



Part of Engineering Staff of the Columbia Broadcasting System gathered in conference in New York, September 27-29, 1939. These men appear in the organization chart on pages 4 and 5.

# CBS ENGINEERING

## Here's How this Department of the World's Largest Single Network Functions

By WILL WHITMORE

**O**ften we are told that there are no new frontiers. Obviously that is untrue because there are frontiers of knowledge as well as frontiers of geography. Radio has made its rapid progress simply because its frontiers were a challenge to everyone who came in contact with them.

When broadcasting began practically nothing was known about it. True, engineers knew how to put a signal on the air and pick it up at some remote point, but that was about all. That meagre knowledge was like a small spot of civilization in the center of a vast and unexplored continent. Once an engineer got out of the clearing he was on his own in a trackless wilderness where no one had ventured before. Wherever he went, whatever he did, resulted in discoveries — discoveries which pushed back the frontier a little farther — discoveries which advanced the art of broadcasting bit by bit.

And so it was that radio attracted to itself men whose pioneering instincts and ambitions were as great as those who built this country. Today in every radio station in the country you find just that type of man. It is this opportunity for exploration and adventure that has attracted men to broadcasting. It is this fact which explains why they are willing and glad to work harder and longer than men who hold down more prosaic posts. They love their jobs and their profession with an intensity foreign to many others.

The above is preface to an understanding of any real radio engineer. Unless you recognize the truth of it and accept it as a premise you cannot understand him and his job — to be more specific, to understand the men who make up the engineering department of the Columbia Broadcasting System. They are a hard hitting group of men who scoff at regular hours and a set existence. Yes, they have regular work to perform, routine jobs to fill, but in addition they constantly have the chance for exploration and adventure in the wilderness beyond the outskirts of present-day knowledge of radio.

Practically every member of the group from E. K. Cohan, Engineering Director, down to the newest recruit, began as a radio amateur and served as a commercial operator. Most of them supplemented and advanced their practical knowledge and experience with engineering courses at Massachusetts Institute of Technology and other prominent engineering schools.

The Engineering Department of C.B.S. grew as the system grew, each expansion coming as the need for engineering increased. It was common-sense, practical growth, and slow enough to pick the right sort of man for each new job. Today, the Engineering Department is still smaller than you might expect it to be, but it is a close-knit group, each man of which can

