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Newark Evening News

Electrical Gun Director Demonstrated

WITH a group of distinguished guests and representatives of the press, about 1,500 members of the Laboratories saw the first public demonstration of one of their developments, the M9 Electrical Gun Director. Set upon one of the parking fields at Murray Hill was a battery of 90-mm. anti-aircraft guns furnished by the Eastern Defense Command. The M9 Director, which is a part of that Battery's regular equipment, was set up in the foreground. Following a gun drill by the Battery and the singing of the "Star-Spangled Banner," with Alan W. Morrison leading, R. K. Honaman, Director of the School for War Training, in introducing the first speaker, said:

For more than two years the people of the Laboratories have been so intent upon immediate war problems that little thought has been given to a pause to take account of progress. This has been partly because of the confidential character of the projects and partly because of the pressure under which they have been carried on. Many of us have had little opportunity to know what is being done outside our own groups. In many instances men and women have worked on the development of one part of a war instrument but have not had the opportunity to get acquainted with the final result. It

seems very fitting, therefore, to be assembled here today to see one of our war developments and to celebrate its completion.

Almost exactly three years ago today, final approval was given to proceed with the development of the electrical director now performing an important part in the control of anti-aircraft guns. Within about a year from that time a model of the first director had been sent to the Army for test. Within another year the tests had been completed and the Western Electric Company was provided with the data necessary to begin production. Today, three years later, many of these instruments are in the hands of our Armed Forces. The exact number is in the realm of restricted information, as is much of the detailed information relating to the director, because we are still at war.

We are very glad, however, to be permitted by the War Department to invite the Press to be here and to see the demonstration of this new use of electrical circuits in war equipment.

As the first speaker, I am privileged to present to you the President of Bell Telephone Laboratories, Dr. O. E. Buckley.

Dr. Buckley then spoke as follows:

. . . The place where we are meeting, as you know from finding your way here, is our Murray Hill laboratory. We were very fortunate to have had this building so far under way that we could start its occupancy for laboratory work before Pearl Harbor. Today, with 50 per cent more people than the building was designed to accommodate, every square foot of its space and all of its facilities are actively employed in the development of devices and equipment for the Armed Forces. This laboratory is not the whole nor even the principal building of the Bell Telephone Laboratories. It is one of seven major locations in which we work. Some idea of the magnitude of our total effort may be had by multiplying what you see here by six; for this laboratory represents about one-sixth of our total establishment. Assembled here today, in addition to those who work here regularly, are some 400 from our other laboratory locations who had a substantial part in the development of the device we are about to demonstrate.

The electrical gun director involved in its development, design and production the coöperation of many groups. Its progress in this regard was typical of many of the hundreds of war projects on which we have worked and are working. In this case a problem was recognized, and in seeking its solution inventions were made. As usually

About 1,500 members of the Laboratories saw the show

Distinguished visitors. Left to right: Brigadier General C. B. Hines; Brigadier General R. K. Robertson; Major General G. M. Barnes; Dr. F. B. Jewett, Vice-President, American Telephone and Telegraph Company; Major General L. H. Campbell, Jr.; Dr. O. E. Buckley, President, Bell Telephone Laboratories; Major General T. A. Terry; R. K. Honaman, Director of the School for War Training, Bell Telephone Laboratories; and A. W. Morrison

happens, both recognition of the problem and the means for its solution came not from the top levels of the organization but from what I might call the productive level, in this instance scientists of our Physical Research Department. The importance of their findings was immediately recognized by the "higher-ups." Dr. Harvey Fletcher, head of our Physical Research group, and Dr. M. J. Kelly, Director of Research, lost no time in organizing a proposal which was submitted to the National Defense Research Committee and the Ordnance Department of the Army.

The merits of the proposal were quickly recognized by these two groups, and the project was given support by the National Defense Research Committee under whose sponsorship we carried the development to a point where a working model could be shown to the Ordnance Department, who made a thorough test of it to determine its possibilities. From the start, there was the closest coöperation among our technical staff, the National Defense Research Committee, and the Ordnance Department to develop a mechanism which we hoped would contribute to saving the lives of our soldiers while endangering those of enemy fliers.

The work of the Laboratories on this project involved several stages which characterize nearly all of our operations:

First, establishment by experiment and theoretical analysis of the soundness of the principles involved.

