineering, the solution of which requires a considerable amount of foresight and planning.

There is no one type of platform that is feasible or economical for all locations, or conditions and each requires a separate analysis due to foundation conditions, drilling practice and program, position in the Gulf and depth of water. There will be continuous research by all operators to develop more economical designs and construction methods.

DEVELOPMENT OF NEW PLASTIC PANELS FROM WOOD

BY ROBERT M. BOEHM*

The development of Masonite hardboard products is now generally familiar but a brief description of the process and of the particular place in the industry which these products occupy will serve to show the role played by the different constituents of the woody material and the development of plastic characteristics which make the production of new types of products possible.

To begin with, although the Masonite operations depend on wood as a raw material, from a technical standpoint, any fibrous lignocellulose material has essentially the same constituents, in essentially the same proportions and therefore other naturally occuring raw materials such as the canes, cornstalks, straw and the like can, at least theoretically, be placed in the same category.

Wood, after removal of extractives, such as turpentine, rosin, tannins and the like, consists of cellulose, comprising about one-half of the wood substance, and lignin and hemicellulose, comprising about one-fourth each. Cellulose makes up the fiber structure, sheathed with and cemented by lignin, woods natural binder. The hemicelluloses, which are the precursors of the wood sugars, are dispersed throughout the Lignocellulose structure. The cellulose fibers are essentially all aligned in the same direction, that is, parallel to the trunk of the tree, which gives wood its high strength with the grain, but its very low strength and high swelling and shrinkage across the grain.

In the manufacture of paper, the lignin is largely dissolved out by the action of strong chemicals, either acid or alkaline, leaving the cellulose fibre, more or less pure. When these fibers are felted and dried, a secondary bond is set up in the absence of lignin, resulting in the familiar paper structure. It should be pointed out here, that this bond, of the so-called "paper-type" lacks the high water resistance of the "lignin-type" bond and consequently is low in strength when wet.

In the Masonite process, the wood fibers are separated without removal of the cementing lignin and, due to the high temperatures involved, a hydrolysis takes place which "reactivates" the lignin and prepares it to again assume its function of high wet strength binder when the fibers are consolidated under the proper conditions of temperature and pressure. This is accomplished by charging wood chips into a high pressure autoclave or "gun", where they are treated with saturated steam under pressure of up to 1200

* Director of Research, Masonite Corporation, Laurel, Miss. Presented on April 11, 1949 at a joint meeting of the New Orleans Chapter, Society of Plastics Engineers, and Louisiana Engineering Society.

pounds per square inch. This softens the ligin cementing agent, while organic acids developed from the wood itself act on the hemicellulose fraction and prepare it for subsequent removal.

At the end of the steaming cycle, which is less than a minute, a hydraulic valve is opened and the wood chips leave the gun, exploding into a fluffy mass of brown fiber. The steam is separated from the fiber in a cyclone, and the latter is suspended in water, from which the hemicelluloses are removed on countercurrent vacuum extractors. The fiber is then refined and screened to remove oversize bundles, following which it is formed into sheets on a modified Fourdrinier forming machine, where excess water is removed by drainage, by suction boxes and by press rolls.

In the manufacture of the familiar Masonite Presswood, these sheets or "wet-laps" are charged directly into multiple opening, steam heated hydraulic presses, each capable of making twenty panels, four feet by twelve feet, or four feet by sixteen feet, in a single pressing. The wet lap lies between a polished, chrome plated steel sheet and a wire screen, the latter serving to permit escape of water and steam, while high pressures and temperatures are applied until all moisture has been removed and the sheet is consolidated to a specific gravity of 1.0, that is, it will just sink in water.

After humidifying to normal moisture content and trimming, a large percentage of these sheets are shipped without further treatment. However, where greater strength, water resistance and hardness are desired, they may be "tempered" by impregnating them with certain liquid resins, which are then polymerized and oxidized in high temperature kilns.

In the manufacture of Masonite Duolux hardboards, which have two smooth surfaces, the degree of hydrolysis in the guns is adjusted to produce fiber of a semi-plastic nature. After extraction of the water soluble material, refining and screening, this fiber is also formed into sheets on a modified Fourdrinier machine, following which the residual water content is removed in a high temperature multi-deck dryer, resulting in a low density, semi-plastic "dry lap" or blank. These blanks are then converted to Duolux hardboards by pressing at high temperatures and pressures in multiple opening, steam heated platen presses, each sheet being placed between two chrome plated steel sheets. This results in a family of products having specific gravities up to 1.3. After cooling, these panels are tempered and humidified to equalibrium moisture content before shipping.

Further modifications of the Duolux process have produced Temprtile, a panel having impressed score lines and adapted for interior installations in kitchens, bathrooms, shower stalls and the

like. Recently Leatherwood has been produced, a panel having an embossed leather surface, which has a variety of applications. During the war other special products of the same general type were produced for the Armed Services, some of which replaced steel, duralumin and other metals in essential industries.

At the beginning of the war, the aircraft and shipbuilding industries required a material of considerable density and thickness to make dies for the shaping of light metals. It was necessary that the material be easily machined but have high resistance to compression and to dimensional change. This demand led to the production of Airplane Die Stock, which has a specific gravity of over 1.4 or essentially the ultimate specific gravity of the wood substance itself. While it is customarily manufactured up to 2" thick and four feet by twelve feet in area, panels have been made for special applications up to 6" thick, in other words, single panels weighing well over a ton.

Hundreds of carloads of Airplane Die Stock were shipped and found a multitude of uses other than for dies, as spinning chucks, routing templates, assembly jigs and the like. It was also introduced into the electrical industry, where, in a modified form known as Benelex 70, it was used in control panels, instrument bases and many other applications.

A study of the electrical properties of this high density lignocellulose plastic indicated that further development might result in an electrical panel of outstanding characteristics in which the properties were derived, not from costly thermosetting resins, but from certain components of the wood itself. Several years of research have now accomplished this result and the latest of this family of products, Benelex 100, is just going into production.

Benelex 100 is made by a modification of the Duolux process, in which an optimum degree of plasticity is secured by close control of the gun hydrolysis, followed by controlled elimination of the hemicellulose fraction and final consolidation at high pressures over a carefully controlled heating and chilling cycle. The product is a lustrous black in color, is essentially of the maximum obtainable density of the fibers and has high physical properties, while retaining its ease of machining. It is essentially wood without added resins or binders except to a very limited degree. It is flame proof and will withstand temperatures over 300°F for 24 hours or more.

The normal electrical constants are in the same range as the conventional paper base laminates. However, in certain respects it shows surprising superiority. For example the dielectric strength parallel to the laminations is two or three times as great, making it possible to place current carrying studs much closer together and

thus reducing the overall size of the panel. Another property of considerable value is its resistance to the formation of a conducting path under the influence of an electric arc. Conventional phenolic laminates will conduct an arc several inches, while Benelex has high resistance and will not carry an arc. It also maintains its high dielectric properties at elevated temperatures and humidities as compared to phenolic laminates.

Wood is well known as the earliest and most widely used structural material. The progress we have made so far in utilizing the wood components to produce "tailor made" materials having certain specific characteristics is some indication of what may still be expected as a result of further research in this field.

ENGINEERING BRIEFS

New Instrument Measures Extremely Small Movements. Movements of as little as a hundred-thousandth of an inch can be detected with the "transducer," a new instrument developed at the National Bureau of Standards.

This device consists of a coiled spring whose turns separate one by one when the ends of the spring are pulled apart. When the spring is closed, it has the same resistance as a solid tube of metal, but when it is completely open, it has the resistance of the total length of the coiled wire. Since the change in resistance when the spring is stretched may be hundreds of times greater than the change in length of the spring, the transducer is a very sensitive way of measuring small displacements. An electrical instrument which measures resistance precisely is hooked up to the transducer and the change in resistance is read.

The transducer may be very useful in industry and science in such things as strain gages, pressure elements, accelerometers, electric weighing devices, automatic temperature controls, direct current-alternating current inverters and voltage regulators.—*From Aminco Laboratory News.*

New Dry Cell Has Longer Life. A new dry battery that is lighter and longer-lasting because it uses oxygen from the air instead of from chemicals within it, was announced recently by Dr. Lauchlin M. Currie of the National Carbon Co., New York, N. Y. Persons who wear electronic hearing aids will be the first to benefit from this development. The new "A" battery weighs about an ounce and lasts 80 hours—three times as long as the slightly heavier cell it replaces.

"The new unit offers the largest output of electrical energy in the lowest weight and volume ever delivered in a commercial battery," Dr. Currie explained. No metal oxides are used as the depolarizing agent which keeps the battery from stalling. This effect is secured by using a highly active carbon electrode that takes up oxygen from the air when the battery is unsealed for use. A paste around the electrode holds the necessary electrolyte which, in effect, is regenerated. The battery continues to operate until the pure zinc is used up in the chemical action that produces the electricity.—*From Aminco Laboratory News.*

Synthetic Detergents find Wide Usage. Synthetic detergents, or "soapless soaps" as they are sometimes called, have achieved a very wide sphere of utility and are making economically practical the achievement of a cleaner world, declared L. H. Flett of the Allied Chemical & Dye Corp., New York City, who spoke before a recent meeting of the Chemical Engineers Club of Washington, D. C.

Synthetic detergents can be made from the same vegetable oils used in soap manufacture, also from mineral oils. Current production is about 600,000,000 pounds a year.

These new soaps are used in new materials to make better products and to conserve processing materials. Durability of industrial finishes have been improved greatly by their use. They are used in the mining industry to control dust and in fire fighting for quenching of deep-seated fires of paper, cotton, and other tightly packed materials.

Synthetic detergents have made possible the production of cleaner foods of higher quality. By reducing sources of in infection, they serve to reduce diseases caused by bacteria.

The use of synthetic detergents to introduce minute air pockets into cement has improved the resistance of cement roads to alternate freezing and thawing.

The quality of butter (up-grading) can be increased by cleaning the milking equipment with some of the synthetic detergents so that 65% of the butter is graded 93 score or better.

The powerful washing action of the synthetic detergents is demonstrated by their use in street washing. Five pounds of the ordinary synthetic is sufficient to clean a mile of city streets.—*From Amineo Laboratory News.*

The Tel Industry. Another tetraethyl lead plant unit is under construction to help satisfy the automobile drivers' continual demand for more gasoline of higher and higher octane rating. Behind this steady rise in plant capacity lies one of the most spectacular success stories in the history of research. With present output of some 250 million pounds a year, tetraethyl lead is one of the most important organic chemicals, although it has but one use and is made by only two companies. Not only has it a prosperous past and a promising future, but its rise has carried other chemical products, notably sodium and bromine, to new heights.

The story began in 1912 with an effort to find an additive which would prevent kerosene from "knocking" in an engine designed for generating electricity on farms. During World War I the emphasis shifted to aviation gasoline, and thereafter to automobile fuel, but no real success was achieved until December 9, 1921. During most of this nine-year search, hundreds of compounds were tried at random. Some were good, but none good enough. Finally, in 1921 the investigators found a clue which gave them some theoretical understanding of what does and what does not make a good antiknock agent. With this theory as a basis for a research program, the prize material, tetraethyl lead, was found in five months and has never since been surpassed. Two more years sufficed to eliminate problems in using the material and to get it into production and on

sale. The various groups responsible for the development were joined together in the Ethyl Gasoline Corp. (now Ethyl Corp.), a joint subsidiary of General Motors and Standard Oil Company (N. J.). It was the sole seller until 1948, when duPont entered the field. Ethyl Corp. is reported now to be making some 175 million pounds of tetraethyl lead annually at Baton Rouge, La., with another 35-million-pound plant coming in 1949. Trade sources estimate that duPont makes about 80 million pounds annually at Deepwater, N. J.

Aside from tetraethyl lead, today's antiknock fluid for motor gasoline includes 18 per cent by weight ethylene dibromide, 19 per cent ethylene dichloride, and 2 per cent other components; fluid for aviation use contains 36 per cent ethylene dibromide and no dichloride. When an engine fires, the ethylene products form volatile lead compounds which are carried out in the exhaust; otherwise the lead would foul the cylinders and the sparkplugs. Up to 3 milliliters (a tenth of an ounce) of tetraethyl lead is added to each gallon of motor gasoline, and 4.6 milliliters to aviation gasoline, depending on the quality of the base stock and the grade of final product desired. More antiknock fluid would be of relatively less value, since additional quantities of fluid raise the octane rating by smaller and smaller amounts. Enough gasoline is treated, however, to use 400 million pounds of fluid, at about 36c a pound; some sources predict close to 600 million pounds consumption by 1951.

New Bromine Source

Soon after antiknock fluid came into use, its bromine requirements were found to be completely beyond the range which could be supplied from brime wells, then the common source. The solution was to "mine the sea" for its 67 parts per million of bromine. After years of research, the first plant for large-scale recovery of the sea's inexhaustible resources came into production in 1934 at Kure Beach, North Carolina, a location where the tremendous quantities of water treated can be returned to the sea some distance from the plant, without diluting the feed water.

This plan was operated by a jointly owned subsidiary of Ethyl Corp. and Dow Chemical Company, and has since been replaced by another Ethyl-Dow plant at Freeport, Texas, built during the war in connection with a Dow plant to obtain magnesium from sea water by a similar technique. Thus, tetraethyl lead helped make magnesium cheap enough to compete with aluminum for the large market for light metals. As yet, however, problems in fabricating magnesium have limited its use. Production has been only 20 million pounds annually in recent years, although capacity for hundreds of millions of pounds was built up during the war.

Another chemical product boosted by tetraethyl lead is sodium metal, used in an alloy with lead to form the tetraethyl compound. At present, roughly 150 million pounds of sodium are made annually, with about half used for tetraethyl lead; the rest is used mostly in making detergents, sodium cyanide for chemical use, and sodium peroxide for bleaching. Increased TEL production and several new uses, including metal descaling, are expected to swell the demand markedly within the next few years. National Distillers Products Corp. plans to join duPoint and Ethyl Corp. as a producer of sodium.

To supplement lead in boosting the octane number when extra engine power is needed, as in accelerating or climbing hills, the Vitameter has recently been introduced. By injecting alcohol, water, and a small amount of TEL into the carburetor at the strategic moment, it may supply part of the high octane fuel demanded by the coming high-compression engines.

Many competitive products have tried to tap the rich market for antiknock fluid, but without success. Iron carbonyl has been used somewhat in Europe and in the U. S. during the war, but it fouls sparkplugs and wears engine parts. Alcohol has been used from time to time as part of national-self-sufficiency and aid-to-agriculture schemes, but it has usually been abandoned as uneconomic. Various new refining processes make high-octane gasoline cheaply, but it can still be improved with tetraethyl lead. Tetraethyl lead can raise the octane rating only a few numbers, but for these last few points it is the cheapest treatment, regardless of what else may be done to the gasoline.—*From Industrial Bulletin of Arthur D. Little.*

Jet-Assisted Vegetables. Sprinkling is an important technique for market gardeners. Overhead irrigation by rotary sprayers speeds growth of desirable produce with less than half the water needed for ditch or furrow irrigation. Improved seeds from selected strains, treated to insure a good start for the plant, and increasing use of chemical weed killers and insecticides are being used by progressive growers to insure maximum yields with minimum labor costs.

Market gardeners, growing high-value produce for nearby cities, can afford expensive means of increasing yields and they sometimes lead larger- scale agriculturists into new practices. The British have reported success with overhead spraying of sugar beets on a farm scale and will try it with peas this summer. The high-pressure revolving sprayers used both here and in England are fed by portable pipe systems. A single sprayer, moved four or five times a day, covers several acres, and a given piece of ground is watered perhaps a quarter of the daylight hours. Many of these sprayers will put on an inch of rain in an hour.

British tests showed that plentiful overhead watering speeded growth and increased yield of one carrot crop by 20 per cent, and improved the flavor of radishes, lettuce, and cauliflower. Because excessive moisture leaches the nitrogen from the soil, small amounts of nitrogen fertilizers must be added to the spray periodically. Other nutrients do not leach out so quickly, and may be applied in the usual manner just before planting.

The gains possible, although not necessarily profitable, with intensive treatment of the soil are indicated by an experiment with hybrid corn in the Columbia River Basin, where an acre yieded 193 bushels, compared with 45 bushels as normal production. For this, about twice the usual amount of irrigation water was used, with five times the normal amount of nitrogen, and the plots were heavily planted with a long-season hybrid seed. Although this is not an extremely high yield for corn—farmers are now aiming at 300 bushels—the increase shows the value of added irrigation.

While natural seeds show great variation in type, commercial hybrids are remarkably uniform. Since they are produced by the combination of selected strains, each plant is equal to the best of its type, rather than to the average. Hybrids are usually selected to give not only superior quality and good yield, but uniform ripening; a single picking often suffices, with a marked saving in labor. Treating seeds with various fungicides and insecticides is becoming common practice. Some seeds are also given a coating which includes a quick acting fertilizer. Adding hormones and plant stimulants to the coating speeds up the emergence rate and gives healthy seedlings. Pelleted seeds are easier to sow, especially when the coating gives bulk to tiny seeds. Later, the laborious thinning, necessitated by oversowing, is eliminated.

Weed Control Important

Chemical weed killers are important to market gardeners, since elimination of hand weeding saves much labor cost. Stoddard solvent and other similar petroleum distillates act selectively in weeding carrots and parsnips. Schemes have been worked out for "fitting" the soil, letting weeds grow for several days, then planting the crop seeds, beet or spinach for example, and finally spraying the plot with weed killer. Another plan to be tested extensively next summer permits simultaneous seeding and weeding, by adding 2,4-D to the soil along with the seed, which is protected from the herbicide by a coating of activated carbon.

The selective herbicide, 2,4D, has been particularly successful in protecting corn and other cereals, lawns, and sugar cane, and tests have shown substantial increases in yield for other crops. One Department of Agriculture official has predicted a potential annual market for 100 million pounds of 2,4D, some four or five

times the present production. A tremendous testing program must be completed before this powerful material can be used confidently on a variety of crops. Large quantities of 2,4D have been used in such non-crop applications as clearing roadsides and vacant land of ragweed and other pests, and clearing quiet waterways and reservoirs of choking aquatic plants.

By dusting sweet corn with five per cent DDT three times, five days apart, before the silk shows, and two or three times after, corn earworm and corn borer may be eliminated in 90 to 98 per cent of the ears. The spectacular success of DDT and other high-powered insecticides has stimulated research and application of other new chemical insecticides. One such product, "Neotran," is specific to control mites, but is so slightly toxic to warm-blooded animals that it can be used freely. Large-scale experiments are to be run this year with "Actidione" in hope of conttrolling powdery mildew on beans and roses.—From Arthur D. Little, "Industrial Bulletin."

* * *

Personals. Professor Harold T. Barr was recently elected Chairman of the Southwestern Section of the American Society of Agricultural Engineers.

Franklin D. Cardwell was recently awarded the American Society of Mechanical Engineers Metropolitan Section Junior prize. His paper was entitled "Optimum Tube Size of Shell-and-tube Type Heat Exchangers". Mr. Caldwell is a member of the Louisiana Engineering Society and a graduate of Tulane University.

The award was made by James M. Todd, President of A.S.M.E. and also a member of L.E.S.

Obituary Of
JESSIE NELSON BALL, JR.

Nelson Ball, Alexandria contractor who for many years was District Engineer with the Louisiana Highway Commission, died in an Alexandria hospital on February 3, 1949. At the time of his death, he was engaged in contracting work in Alexandria and the surrounding area; he had resigned from the State Highway Department on July 31, 1947.

Mr. Ball was born in Alexandria on June 25, 1904. He attended grammar and high schools in that city and received his engineering education at Louisiana State University. He was a member of Kappa Sigma, national social fraternity.

He was employed by the Louisiana Highway Commission as a rodman in 1924, and through successive promotions during the next two years became Resident Engineer on the Baton Rouge-State University project. He also served in that capacity on the West End-Carrollton Avenue highway and the Alexandria-Lecompte highway.

Mr. Ball's association with the Highway Department continued, with the exception of brief periods during which he was engaged in private contracting, until August 1, 1947. During that time he served as Resident Engineer on various projects, and as District Maintenance Superintendent of the Eighth District, and in 1940 was made District Engineer of District Five (Lafayette).

Mr. Ball was described by his friends as "an easy-going, even-tempered man who looked for the best in everybody". One man said, "If Nelson Ball had to fire a man, he wanted to talk with the man and explain why the discharge was necessary. I never knew him to take part in idle gossip."

Mr. Ball was a family man and he liked outdoor life. When he was on a fishing or hunting expedition, it was not common to find with him his wife, the former Beverly Herndon Kennon, and his children, Beverly and Nelson III.

He was on a quail hunt when he was stricken with the attack that took his life.

Services were held in St. James Episcopal Church, of which he was a member. Interment was in Greenwood Memorial Park.

His survivors include his widow and children, his mother and father, Mr. and Mrs. J. N. Ball, Sr., two sisters, Mrs. Felix R. Drouet and Mrs. Robert H. Jones, and one brother, Walter L. Ball.

Soule Butler
C. C. Edwards

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of Meeting, Baton Rouge Section, Louisiana Engineering Society May 12, 1949

The meeting was called to order by President Wallace in the Highway Laboratory Building with First Vice-President Austin J. Mary, Second Vice-President F. A. Hannaman, Jr., Secretary-Treasurer Louis Duclos, and thirty members and guests present.

President Wallace called on the members to introduce the guests.

A motion to dispense with the reading of the minutes and the treasurer's report was carried unanimously.

The secretary was instructed to send notices of meetings to all of the engineering societies in Baton Rouge.

The meeting was then turned over to Mr. William A. Wintz, Jr., Chairman of the Student's Activity Committee, who introduced the three speakers of the evening:

"Mercury-Arc Rectifiers" by Mr. Warren F. Weinstein, Senior Electrical Engineering, L. S. U.

"Air Conditioning and Refrigeration" by Mr. T. M. Logan, Senior, Chemical Engineering, L. S. U.

"Rural Electrification in Louisiana" by Mr. Boone Y. Richardson, Graduate Student in Agricultural Engineering, L. S. U.

There being no further business the meeting was adjourned with a rising vote of thanks to the speakers.

LOUIS DUCLOS, Secretary-Treasurer

Minutes of Meeting of the Board of Direction, Monday, February 14, 1949

The meeting was called to order by President Lehmann with Messrs. Cucullu, Hill, Mire, Wallace and Fernandez present. Minutes of the preceding meeting were accepted as read. President Lehmann reported on the annual meeting of the Lake Charles Section held on February 1, 1949.

Mr. Cucullu, Chairman of the special committee on group insurance, reported that his committee had studied the offer made by the Paul Revere Life Insurance Company and recommended that it be rejected because it is "not consistent with the aims and activities of the Louisiana Engineering Society". A motion to accept the recommendation was made by Mr. Hill, seconded by Mr. Mire and carried.

Resignations of Messrs. Ralph Skinner and Eugene Grace were accepted with regret, both of these members having left the state to reside elsewhere.

A letter from Mr. James S. Janssen, Chairman Technical Papers Committee, suggesting that, in view of the increase in the number of affiliated societies, local chapters be invited to participate in joint meetings in alternate years. Mr. Janssen submitted a tentative schedule of meetings. Mr. Mire moved that this suggested be accepted, seconded by Mr. Hill and carried.

It was announced that the St. Charles Hotel had requested the Society to release a part of its present quarters in order that an air-conditioning system might be installed. The request was graciously acceded to by First Vice-President Cucullu. Mr. Cucullu moved that the House Committee be asked to estimate the resale value of books, book cases and other furnishings, and the cost of refurnishing the Society's quarters. The motion was seconded by Mr. Hill and carried.

Mr. Hill moved that the information furnished by Mr. James P. Kemper on the subject of Old River be referred to the Committee on Civic, Professional, and Industrial Affairs. The motion was seconded by Mr. Cucullu and carried.

Mr. Mire moved that the date of the March meeting be advanced to the 7th, in accordance with the request of the speaker. The motion was seconded and carried.

Mr. Wallace moved that initiation fees be waived for 1949, seconded by Mr. Mire and carried.

Mr. Hill moved that Mr. William Hobson Sparr be reinstated to membership in the Society, seconded and carried.

Messrs. Soule Butler and C. C. Edwards were appointed a committee to prepare the obituary of our late member, J. Nelson Ball, Jr.

A copy of the constitution and by-laws for the Shreveport Section was presented. Mr. Hill moved that the secretary send copies of same to all members of the board so that they may study it and forward suggestions. The motion was seconded by Mr. Wallace and carried.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting of the Louisiana Engineering Society Held on Monday, February 14, 1949

The meeting was called to order by President Lehman, with approximately 110 members and guests present. Mr. E. L. Mire moved that the reading of minutes be dispensed with, seconded by Mr. W. P. Wallace and carried. President Lehmann welcomed members and guests.

The secretary announced that the next meeting of the Society would be held on March 7 and that the subject would be "Gas Turbines".

President Lehmann then introduced the speaker of the evening, Colonel Alvin R. Moore, Corps of Engineers, New Orleans District, who gave a most interesting and instructive illustrated lecture on "Foundation Investigation of the Veterans' Administration Hospital at New Orleans".

A lively discussion followed the lecture, 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, March 7, 1949

The meeting was called to order by President Lehman. Those present were Messrs. Cucullu, Leake, Mire, Newton and Fernandez. Minutes of the preceding meeting were accepted as read.

A financial report on the 1949 Annual Meeting was presented by the Treasurer and accepted.

Mr. Leake moved that the application for reinstatement submitted by Mr. Elmer E. Shutts be approved. The motion was seconded by Mr. Newton and carried.

Correspondence with the S. L. I. Student Chapter and the 7th District Contact Representative was read.

Mr. Newton moved thtat the Chairman of the Membership Qualifications Committee be authorized to appoint an additional member to serve on his committee. The motion was seconded by Mr. Mire and carried.

It was moved that Mr. James G. Nelson's election to affiliate membership be considered void, and that Mr. John M. Morrison be considered as having resigned. Both names appeared on the ballot of September 1948, Mr. Morrison as a transfer from student to junior member, and neither candidate has accepted his election.