*(Continued on page 6)*

# CBS ENGINEERING

DIRECTOR OF  
ENGINEERING



E. K. COHAN

GENERAL  
ENGINEERING

AUDIO - FREQUENCY  
DIVISION  
ENGINEER - IN - CHARGE



H. A. CHINN

TRANSMITTER  
CONSTRUCTION  
ENGINEER - IN - CHARGE



J. L. MIDDLEBROOKS

SHORT - WAVE  
DIVISION  
ACTING ENG. - IN - CHARGE



F. J. BLEIL

RADIO - FREQUENCY  
DIVISION  
ENGINEER - IN - CHARGE



W. B. LODGE

DEVELOPMENT &  
MEASUREMENT



V. N. JAMES

DESIGN &  
CONSTRUCTION



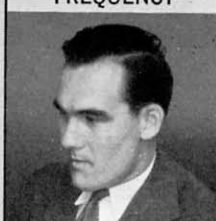
R. A. BRADLEY

ENGINEERING  
LABORATORY



R. B. MOE

HIGH  
FREQUENCY



F. J. BLEIL

INTERNATIONAL  
STATION

W2XE

ULTRA - HIGH  
FREQUENCY



W. H. MOFFAT

EXPERIMENTAL  
STATIONS

W2XDV

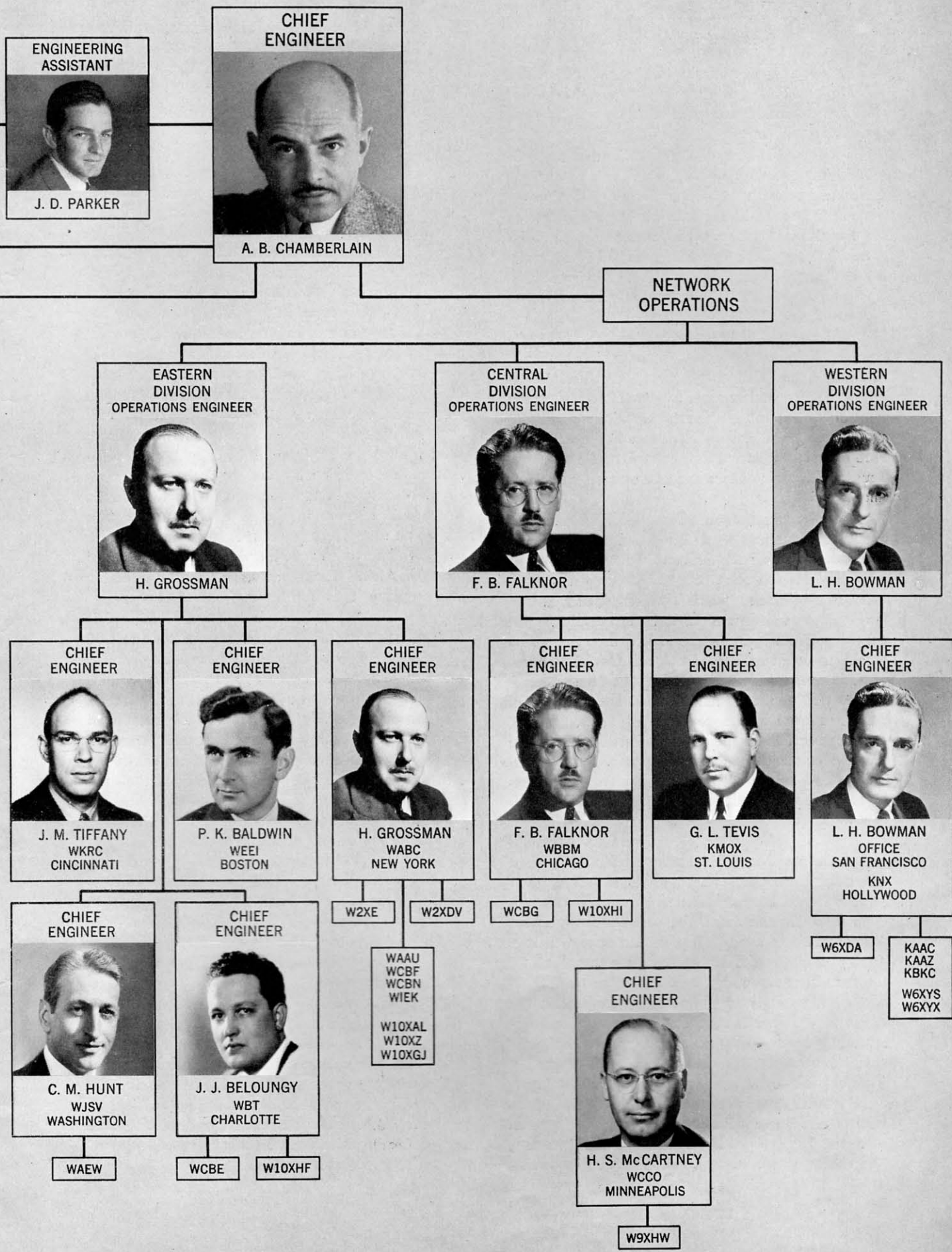
W9XHW

W6XDA

DESIGN &  
MEASUREMENT



G. C. HUTCHESON





## CBS Engineering

*(Continued from page 3)*

double in brass. In it you will find little of the routine, red-tape and iron-clad organization channels which slow up and hinder the work of so many large company departments.

No more logical organization could be found. Any broadcasting unit, whether it be a single station or a network, has two engineering functions — providing the facilities for broadcasting, and operating those facilities to put radio programs on the air. Thus the Engineering Department is composed of two main heads, General Engineering, and Network Operations.