Second, development of a preliminary or "bread-board" model embodying the ideas of the research scientists. These first two stages were handled by Dr. David B. Parkinson and Dr. Clarence A. Lovell, who originally conceived the idea of an electrical device to act as an anti-aircraft gun director. In this they work under the guidance of Dr. Edward C. Wente, Research Physicist, who himself made important contributions.

Third, redesign for manufacture and to meet specific requirements of the Army. This phase of the work was handled by Mr. John J. Kuhn under the guidance of Mr. Halsey A. Frederick, Director of Switching Apparatus Development. At this point, engineers of the manufacturing company, Western Electric, were drawn in to contribute their ideas and to insure that the device could be efficiently manufactured.

Fourth, preparation of the 5,000 detailed drawings and 1,100 specifications for the 3,300 different parts required.

Fifth, building in the laboratory of a final production-type model.

Sixth, engineering assistance to the Western Electric Company during the manufacture of the equipment.

Seventh, coöperation with the Army in its field tests.

Eighth, preparation of instructions for operation and maintenance.

This is the same series of functions which we normally perform on all new devices for the Bell Telephone System in our ordinary peacetime activity as its research and development unit. It is always our procedure to develop equipment to *use*. Taking the user's point of view, we are vitally interested in reliability and life and also in ease and speed of maintenance. That point of view in designing equipment was, I believe, helpful in our relations with the Ordnance Department, who, themselves, are users. In all this work on the electrical director there has been the closest coöperation, among the departments of the Laboratories and the Western Electric Company, and between all of us and the National Defense Research Committee and the Ordnance Department of the Army. All of these groups made contributions to the development of this device which should, therefore, be looked upon as a joint product.

This spirit of coöperation is playing a large part in all of our contributions to the war effort. Throughout, we have been working in close harmony with other organizations, including the development laboratories of other manufacturers and research institutions. As authorized by military authority, our doors have been open to them and theirs to us so as to pool information and skills to do the best job in the least time.

"We want you to know that we are all proud of you"—Major General Campbell, Chief of Ordnance, U. S. Army

Major General Levin H. Campbell, Chief of Ordnance, United States Army, then spoke to the assembly as follows:

As Chief of Ordnance of the Army I am certainly very much pleased to be standing here taking part in these ceremonies. I am especially pleased because we in Ordnance have always felt very close to the Bell Laboratories. We have been close for many reasons. The chief one of these, I think, is the fact that when we have wanted really high-grade, scientific work done we have come to the Bell Lab-

oratories. We gave one of our best officers to the Bell Laboratories, but as I said awhile ago to Dr. Buckley, we knew he would come back just as soon as the fire bell rang. You know him no doubt as Col. H. B. Ely. Hi Ely! He is doing just as good a job for us as he did for you. After the war we may get big-hearted and send him back to you people.

The M9 director, electrically operated, is, we feel in Ordnance, one of the greatest advances in the art of fire control made during this war and we anticipate from the M9 director very great things as the war goes on. I often stop and think of the immense amount of effort involved to get an artillery projectile to an airplane. When we go back to the manufacture of the gun, the ammunition, the fire control apparatus itself, the training of the men, transportation over countless hundreds of miles of water and the dangers involved, then we must recognize the fact that the fire control is, after all, the heart of the whole proposition. If we can only control firing accurately, the rest will take care of itself, and that's why the work you have done in Bell Laboratories is, in our judgment, of such great importance. Do not underestimate what you are doing. We want you to know that we are all very proud of you and are looking for greater things.

Gun pointers at each gun are standing by in case of need, but the motor-drives do the work under remote control of the Director

There was an incident that happened the other day. There was a case out in the South Pacific; 16 Japanese bombers, 14,600 feet high, everything riding fine, no trouble, and all at once the 90 millimeter anti-aircraft gun in the hands of these great artillery troops of ours began to work on it. They only fired 88 rounds and knocked down 12 out of the 16 bombers. Some fighter airplanes got the other four. General Vandercliff told me that he has knocked down planes with the 90 millimeter guns as high as 27,000 feet. In World War I we used to hit a plane, not knock it down, for every 17,000 rounds. Let me repeat that again. Today these great men of ours are knocking them down on an average of 90 shots. In World War I they hit them on the average of 17,000 shots.