The matter of hospitalization brought to the Board's attention by Mr Mario Zervigon was discussed. It was the general opinion that such insurance is not consistent with the aims of the Society. However, Mr. Zervigon was appointed a committee of one to present the facts concerning the matter to the Board before any action would be taken.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting of the Louisiana Engineering Society held on March 7, 1949

The meeting was called to order by President Lehmann, with approximately 125 members and guests present. Mr. Charles P. Knost moved that the reading of minutes be dispensed with, seconded by Mr. R. F. Muller and carried. President Lehmann welcomed members and guests present and reported upon the prospects for the development of state sections, particularly on the progress being made in the formation of the Shreveport Section under the direction of District Contact Representative Ernest M. Freeman.

Past President W. Stone Leake then introduced the speaker of the evening, Mr. B. G. Hatch of the General Electric Company's Turbine Division, who gave a most interesting allustrated talk on "The Combustion Gas Turbine and

Its Possible Applications". The lecture was followed by a lively discussion, after which the meeting adjourned with a rising vote of tanks to the speaker.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting of the Board of Direction held April 11, 1949

The meeting was called to order by President Lehmann, with Messrs. Abrahm, Cucullu, Goodloe, Hill, Mire and Fernandez present. Mr. R. P. Lockett, Jr., also was present by invitation. Minutes of the preceding meeting were accepted as read.

The treasurer's first quarterly report for 1949 was presented.

The secretary announced that all names on the March ballot had received the approval of the membership at large. He then read correspondence from Mr. E. M. Freeman, Contact Representative for the Fourth District, and from the Membership Qualifications Committee Chairman. After some discussion the secretary was instructed to explain to Messrs. Billy W. Ferguson and Lucien F. Valentine why their election to membership has been delayed.

The secretary reported that all 1949 standing committees had been completed with the exception of the House Committee. Mr. Cucullu moved that the naming of this committee be tabled until the board's next meeting, seconded by Mr. Hill and carried.

The resignations of Messrs. George D. Cobaugh, William R. Eaton and James J. Saurage were accepted with regret.

Correspondence received from the organizing committee of the First International Congress of Civil Engineers of Mexico was read, and the secretary was instructed to acknowledge same.

Mr. Hill moved that the application of Mr. Crawford K. Dunbar for reinstatement be accepted, seconded by Mr. Cucullu and carried.

The secretary handed Mr. R. P. Lockett, Jr., a compilation of climatological data for the use of the Outing Committee. It was decided to hold the annual outing later in the year, preferably in September. Considerable discussion followed concerning entertainment for the outing, and it was decided that the question should be submitted to the membership at large in the June ballot.

Upon the recommendation of the board, President Lehmann appointed Mr. John V. Dugan, Jr., as General Chairman for the 1950 Annual Meeting, and Mr. David Moodie, Vice-chairman. Mr. Charles E. Cassagne, Jr., was appointed Chairman of the Technical Papers Committee. Following this the meeting adjourned in order that the Society's general meeting could be opened on schedule.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Joint Meeting of the Louisiana Engineering Society with the New Orleans Chapter, Society of Plastics Engineers, held on Monday, April 11, 1949

The meeting was called to order by President Lehmann, with approximately 100 members and guests present. The president welcomed members and guests of the S.P.E. and announced that this was the first joint meeting of the Louisiana Engineering Society with that organization. He then introduced Mr. E. H. Goodloe, President of the Lake Charles Section, Louisiana Engineering Society; Mr. William W. Tennant, a past president of the Baton Rouge Section, and Mr. Louis Duclos, Secretary-Treasurer of the Baton Rouge Section.

Minutes of the preceding meeting were read by the secretary, and Mr. Harold A. Levey moved that they be accepted as read. The motion was seconded by Mr R. P. Lockett, Jr. and carried.

It was announced that an invitation had been received from the organizers of the International Congress of Civil Engineers of Mexico to participate in their convention. Following this, the chair was relinquished to Mr. Leon Godchaux II, President of the New Orleans Chapter, S. P. E., who called on Mr. Harold A. Levey to introduce the speaker of the evening, Mr. Robert M. Boehm, Director of Research, Masonite Corporation, Laurel, Miss. Mr. Boehm's address, entitled "Development of New Plastic Panels from Wood", was most interesting and instructive. It was followed by a lively discussion, following which President Lehmann resumed the chair and closed the meeting with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ, Secretary-Treasurer

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

June, 1949

"PATRONIZE OUR ADVERTISERS"

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OF THE
LOUISIANA ENGINEERING SOCIETY

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CONTENTS

EDITORIAL NOTES AND COMMENTS

OUR FRONT COVER shows, in the foreground, the concrete work of two sector gate recesses of Bayou Sorrel Lock before the installation of the gates. These gates are of a relatively new type and have several advantages over the more familiar miter gates.

Bayou Sorrel Lock is being constructed by the New Orleans District, Corps of Engineers, at the intersection of the Plaquemine-Morgan City Route of the Intracoastal Waterways and the East Atchafalaya Basin Protection Levee, approximately 18 miles southwest of the town of Plaquemine; and will permit the use of the Waterway during high stages on the Atchafalaya River. The lock will have usable dimensions of 760 x 56 x 14.75 feet below Mean Sea Level. It will consist of a concrete gate block at each end and an intervening earth walled chamber with a timber guide wall down one side. The lock and appurtenant work will cost $4,000,000 when completed in 1950.

A Message from the Vice-President. Louisiana engineers have achieved a degree of coordination of professional activities thruogh L.E.S. that might well serve as a model for other states to emulate. The statewide character of these activities has assumed increasing-

ly clear definition with the passage of time and, concurrently with this progress, professional development in specific local areas has been greatly stimulated.

The value of this latter aspect is particularly obvious when considered in relation to the problem of the national engineering societies. These usually conduct their "local" activities through Sections which are assigned geographical areas of considerable extent in such regions as the Southeast, Southwest, Rocky Mountains, etc. The area of jurisdiction of a given section is frequently as large as that of the state of Louisiana, and the problem of active participation in Section affairs by members remote from Section headquarters has been a challenge to Section officers.

The writer has noted a definite tendency for such problems to diminish in our state as the result of the growing number of Sections of the Louisiana Engineering Society. This is unquestionably due to the excellent work which our sections are doing to provide professional development activities for engineers in their areas. The pooling of all professional engineering interests, which our society practices, has permitted the scheduling of technical programs and social meetings in strategic areas through the state on a scale which is adequate to meet the needs of the profession. Since the frequency of these gatherings is far greater than the frequency with which Sections of national engineering societies could schedule meetings in these local areas, our society is rendering a service to the profession which we can well be proud of. On the other hand, our membership is well aware of the benefits accruing from membership in the national societies ,as is evident from the large proportion of L.E.S. members who belong to national organizations and participate very actively in their affairs.

So, as we appraise in summary what has been and is being accomplished in our state we find: (1) A statewide organization embracing all branches of the engineering profession and operating harmoniously within the framework of a time-proven constitution; (2) A growing number of local groups of sufficient stature to provide adequate local program activities in addition to participation in statewide affairs; (3) Sections of the great national societies which provide far greater opportunities for specialized technical development than L.E.S. is designed to give, and through which many L.E.S. members participate in the shaping of professional policies and activities on a nation-wide and international basis.

We owe a debt to the leadership of past years which has brought us to this stage of development and it is the responsibility of all of us that it shall continue to grow and mature as an asset of which Louisiana can well be proud.

Lionel J. Cucullu.

New Members. The following engineers were recently elected to membership in the Society, or were transferred to another grade. Among the list are four student awards, consisting of junior membership in the Society. This is in recognition of their achievements in their engineering work.

FOR MEMBER

VAN A. BARNETT, Shreveport; age 48. Endoresed: E. M. Freeman, E. M. Gillen, J. P. McCullough. Purdue University, B.S.C.E., 1921. Asst. City Engr., City Engr., Ft. Wayne, Ind., 1921-35. Supt. of Construction, CCC Drainage Projects in Indiana, 1935-37. Civil Engr., private practice, 1938-date. Licensed Indiana, 1931-37; La., 1938-49.

JOHN A. BROWN, Baton Rouge; age 54. Endorsed: H. L. Lehmann, E. A. Landry, L. W. Harrell. La. Hwy. Comm., Resident Engr., 1926-38. U. S. Govt. Project Engr., bldgs., st. improvements, sewage and waterwork const., 1938-42. Lummus Co., N. Y., Engr., foundations and pipe const. for rubber plant, 1942-45. E. I. DuPont de Nemours, Engr.-Inspector, Nylon Salt Plant, 1945-47. Lummus Co., Chief Engr., const. of Recycling Plant, 1947-48. La. Dept. Hwys., Project Engr., 1948-date.

JOHN S. BROYLES, Shreveport ;age 58. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. Univ. of Wisconsin, B.S.C.E., 1916. Milwaukee Sewerage Commission, Res. Engr., 1916-17. U.S. Navy, Chief Machinist Mate, Aviation, 1918. Milwaukee Sewerage Comm., 1919. Various highway survey and construction in Arkansas, 1920-22. Lone Star Gas Co., Asst. Engr., 1922-26. United Gas Pipe Line Co., Engr., 1926-date. Registered Prof. Engr., Texas.

RUSSELL G. CONE, Shreveport; age 53. Endorsed: R. S. Cooper, E. M. Freeman, H. L. Mitchell, Univ. of Illinois. B.S.C.E., 1922. Delaware Bridge Res. Engr. Ambassador Bridge, Detroit, Res. Engr. Tacoma-Narrows Bridge Failure, Wash. State, Consulting Engr. La. Ordnance Plant, Shreveport, Asst. Chief Engr. Silas Mason Co., Shreveport, General Mgr. Licensed Engr., New Jersey and Calif. Member A.S.C.E., A.S.T.M., American Ordnance Ass'n.

ALVIN JAMES CONNER, New Orleans; age 30. Endorsed: C. A. Burton, L. I. Korn, R. L. Nall. La. State University, B.S.Ch.E., 1941. The Flintkote Co., chemical, mechanical, supervisory work, 4 yrs. Now employed by U.S. Corps of Engrs. as Mech. Engr. on the design of asphalt mixing plant Military service in Chemical Warfare and Air Corps.

GLEN LEE CORRIGAN, Ruston; age 30. Endorsed: R. T. Sessums, C. T. Watts, W. E. Owen. Univ. of Texas, B.S. Pet. Eng., 1940; M.M., 1941; Dept. of Pet. Engr., Graduate Assistant, 1940-41. Phillips Petroleum Co., Trainee, June-Sept. 1941. Univ. of Texas, Instructor, 1941-44. U. S. Naval Reserve, Communications & Intelligence, 1944-46. Univ. of Texas, Special Instructor, Dept of Drawing, 1946. Okla. A. & M. College, Assoc. Professor charge Petroleum Production Option, 1946 - Feb. 1949. La. Polytechnic Institute, Prof. and Head, Dept. Pet. Eng., 1949-date. Registered, Texas and Oklahoma.

WILLIAM F. CUMMER, Shreveport; age 30. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. Texas A. &.M. College, B. S. Chem. Eng., 1941. United Gas Pipe Line Co., Shreveport, corrosion control, 1941-1942. Lone Star Ordnance Plant, Texarkana, Tex., 1942-43. U. S. Air Force, Communications Engineer, 1943-46. United Gas Pipe Line Co., Research Chemist and Chem. Engr., 1946-date. Member Am. Chemical Society.

LAWRENCE R. DANIEL, JR., Ruston; age 26. Endorsed: F. E. Hogan, R. T. Sessums, M. R. Johnson, Jr. La. State University, B. S. M. E., 1943. Chrysler Inst. of Engineering, Masters in Auto. Eng., 1948. U. S. Navy, Eng. Officer, 1944-46. Chrysler Corp., Detroit, Student Engr., 1946-48. Wasson Motor Co., Homer, La., Service Mgr., June-Sept. 1948. La. Polytechnic Institute, Ruston, Asst. Prof. Mech. Engr., 1948-date.

WATSON S. DAUBERT, New Orleans; age 56. Endorsed: E. C. Hawkins, W. G. Leibe, C. S. Williamson, Jr. Tulane University, B. E. in Ch. E., Sugar Eng., 1912. Employed in sugar factories in La., Calif., Cuba, Porto Rico, until 1921. Cinclare Central Factory, Supt. of Fabrication, 1921-29; Plant Mgr., 1929-48. Celotex Corp., Office Engr., July 1948 to date. Member Am. Soc. of Sugar Cane Technologists.

CLARENCE DURHAM, Shreveport; age 40. Endorsed: E. M. Freeman, C. A. Frey, L. H. Roeger. Georgia School of Technology, B. S. M. E., 1932. Construction work for various contractors, 1932-36. United Gas Pipe Line Co., Engr. in charge of compressor station installations in Rodessa Field, Office Engr., 1936-date.

OSBORN J. DYKES, SR., Shreveport; age 30. Endorsed: E. M. Freeman, E. M. Gillen, J. P. McCullough. Ga. Institute of Technology, B. S. M. E., 1941. Austin Bridge Co., Dallas, Field Engr. Air Conditioning Contracting Co., General Mgr. Member A.S.H.&V.E.

WILLIAM S. EVANS, Shreveport; age 36. Endorsed: E. M. Freeman, C. A. Frey, W. E. Fitzgerald. Yale University, B. A. (Arch.), 1937; B. F. A., Arch., 1939; M. F. A.(Arch.), 1940; M. E.(majoring in structures), 1942. Harrison & Fouillhoux, N. Y., Design and Drafting, July-Aug. 1940. Austin Co., N. Y., 1940-41. Neild, Somdal & Neild, Shreveport, Design and Supervision, 1941-42. T.V.A., Knoxville, Tenn., Design, Estimating and Reports, 1942-44. Tenn. Eastman Corp., Oak Ridge, Design Engr., 1944-45. Private practice of architecture, Shreveport, 1945-date. Licensed Architect, Conn., Okla., La., Miss., Texas. Licensed Engr., La. Member A. S. C. E., Yale Eng. Ass'n, American Institute of Architects.

BILLY M. FERGUSON, Shreveport; age 26. Endorsed: E. M. Freeman, R. S. Cooper, H. Lane Mitchell. Texas A. & M. College, B. S. C. E., 1943. E. M. Freeman & Associates, 1946 to date.

EDWARD C. GRECO, Shreveport; age 37. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. Northwestern State College, Natchitoches, La., B. S. Chemistry, 1934. United Gas Pipe Line Co., Chemist, 1937-42. U. S. Army Ordnance, Explosive Chemist, 1942-44. E. I. DuPont de Nemours, Explosives Div., Special Chemist, 1944-45. United Gas Pipe Line Co., Research Chemist, 1945-date. Member Am. Chemical Society; Ark.-La.-Tex. Section, A.C.S., National Ass'n Corrosion Engrs; Natural Gasoline Ass'n of America; La. Academy of Sciences.

JOSEPH W. GUNN, New Orleans; age 40. Endorsed: Adloe Orr, Jr., R. M. Persell, J. P. Fernandez. Tulane University, B. S. Ch. E., 1932. Lone Star Cement Corp., 1933 to date, Division Chief Chemist for past six years.

BENJAMIN D. HARRISON, Baton Rouge; age 38. Endorsed: H. L. Lehmann, J. J. Mundinger, W. W. Tennant. Ethyl Corp., Sales Engr., 1936-40; Special Asst. to Vice-Pres. in chg. of mfg., N. Y., 1940-42. Army Air Force, Mtce. Officer, 1942-45. Ethyl Corp., Mgr. Industrial Eng. Section, 1945-date.

CARL J. HELBAK, Hammond; age 59. Endorsed: H. L. Lehmann, E. A. Landry, W. J. Hughes. Technical University, Boragrund, Norway, 1906-08; Technical College, Karlahue, Germany, 1909-11, Civil and Mechanical. 1911-16, Project Engr. on R. R. construction. 1918-21, U. S. Steel Corp., Chief Engr. Ship Construction. 1921-32, La. Highway Comm., Res. Engr. 1933-42. Construction Engr., N. O. City Park. 1942-44. Construction Supt., Pan American Airways. 1944-date, La. Dept. of Highways, Dist. Construction Engr.

THOMAS L. HODGES, Baton Rouge; age 41. Endorsed: H. L. Lehmann, J. J. Saurage, E. A. Landry. N. C. State College, B. S. C. E., 1932. American Bitumuls Co., 10 yrs., now District Mgr. U. S. Coast & Geodetic Survey, 3 yrs. U. S. Forest Service, 1½ yrs. Licensed Engr., North Carolina. Associate Mbr., A. S. C. E.

CLYDE W. HOLLENSHEAD, Shreveport; age 34. Endorsed: E. M. Freeman, J. P. McCullough, E .M. Gillen. La. Polytechnic Institute, B. S. C. E., 1935. United Gas Public Service Co., Office Engr. and Draftsman, 1935-37. United Gas Pipe Line Co., 1927-49, now Engr. charge construction of dehydration plants, gasoline plants and compressor stations.

WAYNE H. HUCKABY, Monroe; age 50. Endorsed: W. J. Hughes, J. E. Jarman, E. A. Landry. La. Highway Dept., 15 yrs. Ouachita Parish Engineer, 2 years. Private contractor, 2 years. U. S. Army Engineers, 3 years.

GEORGE O. HUET, New Orleans; age 57. Endorsed: G. W. Hill, W. S. Leake, M. L. Levy. I. C. S. Course in Mech. Eng., completed Mathematics, Mech. Drawing, Applied Mechanics, Strength of Mtls. and Machine Design, 1911-13. Completed Naval Arch. course, 1918-20. Woods Yard of Yacht Const. & Repair, Gen. Supt., 1930-31. Higgins Lbr. & Export Co., Gen Supt. Sawmill, Water Dept. and Shipyard, 1931-34. Naval Architect and Marine Engr. charge of design ,estimating and supervision, Motor boat, yacht and ship construction, 1934-date. Member American Welding Society, American Society Naval Architects and Marine Engrs., N. E. Coast of Shipbuilders and Engineers of England.

ORVILLE T. ICE, JR., Shreveport; age 40. Endorsed: E. M. Freeman, J. M. Robert, J. P. Fernandez. Tulane University, B. E., M. &.E., 1930. Engineer, N. O. Public Service Inc., 1929-32. Engineer, Shell Petroleum Co., Norco, 1932-36. Ins. Engineer, Harford Steam Boiler Co., 1936-43. Barber Iron Works, Vice-Pres., 1947-date.

THEODORE J. INNES, JR., Baton Rouge; age 28. Endorsed: D. H. Brown, F. A. Hannaman, W. A. Whitaker. Ga. Inst. of Technology, B. S. M. E., 1943. U. S. Army Ordnance Dept., Automotive and tank repair officer, 1943-46 Esso Standard Oil Co., La. Div., Mech. Engr., 1946-date.

E. LEE JONES, Shreveport; age 64. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. Ohio State University, C. E., 1913. City of Columbus, City of Cincinnati, Ohio Fuel Suply Co., Civil Eng. Depts., 1913-14. United Fuel Gas Co., Charleston, W. Va., Civil Eng. Dept., 1914-20. Ark. Natural Gas Co., Shreveport, Chief C. E., 1920-date. Licensed C. E., Ark., La., Tex.

T. BENBURY LOCKETT, New Orleans; age 27. Endorsed: B. A. Grehan, W. J. Verlander, A. M. Hill. Tulane University, B. E. in M. E., 1942. Babcock & Wilcox, Student Engr., 6 mos. A. M. Lockett & Co., Draftsman, 3 mos. U. S. Navy, Lt. (E), 1943-46. Standard Supply & Hdw. Co., Sales Engr., 1946-date.

ANDREW H. McDONALD, Shreveport; age 40. Endorsed: H. F. Carr, E. M. Freeman, M. P. Watson. Texas A. & M. College, B. S. C. E., 1930. United Gas Pipe Line Co., 1931-date, now Gas Engr., Pipe Line Dept., in responsible charge. Licensed C. E., La.

NEIL McNELIS, Shreveport; age 34. Endorsed: E. M. Freeman, E. M. Gillen, J. P. McCullough. Miss. State College, C. E., 1932-36. Miss. Highway Dept., Instrumentman, Test Engr., 1936-42. U. S. Engr. Dept., Airport construction, Associate Engr., 1942-45. Standard Oil Co., Civil Engr., 1945-49.

ERNEST G. MILLER, Baton Rouge; age 44. Endorsed: J. T. O'Brien, W. H. Mercier, W. A. Whitaker. Univ. of Pittsburgh, B. S. M. E., 1930. Standard Oil Development Co., Eng. Inspector, 1930-34. Standard Vacuum Oil Co., Sumatra N. E. I., charge equipment inspection and mech. dept., 1934-38. Esso Standard Oil Co., Inspection, design, construction and mtce. assignment, 1938-date.

R. DOUGLAS MORGAN, Shreveport; age 36. Endorsed: E. M. Freeman, E. M. Gillen, L. M. Odom. Southwestern La. Institute, B. S. Eng. 1933. Stone & Webster Eng. Corp., Rodman, 1935. La. Geodetic Survey, Chief of Party, 1936. Soil Conservation Service, CCC Camp Engr., 1937-42. La. Dept. Public Works, Res. Engr. charge Shreveport Office, 1942-date, except 15 mos. of Naval Service. Licensed C. E., La.

CARL T. MORRIS, Shreveport; age 41. Endorsed: E. M. Freeman, M. B. Helm, H. L. Mitchell. The Texas Co., Draftsman and Surveyor, 1930-36. Gulf Ref. Co., Draftsman and C. E., 1936-42. 2U. S. Coast Guard, 8th N. D., Construction Inspector, Staff Engr., 1942-45. Gulf Ref. Co., Zone C. E., Asst. Chief C. E., Chief C. E., 1945-date. Licensed Surveyor, La.

CLAUDE E. PICOU, New Orleans; age 37. Endorsed: C. A. Burton, R. L. Nall, H. A. Schaeffer, Jr. La. State Univ., Civil Engineering, 3 yrs. Town of Thibodeaux, Engr. in responsible charge, 1936-41. Engr., various defense projects, 1941-44. Flintkote Co., Engr. in responsible charge, 1944-date.

ROBERT KING PROTHRO, Baton Rouge; age 27. Endorsed: H. L. Lehmann, L. W. Harrell, J. J. Saurage. Ga. School of Technology, B. S. Ch. E. Construction and research Engr., Chemical Warfare Service, ½yr. Maintenance Inspector, SAATSC, Air Force, 3 yrs. Research Engr., Celanese Corp., ½ yr. Sales Engr., American Bitumuls Co., to date.

LAWRENCE L. SMITH, JR., Bogalusa; age 31. Endorsed: M. R. Guell, B. B. Pierce, C. J. Mayeux. La. State University, B. S. Ch. E., 1939; M. S. Ch. E., 1941. Gaylord Container Corp., Construction Engr., 1941-42. U. S. Army, Munitions Development Officer, 1942-46. Gaylord Container Corp., Const. Engr., 1946-date.

LLOYD B. SMITH, Baton Rouge; age 54. Endorsed: H. S. Allen, H. L. Lehmann, J. J. Mundinger. N. Y. University, B. S., 1917; M. S., 1918. World War I, Chemical Warfare Service, 1918-19. Atlantic Ref. Co., Process Engr., Chief Development Engr., 1919-38. Esso Standard Oil Co., Chemical Engr., Administrative Asst., 1938-date. Member Am. Institute Chem. Engrs.; Am. Chemical Society, Society of Chemical Industry of England

ALLAN H. SYKES, New Orleans; age 30. Endorsed: C. M. Kerr, H. L. Lehmann, W. H. Rhodes. Rensselaer Polytechnic Inst., B. of C. E., 1941. Gruman Aircraft Eng. Corp., construction work, 1941-42. U. S. Naval Reserve, Lt. C.E. C., 1942-46. Barber Asphalt Corp., Technical Dept., 1946-47. Shell Ool Co., Inc., C. E., 1947-date.

LUCIEN F. VALENTINE, Shreveport; age 39. Endorsed: E. M. Freeman, H. L. Mitchell, J. P. McCullough. Centenary College, 3 yrs. I. C. S. course in Surveying and Mapping; now studying Civil Eng. Standard Oil Co., Pipe Line Dept., Rodman, Instrumentman, 2½ yrs. Geo. E. Dutton and R. L. Tatum, Field Man and Draftsman, 3 yrs. U. S. Naval Construction Battalion, Surveyor 2/C, 26 mos. H. B. Deal & Co. and E. B. Badger & Sons, industrial construction layout work, 8 mos. City of Shreveport, Eng. Dept., Draftsman, 1½ yrs.

WILLIAM W. WILSON, Shreveport; age 39. Endorsed: E. M. Freeman, J. P. McCullough, H. L. Mitchell. San Antonio Jr. College, 2½ yrs. of C. E. United Gas Pipe Line Co., 1939-49, excluding war years; present position Chief Draftsman. Member Reserve Officers Ass'n (Capt., Corps of Engrs.)

BAILEY C. VINCENT, Lake Charles; age 52. Endorsed: E. H. Goodloe, H. L. Lehmann, L. D. McCorcuodale. La. State University, Civil Eng., 1923-26. Agricultural Eng., Ruston, La., 1916-18. U. S. Army Motor Transport Corps, 1918-19. Union Sulphur Co., Construction and mtce. of installations, operation of heater houses and sulphur producting stations, 1921-23. La. Highway comm., Draftsman, Road Design Squad Leader, Supervisor, 1924-48. La. Dept. Highways, Jr. Project Engr., 1948-date.

VERTREES YOUNG, Bogalusa; age 55. Endorsed: M. C. Abrahm, J. H. Collins., A. H. Jensen. Trinity College, Hartford, Conn., B. S., 1914. Mass. Inst. of Technology, M. E., 1916. Aluminum Co. of America, 1916-17. U. S. Army, 1917-19. Robert Gaylord, Inc., later Gaylord Container Corp., now Executive Vice-Pres. and Mgr. Mill Div.