General Engineering is broken down into four divisions: Audio Frequency, Radio-Frequency, Short-Wave, and Transmitter Construction. The breakdown of Network Operations is naturally geographic, resulting in three divisions: Eastern, Central and Western. Internal organization of each of these divisions is more or less similar. The Eastern Division may be considered as typical and in it there are five operating groups of technicians: master control, studio and playhouse, field, maintenance and construction and transmitter.

As between General Engineering and Network Operations there is a striking difference in the work and personnel. General Engineering works by the calendar; Network Operations works by the clock. General Engineering plans and coordinates station development and expansion. It is responsible for the general engineering requirements of the system as a whole. It formulates standard practices for network operation and supervises the technical changes that are necessary in present or new stations. It is the type of job where men have time to plan, study and look ahead, and so you will find the engineers of this department more deliberate, their work generally paced to the passage of days. They move and talk with ease, deliberation and studied calculation of the research and laboratory engineer.

The personnel of Network Operations is just the opposite. Here men work by the minute. The clock is master; for their job is to put programs on the air and keep them there. They talk with fast, clipped speech, and they move with the swift, almost jerky motions of a man who hasn't a second to lose.

You aren't around Columbia long, or for that matter any place where radio men meet, without hearing references to "E. K.," which of course stands for Edwin King Cohan, Director of Engineering. Cohan, tall, slender, complacent and always at ease, has the job of directing and coordinating the work of the two engineering departments. Coming to Columbia in 1930 as chief engineer and technical supervisor of CBS, he calls the almost ten years he has been there the happiest years of his life. "Radio," he says, "is the most satisfactory and satisfying job a man could

have." The "screwly hours" appeal to him, and a job which never gives any hint of what tomorrow may bring is exactly what he likes. Yet, his second choice for a profession would be the law with all its rules, regulation and foundation in precedent. His own feeling that he would have made a good lawyer is seconded by any number of lawyers who have met him at FCC hearings.

Cohan has aimed to make the Engineering Department as self-operating as possible and has succeeded to a surprising degree. "We don't want men who have to be told what to do and how to do it," he says. His ideal engineer is a man who has a solid foundation in engineering knowledge acquired in a good engineering school backed by practical experience and coupled with ambition, imagination and resourcefulness. That's a large order, but he has been successful in surrounding himself with just such men.

Having a self-operating department has given Cohan the opportunity to remove his job far away from official routine work, enabling him to plan far ahead of the immediate needs of the network. For a good many years his interests have been centered in international broadcasting and he is known personally to practically every first rank chief engineer in the world. His interests in this field have carried him abroad on extensive trips for four successive years. He has flown on every airline in this country, Europe and northern Africa. Today, the stamps on his incoming mail would gladden the heart of any philatelist.

Wheel-horse and next in command is A. B. Chamberlain, Chief Engineer, who came to CBS in 1931. The two departments, General Engineering and Network Operations report directly to him and his job is to supervise and coordinate the work of each. Chamberlain is ideally suited to the job because of his experience, background, and personal characteristics. He talks the language and knows the operations of each department. Apparently he can take on the characteristics and meet the requirements of either. He can be quick, alert, ready to move at a moment's notice, or calm, deliberate and serene. In experience and training, he has served in almost every radio engineering capacity, having been chief engineer, director of technical operations of radio stations, and general manager. He is a graduate of the U. S. Naval Radio School and the Submarine School, New London. Following graduation, he acted as instructor at the U. S. Naval Radio School. For more than a year he was engaged in electrical radio construction and radio operation, 8th Submarine Division.

Engineering as such is merely a portion of "A.B.'s" job and since this plays such an important part in the operations of a big network, his broader responsibility becomes one of cooperation with practically every other department in the system. There are endless details to be worked out between such depart-

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## CBS Engineering

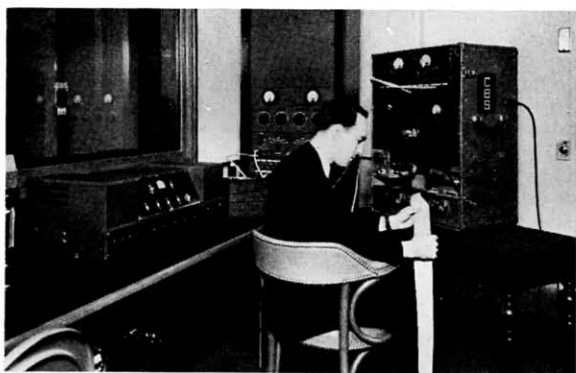
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ments as Traffic, Sales Promotion, Special Events, and Publicity.