I'm very happy to be here today and I want to congratulate you and thank you on behalf of the Ordnance Department and the Army. We solicit your continued support. Goodbye and good luck.

Mr. Honaman introduced the final speaker in the following words:

The remaining part of our program is really one item. Dr. Harvey Fletcher will discuss the electrical director and the manner in which it operates. After that you will see the demonstration of the operation of the instrument. This demonstration will be given by an Anti-Aircraft Battery of the Eastern Defense Command whose drill you saw at the beginning of the program. Captain Karl Monson has been appointed

Dr. Harvey Fletcher

Battery Commander; Lieutenant R. E. Rohleder is Executive Officer. I would like to express the thanks of the Laboratories and of the audience to the officers and men of this Battery for their participation in this program.

Dr. Harvey Fletcher, Director of Physical Research, Bell Telephone Laboratories, then took over the speakers' rostrum:

It is probably a common notion that to fire a gun so as to hit a target it is only necessary to point the gun at the target. This, of course, is true in most small fire arms where the target is near so that the time of flight of the projectile is only a few seconds. However, when firing a gun at a target moving with the velocity of an airplane, to follow this procedure would result in misses of two or three miles. It is therefore evident that in order to control anti-aircraft gunfire so as to score hits, it is necessary to make calculations as to how far ahead of the airplane to shoot and how high above it so that the projectile traveling in its curved flight will meet the fast-moving target. In order to do this it is evident that one must take into account the velocity of the projectile as it leaves the gun and the forces acting upon it after that. To perform these computations by the usual methods, even though all the information could be obtained quickly, would require so long a time that the result would be obtained too late to be of any use. Consequently means must be provided for obtaining the pertinent information and making the calculations very quickly so that the gun may be fired at the earliest possible moment and continuously thereafter.

The apparatus which we are demonstrating today, called the electrical gun director, is a combination of devices for obtaining the necessary information and making predictions for controlling the gun so that projectiles fired from it will meet the moving airplane and explode in its path. As you have heard, these directors are now in production and are being sent to many fighting fronts. We understand they have gone to Fiji, Caledonia, the Aleutians, Sicily, New Guinea and Panama. Thus is fulfilled a dream that some of our engineers had more than three years ago.

It was the defeat of the Allied armies in France that started a number of Bell Labs engineers and research workers thinking about new military devices that might prevent these conquests from spreading. It was then that the idea of the electrical director was born; and within a short time plans were on paper for apparatus which would automatically make anti-aircraft fire control calculations. It has been a long, hard road from those early engineering sketches to the finished directors now coming off the production line.

I wish to add my tribute to that of Dr. Buckley's to this group of experts who were gathered together to do this job, for their wonderful performance, their devotion and enthusiasm in carrying this project to a successful conclusion. During the more critical periods of the work these men were organized into three shifts so that work could proceed continuously 24 hours a day. At all times hours meant nothing to them—they were intent on getting the job out at the earliest possible moment.

The electrical director is associated with a battery of four guns and an optical height finder such as you will see today. It consists of four separate units which are transported in a trailer, namely, the tracker, the

computor, the range converter, and the power equipment.

You see here, at my left on a platform, the tracker. Ordinarily this would be on the ground, but we have elevated it so that you can see more clearly its operation. The two men on the seats of the tracker look through the telescopes and by means of controls, keep the cross hairs in the eye pieces constantly on the airplane. For example, one man is now rotating the tracker about a vertical axis and this rotation determines an angle called the azimuth. The other man raises or lowers his telescope about a horizontal axis and thus determines an angle called the elevation angle. In an actual operation which you will witness later the two actions are simultaneous. These two angles determine the direction of the airplane from the tracker.

The two telescopes are driven by electrical motors, so that the rates of these motors can be set when the telescopes are following the plane smoothly, and they will continue to follow it for short periods without any aid from the men, as when the plane is flying through a cloud. However, even when the plane is flying in a straight line at constant speed the angular rates at the tracker are not constant, so the two men at the tracker must slowly shift the rates so as to keep the target on the cross hairs. If they are skilful in doing this, then, by electrical transmission systems, data, which give the direction of the airplane from the tracker at each instant of time, are continuously being fed from the tracker to the computor of the director.