FOR TRANSFER FROM JUNIOR TO FULL MEMBER

EDWIN R. COUSINS, New Orleans; age 26. Tulane University, B. E., Ch. E., 1944. Goodyear Tire & Rubber Co., Chemical Engr., 4 mos. U. S. Army, June 1944 - March 1946. Southern Cotton Oil Co., Chemical Engr., 1946-date. Member A. I. Ch. E., Am. Oil Chemists, Alpha Chi Sigma.

EMMETT T. CRAIG, Baton Rouge; age 27. La. State University, B. S. Ch. E., 1943. Military service, 1943-46. M. I. T. School of Chemical Eng. Practice, Bangor, Maine, Asst. Director, 1946. Esso Standard Oil Co., Chemical Engineer, 1947-date. Member A. I. Ch. E., Alpha Chi Sigma, Tau Beta Pi, Sigma Xi, Phi Lambda Upsilon.

THEODORE W. DIETZE, New York; age 28. Tulane University, B. E., E. E., 1942, General Electric Co., Test Engr., 1942-44; Development Engr. 1944-date. Licensed Prof. Engr., N. Y. Member A. I. E. E., N. Y. State Society of Prof Engrs.

JAMES T. DWYER, JR., Port Arthur, Tex.; age 28. Tulane University, B. E., in Ch. E., 1941. Gulf Oil Co., 1941-42. U. S. Army, 1942-45. Gulf Oil Corp., 1946-date. Member A. I. Ch. E., A. S. C., N. A. C. E.

BERNARD A. GREHAN, New Orleans; age 27. Tulane University, B. E., C. E., 1942. U. S. Navy, 1942-46. Geo J. Glover Co., May.-Dec. 1946. Freeport Sulphur Co., Asst. Designer, plant expansion program, 1947. B. M. Dornblatt & Associates, Consulting Engrs., Member of firm, 1947 to date.

FOR AFFILIATE MEMBER

JOSEPH V. D'AMICO, JR., New Orleans; age 36. Endorsed: M. E. Kirkpatrick, R. L. Nall, C. M. Solberg. Tulane University, Commerce and Business Administration; studied Mech. Eng. 2 yrs., Univ. of Ill., 1939. Completed Wright Airplane Engine course, 1943; Pratt Whitney Airplane Engine course, 1943. La. Steam Equip. Co., Sales Engr., 1940-42. Wright Fiel Dayton, O., Eng. Officer, 1944-45; Executive Officer, Flight Test Div., 1945. La. Steam Equipment Co., Owner and operator, May 1942-date.

FOR JUNIOR MEMBER

GLENNY P. BLANCHARD, Baton Rouge; age 24. Endorsed: R. L. Barnes, L. J. Lassalle, W. J. Evans. La. State University, B. S. M. E., 1948. A.S.T.P. Basic Engineering Degree, 1944 Stone & Webster Eng. Corp., Jr. Engr., Feb. 1944-date.

GEORGE S. CANNON, Baton Rouge; age 24. Endorsed: J. B. Coltharp, F. G. Hornsby, A. J. Mary. La. State University, B. S. E. E. U. S. Engr. Dept., Vicksbug, Engr. P-1, 2 mos. Gulf States Utilities, Baton Rouge, Jr. Engr., 6 mos.

JOHN HENRY PENNY, Lake Charles; age 26. Endorsed: W. W. Barnes, R. E. Burgess, J. D. Wyman. U. S. Naval Academy, B. S. (Major E. E.), 1945. U. S. Navy, Ensign, 1945-47. Cities Service Ref. Corp., General Eng. Dept., 1947-date.

ALAN S. PINCUS, New Orleans; age 22. Endorsed: M. G. Zervigon, J. P. Fernandez, S. Cambias, Jr. Tulane University, B. E. in E. E., 1945. Tulane University, Instructor in E. E., 1946-date. N. O. Public Service Inc., Temporary Asst. Engr., summer work, 1947-48. Associate Member, A.I.E.. N. O. Section.

ALLEN S. JACKSON, Baton Rouge; age 25. Endorsed: Louis Duclos, J. T. Huey, Steve A. Nasca. La. State University, B.S.E.E., Jan. 1949. La. Dept. of Highways, Emgr., Bridge Design Section, Feb. 1949-date.

LOUIS F. PRIMOS, Shreveport; age 20. Endorsed: C. B. Foster, Jr., F. W. Grant, A. A. Lyons. I.C.S. Civil Eng. course, 1946-date (50% completed). I.C.S. diploma in Surveying and Mapping. City of Shreveport, Water & Sewage Dept., 1945-date, now Chief Draftsman, Water Dept.

J. D. RUSSELL, Baton Rouge; age 23. Endorsed: Louis Duclos, J. T. Huey, S. A. Nasca. Southwestern La. Institute, B. S. M. E., 1946. Stone & Webster Eng. Corp., Senior Draftsman, 1 yr. La. Dept. Hwys., Sr. Bridge Detailer, 1 yr.

NED E. SIMES, Baton Rouge; age 27. Endorsed: E. E. Evans, F. F. Pillet, W. P. Wallace. La. State University, B. S. C. E., 1949. Member Student Chapter, A. S. C. E.

JUNIOR MEMBERSHIP AWARD WINNERS

ALVA LEE COOPER, Engineering Graduate of Southwestern Louisiana Institute.

BOBBY J. HOLLINGSWORTH, Civil Engineering Graduate of Louisiana Polytechnic Institute.

MILTON K. MORRISON, Mechanical Engineering Graduate at Tulane University.

RICHARD B. NERF, Electrical Engineering Graduate at Louisiana State University.

FOR TRANSFER FROM STUDENT TO JUNIOR MEMBER

Graduates in Civil Engineering at Southwestern Louisiana Institute: L. A. BERGERON, VAL D. BREAUX, RALPH CAFFERY, JOHN F. DIAMOND, EMERY DOMINGUE, CALVIN GLAUBRECHT, ROBERT KLESTIL, RAYMOND J. HEBERT, PATRICK J. NAIN, HAMPTON PRIMEAUX, FRANCIS M. ROBERTS, JOHNNY B. SELLERS.

Graduates in Electrical Engineering at Southwestern Louisiana Institute: KENNETH R. BARBAY, FRANCIS X. BARRY, MALCOLM BIENVENU, SIDNEY I. DAIGLE, JULES C. DOMINGUE, HAROLD N. FORD, LLOYD D. HIGGINBOTHAM, MARSHALL LEICHT, EMMETT L. MATHEWS, CECIL P. NORWOOD, L. E. PETTY, L. ROYDON SIBILLE, JAMES S. THIBODEAUX.

Graduates in Mechanical Engineering at Southwestern Louisiana Institute: FELIX J. BLANCHARD, CHARLES R. BRACKIN, JOHN O'R. BREEDEN, ROBERT R. CHAPMAN, C. J. COUVILLION, JAMES D. CUNNINGHAM, SIDNEY A. CURLEY, RENE F. DELAHOUSSAYE, KENNEDY J. DUGAS, MAURICE B. FOURNET, JOSEPH D'L. GARON, LEO J. GAUDIN, WARREN R. HOLLIER, LLOYD A. HYMEL, ROY LEE JONES, FLOYD E. KEENEY, ANTHONY J. LUNGARO, THOMAS R. LONG, FRANK J. MIANO, HARDY L. O'NEAL, JULES G. PATOUT, AL SCHNYDER, GORDON SIBILLE, SAM B. SMART, JR., RICHMOND J. TOURNE, ALLEN VAUGHAN.

FOR STUDENT MEMBER

THOMAS TERRY GRACE, Junior Civil Engineering Student at Louisiana State University.

PAPERS AND DISCUSSIONS

THE COMBUSTION GAS TURBINE AND ITS POSSIBLE APPLICATION

By B. G. HATCH*

The recent activity in the development of the combustion gas turbine, especially since the close of the war, has created a great deal of interest in this new device.

What is the Combusion Gas Turbine?

The combusion gas turbine is a complete, self-contained power plant, designed to transform energy from fuel directly into a useful form, such as mechanical shaft energy; or with the addition of a generator into electrical energy. It consists essentially of an air compressor, a combustor where fuel is burned in the air, a turbine to expand the heated air and convert the energy mechanically, together with the necessary controls, accessories and supervisory equipment. The combustion gas turbine should be distinguished from the expansion gas turbine, which is essentially a special adaptation of the standard steam turbine. The expansion gas turbine may be used as a reducing valve, converting energy from high pressure gas to mechanical energy, due to the expansion of the gas to a lower pressure. This type of turbine is frequently found as a simple reducing value in the oil refining and chemical industry.

The combustion gas turbine offers the simplest type of rotary power plant, to convert energy to useful form with the smallest mass of material per horsepower, in the smallest area, and without the necessity of conversion accessories, such as the steam boiler, the condenser, the development of large sources of water supply, water treatment systems, fans, blowers, etc. In fact the combustion gas turbine can be built to eliminate the use of water, by providing such cooling means as is necessary through indirect transfer in a closed system.

Through the advantages of the combustion gas turbine, we are able to obtain a simple cycle unit developing 5000 HP and weighing only about 25,000 lbs. complete with accessories in a space 19½ ft. long by roughly 6½ ft. wide and 6½ ft. high.

Present State of Development

The principle of the combustion gas turbine, or hot air turbine, is not new and has been known for centuries. Many problems are involved in its design such as the utilization of metals which

* Turbine Division, General Electric Company, Schenectady, N. Y.

* Presented at regular meeting on March 7, 1949.

will withstand high temperatures, the development of a combustion system, and of an efficient compressor which, in conjunction with its turbine, will permit the development of net shaft output. The General Electric Company had an operating gas turbine as early as 1904, but in many of the early designs, the net available output was either nil or its efficiency was so low as to be impractical.

A great impetus was given to the development of the gas turbine during the war in the development of the jet propulsion power plants for aviation. While these power plants in general have no net shaft mechanical output, the energy developed is represented in the reaction from the thrust developed by the rail cone.

Since the war, the energies of the General Electric Co. have been devoted to the development of a simple cycle, single shaft gas turbine which is best known through recent publicity as the locomotive unit. A power plant for the locomotive unit was developed to burn Bunker "C" fuel, with an efficiency of 17%. This unit was assembled with reduction gear driven traction type DC generators, and operated on engineering development test for a period of 11 months before it was mounted in the cab of a locomotive unit. During some 700 hours of actual firing test under various load conditions, very complete test results were obtained from the elaborate instrumentation.

Present Ratings Available

The locomotive type combustion gas turbine, is readily adaptable to a reduction gear driven standard 60 cycle AC generator. When so combined, we have a complete 3500 KW gas turbine generating power plant in a space approximately 49 ft. long overall by 10 ft. high and 8 ft. wide. Because of its simplicity, the required foundation and building is smaller and more simple and less expensive than other modern types of power plants. In addition, the large ground area required for mounting of boilers, condensers, development of water systems, etc. is eliminated. This unit requires only about 250 gallons of water per minute for the cooling of the lubricating oil end of the main generator. This requirement may be eliminated by indirect heat transfer, equivalent to the use of a radiator cooling system such as is used in your automobile, and by designing the generator for open, self-ventilated circulation.

The rotor revolves inside of the compressor casing which is lined with internal intermediate blades. The compressor delivers 80,000 cubic feet of air per minute at a compression ratio of six atmospheres, to the combustors.

These combustors, six in number, consist of a two piece outer shell of ordinary carbon steel within which is assembled an inner

liner of high temperature stainless steel. Within this inner liner occurs the combustion of the fuel, combined with the air from the compressors. The hot gases thus generated are discharged through a diffusion piece to the first stage nozzle of the gas turbine. Air atomized fuel oil is admitted to the combustion chamber through a specially designed fuel nozzle. If natural gas is used for fuel instead of oil, a modification of the nozzle will permit the use of the gas fuel in the same combustion chamber.

In the development of this combustion chamber several months experiments were performed on combustion test stands to determine the total energy which could be developed in each chamber, the temperatures involved, the effect on the materials, and the general problems of ignition and combustion.

From the six combustion chambers air passes to the two-stage impulse type turbine wheel. The construction of this turbine wheel is novel, in that the major very rugged forging is a standard materials, to which has been welded a high temperature rim supporting the bucket blades of special hgih temperature materials. The design of the combustion path is such that the high temperatures are limited to the rim and buckets of the wheel, together with the turbine nozzles and combustion chamber inner liners. The main body of the turbine wheel is air cooled and normally operates at temperature substantially below that encountered in high temperature steam turbines.

The design of the turbine buckets follows more or less the conventional design of steam turbine buckets, except utilizing an axial type of pine tree dovetail, and of special high temperature material. The blades of the axial flow compressor are of conventional air foil design of the same material as used in the blades of standard steam turbines. These are mounted in skew slots in the rim of the individual wheels of the 15-stage compressor.

A second and high efficiency 5000 KW gas turbine has been designed using a regenerative cycle. The cycle has two-stage compression, with inter-coolers, and regeneration between the last compression stage and the combustion chamber.

The low pressure compressor is driven by the low pressure turbine, in the same casing with the two-stage high pressure turbine. The high pressure turbine drives the high pressure compressor, and through reduction gears, drives the main generator. A turbine of this design is approaching assembly for engineering developmental test. This unit will be larger than the 3500 KW simple cycle unit. This unit is designed for mounting on a single floor level, with all interconnections between the compressors, intercoolers, regenerators and combustion chambers within the structure, and enclosed in the sub base under the set. While this entire set will weigh

approximately 300,000 lbs., the individual component of the gas turbine power plant, with the exception of the regenerators and intercoolers, will be light and easily handled for inspection and maintenance. It is not expected that the regenerators, intercoolers or generator stator will need to be moved from their foundation after initial alignment.

This power plant is only about 49 ft. long by 27 ft. wide, and slightly over 13 ft. high including the sub-base.

Sales to Date

The announcement of the foregoing two designs has met with enthusiastic reception, resulting in order for 6 machines, three of each rating, all for public utility generating stations. One of the 3500 KW units will be installed in Oklahoma, using natural gas for fuel. Two of this rating will be installed in the New England territory, utilizing Bunker "C" oil.

Two of the 28% high efficiency, 5000 KW power plants will be installed in Oklahoma using natural gas for fuel, while one of this design will be installed in New England using Bunker "C" oil. Thus within the near future, we expect to obtain practical operating experience in the hands of commercial operators on two designs and ratings of gas turbines, with one-half of the units operating on natural gas and one-half operating on petroleum fuel. In the hands of operators representing several companies, we expect to obtain practical experience as rapidly as possible.

Application Possibilities

Although the ratings of the two designs now available appear small when we think of the super power generating stations, the immediately suggested application and in fact all sales to date are for use on public utility systems. Due to the simplicity of the installation, the requirement for a minimum of cooling water, and the simplicity of operation, these units will find their greatest application on the outlying sections of public utility systems, to encourage load growth development, and to improve services in territories now served only by transmission lines. In the smaller systems, particularly those dependent on hydro-electric generation, the units will also serve as standby or backup units for emergency service, or for peak loads periods. One purchaser intends to use the simple cycle, 3500 KW power plants in an existing steam generating station to heat the boiler feed water for the present boilers by utilizing the waste heat from the gas turbine exhaust. One of the applications will definitely be to improve service in an outlying sector of the system where load is growing rapidly. Two of the units will increase the total load capacity, and firm up the power

now obtained from hydroelectric systems. The gas turbine is particularly adaptable to this type of service because of its quick starting characteristics.

Industrial manufacturing plants who now operate their own power generating stations will find use for the gas turbine power plant paralleling the uses already outlined for public utilities. The gas turbine power plant will prove advantageous either in carrying the base load, with an interconnection to a public utility system for variations in load, or conversely will serve as a standby and peak load plant where the base load is carried through interconnection with the public utility system. The 17% efficiency power plant particularly lends itself to secondary heat recovery from the waste of the exhaust, for industrial processes involving heat. This is particularly applicable in refineries, chemical plants, paper mills, or other industries requiring large quantities of low temperature heat which can be generated in the form of steam from a secondary non-fired pressure boiler.

Another possible application of the gas turbine power plant, without the generator but with gears, if necessary, is as a mechanical drive turbine for operation of compressors or blowers. A typical example of this nature would be to drive gas compressors or booster compressors in long high pressure natural gas pipe lines, such as feed the industrial north and east from the gas fields of the southwest.

The first operating design of the simple cycle gas turbine was conceived for a locomotive unit. Nothing could be more portable than a locomotive power plant, which not only transports itself but offers useful energy to propel trains. A natural step from the locomotive unit is to mount a gas turbine generating power plant on wheels as an emergency portable generating unit. Such a unit, presumably mounted on a railway car, would provide ease in transportation of a complete operative power plant, subject only to fuel supply and connection to existing transmission lines, to any disaster area when normal facilities are destroyed by storm or hurricane, or to furnish seasonal loads where there is a marked shift in population or in industrial demands, for instance between summer and winter. The simple cycle 3500 KW power plant is admirably adapted to this use. The high efficiency power plant, with the increased space requirement for the intercoolers and regenerators, would require two or more cars with duct work interconnection between the units.

Something About Fuels

The first aviation type jet propulsion units were designed for operation on a readily available, but less explosive and more

easily handled fuel than gasoline. Kerosene was chosen for this application.

In the conception of the locomotive type gas turbine, as the first large practical unit, the design was laid out to use the lowest grade and cheapest readily availble fuel, or Bunker "C" residual oil. Most of you are familiar with the characteristics of Bunker "C", in that it is only semi-fluid at normal temperatures and at low temperatures will freeze solid. Before the fuel can be properly atomized for ignition and combustion, Bunker "C" must therefore be heated to about 200 or 250 deg. for proper pumping, fuel regulation and atomization. To avoid the natural difficulties of starting a cold turbine with fuel such as Bunker "C', the gas turbine is designed to be ignited by a conventional spark plug using Diesel oil. After the unit has been brought up to speed on Diesel oil, and after the Bunker "C" oil has been heated, the changeover from Diesel to Bunker "C" oil is made through a motor or solenoid operated valve. In similar fashion, to prevent soildifying the fuel in the lines after shutdown, it is desirable to transfer back to Diesel oil several minutes before the unit is taken off the line, in this way purging the lines, pumps, nozzles, etc. of the heavier Bunker "C".

Where available, natural gas would appear to offer an ideal source of fuel. It is easily transported, in some territories is readily available in large quantities, is rich in heating value and can be used in its native state in the gas turbine. However, since natural gas fuel must be introduced into the nozzles at a sufficiently high pressure for proper diffusion, the natural gas must be available at pressures from 150 to 200 lbs. per sq. in. at the entrance to the turbine compressor. Therefore, where gas at lower pressures is available, a ful gas compressor must be provided to increase the pressure a suitable amount.

Many questions have been raised as to the utilization of blast furnace gas. This is usually of low calorific value. We have no experience in burning gases of low calorific values, which would generally be available at very low pressure, and therefore would have to be boosted in large volume for use in the gas turbine. It is entirely possible that later developments in combustion may permit the successful use of blast furnace gas, but since gases of this nature carry a large volume of solid and abrasive materials, it will unquestionably be necessary to provide some sort of cleaning of the gas before introduction into the turbine to prevent erosion of the turbines blades and surfaces.

What About Coal?

Since coal is probably our most plentiful fuel, there is great interest in the use of coal for the combustion gas turbine. However since coal is in solid form it is neither as readily handled,

ignited or atomized as fluid fuels or gases. Certain agencies are actively working on the development of the direct use of finely powered coal for direct combustion in a chamber external to the gas turbine structure. This involves piping of large quantities of air and hot gases, while the finely pulverized coal must be introduced into the combustion chamber under high pressures.

Another method and perhaps one that will prove more convenient is the production of coal gas at proper pressures directly into the conventional combustion chamber. Experiments are under way on this development but it is impossible at this time to predict whether or when coal combustion will prove economical and practical in the gas turbine. It is hoped and believed that when the distinctly separate problem of handling and combustion of coal has been solved, the process may be applied, perhaps with some modification to the present designs of combustion gas turbines.

A Word About Starting

The combustion gas turbine is essentially an internal combustion engine, and as such is not self-starting. Since the compressor which furnishes the large volume of air required is driven by the turbine itself, some means must be available for cranking the turbine to an operating speed where it will be self-sustaining. For this purpose an electric starting motor is usually provided, so connected and geared to the turbine shaft that when the turbine speed becomes self-sustaining, the starting motor will be automatically disconnected. When located in a remote station, or where a reliable source of electric current is not available for starting, as in the case of the gas turbine locomotive on the rails, an auxiliary source of internal combustion engine generator set can be provided as an accessory for starting.

In the case of remote applications on natural gas pipe line pumping, it has been suggested that a mechanical type of start be provided such as an expansion gas turbine, to operate directly from the high pressure in the gas mains for the few minutes required for starting.

Controls

The gas turbine power plant is provided with a starting and operating control panel, including safety features and supervisory instruments. While the controls so far designed have been based on manual starting, the supervising functions are semi-automatic. It is entirely possible, after reasonable operating experience has been obtained, to consider pushbutton or fully automatic start and control of a remote station. We are not ready as yet to advocate operation of a gas turbine power plant without supervision, but we

believe the mount of supervision and the number of operators will be reduced to an absolute minimum, possibly only one man per shift.

The Future

The successful combustion gas turbine is still in the early developmental stage. We are extremely pleased with the success of the first designs which confirm our engineering calculations. Within a few months, the first combustion gas turbine will be in commercial operation in America. Only a few gas turbines, mostly at lower temperatures than the American design, have been placed in operation in Europe and elsewhere. Therefore our immediate need and requirement is for hours of operation, to prove the design in the hands of normal operators, and to determine such items as life and maintenance.

We are therefore in a position of enthusiastic restraint. There is every indication that the combustion gas turbine will open up many new fields of application. While only two ratings and designs have thus far been brought to the point of test or installation, there seems no real reason why designs of larger capacity cannot be developed within the reasonable future. Because of the essential base cost of such things as accessories, controls, etc., there would appear to be a lower level of economic size below which it would not be desirable to go. In any event, because of the cost of development, it will be necessary to restrict the numbers of designs and ratings to standardized units to obtain the minimum cost, and it does not appear practical to hand tailor or modify each design for a specific application. The gas turbine is distinctly not a cure-all. On the other hand, we believe it has an attractive future, and that pending successful and practical operation experience, developments will go forward at an accelerated rate.

ENGINEERING BRIEFS

Temperature of Rotating Parts Measured by New Apparatus. Apparatus for laboratory-scale measurement of the temperature of machine parts rotating at high speeds has been devised at the National Bureau of Standards, Washington, D. C.

Results obtained at the Bureau with small-scale apparatus in the measurement of the temperature of gas turbine blades show considerable promise that full-scale application would be practicable.

Details are given in an article entitled "Laboratory Evaluation of a Method Proposed by Gnam for Measuring the Temperature of Rotating Parts" by A. I. Dahl and P. D. Freeze, which was published in the December, 1948 issue of the Journal of Research of the National Bureau of Standards. This article included several suggestions as to the design of a full-scale unit.—*from Aminco Laboratory News.*

DFDT, Cousin of DDT, Even Deadlier to Flies. DFDT, a German cousin of DDT, proves to be a better killer of houseflies and certain other flying insects than DDT, and is apparently less toxic to warm-blooded animals and fish. This was told by Dr. W. T. Sumerford of the U. S. Public Health Service to members of the American Chemical Society at a recent meeting held at Shreveport, La.

The "F" in DFDT stars for fluorine, two atoms of which are substituted for chlorine atoms in the original DDT formula. The chemical name of the compound is difluorodiphenyltrichloroethane.

DFDT was much used in Germany during the war, but is only now being investigated in this country. Although it kills fewer insect species than DDT, it has quicker killing power against the ones it does affect.—*from Aminco Laboratory News.*

Paper Pulp Made from Straw. A new alkaline sulfite process for producing fine paper pulps from straw in bleached yields of 50% to 52% and at lower chemical costs was announced recently by the U. S. Department of Agriculture, Peoria 5, Ill. Such yields are said to be 8% to 10% greater than any obtained previously.

It is not the intention of the reporting agency to suggest that fine papers be made from straw alone, but that pulp made by the new process be used as a blend (perhaps up to 40%) with wood pulps to produce high quality book, magazine, offset, litho and other papers.—*Aminco Laboratory News.*

Big Blow-Ups. Peacetime research following developments in World Wide II has led to a better understanding of the behavior of high explosives, how they may be controlled for useful applications, and how accidents may be prevented. While the basic chemistry of highly explosive materials has been well understood for years, spectacular explosions, such as that at Texas City, indicate the need for more detailed knowledge of the conditions which can lead to explosions and for wider application of known safety procedures.

Chemical or combustion explosions, as distinct from explosions caused by overloading pressure vessels, always involve rapid rise in temperature. In one type, probably the most common, finely divided combustible material is dispersed throughout the air as dust or vapor. If conditions are right, and the dust is ignited, the explosive reaction proceeds throughout the mass of cloud with the speed of sound. If cornstarch is suspended in air at the ratio of a seventh of an ounce to a cubic foot of air, and the mixture is ignited under proper conditions, the resulting explosion would have enough power to wreck a substantial building.

In true explosives, there is no need for atmospheric oxygen, for oxygen loosely bound within the molecule of the explosive can, with proper stimulation, combine with carbon and hydrogen also present in the molecule. While a dust explosion pushes away objects in its path, detonation of a true high explosive shatters or penetrates the opposition. The "shock waves" which distinguish a high explosive from straightforward combustion generate pressures estimated as high as 100,000 atmospheres, or one and a half million pounds per square inch. Temperatures may go as high as 7000°F. Impingement of the shock wave on an obstacle is the cause of the damage. Damage may result also from the "kick-back" or reaction at the site of the explosion, due to the inertia of an air mass in the path of expansion or a water mass behind the charge.

The typical high explosive builds up a maximum pressure rapidly, with a total duration measured in millionths of a second; the intensity of the dust type is less, but the duration of the pressure is longer. Although serious results can occur when an explosive reaction takes place between finely divided particles and air in a confined space, the conditions can be recognized and accidents avoided. In handling high explosives, however, the oxygen and its fuel cannot be separated, since they are in the same molecule; danger is always present and occasional spontaneous detonation is unavoidable.