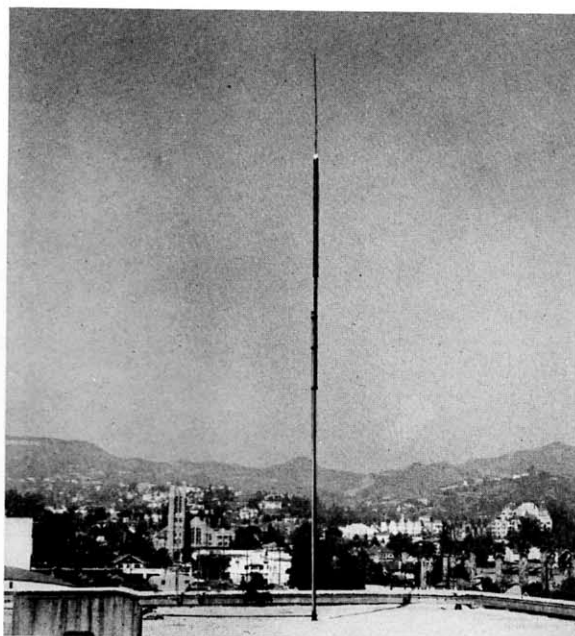
Special Events cooks up some novel broadcast which may call for broadcasts and special transmission from land, sea, and air, from every sort of location and from any sort of moving vehicle ranging from donkey cart to submarine. They come to Chamberlain. Can he do it? What will it cost? What are the chances for failure? And of course it all has to be done day before yesterday. To get away with it a man has to be a combination radio engineer, cost accountant, showman, prophet, magician, and advertising man.

Publicity wants a field transmitter that will have the sex appeal of a chorus girl, the size of a pocketbook, and the power of a broadcast transmitter. Sales Promotion wants coverage maps of every radio station in the country in time to meet next Tuesday's trade paper deadline. An affiliated station wants a five element antenna design and a member station wants a new technician. No wonder Chamberlain says they want men who can come up with the right answer and in a hurry. "Theory alone is no good," he explains. "Our engineers must be good engineers, but they must be good practical men, with lots of imagination to tackle jobs that have never been done before."

Seeing ahead, and effecting the correlation of present equipment and techniques with future needs play a big part in engineering. In the daily operation of a great network, much of the work is concerned with future requirements and it is only natural that out of daily operations should come developments which further the art of broadcasting. The Columbia Engineering Department is proud of the many that it



V. N. James operating the CBS portable automatic audio measuring assembly developed by him for Columbia Broadcasting System. It is recording the reverberation vs. frequency characteristic of one of the CBS New York studios. The equipment also automatically traces a graph of response vs. frequency characteristics of complete systems as well as amplifiers, filters, program lines. Acoustical measurements such as reverberation decay, noise-level surveys, sound isolation and determination of microphone and loudspeaker characteristics, and dynamic range, are readily accomplished by this assembly.



The Bailey Antenna of CBS's experimental station W6XDA, Hollywood.

has already fostered.

Probably no industry is backed by greater research than is carried on in broadcasting. One of Chamberlain's jobs is to consult with and advise the large research and manufacturing organizations in order to guide their research work along the lines most beneficial to broadcasting and to help them to provide the proper equipment.

Another tremendous job is that of keeping abreast of new developments. A thorough knowledge of all equipment offered by competing manufacturers is essential to a network which makes large purchases every year.

At any one time there is a score of new engineering jobs underway. On his desk, Chamberlain keeps a great leather folder which contains a record of every current engineering project. At a moment's notice he can refer to and check up on their status. A reference code in the file refers to complete engineering records of the entire job.