To determine the position of the plane in space we must add to these two direction angles another quantity called the range, that is, the air-line distance from the tracker to the target. This is furnished by either electrical or optical means. The apparatus

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Left to right, three of the four anti-aircraft guns, the computor and the tracker with the height finder behind it

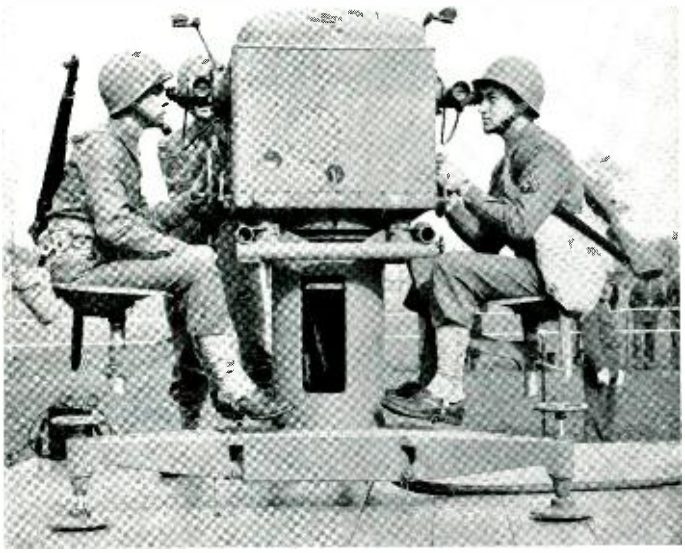
which you see at my left is an optical device for obtaining this information. So it is thus seen that the computor is receiving continuously three quantities: the angle of elevation, the angle of azimuth, and the range. These quantities are known as the present position polar coördinates and all of them vary from instant to instant as the plane moves.

The first operation which the computor performs is to transform these polar coordinates into rectangular coördinates, that is, values are produced in the computor which tell how far the plane is north or south, how far it is east or west, and how far it is up above the ground. These quantities also vary from instant to instant, but on a bombing run the plane is flying a straight-line course at constant speed so they vary at constant rates. The computor then calculates by means of electrical and mechanical mechanisms the magnitudes of these rates, which are indicated on meters. Under the conditions described, the meters will show constant readings, indicating the plane is flying in a straight line and at constant speed.

Before the computor can use these data to make predictions as to where the gun must be pointed at any instant so that a projectile fired at that instant will rise and explode just as it reaches the airplane, the information concerning the power of the gun and the kind of shell that it is firing must be taken into account.

Here is a sample of the ammunition used in the 90 mm anti-aircraft guns you see out there in the field. This top part is a high explosive projectile which is fired from the gun by the explosive stored in this lower part, the cartridge case. At the top of the projectile is a device called the fuse. The position at which it is set determines how long after the projectile leaves the gun before it explodes. I think it is evident from what I have said that this setting is extremely important and must be calculated accurately by the computor. When this projectile leaves the gun its path is determined mainly by the direction in which the gun is pointing and by the velocity which the projectile has as it leaves the muzzle of the gun. This would be strictly true if it were not for gravity and atmosphere. We all know the effects of gravity. For such a fast-moving object as the projectile the forces due to the air are also important. You are all familiar with the fact that a baseball curves due to the pitcher's ability to spin it as it travels in its path. In the same way the projectile has a drift to the right caused by spin such as is produced on an in-curve in

An optical height finder transmits its data by wire to the Director



The tracker in action. As one soldier orients the telescopes in elevation, the other orients them in azimuth by turning the entire tracker head

baseball; also it is slowed down in its path due to air friction and deflected from its normal path by the wind velocity. All of these factors must be taken into account to obtain an accurate prediction. Some of these forces necessarily vary with the weather and with the wear of the gun, so that provision must be included in the computor for making small corrections, and you will see on the computor dials for making corrections for air density, direction and velocity of wind, and the drift of the projectile. These may be set in the computor by means of hand-controlled dials. This is the first computor which has gone into manufacture which has been able to take account of all these directions. Without it errors of 100 yards or more would be common.

In addition, the electrical computor also takes into consideration the fact that the guns are located some distance from the tracker. The computor may be put into a place of safety underground, hundreds of yards from the guns, and still make accurate predictions. The adjustment necessary when the gun and tracker are separated is called the parallax correction. When you see the computor you will notice the dials for putting into the computor all of these corrections, but you will have to take my word for the fact that in turning these dials, the proper amount of interconnections are set up in the electro-mechanical parts of the computor to produce the correct result on the final prediction. The predicted result is transmitted from the computor to the gun by an electrical transmission system and the gun is pointed by an electrical automatic control mechanism in the proper direction to score a hit.