Potential Explosives

Many common chemicals are potentially explosives and some of these are not recognized by manufacturers handling them. A drug product, for instance, exploded recently during manufacture

because it was allowed to become unusually dry. Organic peroxides, which are used in making plastics, can sometimes be detonated by heat or shock, although there have been few explosions of this character. While most of these materials are not powerful as explosives go, they can become very sensitive to detonation, with serious results. Dryness, heat, and mixture with abrasive grit generally increase sensitivity, while moisture and mixture with oil, wax, or talc reduce it.

Another type of dangerous chemical, while not itself an explosive, is so rich in oxygen that it forms a violently explosive mixture with combustible materials, such as petroleum or many other organic liquids. Perchlorates, which have caused several disasters, are bad offenders in this respect. Tetranitromethane can be especially powerful in mixtures; on one occasion it was accidentally mixed with twice the usual amount of toluene, and instead of burning quietly, it exploded with sufficient force to kill ten people and injure thirty more. The infamous ammonium nitrate is quite resistant to attempted detonation when pure, but mixed with combustible materials, it can cause explosions such as the Texas City disaster. The excess oxygen of the ammonium nitrate combines with the fuel material with explosive force, hence the need for extreme caution in preventing contamination in transit.

Safety First

In dealing industrially with recognized high explosives, standard safety practices include isolation of the plant, limitation of the amount of material in any one operation, construction of suitable barricades, provision of structures which will yield to the explosion, and desensitizing of the explosives. Although many common high explosives will withstand drastic treatment without detonating, non-violent decomposition on aging or from heat may lead to an impure explosive of increased sensitivity.

On the other hand, many high explosives will burn smoothly when ignited and unconfined, and then show little tendency to detonate. A large quantity of TNT, for instance, spread thinly will burn quietly, while the same amount compressed in a heap will begin to burn, and may then explode without further warning. A theory has been advanced that there is a critical mass for any explosive compound, and that surface ignition of this mass will be unattended by explosive violence until some critical point is reached, at which the heat and pressure generated by the burning exterior have speeded up the oxidation reaction within the mass to the point where detonation occurs. The presence of a large mass, several thousand tons, has apparently contributed to the numerous ammonium nitrate disasters.—*from the Industrial Bulletin of Arthur D. Little, Inc.*

OBITUARY OF WILLIAM H. VON PHUL

The engineering world and the Louisiana Engineering Society suffered a distinct loss in the death on April 17, 1949 in Larchmont, New York of William H. Von Phul at the age of 77. Mr. Von Phul had been in bad health for several years.

Descendant of a very old Louisiana family, Mr. Von Phul was a native New Orleanian, and although his business interests kept him in the East, he always welcomed an opportunity to visit New Orleans.

Many Society members will recall the handsome New Orleans replica of his antebellum home where he often entertained the Society.

Graduating from Tulane University in Engineering in 1893, he spent several years here in utility work with the old Edison Electric Company, later the New Orleans-Carrollton Railway Light and Power Company.

In 1905 he joined the engineering firm of Ford, Bacon and Davis in New York, of which he became a partner in 1912, and later President until he retired in 1942.

He received an honorary Doctor's Degree in Engineering in 1931 from Tulane University.

He joined the Louisiana Engineering Society in 1908; he also was a member of the American Society of Mechanical Engineers, American Society of Civil Engineers, American Society of Municipal Engineers and a Fellow of the American Society for the Advancement of Science.

With his keen knowledge of engineering, management and finance his company under his able leadership became a widely known organization handling important work in many parts of the country, including the engineering of our own Watson Williams Bridge.

During the great expansion of the natural gas industry, starting in the '20's, his firm was a pioneer in promoting, financing, engineering and constructing major gas pipe lines, including the Interstate Line to New Orleans, Memphis Gas Line, The Southern Natural Gas Line, The Colorado Inter-State and others.

All of us who knew him personally will miss his active mind, genial personality and keen humor.

Be it resolved that on behalf of the members of the Louisiana Engineering Society this memorial be adopted in tribute to the memory of our late life member, William H. Von Phul.

Be it further resolved that these resolutions be spread upon the minutes of the Society and that copies be sent to the surviving members of his family with expressions of sympathy and condolence.

B. S. Nelson, *Chairman*
James M. Todd, R. P. Lockett, Sr.

AUDITOR'S REPORT

Board of Direction,
Louisiana Engineering Society
New Orleans, Louisiana.

Dear Sirs:

I have audited the accounts of the Louisiana Engineering Society for the year ended December 31, 1948 and submit the following:

Balance Sheet, December 31, 1948 (Cash receipts and disbursements basis)—Exhibit A
Statement of Income and Surplus For The Year Ended December 31, 1948 (Cash receipts and disbursements basis)—Exhibit B

The cash on deposit at December 31, 1948 in the regular checking account was verified by certification obtained from the depositary.

The U. S. Savings bonds and certificates evidencing shares of stock in the various homesteads were inspected by me on May 5, 1949 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.

During 1948 liquidating dividends in the amount of $191.78 were received from Interstate Trust and Banking Co. in Liquidation. Up to December 31, 1948 this institution had paid 95% of the original amount frozen, leaving a frozen balance of $191.82 for which a reserve for loss of $190.82 is provided.

The Net Income From Operations as shown by Exhibit B was $390.79 which represented a decrease of $700.63 compared with the preceding year. This decrease is attributable primarily to expenses incurred in connection with underwriting cost of passage of "Engineers License Act" amounting to $1,011.24 less contributions received of $411.50, or a net expense of $599.74.

In my opinion, the accompanying balance sheet and statement of income and surplus fairly present, respectively, your financial condition at December 31, 1948, and the results of your operations for the year ended that date.

Yours truly,
CARLOS J. GRIMADER,
Certified Public Accountant

New Orleans, La.,
May 24, 1949

Exhibit A

LOUISIANA ENGINEERING SOCIETY

Balance Sheet, December 31, 1948
(Cash Receipts and Disbursements Basis)

Assets

Cash in Bank		
Checking account		$ 5,168.69
Total cash in bank		$ 5,168.69
United States Savings Bonds, Series F		
(Maturity value—$4,000.00)—redemption value		$ 3,152.00
Investments—Homesteads: (at cost)		
Columbia Homestead Association	$ 364.27	
Commonwealth Homestead Association	305.79	
Greater New Orleans Homestead Association	1,603.81	
Security Building and Loan Association	500.00	
Sixth District Building and Loan Association	500.00	
Union Savings and Loan Association	500.00	
Total investments—homesteads		$ 3,773.87
Property—Furniture, Fixtures, Equipment and Books—nominal value		$ 1.00
Funds on Deposit with Banks and Homesteads in Liquidation:		
Interstate Trust and Banking Co. in Liquidation (less reserve for loss $190.82)		$ 1.00
Total Assets		$12,096.56

Liabilities

Surplus (Per Exhibit B)	$12,096.56

Exhibit B

LOUISIANA ENGINEERING SOCIETY

Statement of Income and Surplus (On Cash Receipts and Disbursements Basis)
For the Year Ended December 31, 1948

Income:		
Dues collected		$ 5,642.75
Advertising revenue		943.47
Income from investments and savings accounts		191.24
Net profit—sale of certificates, buttons, etc		16.75
Total Income		$ 6,794.21
Expenses:		
Expenses incurred in connection with underwriting cost of passage of "Engineers License Act" less contributions thereto of $411.50	$ 599.74	
Salary—secretary-treasurer	1,500.00	
Cost of publishing proceedings	1,803.22	
Cost of annual meeting (expended $2,252.77 less receipts of $1,769.04)	483.73	
Expenses paid in advance—succeeding year's annual meeting	25.21	
Cost of annual golf tournament ($558.97 less receipts of $449.00)	109.97	
Refreshments at meetings ($489.64 less pro rata receipts from joint meetings held, $183.70)	305.94	
Printing, stationery, and postage	590.20	
Payments to Baton Rouge and Lake Charles Sections	471.50	
Present to retiring officer	46.13	
Library expense—porter	48.00	
Social security tax	29.16	
Auditing	80.00	
General expenses	310.59	
Total Expenses		$ 6,403.42
Net Income from Operations		$ 390.79
Surplus Credit:		
Reduction of reserve for loss due to receipt of liquidating dividend from bank in liquidation		191.73
Surplus for the Year		$ 582.57
Surplus at Beginning of Year		11,513.99
Surplus at End of Year		$12,096.56

MINUTES OF THE MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of Meeting of the Board of Direction Held May 9, 1949

The meeting was called to order by President Lehmann, with Messrs. Abrahm, Cucullu, Leake, Hill, Mire and Fernandez present. Mr. John V. Dugan, Jr., Mr. Louis Duclos and Mr. E. M. Freeman also were present by invitation. Minutes of the preceding meeting were accepted as read. The secretary informed the board of the action taken by the Professional, Civic and Industrial Affairs Committee.

Mr. Duclos, Secretary-Treasurer of the Baton Rouge Section, announced that the Baton Rouge Section would be hosts to the parent society during the month of June, instead of the Lake Charles Section as originally planned.

Communications from the International Congress of Civil Engineers in Mexico, the Chicago and Southern Air Lines, and the Association of Small Business were read. The Secretary was instructed to accept the offer of the Institute of Technical Documents of Bucharest, Romania, to exchange publications.

Correspondence concerning the Society's Proceedings was read, and it was decided to invite Mr. Jeff Collins to present his views at a future meeting of the board.

Wording of the June ballot with reference to entertainment at the Annual Outing was drafted.

It was moved and passed that Mr. A. L. Dunlap be appointed chairman of the House Committee.

It was decided that the 1950 Annual Meeting would be held on January 12, 13, and 14. Selection of committee personnel for the meeting was made as follows:

Banquet Committee: A. R. Wingate, Jr., chairman; A. W. Durning, vice-chairman.

Contact with Woman's Auxiliary: Gayle Schneidau, Jr., chairman; Walter E. Blessey, vice-chairman.

Industrial Plant Inspection: William T. Hess, chairman; E. A. McLellan, vice-chairman.

Program: Albert J. Fransen, chairman; Frank E. Johnson, Jr., vice-chairman.

Publicity: E. Edward Ernst, chairman; Allen H. Jensen, vice-chairman.

Registration: Sydney Ellis, Jr., chairman; J. H. Peebles, vice-chairman.

Tech. Exhibits: Claude J. Kelly, chairman; Allan Harris, vice-chairman.

Tech. Papers: Chas. E. Cassagne, Jr., Chairman; J. Robert Rombach, vice-chairman.

Mr. E. M. Freeman presented a petition for the formation of the Shreveport Section. Mr. Cucullu moved that a charter be granted for this group and that presentation of same be deferred until the names of applicants appearing in the June ballot may be incorporated as charter members. The motion was seconded by Mr. Leake and carried.

It was moved and passed that the election of Mr. Frank R. Lyman be considered void; more that three months have elapsed since notice of election was forwarded to him and same has not been acknowledged. The following members were dropped for non-payment of dues:

Thomas J. Bryson, Jr.
Felix B. Camors
Raymond J. Carroll
*Marshall M. Cloud
George A. DeWolf
Wallace B. Diboll, Jr.
William M. Fortenberry
*L. S. Kornicker
Robert B. Lautner
*John M. Morrison
Ned S. Muse
George E. Oldham
*George B. Oldham
Stayton L. Perry
John E. Quarles
*Walter F. Read
Edward B. Rice
Richerson D. Rhodes
Robert E. Schneider, Jr.
Robert W. Seidler
*George P. Sharp
*Norman F. Strachan
George H. Tunner
Thomas A. Watson
Hugh Worley, Jr.

The resignation of Mr. Clyde E. Bolton was accepted with regret.

* Address unknown.

It was announced that Junior Membership Awards for the highest scholastic averages in their respective schools were won by:

Milton K. Morrison	Tulane University
Alva Lee Cooper	Southwestern La. Institute
Bobby J. Hollingsworth	La. Polytechnic Institute
Richard B. Nerf	Louisiana State University

Mr. John Riess, Chairman, Ole K. Olsen and A. T. Dusenbury were appointed a committee to prepare the obituary of the late John Klorer,a Past-President and Life Member of the Society. Mr. B. S. Nelson was appointed chairman of a committee of his own choice to prepare the obituary of the late William Von Phul, Life Member.

The secretary reported that the Metropolitan Section of the A.S.M.E. was addressed at a meeting held in New York on May 6 by Mr. James M. Todd, a Past-President of the Society. At the same meeting, presentation of an award for the winning paper in a Junior Competition was made to Mr. Franklin D. Cardwell, who also is a member of our Society.

Following this, the meeting adjourned in order that the Society's general meeting could be opened on schedule.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting of the Louisiana Engineering Society Held on Monday, May 9, 1949

The meeting was called to order by President Lehmann, with approximately 100 members and guests present. Mr. Sydney Ellis moved that the reading of minutes of the preceding meeting be dispensed with, seconded by Mr. D. W. Stewart and carried.

An obituary of the late J. Nelson Ball, Jr. was read by the secretary, after which a moment of silence was observed in memory of deceased member.

President Lehmann announced that the Board of Direction had accepted the petition submitted by a group of members from the Fourth Congressional District, and that the Shreveport Section of the Louisiana Engineering Society was now a reality. He then introduced the principal organizer of the new section, Mr. Ernest M. Freeman, and Mrs. Freeman.

Mr. August Durning then introduced the speaker of the evening, Mr. R. A. Cuyler, Industrial Sales Manager of the Louisiana Power & Light Company, who gave a most instructive lecture on "Industrial Development in Louisiana".

Following Mr. Cuyler's address, the meeting adjourned with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting, Baton Rouge Section, Louisiana Engineering Society June 18, 1949

The meeting was held at Harry Cloud's Camp in Baton Rouge, La., with the following officers present: W. P. Wallace, President; A. J. Mary, 1st Vice-President, and Louis Duclos, Secretary-Treasurer.

This was a joint meeting with the Lake Charles Section and the Parent Organization. After an afternoon of golf and horseshoe pitching the dinner and business session began at 8:00 p. m. with 48 members and eight guests present.

President Wallace opened the meeting by asking the members to introduce their guests. The meeting was then turned over to Mr. H. L. Lehmann, President of the Parent Organization, who addressed the members briefly and conducted the business meeting of the Parent Organization.

President Wallace then turned the meeting over to Mr. F. T. Clarke, representing the Lake Charles Section. Mr. Clarke addressed the members briefly and the business meeting of the Lake Charles Section was dispensed with.

President Wallace then introduced the special guest of the Baton Rouge Section, Mr. E. M. Freeman of the newly organized Shreveport Section, who made a brief address.

President Wallace then opened the business meeting of the Baton Rouge Section by calling for the reading of the minutes. A motion to dispense with the reading of the minutes was carried. There being no old or new business to come before the Section the meeting was turned over to Mr. A. J. Mary and, after a few introductory remarks by Mr. Mary, a sound film, "The Power of Free People" was shown. The film was furnished by the Gulf States Utilities Co.

There being no further business the meeting was adjourned.

LOUIS DUCLOS, Secretary-Treasurer

PROCEEDINGS
OF THE
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August, 1949

"PATRONIZE OUR ADVERTISERS"

INDEX TO ADVERTISERS

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VOL. XXXV OCTOBER, 1949 NO. 5

CONTENTS

EDITORIAL NOTES AND COMMENTS

Our Front Cover. The picture on this issue shows the bridge at Lake Charles, now under construction. It was designed by and is being constructed under the supervision of the Louisiana Department of Highways. Contractors are Massman Construction Company and Kansas City Bridge Company.

Monroe Section. Plans are being made for the first official meeting of the Society's newest section, which comprises the Fifth Congressional District, with headquarters at Monroe.

The new section was organized largely through the efforts of our District Contact Representative, Mr. Roy T. Sessums. Temporary officers who have assisted in the work are Messrs. S. E. Huey, Acting President, O. C. Roddey, Acting Vice-President, and Calvin T. Watts, Acting Secretary.

The meeting will take place in Monroe on October 25, when President Lehmann will present the section's charter. Several other officers and board members of the Society expect to attend.

The occasion promises to be an interesting one, with Mr. M. H. Leavenworth, Manager Southwestern Office of the Dow Corning Corporation, addressing the gathering on "Silicones at

Work for Industry". This lecture was presented at a recent meeting of the Society here in New Orleans and was received with great enthusiasm.

Annual Meeting. Our Annual Meeting committees are hard at work and we may look forward to one of the most successful meetings in the Society's history. The complete personnel of all committees have not yet been selected, but here are the chairmen and vice-chairmen of the various groups whose efforts will contribute to the success of the three-day session which is scheduled for January 12, 13, 14, 1950:

John V. Dugan, Jr., General Chairman; James S. Janssen, General Vice-Chairman; John P. Fernandez, Secretary; Herman L. Lehmann, Chairman, ex-officio.

Banquet committee: A. R. Wingate, Jr., Chairman; A. W. Durning, Vice-Chairman; Contact with Woman's Auxiliary: Walter E. Blessey, Chairman; W. Stone Leake, Vice-Chairman; Industrial Plant Inspection: William T. Hess, Chairman; E. A. McLellan, Vice-Chairman; Program Committee: Albert J. Fransen, Chairman; Frank E. Johnson, Jr., Vice-Chairman; Publicity Committee: T. Edward Ernst, Chairman; Allen Jensen, Vice-Chairman; Registration Committee: Sydney Ellis, Chairman; J. Howell Peebles, Vice-Chairman; Student Conference Committee: F. J. Germano, Chairman; John L. Martinez, Vice-Chairman; Technical Exhibits: Claude J. Kelly, Chairman; Allan Harris, Vice-Chairman; Technical Papers: Charles E. Cassagne, Jr., Chairman; J. Robert Rombach, Vice-Chairman.

Louisiana Council of Engineers. On September 26, 1949 President Lehmann called a meeting of the Louisiana Council of Engineers, which was attended by the following representatives of their respective societies:

E. I. Blanchard, A.I.E.E.; Louis Duclos, La. Highway Engrs. Ass'n.; Byron P. Lyons, La. State Institute of Civil Engrs.; Leon Godchaux, Society of Plastics Engineers; Harold A. Levey, Society of Plastics Engineers; F. Tackett Clarke, Lake Charles Section, L. E. S.; Henri J. Molaison, N. O. Section, A.I.Ch.E.; E. L. Patton, N. O. Section, A.I.Ch.E.; S. P. Merrill, La. Highway Engrs. Ass'n.; Ross B. Guest, A.S.H. & V.E.; R. E. Hunter, S.A.M.E.; Charles M. Kerr, S.A.M.E.; J. M. LeDoux, A.S.C.E., C. S. Crawford, A.S.R.E.; C. G Cappel, A.S.C.E.; Fred E. Simmons, Jr., A.I.M.E., E. N. Dunlap, A.I.M.E.; Edward A. McLellan, A.S.M.E., Wayne P. Wallace, Baton Rouge Section, L.E.S.; John P .Fernandez, Secretary of the Council.

The object of the meeting was to determine whether the Professional Engineers' License Bill, which was vetoed by Governor

Long after having passed both houses of the Louisiana Legislature at its last session, should be again presented for enactment.

A committee consisting of Messrs. W. Stone Leake, Chairman, E. A. McLellan and Henri J. Molaison, was appointed to contact representatives of the R. E. A. Cooperatives, who it is believed were instrumental in causing the governor's veto.

Mr. Leake reports that this interview apparently was successful, and believes that the group may not only remove its objections to the bill but may even favor its passage when it is next presented. A photostat copy of the bill has been mailed to the Cooperatives' attorney for study and comment.

New Members. The following members were recently elected. We welcome then into the society.

FOR MEMBER

JACK W. ALLEN, New Orleans; age 38. Endorsed: A. W. Betz, E. C. Hawkins, W. G. Leibe. La. State University, 1931-34; La. Polytechnic Inst., B.S.M.E., 1938. International Paper Co., Plant Engr., 1942-47. The Celotex Corp., Plant Engineer.

CECIL W. BIGGS, Winnsboro; age 36. Endorsed: R. C. Duchesne, J. T. Folk. C. T. Watts. La. Polytechnic Inst., B.S.C.E., 1937. Petroleum Engineering Inc., Houston, Tex., 1947-49. U. S. Engineers, 1937-46

BEN T. BOGARD, Ruston; age 35. Endorsed: L. J. Lassalle, R. T. Sessums, C. T. Watts. La. Polytechnic Inst., B.S.M.E., 1935; La. State Univ., M.S.M.E., 1937. La. Polytechnic Institute, Prof. Mech. Eng., 1946-date. U. S. Army Ordnance, Captain, 1942-46. Member A.S.M.E., A.S.C.E., American Ordnance Ass'n.

HENRY BOH, New Orleans; age 55. Endorsed: M. C. Abrahm, D. E. Guiza, D. W. Stewart. General Contractor in the City of N. O. for past 35 years.

JAMES A. BOX, JR., Bogalusa; age 32. Endorsed: W. C. Barnwell, M. R. Guell, J. E. Wallace. Mississippi State College, Chemical Eng., 1938-42. Chemical Warfare Service, Huntsville, Ala. Arsenal, Civilian Plant Supt., 1942-43. Tennessee Eastman Corp., Electro-Magnetic Plant, 1943-45. Gaylord Container Corp., Mech. Engr., 1946-date.

WILLIAM G. BRANCH, Monroe; age 44. Tulane University and La. College, 1922-24. La. Highway Commission, Inspector, Instrumentman, Const. Supt., 1929-40. Engineer with Consulting Engineers, Contractors and U. S. Navy, 1940-46. Supt. of Construction, contact road projects, and Sales Engineer, 1946-48. La. Dept. of Highways, Asst. Dist. Maint. Engr., 1948-date.

JAMES LEWIS CARTER, West Monroe; age 26. Endorsed: A. P. Andrews, S. E. Huey, R. T. Sessums. Arkansas University, B.S.C.E., 1944. Ohio State University, 1944-45. U. S. Army Engineers, 1945-46. Missouri Pacific R. R., Instrumentman, 1946. Southwest Gas Prod. Co., Inc., Civil Engr., 1946 to date. Licensed C. E., La. Member A.S.C.E.

JOSEPH G. CHUMLEY, Ruston; age 28. Endorsed: F. E. Hogan, H. L. Henry, R. T. Sessums. Central State College, Edmond, Okla., B.A. in Edu., 1947; B.S., 1948. Okla. A & M College, Industrial Arts Educa., M.S. R. W. Thomas, Surveyor, Eng. Aide, 1940-41. U. S. Eng. Dept., Denison Dist., Instrumentman, 1941-42. V. V. Long Eng. Co., Party Chief, 1942-43. Oklahoma A & M College, Graduate Teaching Asst., 1948-49. Louisiana Polytechnic Inst., Instructor, Jan. 1949 to date. Member A.S.E.E.

CLARENCE E. DICKEY, Sterlington; age 31. Endorsed: H. D. Richardson, R. T. Sessums, J. J. Thigpen. Virginia Polytechnic Institute, B.S.M.E., 1941. Sylvania Elec. Products, Emporium, Pa., General Foreman, 1947-48. General Electric Co., Atlanta, Field Engr., 1941-47. La. Power & Light Co., Engr., June 1948 to date.

GEORGE P. FORMAN, Monroe; age 41. Endorsed: J. E. Jarman, J. E. Ross, E. R. Woodman. University of Georgia, B.S.C.E., 1929. North Carolina Dept. of Highways, 1929-34. Georgia Forest Service, 1934-35. U. S. Forest Service, 1935-37. U. S. Govt. Engr., 1937-42. U. S. Army, 1942-46. La. Dept. of Highways, Project Engineer, 1946-date.

MINOR M. FUNDERBURK, SR., Sterlington; age 53. La. State University, B.S.E.E., 1925. Technical Asst. to Supt. of Power Plant for 10 yrs. Electrical Engineering, 14 yrs. Member A.I.E.E.

VERGIL SMITH GARNETT, Monroe; age 53. Endorsed: S. E. Huey, R. T. Sessums, C. T. Watts. Missouri State University, B.S.C.E., 1918. Zeigler Coal Co., Asst. Engr., 1918-20. Missouri-Pacific R. R., Instrumentman, Eng., 1921-24. Ford, Bacon & Davis, Drafting and abstracting, 1927-28. Interstate Natural Gas Co., Inc., 1928 to date, now Chief Engineer. Licensed C.E., La., since 1929.

SIDNEY S. GILL, Monroe; age 36. Endorsed: A. T. Givens, S. E. Huey, R. T. Sessums. Louisiana State University, B.S.M.E., 1933. U. S. Coast & Geodetic Survey, Draftsman, 1934-35. Thermatomic Carbon Co., Mech. Engr., 1935-45; Plant Engr, 1945-date.

ELBERT S. HEIM, Bossier City; age 58. LeTellier's School (now closed), 1911-12. I.C.S. Civil Engineering Course 70% Completed. City of Denison, Texas, Res. Engr. construction concrete and steel viaduct, 1916. T. & P. Ry. Co., valuation work, 1917-18. M.K.T. Ry. Co., responsible charge of concrete replacement bridges, 1919. Texas Dept. Highways, 1920-26. Ark. Fuel Oil Co., Bossier City, 1926-45. La. Dept. of Highways, 1945 to date.

JOHN R. HORTON, Sterlington; age 52. Endorsed: R. T. Sessums, J. J. Thigpen, C. T. Watts. La. Polytechnic Institute, 1 term, 1914-15. Merchant Marine Engineer's Correspondence Course. Home Study courses in Mechanical and Electrical Engineering. U. S. Navy, Chief Machinist Mate, 1917-19. Ark. Power & Light Co., Construction Supt., 1919-20; Asst. Chief Engr., 1920-25. La. Power & Light Co., 1925-date, now Station Chief.

WILLIAM B. JORDAN, Sterlington; age 33. Endorsed: R. C. Duchesne, R. T. Sessums, J. J. Thigpen. Louisiana Polytechnic Institute, B. S. Eng., 1936. La. Power & Light Co., Steam-Electric Generating Station, 13 yrs., now Maint. Engr.