All owned stations of the system make detailed monthly operating reports to Chamberlain. From these detailed reports, he keeps an accurate record of every man and every piece of equipment in every station. If you want to know the life of a final amplifier tube in any CBS station, Chamberlain can tell you. From such reports accurate life records of all tubes and other equipment are used to guide future purchases. Costs of operating each station are minutely checked. Should a power bill from any station seem too big for a month, somebody will have to explain why. Yes, it's quite a job, and it takes a man like "A.B." to run it.

Each of the four divisions in General Engineering under Chamberlain has an Engineer-in-Charge. In the Audio Division it's Howard A. Chinn,

graduate of M.I.T. From the day he joined CBS the calibre of his work was so good, Cohan sent down word that he wanted more men like Chinn. So it is that there are mostly M.I.T. graduates in Columbia.

Chinn's department is concerned with everything that happens to a sound wave from the time it leaves a performer's mouth until it reaches the transmitter in the form of electrical pulsations. His department is split three ways into Development and Measurement under Vir N. James; Design and Construction under Robert A. Bradley; and Engineering Laboratory under Robert B. Moe.

These three groups, individually and collectively, turn out an amazing amount of work. Chief among the jobs is the design and construction of studios and all audio facilities for the CBS owned stations, but the work is far greater than that because they are constantly being called upon to render similar services for affiliated stations, a service which is given free of charge or at actual cost depending upon the nature and scope of the work. Typical of such work are the studios and audio facilities at Columbia's West Coast Outlet, KNX, Hollywood; the entire design and construction of which was done by Chinn's department. Bradley was on the job there for more than six months, and regularly spends half of his time in the field supervising construction of studios and installation of speech input equipment in owned and affiliated stations.

Acoustic measurement, and treatment, where needed, of every studio in each of the nine owned CBS stations plus any number of affiliated stations is just one job of this department. It is handled by James as a function of Development and Measurement. To do this work, James had under development for several years the CBS Transmission Panel, and the CBS Automatic Audio Measuring Assembly, special instruments for making complete electrical and acoustical measurements of studios and audio equipment. They are considered distinct contributions to the industry.



Realizing a life-long ambition, E. K. Cohan, CBS Director of Engineering, this year launched his own boat, the Electron. A Western Electric Marine Radio Set features one of the finest radio installations afloat. The station's call letters stand for the Master's name.



J. D. Parker and the CBS two-element directional array graphical calculator, which he developed. This calculator enables the radiation along the horizontal plane, or in any direction in space, of a two-element directional antenna array to be estimated rapidly and accurately in terms of field strength units for any given operating conditions of the array.

Another job of Chinn's department is to make comparative tests of all competitive equipment. This work is carried on extensively and continuously. It enables the System to keep up to date on all developments and places it in the position of knowing the best equipment offered on the market.

Development of new equipment, research work investigations and general all around engineering is carried on by Moe who is in charge of the CBS laboratory.

William B. Lodge, another M.I.T. graduate is Engineer-in-Charge of the Radio-Frequency Division. This department comprises the chief transmission data collecting agency of the entire CBS system. Under Lodge the first conductivity map of the United States was prepared and published. Later he cooperated with the Canadian Broadcasting Company and introduced the first conductivity map of Canada. Coverage maps of the country have been presented before the FCC representing more than 8,000 man hours of work simply to assemble the material and in addition to the years of work of many men in making the actual surveys.

Making coverage surveys and signal strength maps for affiliated and owned stations is an all-the-year-round job of Lodge's Division. One of the things he likes best to do is selecting new station sites, and he has done this more than 25 times since he came to Columbia in 1931. To the laymen this may not sound like an unusual job but it requires not only skill and diplomacy but also a great deal of hard work. Making a survey may require weeks plus the juggling of such factors as land costs, FCC requirements, Department of Commerce rulings and regulations, local zoning ordinances, soil conductivity, topography, and directional characteristics.