BOLESLAUS M. KOPACZ, New Orleans; age 29. Endorsed: C. A. Burton, J. L. Dickson, W. J. Schwarz. St. John's College, Brooklyn, N. Y., B.S. Chemistry. Hoffman-LaRoche, Analytical Chemist, 1½ yrs. Duramold, Div. Fairchild Aircraft, NYC, Industrial Chemist, 1 yr. Higgins Industries, Research, Plastics Eng., 1½ yrs. S. E. Massengill Co., Bristol, Tenn. Chemist, 1 yr. Flintkote Co., Industrial Chemist, 1½ yrs. Process Equipment Co., Sales Engr., 4 mos.

JOSEPH S. KOPFLER, JR., Kenner; age 35. Endorsed: J. E. Coyne, E. E. Guillot, M. H. Reilly. Tulane University College of Commerce and Bus. Admin., 1930-34. La. Highway Comm., Rodman, Sr. Instrumentman, 1934-42. T. L. James & Co., Moisant Airport, Contractor's Engineer, 1942-43. Consolidated Vultee Aircraft, Tool Planner, 1943-45. Aide to Private Engineer, Calif., 1945-47. Keller Construction Corp., Asst. Supt., 1947-48. Member, Board of Highways, State of La., 1948-date.

JOHN STUART LOGAN, Baton Rouge; age 54. Endorsed: C. C. Bernard, Louis Duclos, H. L. Lehmann. Utah State College, Hwy. Engineering, B.S., 1924. Highway Engr., U. S. Bureau of Public Roads in Utah, Texas, Ark., Okla., and La., 1924 to date. Distric Engineer in La. since 1945.

EDWARD S. McROBERTS, Shreveport; age 45. Endorsed: W. W. Alsup, E. M. Freeman, W. C. Sorensen. Draughon College, Business Admin., 1924-25. I.C.S., Mech. Eng., 1932-36. Kilgore Jr. College (night), Eng. Drawing, 1941. Univ. of Tulsa (night), Fluid Flow & Heat Transfer, 1943. Sales Engr., Oil Field Machinery, 1936-42. Frick Reid Supply Corp., Eng. & Const. Div., 1942-44, Draftsman, Concrete and Pressure Vessel Design. J. B. Beaird Co., Heat Trans. Engineer, Asst. Chief Engr., 1944-date.

CHARLES A. MITCHELL, Baton Rouge; age 44. Endorsed: L. Duclos, H. L. Lehmann, W. P. Wallace. University of Michigan, B.S.M.E., 1928. Cincinnati Gas & Elec. Co., Test Engr., 1928-33. L. I. Snodgrass Co., Sales & Service Engr., 1933-48. J. W. Eshleman & Co., Birmingham, Representative in La. and Miss., 1949.

THURMAN C. MORGAN, Tallulah; age 42. Endorsed: A. P. Andrews, G. H. Dudley, S. C. Smith. La. State University, B.S.C.E., 1927. La. Highway Comm., Instrumentman, Inspector, Resident Engr., 1927-32. U. S. Engineer Depot, N. O., Chief of Party, Chief Surveys and Computation Section, Asst. to Chief of Levee Section, 1932-46. La. Dept. Public Works, Asst. to District Engineer, 1946-date. Licensed C.E., La.

KARL C. P. MULLER, W. Monroe; age 28. Endorsed: S. E. Huey, R. T. Sessums, J. J. Thigpen. La. Polytechnic Institute, B.S.M.E., 1943. U. S. Naval Academy, V-7 Midshipman, Ensign, 1943. U. S. Navy, active duty, 1944-46 La. Power & Light Co., Sterlington, Associate Engr., 1946-date.

RAN LORENZO PHILLIPS, SR., Sterlington; age 60. Endorsed: R. T. Sessums, J. J. Thigpen, C. T. Watts. E.E.I.C. Schools 1913. U.S.N. School of Steam Eng., Stevens Institute of Tech., 1918. U.S.N. School Turbine Eng. of Carnegie Inst. of Tech., 1919. Lagrange, Ga., Dept. Streets & Utilities, Engr. Gulfport & Miss. Coast Traction Co., Supt. of Power & Equipment, 1920-23. Miss. Power & Light Co., Chief Engr., 1923-25. La. Power & Light

Co., Supt. Sterlington Steam Elec. Power Station, 1925-49. Member A.S.M.E. A.I.E.E., A.S.CE

HENRY T. POULAN, Monroe; age 41. Endorsed: J. T. Folk, R. T. Sessums, C. T. Watts. Louisiana Polytechnic Institute, B.S., M & E, 1936. Gulf Power Co., District Engr., Asst. District Engr., Asst. Dist. Manager, 1936-37. Southern Kraft Co., Elec. Design Engr., Const. & Operating Electrician, 1937-41. Town of Springhill, La., Electrical Inspector, 1939-41. Design of Distribution Oil Circuit Breakers & Transformer Stations, 1942. H. B. Deal & Co., Ozark Ordnance Works, Electrical Inspector, 1942. Silas Mason Co., Asst. Supt., 1943-44. Electrical Contractor and Engineer, private practice, 1944 to date. Member International Ass'n of Electrical Inspectors, A.I.E.E.

WALLACE VERNON RATCLIFF, Ruston; age 35. Endorsed: J. M. Doyle, J. E. Ross, E. R. Woodman. Louisiana Polytechnic Institute, Civil Engineering, 1931-33. La. Dept. of Highways and U. S. Engineer Dept., various positions, 1933-42. R. P. Farnsworth Co., Construction Supt., 1942-43. 116th Naval Const. Battalion, 1943-46. La. Dept. of Highways, Project Engineer, 1947-date. Member La. Highway Engineers' Association.

I. MARSHALL RICHARDSON, New Orleans; age 30. Endorsed: B. M. Dornblatt, Charles Keller, Jr., L. J. Lassalle. Louisiana State University, B.S. Pet. Eng., 1941. U. S. Army Corps of Engineers, 1941-45. Standard Oil of Calif., Asst. Area Engineer, 1945-48. Keller Construction Corp., Asst. to President, 1948-date. Licensed Prof. Engr., Calif. Member A.P.I., A.I.M.-M.E., S.A.M.E.

ERNEST T. ROBINSON, JR., Shreveport; age 31. Endorsed: E. M. Freeman, J. P. McCullough, E. M. Gillen. La. Polytechnic Institute, B.S.C.E., 1938. U. S. Engineer Dept., Vicksburg, 1938-39. United Gas Pipe Line Co., Monroe, 1939-44. Columbian Gasoline Corp., 1944-47. Texas Eastern Trans. Corp., Shreveport, 1947-date.

OTHA C. RODDEY, Monroe; age 54. Endorsed: A. T. Givens, S. E. Huey, R. T. Sesums. Interstate Natural Gas Co., Inc., 1926 to date, supervision of construction, operation and maintenance of elec. equipment and radio communication system. Member National Ass'n of Corrosion Engineers, The Electrochemical Society, and Baton Rouge Industrial Forum.

CHARLES J. RUSSELL, Lafayette; age 45. Endorsed: P. P. Angier, H. L. Lehmann, J. E. Jarman. Louisiana Highway Commission, Rodman, Levelman, 1930-32. Siems Helmers Const. Co., Rodman, 1933-34. La. Dept. of Highways, Instrumentman, Jr. Project Engr., Sr. Project Engr., 1935-date.

FRANCIS X. SHAUGHNESSY, Sterlington; age 36. Endorsed: H. D. Richardson, R. T. Sessums, C. T. Watts. Louisiana State University, Arts & Sciences, B. S., 1935. La. Highway Commission, Survey Crew, 1935-36. La. Power & Light Co., 1936 to date, as Asst. Engineer, and Engineer.

ROY SINGLETARY, Lafayette; age 51. Endorsed: R. T. Brooks, J. E. Jarman, H. L. Lehmann. Louisiana State University, 3 yrs. in C.E. La. Dept. of Highways, Instrumentman, Project Engineer and Office Engineer, 1926-49. Asst. District Maintenance Engineer, Feb. 1949-date.

WESLEY J. SPERIER, New Orleans; age 31. Endorsed: A. J. Conner, L. I. Korn, J. P. Fernandez. Louisiana State University, B.S.M.E., 1940. Boeing Aircraft Co., Seattle, Engineer, 1940-44. Corps of Engineers, N. O. Dist., Mech. Engineer, Oct. 1947-date.

CHARLES W. TAYLOR, W. Monroe; age 33. Endorsed: G. O. Edelen, R. T. Sessums, C. T. Watts. Louisiana Polytechnic Institute, B.S., M & E., 1938. Westinghouse Elec. Mfg. Co., Junior Steam Engr., 1940-44. McBryde Sugar Co., Kauai, Hawaii, Electrical Engineer, 1944-46. La. Power & Light Co., Commercial Service Representative, 1946-date.

ALVIN C. VOLK, Bastrop; age 57. Endorsed: S. E. Huey, R. T. Sessums, R. A. Smith. University of Illinois, C.E., 1915. Railroad work, 1916-22. Private practice since 1922.

AARON D. WILLIAMS, JR., Monroe; age 34. Endorsed: A. T. Givens, S. E. Huey, W. S. Leake. Louisiana Polytechnic Institute, B.S.C.E., 1935. T. L. James Const. Co., Field Clerk, 1935-36. Columbian Gasoline Corp., Engineer, 1936-41; Supervisor Eng. Dept., 1941-48; Chief Engineer, 1948-date.

FOR TRANSFER FROM JUNIOR TO FULL MEMBER

LOUIS J. ROSENBOHM, JR., New Orleans; age 26. Tulane University, B.E. in C.E., 1944. Civil Engineer Corps., Road Grading, Pit Operation, Concreting, 1944-46. Jones & Laughlin Steel Corp., Design and detailing ,1946-48. American Sugar Refining Co., Engineer Inspector, Wharf Construction, 1948-date. Licensed C.E., Louisiana. Member A.S.C.E.

FOR AFFILIATE MEMBER

CHARLES EDWORD DOERLER, Shreveport; age 39. Endorsed: E. M. Freeman, V. A. Lyons, F. W. Grant. University of Akron, 1931; A.B., B.E.,

M.A. degrees. Traffic and industrial safety engineering since 1936, now Managing Director, Caddo Bossier Safety Council, Inc. Member American Society of Safety Engineers.

POOLER B. THIGPEN, JR., Tallulah; age 38. Endorsed: J. B. Pettey, J. E. Ross, E. R. Woodman. Inspector, Laboratory Technician on Asphalt Seal Construction; Field Laboratory, Inspector, Bit. Surface Treatment; Jr. Instrumentman on Soil Cement Construction; Instrumentman on Location Surveys; Sr. Plant Inspector, concrete paving construction; Soils Technician, soil cement construction; General Office Man, Inspector on Asphalt Underseal Construction, 1946-49.

CLARENCE J. ROBERTS, JR., Baton Rouge; age 28. Endorsed: H. L. Landry, W. D. Poole, H. T. Barr. University of Georgia, B.S. Agri. Eng., 1943. Penn. Salt Mfg. Co., Philadelphia, Mfg. Representative, 1946-47. La. State University, Instructor, Dept. Agri. Eng., 1947-48. Gulf States Utilities Co., Junior Farm Representative, 1948-date.

FOR JUNIOR MEMBER

HARRY IZEN ABBOUD, Monroe; age 27. Endorsed: S. E. Huey, R. T. Sessums, C. T. Watts. Louisiana State University, B.S.Ch.E., May 1948. Thermatomic Carbon Co., Sterlington, Plant Engineer. Junior Member A.I.Ch.E.

W. RAY BAATH, Monroe; age 25. Endorsed: R. A. Smith, J. J. Thigpen, C. T. Watts. Louisiana Polytechnic Institute, B.S.Ch.E., 1948. Texas Technoligical College, ASTP Program Mech. Eng., 1943-44. Interstate Natural Gas Co., Trainee, June 1948-date. Jr. Member American Chemical Society.

JAMES KENDALL BROTHERS, JR., Monroe; age 28. Endorsed: A. T. Givens, H. D. Richardson, R. T. Sessums. Louisiana Polytechnic Institute, B.S.M.E., 1948. Columbian Gasoline Corp., 1948-date.

RICHMON S. BURNSIDE, JR., Tallulah; age 22. Endorsed: J. B. Pettey, R. T. Sessums, C. T. Watts. Louisiana Polytechnic Institute, B.S.C.E., 1948. La. Dept. of Highways, Chief of Party, 1948-date. Licensed C.E. and Surveyor Louisiana.

SALVADOR J. CAMPAGNA, Chalmette; age 24. Endorsed: L. I. Korn, L. J. Lassalle, J. P. Fernandez. Louisiana State University, B.S.M.E., 1948. University of New Mexico and California, Inst. of Technology, Meteorology courses. Stone & Webster Eng. Corp., Baton Rouge, June-Aug. 1948. Corps of Engineers, N. O. District, 1948-date. Member Tau Beta Pi.

RAY L. DAY, Bastrop; age 23. Endorsed: S. E. Huey, R. T. Sessums, R. A. Smith. Louisiana State University, B.S.M.E., 1948. A. C. Volk, Bastrop, La., Party Chief and Asst. Eng., summer 1947, and 1948-date. Member A.S.M.E.

HAROLD J. DeBRAY, Monroe; age 25. Endorsed: S. E. Huey, R. T. Sessums, C. T. Watts. La. Polytechnic Institute, C.E., 1948. Interstate Natural Gas Co., 1 yr. Licensed C.E., Member La. Institute of Civil Engineers.

CLARENCE M. DUNLAP, Monroe; age 26. Endorsed: F. E. Hogan, S. E. Huey, R. T. Sessums. Louisiana Polytechnic Institute, B.S.C.E., June 1949.

LESLIE M. DYSON, Ruston; age 25. Endorsed M. R. Johnson, Jr., R. T. Sessums, C. T. Watts. Louisiana Polytechnic Institute, B.S., 1948. Army Air Forces, Aerial Navigator, 1944-45. La. Polytechnic Institute, Instructor, Dept. of E.E., 1948-date.

NORMAN P. FAUCHEUX, Monroe; age 25. Endorsed: H. L. Henry, H. D. Richardson, R. T. Sessums. Louisiana State University, B.S.E.E., 1949. La. Power & Light Co., Asst. Electrical Engineer, 1949-date. Student Member A.I.E.E

EUGENE A. FRISCH, JR., New Orleans; age 24. Endorsed: J. E. Hassinger, Jr., I. Isaacson, Jr., C. A. Peyronnin, Jr. Tulane University, B.E., Mech. Eng., 1947. North Carolina State College of A & M, 3 months Mech. Eng. course, Army Specialized Training Program. La. Power & Light Co., Cadet Engineer, Asst. Engineer, 1947-date. Member A.S.M.E., Tau Beta Pi.

ROBERT J. GRUSH, New Orleans; age 31. Endorsed: J. P. Fernandez, R. P. Lockett, Jr., H. J. Molaison. Tulane University, Mech. Eng. Degree, 1943. U. S. Navy, Lt. DE, Eng. Officer "AA" Cruiser, 1943-44; Destroyer, 1944-45. Inspector of Supplies, War Equipment, U. S. Gov. 1945-47. F. N. Johnson Co., Sales Engineer, 1947-date.

DALE LEROY HANNAFORD, West Monroe; age 24. Endorsed: M. R. Johnson, Jr., R. T. Sessums, C. T. Watts. Louisiana Polytechnic Institute, U.S.N. V-12, 1943-45. Princeton University, Premidshipman; Columbia University, Midshipman, 1945. U. S. Navy. Engineering Officer, 1945-46. Louisiana Power & Light Co., Asst. Engineer.

THOMAS REGINALD HENRY, JR., Monroe; age 25. Endorsed: A. T. Givens, R. T. Sessums, C. T. Watts. Louisiana Polytechnic Institute, B.S.C.E., 1948. Columbian Gasoline Corp., Monroe, June 1948-date. Member La. State Institute of Civil Engineers. Registered C.E., La.

DAVID F. POBST, JR., Bastrop; age 23. Endorsed: E. N. Brodnax, S. E. Huey, C. T. Watts. University of Texas, B.S.C.E., Aug. 1947. Turpin Lumber Co., Monroe, residential and commercial construction, Jan. 1949-date. Licensed C.E., La. Member A.S.C.E., American Concrete Institute.

ALBERT B. TRICHE, New Orleans; age 20. Endorsed: H. L. Lehmann, A. G. Mundinger, J. J. Mundinger. Louisiana State University, Graduate in E.E., June 1949.

JAMES J. VONHOOF, Bossier City; age 25. Endorsed: T. F. Cash, E. M. Freeman, C. A. Frey. University of Texas, B.S.C.E., 1948. Humble Pipe Line Co., Head Chainman, 1944. United Gas Pipe Line Co., Junior Engineer, 1 yr. Licensed C.E., La.

ALFRED OMAR WARE, Monroe; age 26. Endorsed: S. E. Huey, R. T. Sessums, C. T. Watts. Northeast Jr. College of L. S. U., 1939-41. University of Arkansas, 1941-42. La. Power & Light Co., Sterlington, Chemist, Dec. 1946-date, in charge of boiler water control.

ROBERT MILTON WILLIAMS, New Orleans; age 28. Endorsed: C. G. Cappel, R. E. Gosa, J. K. Woolf. University of Mississippi, B.S.C.E., 1949. Member A.S.C.E.

JOSEPH A. YAZBECK, Shreveport; age 24. Endorsed. W. W. Alsup, H. E. Kellar, E. M. Freeman. Mechanical Engineering work in college, 2½ yrs. Southern Methodist University, degree in Mathematics (lacking only a few hours for a Masters') with a minor in Physics, 1948. The J. B. Beaird Co., Planner-Estimator, 8 mos.

PAPERS AND DISCUSSIONS

SOME ASPECTS OF LIQUEFIED PETROLEUM GAS (BUTANE AND PROPANE) INDUSTRY

By Frank Fetherston *

It is pleasing to me to have the opportunity of talking to your Society about Liquefied Petroleum Gases for it has been my special privilege to be associated with that industry from the time it began to gain some public notice.

The origin of the industry is still a matter of debate but I believe that most of the interested people credit a young German chemist named Herman Blau with the first experiments in the liquefaction and utilization of the fore-bears of this industry. Young Blau was engaged in the manufacture of an oil-gas called Pintsch Gas when he detected a phenomenon that inspired further investigation. He noted that liquid spilled from one of his containers of Pintsch Gas turned to a gas as it flowed toward the ground. From this observation grew the experiments that produced a liquid which was then called Blau-Gas, and which today, after considerable refinement, we know as Butane. These first experiments were made in 1903. I will not bore you with a history of the LP Gas industry. Blau gas had its chance here in the United States but failed to 'make the grade" for many reasons, both technical and economic. However, the need for a fuel gas did not die with the passing of Blau gas. Hydrocarbon gases recovered from natural gas sources gradually began to replace it.

According to the reports of the U. S. Bureau of Mines the amount of liquefied petroleum gas sold in the United States in 1922 amounted to two hundred twenty three thousand gallons. The industry really started to grow about this time and ten years later in 1932 the report of the Bureau of Mines indicated sales for that year of thirty four million gallons. Ten years later, in 1942 and just before the restrictions upon expansion of the industry dictated by the War, the sales of LP-Gas approximated five hundred eighty five million gallons. The last published information on this subject concerned the sale for 1948. In that year the industry sold more than two billion gallons. These figures show a remarkable rate of growth, and those of us who have had the privilege of playing even a small part in the affairs of the industry are extremely proud of it. It is estimated today that approximately five million domestic consumers of gas are obtaining their fuel directly

* Vice-president, Liquefied Petroleum Gas Association; Secretary-treasurer, Compressed Gas Manufacturer's Association. Presented at the regular meeting of the Society on Aug. 8, 1949.

from the liquefied petroleum gas industry. It would be impossible to estimate the number who are using so called "city" gas which contains LP-gas in some proportion.

Just in case you are not familiar with what the LP-gases are used for I would remind you that they provide a fuel for domestic consumers generally located beyond the reach of city gas mains. They furnish heat for cooking, water heating, space heating, and refrigeration. City gas plants use huge quantities to augment their manufactured or natural gas supply, or use it mixed with air directly in their mains as a substitute for manufactured gas. The chemical industry consumes great quantities for the production of many important materials such as synthetic rubber aviation gasolines, plastics, etc. In fact new uses are constantly coming to the attention of the industry.

The Liquefied Petroleum Gases, as we know them today are hydrocarbons that are chiefly recovered for commercial purposes from natural gas, although in recent years more and more of these gases are being obtained from refinery sources.

Natural gas, as you undoubtedly know, flows from a well together with crude oil. The oil and gas is led into a gas trap at the surface where they are separated. The oil goes into storage for delivery to the refinery, while the gas, which at this stage is called "wet gas" is piped to a gasoline absorption plant. In this plant the "wet gas" is passed through an absorber where the natural gasoline and liquefied petroleum gases are removed from the bottom, while the "dry gas" goes off the top and is piped into transmission lines for sale to utilities and elsewhere.

The absorbing medium, called absorption oil is pumped to a still where its content of natural gasoline and liquefied petroleum gases is boiled off forming "wild" gasoline. The stripped absorption oil is returned to the absorber to pick up another charge. The "wild" gasoline is piped to stabilizing towers where the natural gasoline content is removed from the bottom as a finished product, and the mixture of LP-gases is removed from the top. If so desired the mixture of LP-gases can then be separated into the several products that constitute the range of these gases.

These are normal butane (C4 H10); Isobutane (C4 H10) and propane (C3 H8). It is interesting to note on passing that both Normal and Iso butane have the same chemical formula (C4 H10). The molecular structures are different, however, which accounts for the differences in physical characteristics.

These three gases are very similar to each other, the main difference being their boiling points and vapor pressures. Normal butane for instance boils at 30.9°F, while Iso butane boils at 10°F

and propane at minus 44°F. These temperatures are measured at sea level.

Every liquid has a vapor pressure at temperatures above its boiling point. These pressures naturally increase as the temperature is increased above the boiling point. Water is a well known example. If water is heated to 212°F at sea level its vapor pressure is greater than atmospheric pressure and so it starts to boil. If this boiling water is confined to a closed vessel, and additional heat is applied, the pressure of the water vapor in the container increases. So it is with the LP gases. If propane, for instance, is placed in a closed container it will have a vapor pressure (or pressure in the container) providing the effective temperature is above minus 44°F. The propane will boil and the vapor pressure will increase until this pressure reaches the vapor pressure of propane at the effective temperature. For instance, if the effective temperature is 70° F the propane will continue to boil until a pressure in the container of 109 pounds per square inch is reached, this being the vapor pressure for propane corresponding to an effective temperature in the container of 70°F.

Now it is these phenomena that make the Liquefied Petroleum Gases so extremely suited for economic storage, transportation, and use. They are handled as liquids under pressure; stored in pressure vessels; transported by rail tank car, motor tank trucks and in portable pressure vessels.

Before these LP-gases can be utilized they must be converted again to the gas state. This slide shows a cut away section of a typical portable cylinder. Above the liquid in the container is gas in the vapor state under pressure equivalent to the vapor pressure of the LP-gas at the temperature that is effective in the system. The gas is removed through a valve and pressure regulator. The pressure regulator reduces the pressure from that which is in the container to the low pressure required to operate the gas consuming appliance. For home use this latter pressure is usually between about eight to eleven inches of water.

The similarity between LP-gases and natural gas is found again in the fact that they are both flammable and both form explosive mixtures with air under certain conditions. This is no cause for alarm, however, as any gaseous fuel will form an explosive mixture with air in certain proportions. But if they were not combustible gases, there would be no need for them as a source of heat energy.

And right here I want to state that considerable emphasis is placed upon these characteristics of the LP-gases. However, LP-gas

is no more hazardrous and presents no greater hazard in handling and use than does natural gas, or even natural gasoline.

The lower limit of flammability represents the minimum percentage of the gas in air which will support combustion, while the high limit is the maximum percentage that will support combustion. It will be noted that the lower limit for carbon monoxide is 12.5% with a high limit of 74.2%. For Hydrogen the low limit is about 4% and the high limit is again about the same as for carbon monoxide, 74.2%. These gases represent the extreme conditions. Hydrogen and air mixture are flammable over a range of about 70%. The maximum spread between the lower limit and the high for the LP-gas that has the widest range is only 9.1%. This spread is for propylene.

Compared with the data for LP-gas the spread between the lower and higher limits for natural gas is 9.8%. The spread for manufactured or water gas is 31.3%. From these comparisons it is noted that the limits of flammability are less for LP-gas than for other commercial fuel gases. It is true, however, that the lower limit for LP-gas is lower than that of other commercial fuel gases. But by the same token, you are out of the flammable range with LP-gases sooner than you are with the other fuels, and the range is narrower.

Here is one of the bug-a-boos that has constantly plagued the LP-gas industry. The specific gravities of these gases are heavier than that of air. Propane, for instance, has a specific gravity approximating 1.5, air equaling unity. It is often erroneously claimed that the LP-gases seek out low levels and remain in heavy concentrations at low levels for protracted periods of time. This I want to refute.

The LP-gases mix with air just as other gases do. They are not exceptions to the gas laws. The mixing of gases occurs through a combination of two factors, (1) mass movement and (2) kinetic motion. Mass movement is due to currents inducted by (a) discharge velocity of one gas into another, (b) temperature differentials, (c) Moving objects (d) pressure changes, etc. Kinetic motion is wholly a molecular phenomenon of random motion and is independent of mass movement pressure, etc. The mathematical derivation of its effect is a problem involving the calculus. It is nevertheless solvable for fairly simple conditions. Basically the kinetic theory of gases states that the average kinetic energy of all gas molecules at a given temperature is the same and can be expressed in the formula that is well known to you all.

$$\text{Kinetic Energy} = \tfrac{1}{2} \text{ Mass} \times (\text{Velocity})^2$$

$$K = \tfrac{1}{2} MV^2$$

$$\tfrac{1}{2} MV = \text{A constant} = K$$

Since the rate of gas diffusion is proportional to the velocity of the average molecule, then

$$\text{Rate of Gas Diffusion} = \frac{K}{\sqrt{\frac{M}{2}}}$$

Since gas density is proportional to gas mass, we may substitute density for mass in the equation above.

$$\text{Rate of Gas Diffusion} = \frac{K}{\sqrt{\text{Gas Density}}}$$

or expressed another way the rate of diffusion is inversely proportional to the square root of the gas density.

I do not know of any tests having been made intentionally to prove that LP-gases do not stratify and do not settle into low places for unusual length of time. There were, however, a series of tests made by Underwriters Laboratories in Chicago in 1942 for the purpose of determining the effectiveness of a certain odorant used by the LP-gas industry as a warning agent. In connection with this study the Laboratories built a room ten feet by ten feet by twenty feet long, (cubical content two thousand cu. ft.) This room was built as nearly gas tight as possible. Gas sampling apparatus was set up outside with connections to sampling tubes placed one foot, five and one half feet and nine feet above the floor in the horizontal plane and three feet, and eleven feet three inches and nineteen feet six inches from end of the room through which gas was injected. There were twelve sampling stations in all.

Propane gas was released into this room at a point twelve inches above the floor at the midpoint of one end of the room. The gas was released through a quarter inch tube at the rate of one pound of propane per hour, or 8.76 cubic feet. This quantity incidentally is equivalent to the consumption of an average domestic hot water heater (21,500 B. T. U.) As mentioned before, these tests were not set up intentionally to provide data on gas concentrations, however, some very interesting information can be found in them. I do not have illustrations to give you this story graphically as time did not permit my preparing it. Some of the highlights, however, may provide food for thought.

In the first test reported propane was allowed to flow into the room for three hours. Samples were taken at all twelve sampling stations at fifteen minute intervals. Plotting the results of these samplings using time as obsyssa and percentage of propane by-volume as ordinates it is noted that the maximum and minimum concentrations found varied less than one quarter of one percent. By plotting a curve representing perfect mixing of the gas in the room it is noted that the curves plotted from test data followed he

theoretical very closely. In fact the widest variation between highest concentration and lowest concentration in the room at any one time was less than one quarter of one percent. The curves merged after about the fifth hour and took a gradual slope downward indicating that there was loss of gas somewhere in the system. In other words the room was not completely gas tight; otherwise the gas concentration would have remained constant after reaching equilibrium. At no time during this test did the gas concentration reach the lowest limit of flammability.

In the second test similar data were developed. Propane was injected at the same rate for four hours before shutting it off. Analyses were made at fifteen minute intervals, at each of the twelve sampling points for six hours—two hours after the gas was turned off. The results were almost identical with those found in the first test. The curves representing highest and lowest concentrations of gas were almost identical with the thereical mixture curve, and became constant shortly after the gas was turned off. Again the concentration did not reach the lowest limit of flammability for propane (2.2%.

Now you may wonder what the point is in reviewing these tests. It is simply this. Almost from the conception of this industry much stress has been placed upon the fact that these gases because of their heavier than air densities, present a greater hazard in use than do such lighter gases as natural and manufactured gas. Unfortunately the LP-gas industry, like all industries that utilize potentially hazardous commodities is regulated by Federal, State, and in some cases by Municipal authorities. Our industry has felt on occasion, that an injustice is inflicted upon it where prohibitions are enforced which are the result of misunderstanding. I must add here in fairness to the regulating authorities that the industry itself is largely responsible for many of these misunderstandings.

In some jurisdictions prohibitions have been placed on certain uses of LP-gas because of its heavier-than-air density while similar prohibitions do not exist with respect to the same use of manufactured or natural gas. In the statements previously made I have attempted to present some evidence that the premise has been unfounded. Propane when in the gas phase does not stratify in air mixtures. It presents therefore no greater hazard when used under similar conditions than does natural or manufactured gas.

Because I have made these comparisons with natural and manufactured gas please do not think that there is any quarrel between those industries. These gas industries are all allies and competition between them is almost an unknown quantity. I am interested, however, in obtaining for the LP-gas industry recognition of what may be called the same acceptable risk in use as is recognized in the instance of natural and manufactured gas.

RURAL ELECTRIFICATION IN LOUISIANA

Boone Richardson *

Rural electrification had its beginnings in Louisiana in the early 1920's. Pioneering in this field was the Louisiana Power and Light Company. Existing records show 400 farms receiving electric service in 1924. Louisiana Power and Light Company employed an agricultural engineer to begin rural development in 1929. The economic status of most Louisiana farms did not invite development by private enterprise and progress remained negligible for several years. By 1938 various federal programs had raised the econimic standing of the farmer and the construction of rural lines was stimulated by the entrance of REA into the state. Since this time the per cent of electrified farms in Louisiana has risen from 4.7 in 1937 to 55.3 in 1948.

Transmission and distribution voltages vary throughout Louisiana. REA cooperatives serve slightly more than half the farms receiving electricity. These distribution lines are chiefly 7620 volts. Utility company distribution voltages range from 2300 to 7620. The major transmission lines spanning the state are privately owned and are either 66 or 110 KVA—with some 132 KVA lines under construction. Many of the cooperatives and smaller companies operate 33 KVA transmission lines within their own systems. Transmission is all three phase and the amount of three phase distribution line is increasing rapidly.

While rapid strides have been in methods of bringing electricity to the farmer. consumer education has lagged far behind. The consumption of electricity on the farm remains lower in Louisiana that in any other state in the Union. This is due to several factors. One—the majority of Louisiana farmers were in the lower income groups. Two—wartime scarcities of appliances and equipment. Three—expansion of generation and transmission facilities was unable to keep up with rapidly increasing demands. For these and other reasons power suppliers have been handicapped in promoting load building programs. With the imminent approach of a more balanced condition, there is no reason why educational programs should not be undertaken by all power suppliers.

Great savings could result from the increased use of electricity in farm work. Today, as always, hired help is a major item of expense around a farm. This cost stands out especially when compared with the price of a kilowatt hour. There is a need for someone to educate the farmer in the proper applications of electricity around his farm. This must be done by means of a well

* Graduate Research Student, Louisiana State University. Presented at Baton Rouge Section meeting.

planned sale sand education program. Salesmen having the technical and practical knowledge to discuss the farmer's problems with him are needed. Complete information on the proper installation and use of equipment must accompany the sale. When all of the power suppliers have the services of an agricultural engineer and a home economist available for consultation and guidance of consumers, uses and applications of electricity on the farm will increase.

A study of past records reveals that certain trends are usually followed by the farmer in purchasing electrical equipment. No planned system of equipment purchase is applicable to all farms. The general trend, however, is to follow this order: Lights, radio, iron, refrigerator, water pump, washing machine. From these he goes to the purchase of machinery for farm operations according to the particular type of farm.

Applications of electricity to farming operations will vary throughout Louisiana with the type of farming practiced. No farm should be without the convenience of barnyard lighting and hot and cold running water. The dairy industry could make far greater use of electricity. The dairy farmer can profitably use a milking machine, milk cooler, food grinder, and feed mixer. Barn ventilation is needed in the larger dairies. In a dairy selling bottle milk, separators, bottling equipment, bottle washers, pasteurizing ... and churns are all needed.

The poultry farmer is continuously finding new uses for electricity. Two of the greatest inventions for the poultryman are the electric incubator and brooder. Egg production has been increased by timed poultry house lighting, which lengthens the working day of the hen. There are also burglar alarms, water warming devices, egg graders, spraying apparatus and feed grinders. The use of ultra-violet and bactericidal lamps has lowered the mortality rate of chicks and held down diseases among the laying flock.

The need for increased knowledge in the applications of electricity can be found throughout the state. The farmer's wife is just beginning to realize the benefits and pleasures that go with the use of frozen foods. The high and unpredictable Louisiana rainfall has caused the University to start experimentation and research in barn hay drying methods.

Louisiana State University is attempting to meet the need for education in rural electrification. The extension department employs a rural electrification specialist for state wide assistance. His work is chiefly with the county and home demonstration agents throughout the state.

The agricultural engineering department now offers an option in rural electrification for agricultural engineers. This was started with the present school year and provides students who wish to specialize an opportunity to receive more detailed instruction in the applications of electricity to farm operations. The chief difficulty encountered in this course has been the dearth of material for use in teaching. This has been true of reference material as well as of eqiupment for demonstrations and experiments. The new agricultural engineering building—now nearing completion—will have facilities for installation and operation of electrical equipment which it is hoped manufacturers will provide. In the field of research, the department has a graduate research fellowship financed by private endowment for rural electrification study.

The combined efforts in extension, teaching and reaserch will serve to train specialists in the field of rural electrification. These engineers will find awaiting them the task and opportunity of helping the Louisiana farmer raise his standards through electrified farming practices.

ENGINEERING BRIEFS

Two-level expressway predicted for Houston. Houston, Tex., may be no more than a decade away from an elevated highway through its business section which will rise as high as six stories—and stack up the motorists four deep at one point. At present, it's estimated to be a $30,000,000 job.

Houson office employes of the Texas Highway Department already have some of the expressway sketched. Five miles of double-decked construction are envisioned—four lanes wide—form the Ship Canal area east of Houston to Eureka, on the west.

There's a possibility of roof-top parking on the MK&T building, and at one downtown point, motorists would have to choose between a ground level road, an elevated road which already exists, and the two-lane expressway. The upper deck would range from 40 ft. above ground to six-story level.

The expressway plan is only one of several proposals, but some engineers say it's the most likely.—*Engineering News-Record.*

Boiler Paid Dividends. We have often read about equipment that "pays for itself." That this is actually true on occasions is proved by an instance reported in a letter that recently appeared in *The Engineer,* a British technical publication. It relates to the late Sir George Willis, an English engineer who was assigned by his government to serve in the Bombay, India mint during World War I. In anticipation of the need for additional coinage during the war, it was decided to increase the mint's power-generating facilities. An inspection of the massive steam engines that had served for nearly 100 years revealed that they could be operated at double the prevailing pressure, and it was decided to retain them but to provide new boilers. After the changes had been made, the old boilers were examined and found to be of solid copper more than an inch thick. The metal was melted down, alloyed properly, and converted into coins whose value was greater than the initial cost of the original boiler plant plus that of the new equipment.—*Compressed Air Magazine.*

Large Phenolic Moldings. According to the Durez Plastics News, the year 1949 will be marked on the calendar by historians of the plastics industry as a period during which old conceptions of size limitations for compression-molded pieces were abandoned by progressive engineers. After a steady upward trend in size during 1948 and the early months of 1949, Molded Products Corporation recently announced production of a one-piece, 35-lb, phenolic-plastic, television console cabinet for the Admiral Corporation.

In almost every case where a big plastic housing or part has been utilized, the cost of the final product has been reduced. In the case of the Admiral console, the retail price of the plastic-housed model is approximately $100 below that of comparable sets with wood cabinets.

Besides its proved ruggedness, other advantages of the plastic from the consumer point of view are its immunity to alcoholic and other beverages which may be spilled on it, and its resistance to burning should a lighted cigarette or cigar be dropped on its surface. Further, the finish is practically marproof, since it is an integral part of the cabinet rather than an applied coating.

A 30-ft-high compression-molding press is used to supply the 4,000,000 lbs of pressure which is required to mold the big console cabinet. Built by Bethlehem Steel during the war for the Russian government, the big press was never picked up. Molded Products Corporation purchased it from an Akron, Ohio, machinery dealer. It was shipped piecemeal to Chicago, and twelve weeks were required for installation and assembly.

A 75-hp motor operates the powerful oil pump which supplies the hydraulic pressure to operate the press. Because of this hydraulic operation, the enormous pressure exerted by the press is built up slowly, thus allowing the gas and air to escape from the mold before hardening of the softened plastic begins to take place.

Other data on the press are: molding stroke, 60 in.; maximum press opening, 128 in.; molding bed dimensions, 96 in. on each side; clearance between pillars, 54 in.

Starting with flawless castings, the various parts of the mold were first rough-tooled to approximately their final shape. Then hand finishers brought them to their final state of perfection. Each part was then case-hardened by "soaking" in a cherry-red bath of bone charcoal.

Several of the finished pieces were then assembled together on a back plate to form the mold insert section or bottom die. This section forms the front outside surface of the console, being mounted stationary, face up on the molding bed of the hydraulic press.

Two other pieces were bolted to a second back plate and clamped to the press ram to form the plunger section or male die, which applies the pressure generated by the hydraulic pump. This male die is deliberately left slightly rough so that the finished cabinet will stick to it, thereby being extracted from the cavity when the press ram is raised upon completion of the molding operation.

The third section of the mold, weighing 6000 lb, is a massive cavity which shapes the top, sides, and bottom of the console.

In order to withstand the tremendous pressures built up during the molding operation, the walls of this cavity are nine to ten inches thick.

The mold complete with back plates and die supports, weighs about 20,000 lb.

The actual molding process employed follows closely standard compression molding procedure, with the exception of being on a much larger than normal scale. Seventy half-pound preforms or "bricks" of the phenolic material are first brought up to molding temperature in a high-frequency electronic preheating machine. When the preheating is completed, the mold cavity is cleaned out with a high-pressure air blast and the "charge," totaling 35 lb of molding material, is carefully loaded in the bottom of the mold. The press is then started in motion, and the plunger section starts its descent into the cavity. The time required for the complete cycle is seven minutes.

As the plunger comes into contact with the heated preforms, it slows to a crawl and begins building up the tremendous pressure required to liquefy the molding material and force it into every crevice of the mold. Once this is accomplished and the mold is fully closed, the baking period begins, during which the combination of heat, supplied by high-pressure steam circulated through cones in the mold, and pressure completes the polymerization of the phenolic compound, and changes it into its final hard infusible state.

After this baking period, which consumes approximately 3½ min, is completed, the plunger is extracted from the mold cavity, bringing with it the completed one-piece console. This is immediately removed from the plunger, and the cycle begins over again.

The cabinet, complete in every detail, including the center shelf which supports the television chassis, is ready for assembly after the thin flash, which forms around the mold parting line and in the grillwork, is removed.—*Mechancial Engineering.*

Looking Backward, 1959. Peering into the future is always fascinating, and is becoming more and more essential to business thinking now it is also part of the course in manufacturing conducted at the Harvard Graduate School of Business Administration by Georges Doriot. This colorful industrial engineer's Gallic creativeness has also been imprinted on the Quartermaster Corps' research and development policy, which he has directed, and on the American Research and Development Corp., of which he is now President. The Harvard course in manufacturing covers not only manufacturing problems, but also the general problems of management, including, especially, provision for the future of the business. Particular emphasis is placed on technological change in-

fiuencing business development. Students keep up with current news through newspapers and business periodicals.

For the term paper, groups of three to six students report on an industry as it might look ten years hence. Predictions as to general economic and political trends, as well as the commercial and technological factors peculiar to the individual industry, are required for writing history ten years ahead. The reports foresee many radical changes, and this year seem to be characterized by a general optimism. Most of the technological questions now in doubt are settled satisfactorily by 1959, and few of the reports predict a serious depression, although some see a relatively minor one for the early 1950's. War is not generally expected.

The synthetic gasoline industry, according to one report, is well on the way to commercial success by 1959, althought it was established only with the aid of Government subsidy. By 1957, synthetics from coal and oil shale are 1.2 per cent of the total production of liquid fuels. With petroleum prices rising, subsidies will not be necessary for the several future plants planned in 1959.

Although automatic industrial controls have not yet created the automatic factory by 1959, another study reports them well on the way. After a depression ending in 1953, the metal-working industries find profit margins so reduced by fixed labor costs that they adopt automatic controls for machine tools, reducing labor costs by 80 per cent. As industry emerges from this depression, it increases production by more automatic controls, rather than by rehiring workers.

By 1959, television has fulfilled the wildest claims made for it in its infancy. Broadcasters operate at a loss only until 1951. Eighty per cent of the U. S. population can be reached by television in 1959, and 69 per cent of all families have sets, to a total of 30 million. The average set price is down to $75 for black and white, and $100 for color, which was introduced in 1956.

Aluminum, too, sails to new statistical heights, but by 1959 it has reached a mature stage, and other metals, magnesium and titanium, which have developed rapidly in the previous decade, are becoming competitive threats. Atomic energy provides the power for some of the alumnium production. Although hydroelectric power is cheaper, where available, atomic power can be located at the mines, and thus is more advantageous for alumnium production. Clay is becoming a satisfactory raw material for aluminum, and occurs so widely that aluminum plants, with their atomic power source, can be located near the markets.

The automatic merchandising industry does as much as anything to revolutionize life by 1959. Sales in coin machines are up to $20 billion from the $3.5 billion of 1949. With such new features as an automatic bill changer, coin machines sell magazines, men's

shirts, diapers, and movie tickets. The ticket vendor is coupled with an electric eye, which counts outgoing patrons, keeping ticket sales in line with the capacity of the theatre. The Keedoozle, or automatic grocery store, is a great success and a serious competitive threat to chain stores which do not adopt the system. Drug stores, however, are not automatic; the individual purchase is too small to justify the equipment.

Not all of the reports are on technological industries, nor are all so optimistic. The review of the toy industry emphasizes the decline of the family as a social unit and the increasing importance of schools, nurseries, and other institutions as toy buyers. The social tone for the decade is indicated by one girls' play kit called, "Going to Reno," which enables a girl of six to ten years to live vicariously the life of the gay divorcee. *Arthur D. Little, Inc., Bulletin.*

From Horses to Cows A new cuurled casein fiber is now being used where the resiliency of horsehair previously had been uniquely suitable. The new fiber, known as Caslen and used as a single filament a few thousandths of an inch thick, is cheaper than the best quality horsehair, equally resilient, and much more dependably uniform and available. The process was suggested by work of the Department of Agriculture, and was developed for these applications by Arthur D. Little, Inc., and the Rubberset Company, which is now producing Caslen.

Casein, obtained from skim milk, is one of the proteins, as are wool, horsehair, and human hair. When "regenerated" in fiber form it will take a permanent curl which gives a mass of fibers a springy quality. Curled Caslen is now used in a new automative air filter made by Fram Corp.; here the Caslen blended with wool filters dust from the air entering the carburetor. The filter unit can be used in old cars as well as new, and can be replaced more easily than the oil in conventinoal filters can be renewed. Mattress and furniture manufacturers are experimenting with Caslen as stuffing; in an uncurled form which is also available it may be blended into textiles to produce novel effects.

Curled Horsehair

The horsehair which has been used primarily as stuffing comes chiefly from Argentina, where wild horses are rounded up each year and their manes and tails are cut. After the raw hair arrives in the United States, it is curled by a laborious hand process. A ropelike roving, about 80 feet long, is softened by steam, wound tightly, and then hung for about six months to set the "permanent wave." When it is torn apart, the intertwined hair makes a soft springy bat. The supply and quality of horsehair fluctuates, and there are indications that the supply is diminishing. About two

and a half million pounds were imported in 1948 and sold at $1.25 to $1.40 a pound.

The curled casein monofilament is now selling for 94 cents a pound, but the price may decline as production increases and the price of dry casein drops. During the war, skim milk was used widely in dried form for human feeding. As foods become more abundant and cheap and surpluses become a problem, the casein market may help to stabilize farm income to some extent.

When skim milk is solidified by hydrochloric or other acids, the casein settles out as a curd, similar to that obtained when milk sours naturally. The casein is dried, water is added, it is heated, and forced through fine jets. The resulting filament is hardened in a tanning agent such as formaldehyde, curled, and dried to a permanent set.

Besides its favorable price position, the curled casein is uniformly clean, the diameter and length of the staple are controllable, and it is believed to be non-allergic. Cleanliness is a particularly important point for mills handling large quantities of fiber, for the natural materials are often heavily contaminated. The filament may also be treated to make it mildew-, moth-, or bacteria-proof. The success of the new product as an improvement over natural horsehair is expected to give impetus to the whole field of filaments and textiles from regenerated proteins.—*Industrial Bulletin of Arthur D. Little, Inc.*

A Most Peculiar Chemical. More research has been done in America and Russia on the strangest liquid known to man.

Helium—the lighter-than-air gas used in dirigibles—when subjected to extreme cold goes into a fluid state like any other gas. Even ordinary air at very low temperatures becomes a dark blue fluid.

If the temperature is still further reduced all liquids change into solids, just as water turns into ice, *excepting liquid helium.* Instead of solidifying, the liquid helium becomes something which appears to be neither solid, liquid, nor gas.

For example, it will leak through the minutest cracks which even a gas cannot penetrate, and in this strange state it possesses no ordinary viscosity such as other liquids have.

Among its many almost uncanny properties is its power to transfer heat. It can do so by a unique method with an ease which puts anything else far behind as a heat conductor, and so utterly remarkable is this property that scientists are referring to it as "heat super-conductivity."—*Intelligence Digest.*

Golf is a game where a ball 1½ inches in diameter is placed on another ball 8000 miles in diameter.

The object is to hit the small ball, but not the large one.

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of Meeting of the Board of Direction Held July 11, 1949

The meeting was called to order by President Lehmann, with Messrs. Abrahm, Cucullu, Hill, Leake, Mire, Newton, Wallace, and Fernandez present. Minutes of the preceding meeting were accepted as read.

The secretary reported that all applicants for membership named in the June ballot were elected, and that the membership at large had voted in favor of continuing the forms of entertainment usually provided at the Annual Outing. Mr. Newton moved that, in view of the results of this poll, the Society continue to provide a floor show as in the past. The motion was seconded by Mr. Mire and carried, with Mr. Cucullu dissenting.

The secretary reported that all chairmen and vice-chairmen of 1950 Annual Meeting committees had accepted their appointments with the exception of the Contact with Woman's Auxiliary Committee. It was moved and passed that Mr. Walter E. Blessey be appointed chairman, and Mr. W. Stone Leake, vice-chairman, of this committee.

General Newton moved that Mr. James S. Janssen be appointed General Vice-Chairman of the Annual Meeting, seconded by Mr. Mire and carried.

The secretary announced that Mr. Archie Lee Dunlap had accepted the chairmanship of the House Committee and that he would select his committee members.

The auditor's report for 1948 was presented. General Newton moved that same be accepted and that the auditor be paid a fee of $100.00 for his work. The motion was seconded by Mr. Wallace and carried.

Letters of thanks for invitations to the cocktail party held on June 30 were received from Mrs. William B. Gregory and Mrs. Charles R. Holle. Cards of thanks for floral offerings were received from the Lehmann and Von Phul families.

Correspondence from Dean Sessums concerning the formation of a section in the fifth congressional district was read. Letters received from the following organizations were read, and the secretary was instructed to answer same: Engineers' Club of Philadelphia, National Society of Professional Engineers, North Louisiana Chapter of the American Institute of Architects.

Mr. Cucullu moved that the letter received from the Board of Standards and Appeals be read at the Society's meeting, seconded by Mr. Mire and carried.

The resignation of Mr. J. F. Halsey was accepted with regret. It was moved and passed that Mr. Thomas J. Rennie, Jr. be reinstated as a local Junior Member. The secretary announced that Mr. Richard Klorer had offered to donate books belonging to his late father, John Klorer, to the Society's library. The secretary was instructed to thank Mr. Klorer, but to decline the gift for the reason that the Society's library is soon to be dismantled because of lack of space.

Correspondence with the various member organizations of the Louisiana Council of Engineers was read, and it was decided that a meeting of the council should be called sometime in September.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Joint Meeting of the Louisiana Engineering Society with the Louisiana Section, American Society of Civil Engineers Held on July 11, 1949

The meeting was called to order by President Lehmann in the Jackson Room of the St. Charles Hotel, with approximately 160 members and guests present. President Lehmann welcomed the A. S. C. E., its members and guests. Mr. J. M. LeDoux moved that the reading of minutes be dispensed with, seconded by Mr. Richard N. Graham and carried.

The secretary read an announcement concerning meetings of the Board of Standards and Appeals.

An obituary of the late William Von Phul, prepared by a committee consisting of Messrs. B. S. Nelson, Chairman, James M. Todd and R. P. Lockett, was read. Following the reading a moment of silence was observed in memory of the deceased member.

The chair then was relinquished to Mr. Walter Scales, Chairman of the Louisiana Section, A. S. C. E., and following the business of that organization Mr. Scales called attention to a bill now pending in Congress (H.R. 3224—Earned Income Tax Adjustment Act of 1949) and urged those present to write supporting letters to their congressmen.

Mr. Louis Bisso then was called upon to introduce the speaker of the evening, Mr. Russell H. Riley, member of the firm of Harland, Bartholomew & Associates, City Planners of St. Louis, Mo., who gave a most interesting address on "Present and Proposed Comprehensive Plan of the City of New Orleans". The lecture concluded with a rising vote of thanks from the audience.

The chair was returned to President Lehmann, who adjourned the meeting.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting of the Board of Direction, August 8, 1949

The meeting was called to order by President Lehmann, with Messrs. Abrahm, Cucullu, Mire, Newton, Wallace and Fernandez present. Messrs. Jeffrey H. Collins, Sr. and R. T. Sessums also were present by invitation. Minutes of the preceding meeting were accepted as read. The treasurer's semi-annual report was presented.

A letter from the N. O. Chapter, Society of Plastics Engineers, concerning the placing of their charter in the Society's library, was read. Mr. Mire moved that the request be granted, seconded by General Newton and carried.

The resignation of Mr. Charles E. Steidtmann, Jr., was accepted with regret.

Mr. Collins presented his views on a new type of publication for the Society. The possibility of exchanging articles with other engineering society publications was suggested by General Newton. Mr. Collins agreed to get cost information and present same to Mr. J. M. Guillory, Chariman Publication Committee.

Dean Roy T. Sessums, Fifth Congressional District Representative, presented a petition signed by 15 voting members and by 45 other persons who are either Junior Members or applicants for membership in L.E.S. The petition requested permission to establish a section of the Society in the Fifth District, to be known as the Monroe Section. Mr. Cucullu moved that the petition be accepted and that a charter be granted to this group following the September elections, so that applicants on this ballot may become charter members. The motion was seconded by Mr. Wallace and carried.