Coupled to this is the work of designing antennas for owned and affiliated stations. More



than 200 have been designed by Lodge and J. D. Parker, antenna expert, and assistant to Cohan and Chamberlain. Indicative of the scope of Lodge's Division is the operation of the Columbia Field Intensity Automobile. In three years this car traveled more than 53,000 miles, was engaged in more than 9,000 field intensity measurements in the course of making surveys for more than 50 stations in the Eastern half of the country. This car has been retired and replaced by a new Chrysler with the most modern of survey equipment. It is operated by G. C. Hutcheson. Surveys for Western stations are made by cars operating out of Chicago and Los Angeles.

Another phase of Lodge's work is testifying before FCC hearings. To date he has made perhaps a score of appearances. He spends several days each month in Washington.

The Short-Wave Division comprises two sections, High-Frequency and Ultra-High-Frequency. F. J. Bleil is Acting Engineer-in-Charge of the Division and head of the High-Frequency end. W. H. Moffat heads the Ultra-High-Frequency end.

Bleil, graduate of M.I.T., has charge of all intermediate and short wave transmitters used by Columbia for relay broadcasting as well as the 10 KW. international station W2XE, located at WABC, and now known as WCBX. Most relay transmitters are bought from outside suppliers, although often they are built to CBS specifications resulting from designs developed by Bleil.

An interesting and valuable part of Bleil's work is the scheduling of operating frequencies for the international station. These schedules must be made up four months in advance and are based on predicted propagation characteristics of the heavy-side layer and countless other factors including sunspots. So accurate has the science of propagation predictions become that it is rarely necessary to change schedules even though they are prepared far in advance. Much help is obtained in this work from the daily reports of the monitoring of the station's signals by the British Broadcasting Company, and also through commercial



Columbia's new Field Intensity Measuring Car, which this year replaced one that had made more than 9,000 measurements in 53,000 miles of travel.

radio operations in South America.

W. H. Moffat, Georgia Tech, is in charge of Columbia's three experimental ultra-high-frequency stations, W2XDV, New York; W9XHW, Minneapolis; and W6XDA, Los Angeles. Much of his time is spent in making coverage surveys, noise level surveys, and level variations. At present he is making an elaborate study and comparative tests of vertical and horizontal polarization of ultra-high antennas.

The fourth Division of General Engineering operates under J. L. Middlebrooks, architectural graduate of Alabama Polytechnic Institute and engineering graduate of Georgia Tech. It is his job to plan and supervise the construction of new Columbia stations. Right now he is down in Washington busily putting Columbia's new Western Electric 50 KW. transmitter on the air at WJSV. He supervised the construction of WKRC and WEEI at the same time by commuting via airplane between the two jobs.

Such is the General Engineering Department. In man power, Network Operations is a much larger organization. In each division, the chief engineer of the key station of the division serves also as Division Operations Engineer. Thus, Henry Grossman is Chief Engineer of WABC, New York and Operations Engineer for the Eastern Division; F. B. Falknor, Chief Engineer of WBBM, Chicago, is Central Operations Engineer; and L. H. Bowman, Chief Engineer of KNX, Hollywood, is Western Operations Engineer.

In all there are 290 persons in the CBS Engineering Department. The System owns and operates nine broadcasting stations, and has 106 affiliated stations which comprise the network stations, one international short-wave station, three experimental stations, and 16 relay and experimental relay stations.

Besides operating the largest single network in the world CBS Engineering has made innumerable important contributions to the entire field of radio broadcasting. This includes new equipment, new techniques and new operating procedures. Its scope and influence has helped tremendously to speed engineering research and direct it along lines productive of better and more efficient operations. Scores of technical papers have been presented before scientific organizations such as the Institute of Radio Engineers, and many CBS engineers take active part in such engineering bodies.

In the words of E. K. Cohan, "the Engineering Department, man for man, constantly strives for that happy balance between engineering perfection and economic justification."

Radio as a whole had its acid test this fall when the nations of Europe hung for days between war and peace. If ever an industry, its organization, personnel, and facilities had a supreme test of its fitness, radio had it then. CBS Engineering came through with flying colors.