The secretary reported that the Presidents' Trophy awarded at the Annual Golf Tournament was filled with names of former winners and that a new one was needed. General Newton moved that the secretary be authorized to purchase a new trophy, seconded by Mr. Mire and carried.

Mr. Abrahm moved that the Society's membership be polled in order to determine whether they would join an Engineers' Club should one be formed in New Orleans, and if so, what dues they believe should be levied. The motion was seconded by Mr. Cucullu and carried.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Regular Meeting of the Society Held August 8, 1949

The meeting wsa called to order by President Lehmann, with approximately 90 members and guests present. Mr. Charles P. Knost moved that the reading of minutes of the preceding meeting be dispensed with, seconded by Mr. R. N. Graham and carried.

President Lehmann announced that a petition to establish a Monroe Section of the Society had been accepted by the Board, and then introduced Dean Roy T. Sessums, the Society's District Contact Representative for the Fifth Congressional District, who was instrumental in forming this section.

Mr. Aaron Abramson then introduced the speaker of the evening, Mr. Franklin R. Fetherston, Vice-President, Liquefied Petroleum Gas Association, and Secretary-Treasurer, Compressed Gas Manufacturer's Association, who gave a most informative lecture on "Some Aspects of the Liquefied Petroleum (Butane and Propane) Gas Industry".

An active question period followed the lecture, and the meeting closed with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ, Secretary-Treasurer

PROCEEDINGS
OF THE
LOUISIANA ENGINEERING SOCIETY

VOL. XXXV DECEMBER, 1949 NO. 6

CONTENTS

EDITORIAL NOTES AND COMMENTS

Annual Meeting. The cover on this issue of the Proceedings indicates the dates of the annual meeting—January 12, 13, 14, 1950. The various committees are busy shaping up an interesting program. Each member will receive a copy of the list of activities.

New Sections Formed. Within the short period of two weeks, two new state sections have been officially added to the Society. On October 25 a charter was granted to the Monroe Section at a dinner held at the Hollywood Restaurant in Monroe. President Lehmann acted as master of ceremonies and made the presentation, which was accepted by Mr. S. E. Huey, President of the Monroe group. The main speaker for the evening was Mr. M. H. Leavenworth of Dow Corning Corporation, Dallas, whose talk was entitled "Silicones at Work for Industry."

Approximately 65 persons were present, including members of other sections throughout the state: Mr. J. B. Carter, representing the Baton Rouge Section; District Contact Representative Soule Butler, Mr. Charles A. Myers and Mr. Tom C. David of Alexandria; and a number of Shreveport members were observed among the audience. The delegation from New Orleans included

First Vice-President Lionel J. Cucullu and Secretary-Treasurer Fernandez.

On November 11, at the Caddo Hotel in Shreveport, the Shreveport Section received its charter. Though the presentation took place after the Monroe meeting, this section actually was established three months earlier and its charter bears the date of July 3, at which time it was officially recognized by the parent society.

President Lehmann was the principal speaker at this meeting, and presented the charter to Mr. E. M. Freeman, District Contact Representative for the section. Following the speakers, the audience was entertained with some very clever legerdermain by one of our Shreveport members, Mr. Orville T. Ice, Jr.

About 60 attended the banquet, including our First Vice-President Cucullu and Secretary Fernandez; Mr. Louis Duclos, Secretary-Treasurer of the Baton Rouge Section; President E. H. Goodloe and Contact Representative Ray E. Burgess of the Lake Charles Section; and a number of Monroe members led by Mr. Calvin T. Watts, Secretary of the Monroe Section.

A copy of their respective charters was presented to each charter member of both groups. If anyone was unable to attend and did not receive his copy, it may be obtained from the secretary of the section or from the parent organization.

President Lehmann's remarks to the Shreveport group are printed under Papers and Discussions in this issue.

Annual Outing. Departing somewhat from past custom, our annual outing this year was held on October 6 instead of June or July. All phases were well attended, and much of this success is due to the untiring efforts of the committee headed by Chairman R. P. Lockett.

The donors of the attractive prizes which always feature this occasion deserve much praise, and an expression of appreciation. Following are winners and donors of the prizes.

Place—Donor	Prize	Won By
President's Flight		
1 H. L. Lehmann	Cory Coffee Maker	D. W. Stewart
Guests—Low Net		
1 Westinghouse Electric Corp.	Automatic Toaster	H. Twilbeck
2 Murray-Baker-Frederic Corp.	Silver Prize	W. Hinshaw
3 Maritime Electric Co.	Telechron Kitchen Clock	O. Kubel
4 Shilstone Testing Lab. Inc.	Telechron Kitchen Clock	S. M. Rosamond
Members—Low Net		
1 W. Horace Williams Co.	Rod & Reel	H. P. Newton
2 W. D. Taulman & Associates	G E Automatic Blanket	H. J. Lane
3 United Gas Pipe Line Co.	Silver Prize	A. H. Lehman

4	A. M. Lockett & Co., Ltd.	Electric Hot Plate	J. R. Rombach
5	Gulf Engineering Co., Inc.	Dozen Golf Balls	H. L. Blain
6	Orleans Materials & Equip. Co. Inc.	Silver Prize	Espey Reed
7	John H. Carter Co.	Pendleton Shirt	B. Louviere
8	Dixie Machine Welding & Metal Works Inc	Cory Knife Sharpener	D. W. Stewart
9	Southern States Equipment Co.	Golf Balls	L. L. Smith
10	Boh Bros. Construction Co.	Silver Prize	R. N. Nall
11	Allis-Chalmers Manufacturing Co.	Switch Clock	R. P. Lockett, Jr.
12	New Orleans Cement Prod. Co. Inc.	Telechron Kitchen Clock	J. Riorda
13	Jahncke Service Inc	Silver Prize	R. A. Rusca
14	Pittsburgh Testing Laboratory	Table Lamp	K. P. Kammer
15	Patrick H. Dillon	Telechron Kitchen Clock	C. P. Knost
16	Mr. R. E. Gosa	Silver Prize	G. R. Hammett

Members—Low Gross

1	Equitable Equipment Co. Ltd.	Cocktail Tray	L. L. Smith
2	Eugene Dietzgen Co.	Dozen Golf Balls	H. J. Lane
3	Taylor-Seidenbach Inc.	Pendleton Shirt	J. K. Woolf
4	Mr. A. B. Paterson	Silver Prize	C. S. Williamson, Jr.

Member—High Gross

1	N. O. Blue Print & Supply Co. Ltd.	Putter	R. G. Cappel

Horse Shoe Pitching—Singles

1	Boland Machine & Mfg. Co. Inc.	Automatic Toaster	J. J. Brown
2	R. P. Farnsworth & Co. Inc.	Silver Prize	F. M. Taylor
3	Lone Star Cement Corp.	Pendleton Shirt	Harry Tormey
4	General Electric Company	G. E. Kitchen Clock	Sidney Ellis

Horse Shoe Pitching—Doubles

1	New Orleans Public Service Inc.	Lamp	R. V. Payne
1	Allan J. Harris Co.	Sunkist Juicer	J. R. Sellers
2	Frerichs Lumber Co. Inc.	Horse Shoe Set	J. J. Brown
2	Dixie Mill Supply Co. Inc.	Horse Shoe Set	W. P. Massey

Attendance—Guests

1	Asbestone Corporation	G E Fan Heater	R. Augrain
2	Crane Company	Bathroom Scale	D. Granberry
3	Mr. John Riess	Silver Prize	C. H. Young, Jr.
4	Ole K. Olsen Company	Table Lamp	V. A. Tirri

Attendance—Members

1	Reed Unit Fans Inc.	Window Fan	A. J. Harris
2	American Creosote Works	Holliwood Broiler	J. V. Dugan
3	James M. Todd & Associates	Silver Prize	A. W. Betz
4	Standard Supply & Hardware Co.	Barometer	W. K. Bankston
5	Eagle Asbestos & Packing Co.	Man's Gold Knife	T. Alexander
6	Mr. C. G. Cappel	Silver Prize	A. Abramson
7	Flintkote Co.	G E Automatic Coffee Maker	R. M. Seago
8	Jones & Laughlin Steel Corp.	Sandwich Grill	J. R. Rombach
9	Freeport Sulphur Co.	Cory Knife Sharpener	W. M. Larkin
10	Fletcher Equipment & Supply Co.	Silver Prize	D. W. Stewart
11	Frank P. Fisher Engineering Co.	Cory Knife Sharpener	J. D. Haverkamp
12	Service Foundry Inc.	G E Automatic Coffee Maker	F. C. Fromherz
13	Mr. C. P. Knost	Silver Prize	F. B. Blackstone
14	Mr. W. T. Hess	Golf Balls	R .N. Habans
15	Mr. J. K. Woolf	Club Covers	R. Muller
16	Chase Brass & Copper Co.	Silver Prize	
17	Mexico Refractories Co.	Beauty Sage Vibrator	R. Nall
18	Anchor Packing Co.	Dozen Golf Balls	R. Y. Payne

Obituary of

RUDOLPH HERPICH

The Louisiana Engineering Society and our community lost a fine engineer, his family a devoted husband and father, and his friends a loyal associate, with the death on September 25, 1949, of Rudolph Herpich.

He was born in Dresden, Saxony, Germany, on August 9, 1878, and after finishing school, worked as an apprentice machinist in various industrial plants throughout Europe. After visiting this country several times, while working with the North German Lloyd Line, he decided to enter the United States and to become a citizen, an ambition which he realized in 1907. While working as a machinist during the day, he completed a course in engineering at night. Progress in engineering then was rapid—as Chief Engineer for a large brewery, then Port Engineer for the Mexican Fruit and Steamship Company, to a position of Consulting Engineer for Standard Fruit and Steamship Company.

His service to this country during World War I was as an engineer on the U.S. Fuel Administration Board; and World War II ,as an estimator and planner for the U.S. Navy. It is appropriate to note here that upon separation from the Navy he received a certificate bearing a 98% average, of which he was justly proud.

He leaves a wife and two sons, Dr. E. J. Herpich of Baton Rouge and R. Walton Herpich of New Orleans, and four grandchildren.

Rudolph Herpich was a good citizen, a public spirited man, and was devoted to the ideals of this country.

It is, therefore, fitting that we honor his memory by adopting the following resolution:

BE IT RESOLVED, that the Louisiana Engineering Society adopt resolutions embodying the facts as expressed above, and,

BE IT FURTHER RESOLVED that this Resolution be included in the minutes and published in its proceedings, and that copies be sent to his family.

Michael C. Abrahm, Chairman
George R. Hammett
Leo S. Weil

PAPERS AND DISCUSSIONS

APPLICATION OF SUBMERGED COMBUSTION TO THE PROCESSING OF CITRUS WASTES*

Considerable interest has recently been shown in the novel unit operation called submerged combustion, and it is this process that I will attempt to describe along with its successful application to the solution of a serious and difficult scaling problem. In order that we can better understand the nature of the problem and the simple principles involved I would like to take a few minutes to discuss some of the more important factors leading up to the main problem.

During the present season somewhat over 80 million boxes or about 3½ million tons of citrus fruit will be processed into such products as canned juices, frozen concentrates, sections and other less important by-products. Over two million tons of waste, mainly in the form of peels, will be produced as a result. It is easy to see the utilization or disposal of this termendous volume of material has presented quite a problem to the citrus industry. As engineers you are accustomed to dealing with large numbers, but I dare say that most present have been denied the privilege of seeing two tons of grapefruit being processed per minute. The figure was correctly stated . . . two tons per minute, hour after hour. Such is the capacity of the world's largest grapefruit processing plant located at Weslaco, Texas and in which are installed the submerged burners. The large *Texsun* plant is owned and operated by The *Texsun Citrus Exchange,* a grower controlled cooperative. The capacity is more conservatively rated at 1500 tons per day, but often hits the two ton per minute figure, and thus produces in the neighborhood of one ton of waste per minute, throughout the season of about 150 days. Immediately following the costly freeze last winter, Texsun processed as much as 3500 tons per day . . . stated in other words, thus is equivalent to enough finished product to fill a 63 car train each day. Grapefruit are delivered to the plant by trucks and immediately inspected and all bad fruit is discarded. The fruit is then stored in large wooden bins in which it never remains more than a few hours before it is again inspected, washed, and finally passed to high speed mechanical extractors for the juicing operation. The juice is then screened, deoiled and deaerated, pasteurized and finally sealed in tin cans.

* Paper presented by Dr. Everett M. Burdick, Director of Research, Texsun Citrus Exchange, Weslaco, Texas, at the regular meeting of the Society, Oct. 10, 1949. This was a joint meeting with the American Institute of Chemical Engineers.

There are several interesting engineering problems connected with this phase of the citrus industry, but we are more interested this evening in the disposal of the peel coming from the juice extractors at the rate of about one ton per minute. A fairly large dump truck will hold about 5 tons of grapefruit peel, so you can imagine the pile of peel that would soon accumulate should no dehydration facilities be available. Fortunately we have a large dehydration plant in which the peel is ground in hammer mills, treated with lime and partially dewatered by draining. The pulpous portion is converted into a citrus pulp for use as a cattle feed. The sugary liquid draining from the limed peel is called peel liquor, and is concentrated to a citrus molasses that is very similar to the familiar blackstrap molasses. Citrus molasses is difficult to evaporate because of severe scaling. It also has a marked tendency to froth ferment during storage or shipment. These difficulties were overcome by use of submerged combustion.

Before we proceed with the solution of our problem a few words on the theory of submerged combustion are in order: Submerged combustion, just as the term implies, is a method of simultaneously heating and evaporating a liquid by burning a gaseous fuel within a completely immersed fire box in such a way that the flame is in direct contact with the liquid, and the products of combustion are discharged directly into the liquid. For over sixty years attempts have been made to utilize the more obvious advantages of submerged combustion, but it has only been the past few years that much success has been gained. Some of the more important advantages include: high thermal efficiency which is due to the very nature of the heat transfer; extremely large quantities of heat can be released in a very small space. For example, the Ozark burners liberate between 4 and 5 million BTU's per cubic foot per hour while ordinary fire boxes can liberate only about 50 thousand. Scale forming solutions generally offer no obstacle. Slurries and high boiling point solutions can be handled. Heat transferring surfaces are reduced to a minimum, an important factor when dealing with corrosive solutions. Initial cost of equipment is low, maintainance and operating costs are likewise low.

Submerged combustion is not without limitations. It is not too satisfactory on foaming materials and it cannot compete with the economy of multiple effect evaporators. However, it should not be overlooked when difficult heating and evaporating problems are encountered.

The theory of submerged combustion has not been adequately covered in chemical literature; maybe this is because it is so simple. It does present some conditions that at first seem quite peculiar. For example, the submerged combustion "boiling point"

may vary with the rate of feed and the composition of the fuel being consumed.

Heat released in a submerged burner is rapidly transferred to the liquid being treated by two methods; first and most important, by the hot gases being cooled to the temperature of the liquid; and secondly, by the walls of the burner. The heat released by the burner is likewise available for two processes, heating and evaporating and distributes itself according to the prevailing conditions.

Probably the simplest way to picture the processes involved is as follows: as the gases are forced from the combustion chamber they form small bubbles which rapidly rise to the surface and in so doing give up their heat and in turn become saturated with the volatile constituents of the liquid. The heat of combustion is thus available for both heating and evaporating, depending upon the conditions.

A more fundamental approach is to go back to the basic principles of boiling, that is, we know that a liquid will boil whenever its vapor pressure equals or slightly exceeds the external pressure. Submerged combustion involves the so-called non-condensable gases and it becomes necessary to recall Dalton's Law of Partial Pressures. At equilibrium, the "boiling point" during submerged combustion will be that temperature at which the sum of the partial pressures of all the gaseous materials present equals or slightly exceeds the external pressure. In other words the solutions are always boiling or evaporating which ever you prefer. The submerged combustion boiling point has generally come to mean the temperature at which all of the heat of combustion is available for evaporating, that is, the maximum temperature.

I feel sure a couple of specific examples will bring out these points. Let us consider what happens when a hydrogen oxygen burner is ignited in a bath of cold water. Since the sole product of combustion is water, all of the heat of combustion will be available for heating and no evaporation will result. In fact, the water of combustion will condense just the same as though steam were being injected. The amount of energy released in the case of the hydrogen-oxygen burner would be considerably greater than in the case of even super heated steam. The submerged burner is injecting super-super heated steam. The heat released will increase the temperature until 212 degrees is reached, and assuming atmospheric conditions the water will then boil without further increase in temperature.

Now let us see what happens when water is treated with a submerged burner consuming methane and just enough air for complete combustion. The products of combustion will, of course, be carbondioxide and water. There will also be large quantities of

nitrogen that will complicate the picture. The heat of combustion will have to distribute itself between heating and exaporating and at temperatures below about 138 degrees the water vapor formed by the combustion will more than satisfy the vapor pressure requirements and some will actually condense in the bath giving up not only its sensible heat but also its latent heat of evaporation. It is this fact that permitted early workers to report efficiencies of over 100% and cast considerable doubt on their work. In the meantime, the temperature will continue to rise due to the heat released. At temperatures above 138 degrees the vapor pressure of water is such that water formed by the combustion is insufficient to satisfy the necessary partial pressure and water must evaporate from the bath to supply this need. As the temperature continues to rise this evaporation becomes larger and larger until about 192 degrees is reached. At this point all of the heat of combustion is being used for the evaporation of water and none is available for further increasing the temperature. Thus we have reached the "submerged combustion boiling point".

We now see how the boiling point is affected by the fuel.

Hydrogen-Oxygen	212 degrees
Hydrogen-Air	200
Methane-Oxygen	210
Methane-Air	194
Acetylene-Oxygen	209
Acetylene-Air	193

Other theoretical boiling points can easily be calculated. Submerged burners can be made to operate under either oxidizing or reducing conditions and will tolerate rather large excesses of air which lowers the temperature. The feed rate affects the temperature. This is because part of the heat of combustion is used in heating the feed liquid and less is available for evaporating. I might add at this point that Roult's and Henry's Laws apply for boiling point changes due to non-volatile and volatile constituents.

Submerged combustion has proven successful on a variety of materials. Professor Kobe, now at the University of Texas, first reported the application of submerged burners for treating sulfite liquors, sodium sulfate, potassium chloride, and sodium carbonate. I believe the first commercial operation with submerged burners was at the Ozark-Mahoning Chemical Company's plant at Monahans, Texas where anhydrous sodium sulfate is made from Glauber's salt. Other applications include concentrating magnesium chloride solutions, phosphoric acid and nitric acid. Several large

cities have burners for recarbonating their city water supplies. Clarification of raw sugar solutions and the evaporation of other salt solutions have also been worked out. In these latter cases carbondioxide is cheaply produced under controlled conditions in high concentration and in the presence of vigorous agitation. Another very interesting example, although not strictly submerged combustion, is the burning of hydrogen in the presence of chlorine to produce hydrochloric acid.

Now that we are a little better acquainted with submerged combustion and have only a meager idea of the peel liquor problem of the citrus industry, we had better move on with a discussion of this problem.

Citrus Wastes

As the citrus industry grew during the past decade to its present proportions, larger and larger tonnages of peels accumulated. For a time these residues were hauled away and either disked into the soil for fertilizer or fed to cattle as such. In spite of these crude methods, they served to establish the value of citrus wastes as both a fertilizer and cattle food, which is the basis of our modern dehydration industry. When these wastes are used for fertilizer drying is unnecessary, but this method of disposal is limited to alkaline soils. Hauling and discing are also expensive. There was quite an incentive to develop improved dehydration methods. The early operations consisted merely of grinding and drying in rotary kilns or on atmospheric drum driers. Such processes always produced a charred and dark colored product. The only thing good about these early methods was the fact that they recovered practically all of the solids present and thus produced no secondary waste. A few small plants still operate on this plan, but it is considered neither good practice nor advisable

Modern citrus dehydration involves grinding, liming, mixing, curing, dewatering by draining or pressing, drying and bagging. The basis for this process hinges upon the alkaline demethylation and coagulation of the pectin in the albedo layer of the peel by lime. No entirely satisfactory method of controlling this process has been worked out. Too much lime is just as bad as too small an amount, and the amount needed varies with the acidity and pectin content of the peel. Proper addition of lime produces a gel which upon curing undergoes a syneresis after a few minutes and permits dewatering. The Texsun Plant uses large curing bins that permit draining. The pulpous portion is dried in direct fired rotary kilns. Unless liming is practiced the slimy peels stick and burn

badly in the driers. When a satisfactory cure has been accomplished through the proper addition of lime, the peels can be dewatered to 70% moisture or less by merely pressing. Dehydration plant operators soon recognized the apparent advantages of pressing and proceeded to install presses. In fact, the general practice of pressing as much as possible and completely discarding the peel liquors rapidly developed, and in some localities is still practiced. These peel or press liquors contain approximately 12% solids of which about 60% are fermentable sugars, and have a 5 day B.O.D. ranging from 40 to 50 thousand. As a result of the ever increasing volumes and the high B.O.D. loads of these liquors, suitable disposal procedures became imperative.

About 1940 a plant in Florida installed a multiple-effect evaporator and produced the first citrus molasses. This looked like a simple solution, not only eliminating the disposal problem but offering the possibility of increased returns. This was too good to be true, and serious difficulties were soon encountered. Most important was the severe scaling. So severe was this scaling problem that several plants supposedly solved it by installing twice the needed evaporative capacity in the form of two evaporators so one could be operating while the other was being cleaned. Citrus molasses also has the bad habit of foaming or froth fermenting while in storage or transit. The exact cause for this has not been proven, but we feel quite sure that most of the carbon dioxide liberated is coming from the decarboxylation of galacturonic or higher pectic acids.

Other less satisfactory methods of disposal include such practices as pumping into deep wells, discharging into lakes or large bodies of water, lagooning, spreading on groves, and utilization for growing yeast or other microorganism.

Reference to Table 1 entitled dewatering data will show some of the salient factors connected with this phase of dehydration.

Table 1

Dewatering Data

	Texsun	Pressing
Moisture reduced to, %	81.75	70
Lbs. Pulp (10% H_2O)	378	185
Lbs. Molasses (72°B)	66.7	241
Gals. Peel Liquor	46.5	170
Lbs. water evap/lb. Pulp	4.21	2.16

If the peel is pressed to 70% moisture, only 2.16 pounds of water have to be evaporated to produce one pound of citrus pulp. While if Texsun's draining method is used, the moisture is reduced

from 83% to 81.75% and 4.21 pounds must be evaporated per pound of pulp. Thus by using presses, kiln capacity and fuel economy are almost doubled, and it is easy to see why most plants went to the pressing method. I might mention that Texsun even installed presses but soon discarded them for several reasons which I will explain in a minute.

The Texsun draining method produces only 46.5 gallons of peel liquor per ton of peel while the pressing method gives 170 gallons or about four times as much that must be hauled away, evaporated or disposed of in some way. When it is necessary to use troublesome and costly methods of disposal, one begins to realize the advantages of not pressing. Then too, Texsun had found the pressing method rather difficult, since citrus peel when improperly cured with lime is very slimy and defies pressing or filtering.

The nutritional value of the feed made by pressing is lower; the crude fiber is higher and the NFE is lower. Unless molasses is made from the peel liquors, raw material costs are higher. This brings up an interesting point on coop economics. Co-ops, have no raw material costs since all so-called profits appear as returns to the grower for his raw material. To explain this point a little better, we find the pressing method yields only 185 pounds of pulp or finished product while the draining method yields 378 pounds or about twice as much.

The reason for this is obviously due to the solids pressed out in the peel liquors.

The Texsun method does not eliminate peel liquors, but it does greatly reduce their volume, hence less evaporative capacity is needed. Texsun still found it very difficult and costly to evaporate even this relatively small volume. Evaporator capacity often decreased as much as 50% in eight hours. At the average rate of about 2000 gallons per hour, slightly over a ton of scale was formed per day.

The fact that submerged combustion equipment could handle scale-forming solutions and slurries prompted its consideration. Small scale tests in our laboratory showed us that the liquors could be concentrated to 70 or 80 degrees Brix, but charring occurred at concentrations above 35 degrees Brix. But we had previously studied the conditions under which scale formation or precipitation occurred. The scale is mainly calcium citrate, mixed with lesser amounts of calcium pectinate, and calcium galacturaonate. All of these materials appear to have inverted solubilities, that is, they become less soluble with increasing temperatures.

They also form super saturated solutions with ease. Our peel liquor was found to yield a precipitate at about 180 degrees. The submerged burners gave slightly higher temperatures and at the same time produced a precipitate that could be separated readily by settling, after which further concentration of the clear supernatant syrup proceeded without further scale formation. A small pilot plant was then installed and tested. Results looks so good that the first commercial unit was placed in operation almost immediately. We thus went from laboratory to pilot plant to full scale operation in about seven months. Our first unit was so successful that we installed another unit for the next season to insure adequate treatment at all times.

The effectiveness of the submerged combustion treatment can best be shown by the fact that we found it necessary to wash the evaporator with caustic only about once each week, whereas, a weeks operation before would have necessitated drilling. After installation of the second burner the evaporator was run 73 days with out a caustic cleaning.

So far I have discussed only the treatment in a general way and now that you have a better idea as to our problem and the principles of submerged combustion connected with it I will briefly describe the peel liquor circuit of our plant. Going back to the plant you will recall the peels were ground and treated with lime then placed in large wooden bins where the peel liquor drains out. This liquor is collected in a large sump at the rate of about 2000 gallons per hour. The flow will vary from almost zero to as much as 10,000 gallons per hour, and this calls for an extremely flexible piping arrangement to insure satisfactory treatment. The liquor is screened and then flows by gravity to the first burner where it is held at about 187° for about thirty minutes. The temperature and time will vary with the rate of flow. The burner tanks hold about 1000 gallons, and the burners consume 100 cubic feet of natural gas per minute with a heat release of about 6 million BTU's per hour.

Enough carbon dioxide is produced each minute to neutralize about 15 pounds of lime. So should the peel liquor be alkaline it is automatically adjusted to neutrality. It is necessary to protect the units from becoming dry so they are provided with automatic level controls. This was learned the hard way, after we had experienced severe corrosion at the throats of the burners and several explosions. The liquor then passes to a continuous clarifier or thickener where the precipitated scale is separated, and

returned to the raw peel ahead of the hammer mills or hauled away. Some foam accumulates on the surface of the clarifier and is skimmed off continuously to an auxiliary tank where it is filtered through a bed of rocks and returned to the citrus. The clarified liquor again flows by gravity to the second burner where additional treatment takes place. Often lime is added prior to this treatment to secure a better clarification and pH adjustment. The syrup is again pumped to another clarifier and finally to the multiple-effect evaporator. Those familiar with the sugar industry will recognize the close relation to a two stage carbonation system, around which the process was designed.

Let's take a look at Table 2 to get a little better idea as to what is taking place and how the varying feed rates affect our system.

Table 2

Effect of Varying Feed Rates

Feed Rate, 1000 GPH	1	2	5	10
Equil. Temperature	192	189	173	140
Gallons Evap.	515	421	162	4
Brix of effluent	25	16	12.3	12
% Net Heat:				
Heating	17	29	72	97
Evaporating	78	67	25	1
Total	95	96	97	98

Submerged Combustion Equipment

Submerged combustion equipment is very simple both in construction and operation. Our burners for example consist of nothing more than a 10 inch iron pipe about three feet long tapered at the upper end to join a 4 inch pipe. This simple burner is fitted so that it extends well down into the bottom of a cone shaped tank. Compressed air is supplied at about 7 lbs./sq. in. gauge and the gas pressure is controlled at about 9 lbs. The gas and air are metered through orifices which operate a ratio controller. The air and gas are mixed in a carburetor or mixing chamber and then fed directly to the burner, Most submerged burners are provided with a velocity tube of such dimensions that the flow of combustible mixture through it exceeds the rate of flame propagation and thus acts as a safety valve.

Ignition of the burners can be effected in several ways. The manufacturer supplies a probe, on the end of which is a small coil of resistance wire that can be heated to incandescence after insertion. However, we have found other methods preferable. The probes often became fouled due to moisture and failed. We now use a

standard spark plug operated by a high voltage coil fitted above the burner to which it is connected by a small pipe and a bleed valve. To start the burner it is merely necessary to turn on the air supply, open the bleed valve above the spark plug, start the spark, and finally open a solenoid valve controlling the flow of gas. The air-gas ratio controller automatically adjusts the right amount of gas and the burner fires once or twice before a smooth combustion is obtained. The spark and bleed valve are turned off and the burner continues to operate automatically. To establish the proper air to gas ratio it is of course necessary to start and operate the burner manually. There is one other feature worthy of mention at this point, the automatic shut off mechanism. This consists of a thermocouple that is placed in operation sometime after a predetermined temperature has been reached and so arranged that should the flame temperature fall below this predetermined point, for any reason, the solenoid valve controlling the gas is shut off. This is a safety feature. Another safety feature necessary or advisable on submerged combustion equipment is an explosion hatch. Our units do not have these explosion hatchs since they are provided with 30 inch stacks which seem adequate, having experienced several rather violent explosions which forced liquid several feet into the air above the stacks, but without any other more serious effects.

THE PURPOSES AND OBJECTIVES OF THE LOUISIANA ENGINEERING SOCIETY

By H. L. LEHMANN*

President Freeman, members of the Shreveport Section, Louisiana Engineering Society and guests, it is indeed a distinct honor and privilege to meet with you on this your "Charter Night" to bring you a brief message of the purposes and objectives of our society. The splendid attendance is certainly indicative of your interest that means much to an organization, especially one as young as yours.

The objectives of the Society may be best explained by reading to you Article I of the Constitution. Incidentally, this article has remained unchanged even though we have had seven constitutions and numerous revisions. The Article as written is as follows:

> "The objects of this Society are, the professional improvement of its members, the encouragement of social intercourse among Engineers and men of practical science, and the advancement of Engineering; and for the promotion of these objectives, stated meetings of the Society shall be held, and a library formed for the use of its members."

Re-wording and expanding upon this Article, the professional improvement of its members is obtained:

(1) By advancing the theory and practice of engineering and the allied arts and sciences. For example, in advancing the practice of engineering, the building code of the City of New Orleans has been revised upon the recommendation of and under the supervision of the Louisiana Engineering Society. This was quite a privilege and indicates recognition of our organization.

(2) By encouraging engineering research, tests, and other original work. An example is the book "Foundation Data" compiled by the W.P.A. at the request of the Louisiana Engineering Society, which contains valuable information regarding subsurface soil conditions.

(3) By the encouragement of social intercourse among engineers and men of practical science; the Society's annual banquet, annual outing, and the refreshment period which follows each regular meeting are for this purpose. This fellowship cannot be measured in dollars and cents—brings its members on a common level and often more is accomplished in this manner than by attending lectures.

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* President of the Louisiana Engineering Society. Delivered to the Shreveport Section, L.E.S., Friday, Nov. 11, 1949.

(4) By holding meetings for the presentation and discussion of technical papers. Meetings are held on the second Monday of each month. On an average alternate meetings are held jointly with one of the other engineering organizations. This promotes good feeling among engineers of different fields.

(5) By offering awards and other honors to encourage contributions to engineering; conferring awards and other honors in recognition of meritorious contributions to engineering. Each year a Junior Membership Award is made to the student graduating with highest scholastic honors in engineering from each of the following universities: Tulane, Louisiana State University, Louisiana Polytechnic Institute, and Southwestern Louisiana Institute.

(6) By cooperating with other engineering and technical societies. This year there were ten other societies represented at our annual meeting. A very fine relation exists between other engineering and technical groups.

(7) By encouraging a high standard of citizenship among engineers. Since its inception the Society has maintained an excellent code of ethics. In December of 1948, it was voted to accept the canon of ethics recommended by the Engineers' Council for Professional Development. This was done not because it was an improvement over our own code, but for the sake of national uniformity. A copy of the Canon of Ethics is mailed to each member upon his election. It has since been accepted by all the founder societies.

(8) By encouraging engineers to participate in public affairs. The Society has a standing committee on Civic and Industrial Affairs. This committee has participated in hearings and passed resolutions on the New Orleans Terminal Station and Grade Crossings, the Tidewater Ship Channel, and the prevention of traffic accidents.

The most recent project in the making is towards an award to be established by Louisiana Engineering Society in connection with civic activities. It is proposed that this award be made to that engineer in the state, who for any period of time under consideration, has given most fully of his time and effort for civic or public benefit without compensation. This suggestion was made at our last annual meeting by one of our members, Mr. James M. Todd. A committee was named with Mr. Todd as chairman to prepare requirements for such an award. This committee will present the proposal at our next annul meeting. The committee is well represented by a member of each of the state sections and the parent society.

(9) By cooperating with governmental agencies in engineering matters, Federal, State or Parish.

(10) By raising the standards of the engineering profession. The Legislative Committee drafted a general engineering license law, advocated by the founder societies, which would give practicing engineers in this state a legal standing as professional men. I am sure that you are familiar with our recent efforts to secure enactment of this piece of legislation, and the Society will continue to work towards that accomplishment.

The Council of Engineers fostered by the Louisiana Engineering Society is made up of engineers from every engineering organization—its representative appointed by the presiding officer of the respective unit. The Shreveport Section will be represented in the Council. Additionally the President of the Shreveport Section will automatically become a Board member of the Louisiana Engineering Society as are the Presidents of the Baton Rouge, Lake Charles and Monroe Sections.

We of the parent society are very proud of your accomplishments. Starting with approximately ten or twelve members your efforts have paid good dividends with a charter membership of sixty-five and since the date of your charter, five new members have been added to this number. The growth of our organization is well reflected by this steady and I may say rapid increase in the membership of each state section. As I come today to present this Charter to The Shreveport Section of the Louisiana Engineering Society, I am anxious for you to feel the real impact of this occasion for there is deep significance in the character of this Charter.

Charters, properly read, tell the story of man's progress. They reveal his deepest desires and highest aspirations. A Charter is more than mere words upon a piece of paper. It is the self-disclosure of man's best thought, that which reflects the community attitude and civic standards of the day. The stepping stones to modern civilization can be found in the political and economical Charter records among the people of the world. When the word "Charter" is mentioned, we immediately think of the Great Charter—the Magna Charta which was issued by King John in 1215 which guaranteed the preservation of English liberties. A Charter is an instrument in writing from the sovereign power of a state or country, executed in due form, guaranteeing certain rights and privileges. That agreement which was made between King and people, Lord and servant, and issued for public proclamation, was called a Charter. It is a written agreement between man and man, that sacred relationship which makes our way and life possible. The Magna Charta is the first detailed statement of futile law, the first clear agreement between King and his Barons as to exact

demands which the King can make on them and which they can make on their men. This Charter only reflects earlier agreements in England and more primitive demands on the people.

The Charter guarantees certain rights and privileges to the people on the part of the sovereign power. That spirit expressed the cry of the people in the 17th and 18th century which has been crystalized in revolution and riot in the 20th century when man still remands rights and privileges. The early Charters reveal the destruction of a future generation, for when mankind demands only rights and privileges such spirit will act like a boomerang and return like a swastika, for it lacks the element of cohesiveness and unity which gives stability to the social order.

Our Charter today guarantees certain rights and privileges from the sovereign power but it places upon our organization certain responsibilities to the sovereign power. This is not a one-sided agreement but a mutual sharing in protecting our organization from mediocrity. We guarantee to render the highest type of service that the Engineers of this state can render. This Charter quarantees individual responsibility with liberty and freedom for each man. It guarantees collective cooperation and protection from others who would not live up to the high standard of our profession. It also demands efficiency and service to all who would accept our services in our chosen field of work. Let this Charter be as a beacon light to remind us of the privileges and liberties granted through our government and our responsibility to serve the people to the best of our ability.

President Freeman it is with a great deal of pleasure and pride that I hand you the Charter of the Shreveport Section of the Louisiana Engineering Society. Through your untiring efforts and those of your co-workers this presentation was made possible—and to you charter members, I have a replica of this Charter for each of you. As the secretary calls your name will you please come forward to receive it. To all of you I wish you much success. Again I wish to thank you for having given me this opportunity of meeting with you.

ENGINEERING BRIEFS

Progress Noted in State Engineering Registration Laws. A recent survey on what has been happening to the engineering registration laws of the individual states shows that there is a definite trend toward raising the standards of registraion by improving methods of giving examinations, granting interstate registration, and adopting amendments providing for the certification of the engineers in training.

The study was conducted by T. Keith Legaré, executive secretary of the National Council of State Boards of Engineering Examiners, and chairman of the Committee on Registration of Engineers of the American Society of Civil Engineers.

According to Mr. Legaré, the engineers-in-training program are winning the enthusiastic support in more states and engineering educators are becoming more interested in putting it in effect.

Thirty of the state boards report that they do not plan any amendments this year or next. Some boards believe this present laws are operating very satisfactorily and do not wish to propose minor changes through fear that such legislation may result in undesirable amendments. Many of the boards still control the funds paid in by registered engineers for administration of the Act, and these hesitate to change their registration laws in other respects as the provision for handling finances may be tampered with. In most states the proposed amendments are sponsored by the state engineering society, with the approval and co-operation of the state board. However, in a few states the changes are promoted by the state board, and the members of the profession do not always seem to recognize their opportunity for service and their responsibility to the public.

Twelve states have amended their registration laws during the past two years—some as recently as March, 1949. These states are Alaska, Arizona, California, Indiana, Kansas, Maryland, Minnesota, Nevada, New Jersey, New York, Oregon, and South Carolina. The majority of these amendments are for the purpose of providing for the certification of engineers in training.—*Mechanical Engineering.*

Rapid Selector Sorts Out Vast Amounts of Information. The "rapid selector", latest of the famed postwar "electronic brain" machines, has been announced at the U. S. Department of Agriculture, Washington, D. C., with a promise of shorter hours in the library for researchers.

Information to be coded for the selector is put on 35-mm. motion picture film, and the contents of some half-million conven-

tional library cards can be put on a single reel. When all the information on a certain subject is wanted, and which is on some of the cards, a master key card is placed in the machine. Photoelectric "eyes" of the machine pick the material wanted and the machine photographs it.

The selector can scan the film at a rate of more than 60,000 subjects a minute, and some 10,000,000 different subjects can be coded in the selector.

Information to be stored in the selector is microfilmed and coded by the use of black and white squares, and it is the pattern of the squares which catches the "eye" of the photoelectric cell. Photographing of the selected information is done by using high-speed photoflash techniques, including a repeating flashlamp.

Scientific literature and any other material containing vast amounts of information which need to be stored compactly, yet available for use, are expected to be put into rapid selector machines. It is estimated that the new machine could scan in 15 minutes all the entries in *Chemical Abstracts* which have appeared in the past thirty years.

The first rapid selector is now being tested in the Department of Agriculture library under the direction of Librarian Ralph R. Shaw. Principles from which the machine was developed are credited to Dr. Vannevar Bush, president of the Carnegie Institution of Washington.— *Aminco Laboratory News.*

Field Trips Pay Off. Employers of engineers everywhere should be able to profit through adoption of a personnel policy of the Hydro-Electric Power Commission of Ontario. In its Toronto headquarters the commission has a staff doing engineering, design and drafting on major hydroelectric projects—the nearest of which is over 250 miles away. Yet, every executive, engineer, draftsman and stenographer in the Toronto office has been given a look at the field operation at one or more of these projects.

Take the Des Joachims project on the Ottawa River as an example. All of the 40 men who are at work on the design and drafting for this project in the home office have visited the site at least once. Two- and three-day, expense-free circuits of this and the other developments are regular for project design engineers.

Meanwhile, whole busloads of office personnel are being taken to the Des Joachims project for an overnight stop. After a guided tour there, they move on to one of the other jobs on the Ottawa River.

In contrast to this, consider the innumerable office engineers working for private consultants and public works agencies who

never see their job at all-except at ¼-in. scale on their drawing boards. Consider how many of these office men, though skilled and capable, are lacking in field experience, largely ignorant of field problems and field methods.

Acquainting design staffs with their projects by firsthand inspection has become a set policy of the Hydro Commission. It has paid off. Experience has proved its worth as a morale and efficiency builder. Cost, though considerable with staff and distances so large, is held to be dollars well spent.—*Engineering News-Record.*

No Common Clay. Ceramics and metals can now be combined to make a new material for turbine blades which promises to increase the temperature, and thus the efficiency, at which gas turbines for aircraft and other applications can operate. Ceramic materials have been widely used for linings and non-moving parts of gas turbines, but for use in moving parts they are too brittle and subject to cracking with quick temperature changes. The new "cermet" combinations (also called "ceramals" and "metamics") are usually made by pressing together the components in powdered form, and seem to possess better properties than either of the components, while minimizing many of the disadvantages. Research on these materials is still at a preliminary stage, but the early test data are encouraging. Several new metallic alloys have also been developed to withstand stress and corrosion at high temperatures, but they are more subject to creep and failure under the conditions encountered in gas turbines and jet engines.

In the gas turbine, the turbine rotor is driven by the exhaust blast from the burning fuel, and the blades are subject to extremely high temperatures, as well as to a corrosive atmosphere and the strain of whirling at the thousands of revolutions per minute. Present metal alloys for turbine blades limit temperatures to about 1500°F., which gives the engine an efficiency of about 24 per cent. Designers welcome new materials which permit even small temperature increments, since a rise to 1800°F. would mean an engine efficiency of about 28 per cent. The new materials, if successful in other respects, would permit operating temperatures of at least 2,000°F.

In the jet engine for aircraft, the same exhaust which propels the aircraft also drives a turbine which sucks air into the combustion chamber. Although a rise in operating temperature beyond 1500°F. would not improve the jet engine's ratio of fuel input to power output above about 14 per cent efficiency, there would be an increase in the absolute thrust obtained.

German ceramists experimented with mixtures of aluminum oxide and powered iron; an extensive research program in this

country has substantiated the meager results obtained by the Germans and has yielded much new information. Standard powder metallurgy techniques are usually used in the fabrication of cermets. The metal and ceramic grains are milled together to the desired size, and are frequently held by a temporary binder, such as wax. The pieces are then pressed in molds at a pressure of 10,000 to 100,000 pounds per square inch. The wax is burned out at a relatively low temperature, and the final firing is in the temperature range between 2500°F. and 3000°F. This firing takes place in a carefully controlled atmosphere of argon, helium, nitrogen, hydrogen, or sometimes water vapor, or in a vacuum, which helps the particles of metal and ceramic to fuse to a solid structure. In the resulting combination the metal bonds together the grains of ceramic material. Apparently the resistance of the metal to thermal shock is transmitted to the brittle ceramic material, while the resistance to high temperatures which is characteristic of the ceramic is imparted to the metal.

Other Techniques

Other interesting techniques which have been tried are evaporating a mixture of the two powders onto a metal surface under vacuum, and flame spraying a molten combination onto a metal core, to lay down a thin coating of cermet. Impregnation of a piece of porous ceramic with molten metal has also been successful. Some cermets during tests for their ability to withstand rapid temperature change were heated and quenched through several cycles and they showed considerable improvement in strength over the original untreated samples, similar to the effect of heat treating of metals.

The possible metal-ceramic combinations are almost endless. The ceramics include borides, carbides, oxides, spinels, or combinations of these, while the metal could be almost any of the heat-resistant metals or alloys. Only a few combinations have been tested thus far.

To date only a few actual turbines using cermet blades have been tested, and the results have not been conclusive. New compositions are continually being tested for physical properties in various laboratories, and the more recent of these tests are especially promising for the extreme conditions which may be encountered in future aircraft turbines. When and if the technique is perfected, applications outside the gas-turbine field will probably be found. A possible one is in shearing knives for metallurgical operations, which require high abrasion resistance at elevated temperatures. Valve seats which can be ground smoothly and have good compressive strength are perhaps another place where the cermets may be important.—*Industrial Bulletin of Arthur D. Little, Inc.*

MINUTES OF MEETINGS AND BUSINESS OF THE SOCIETY

Minutes of Meeting of the Board of Direction, September 12, 1949

The meeting was called to order by President Lehmann in a private dining room of Arnaud's Restaurant. Members present were Messrs. Abrahm, Hill, Newton, Wallace and Fernandez. Mr. James M. Todd also was present by invitation.

The order of business was dispensed with so that Mr. Todd could be heard. Mr. Todd suggested that the Louisiana Engineering Society make an award to that engineer in the State of Louisiana who, for any period of time under consideration, has given most freely of his time and effort for civic or public benefit without compensation.

General Newton moved that the president appoint a committee of not more than 7 members to prepare a form of procedure for selecting the winner of such an award. The motion was seconded by Mr. Wallace and carried.

President Lehmann then appointed Mr. Todd Chairman, and Messrs. Louis Duclos (Baton Rouge), F. T. Clarke (Lake Charles), E. M. Freeman (Shreveport) and R. T. Sessums (Monroe), and two other members to be selected by Mr. Todd.

Minutes of the preceding meeting were accepted as read. The secretary read minutes of a meeting of Annual Meeting Chairmen held on August 15, and reported that the Annual Outing would be held on October 6, stating that Outing Chairman R. P. Lockett, Jr., had arranged everything in readiness for the occasion.

Letters from the President and from the Assistant Secretary of the Louisiana State Board of Engineering Examiners concerning a vacancy on the board were read. In accordance with Section 4 of Act 242 of 1920, the secretary was instructed to submit to the Governor the names of the following engineers to fill the vacancy:

F. N. Billingsley, Bernard H. Grehan, T. Baker Smith.

Letters from the Louisiana Highway Engineers' Association and from the Electrical Association of New Orleans were read. The secretary was instructed to read the latter at the Society's regular meeting to be held immediately after adjournment of the Board.

The proposed constitution and by-laws of the Monroe Section were accepted.

A request by Mr. J. I. Hebert for reinstatement to membership was read. It was moved by General Newton, seconded by Mr. Wallace, that the request be granted.

Upon the recommendation of the Board, President Lehmann appointed Mr. W. Stone Leake Chairman, F. N. Billingsley and F. H. Fox to serve on the Nominating Committee for the forthcoming election of officers.

The secretary announced that the November meeting would be held jointly with the A.S.M.E. The meeting then adjourned in order that the Society's regular meeting could proceed on schedule.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Regular Meeting of the Louisiana Engineering Society Held Jointly with the N. O. Section, A.I.E.E. on Monday, September 12, 1949

The meeting was called to order by President Lehmann in the Jackson Room of the St. Charles Hotel. President Lehmann welcomed members and guests of the American Institute of Electrical Engineers. Minutes of the preceding meeting were accepted as read.

The secretary read a resolution by the Electrical Association of New Orleans urging our national legislators to halt the rapid trend toward socialism. All those present were asked to contact their congressional representatives in behalf of this cause.

It was announced that the Annual Outing would be held on Thursday, October 6 at the Colonial Country Club.

The chair then was relinquished to Mr. E. I. Blanchard, Chairman of the local section of A.I.E.E. After their business was completed, Mr. William Stroud introduced the speaker of the evening, Mr. M. H. Leavenworth, Manager, Southwestern Branch Office, Dow Corning Corporation, who delivered a most interesting address on "Silicones at Work for Industry". A question period followed, after which the chair was returned to President Lehmann, who closed the meeting with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting of the Board of Direction, Monday, October 10, 1949

The meeting was called to order by Vice-President Cucullu, with Messrs. Abrahm, Hill, Mire, Newton and Fernandez present. Minutes of the preceding meeting were accepted as read. The Secretary announced that all applicants Engineers' Club sponsored by the Louisiana Engineering Society; 81 were for membership named in the September ballot had been elected. He also reported that 317 votes were cast, of which 135 were in favor of having an opposed to such a plan, and 101 did not express any preference.

A report on the attendance at the Annual Outing was as follows:

18 participated in horseshoe pitching
86 played golf
170 attended the dinner and entertainment

It was pointed out that this was the largest dinner attendance in the history of the event.

The Secretary reported on the activities of the Louisiana Council of Engineers, stating that the attorney for the Southwest Louisiana Electrical Cooperative was to be contacted with reference to their objection to the proposed Engineers' License Bill.

An invitation from the Louisiana Chapter, National Association of Practical Refrigeration Engineers was read, and it was decided to make an announcement of same at the Society's regular meeting immediately following the Board meeting.

The secretary read the suggestions of Chairman James M. Todd relative to the procedure for awarding an Engineers' medal for distinguished civic service without compensation. General Newton moved that the matter be deferred until the November meeting and that members of the Board be furnished copies of the suggested rules for study. The motion was seconded by Mr. Abrahm and carried.

The secretary presented a tentative form of charter for the Monroe Section. Mr. Mire moved that this be accepted and that each charter member be given a copy. Motion seconded by Mr. Hill and carried.

Mr. Abrahm was appointed Chairman of a committee including Messrs. Leo S. Weil and George R. Hammett to prepare the obituary of the late Rudolph Herpich.

There being no further business, the meeting adjourned.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting of the Louisiana Engineering Society held jointly with the New Orleans Section American Institute of Chemical Engineers, on October 10, 1949

The meeting was called to order by Vice-President Cucullu, with 76 members and guests present. Mr. Cucullu welcomed members and guests of the A.I.Ch.E. Mr. Sydney Ellis moved that the reading of minutes be dispensed with, seconded by Mr. W. F. Guilbeau and carried.

The secretary read an invitation from the Louisiana Chapter, National Ass'n of Practical Refrigeration Engineers, to attend their meeting on the following Wednesday at the St. Charles Hotel.

Mr. Cucullu announced that the Board of Direction had appointed the Nominating Committee for the 1950 Election of Officers as follows: Messrs. W. Stone Leake, Chairman, F. N. Billingsley, F. H. Fox. He urged members to send their suggestions to the committee.

The chair then was relinquished to Mr. Elmo Patton, Chairman, New Orleans Section, A.I.Ch.E., and following the business of that organization Dr. Everett M. Burdick, Director of Research, Texsun Citrus Exchange, delivered an interesting lecture on "Application of Submerged Combustion to the Processing of Citrus Wastes."

Following the lecture, the chair was returned to Vice-President Cucullu, and the meeting adjourned with a rising vote of thanks to the speaker.

JOHN P. FERNANDEZ, Secretary-Treasurer

Minutes of Meeting, Baton Rouge Section, Louisiana Engineering Society, October 12, 1949

The meeting was called to order by President Wallace in the Highway Laboratory Building with Second-Vice-President F. A. Hannaman, Jr., Secretary-Treasurer Louis Duclos, and about 40 members and guests present.

President Wallace called on the members to introduce their guests.

It was moved and carried to dispense with the reading of the minutes.

President Wallace reported briefly on the recent meeting of the Louisiana Council of Engineers in regards to the proposed introduction of a bill providing for the registration of Professional Engineers.

There being no old or new business to come up, the chairman of the Technical Papers Committee, Mr. F. A. Hannaman, Jr., introduced the speaker of the evening, Mr. R. D. Patch of the Esso Standard Oil Co., who gave a very interesting lecture on "The Development of the Synthetic Rubber Program."

After a lively period of discussion, the meeting was adjourned with a rising vote of thanks to the speaker.

LOUIS DUCLOS, Secretary-Treasurer.

Minutes of Meeting, Baton Rouge Section, Louisiana Engineering Society, November 8, 1949

This was a joint meeting with the American Institute of Electrical Engineers.

The meeting was called to order by President Wallace in the Highway Laboratory Building with 106 members and guests present. Mr. H. L. Lehmann, President of the Louisiana Engineering Society, was present and was invited by President Wallace to address the members and guests.

It was moved and carried to dispense with the reading of the minutes.

There being no old or new business to come up before the Section, the meeting was turned over to Mr. Fred R. Adams, President of the Baton Rouge Chapter of the A. I. E. E., who introduced the speaker, Mr. Ben F. Hatfield, Louisiana Chief Engineer for the Southern Bell Telephone Co. Mr. Hatfield gave a very interesting and informative lecture on "Long Distance Intercity Toll Dialing."

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

LOUIS DUCLOS, Secretary-Treasurer.