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In the computor (left) data from the tracker and in the altitude converter (right) are combined with other information and the resulting electric currents are used to control the guns

O. H. Danielson, Francis A. Hubbard and H. A. Frederick. This and the other photographs on these two pages show some of the men who took a leading part in the development

All I have said is based on the ideal case mentioned of the plane flying in a straight line and at constant speed. However, even when a pilot tries to fly his plane in a straight line for a bombing run he does not succeed but makes deviations owing to air pockets, wind effect and other uncontrollable factors. Even if he did succeed in traveling in a straight line, the two men operating the tracker produce perturbations in trying to follow the plane. As a result of both of these factors, the data which are sent to the computor do not represent the exact present position of the plane at each instant, and also the rates are not constant but varying. We then have the familiar statistical problem of selecting from a large number of measured values of quantity that which is the most probable value of the thing being measured. This computor actually does this averaging process and uses the most probable values for the straight line course and rates to make the prediction. . . .

At the completion of an experimental model to perform these marvelous things only a small part of the job was done. The art of determining how best to manufacture and maintain these instruments in service is very important. Here again the background of the telephone business was a great help. As a matter of fact, nearly all groups in the Laboratories were called upon to make contribution along their special line. As an illustration of one of the difficult design requirements, this apparatus must operate over a wide range of temperatures from the hot climate of the desert to the coldest weather of Iceland or Alaska. It also is designed to withstand vibrations, shock and other rough treatment experienced on battle fields. Another requirement considered of major importance by the Armed Services was to design this apparatus to be capable of large-scale production.

Not only did the Laboratories invent and develop the gun director and guide its manufacture through the shops of the Western Electric Company, but it felt a keen responsibility for its proper operation and maintenance. Consequently, it was necessary to invent and develop methods and apparatus for testing this equipment before it leaves the factory and also while in service

J. J. Kuhn, G. E. Perrault and W. W. Werring

in the field. After having invented, designed and manufactured testing apparatus there is still a further problem that must be met, namely, the training of personnel to maintain and operate the equipment. Accordingly, a course of training was instituted at the Laboratories' School for War Training. In this program several hundred Army men have been trained. Many of these were

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D. B. Parkinson *C. A. Lovell*

key men who were sent into the field to train other men in the Armed Services how to use and maintain these directors. This schooling has consisted not of a few lectures, but of a full nine-week course which is conducted on a laboratory and classroom basis, using texts prepared by its instructors.

Our engineers in the field are constantly studying the equipment in service and they give the benefit of their experience in recommending changes in design and maintenance that will improve the performance of the gun director.

There is no doubt that the emphasis upon

F. E. Masek *O. J. Murphy*

E. C. Wente *R. V. Terry*

these maintenance and improvement phases are important factors in the success of this equipment.

In conclusion, I might add that many of the principles and component parts developed for this director have peacetime possibilities, for some of these newly discovered principles can be incorporated into various products and may be adapted to the improvement of telephone switching systems, and thus benefit the telephone users of America.

As the Director and Height-finder crews tracked two coöperating Civil Air

Philip Husta *H. G. Och*

Patrol planes and the four guns followed their target across the sky, Dr. Fletcher explained the action in detail. The barriers were then lowered, and the spectators gathered around each piece of equipment. To their great interest, the crews went through their loading drill several times.

Carrier System for the Spiral-4 Cable

By O. B. JACOBS
Transmission Engineering Department

A CARRIER system suitable for distances up to 150 miles or more has recently been developed for and in conjunction with the Signal Corps. Rapid and simple installation and ease of operation have been important objectives. This system provides four telephone circuits, of which one will ordinarily be used for voice-frequency telegraph operation to obtain four full or half duplex telegraph circuits. In addition, two simplex paths are provided: one for a signalling circuit employed in lining up and maintaining the system, and the other for a grounded d-c telegraph circuit.

Spiral-4 cable, already described in the RECORD,* is used as the transmitting medium. This is a four-wire, rubber-insulated cable with loading coils at the junction points of the cable sections, which are made in quarter-mile lengths. One pair of conductors serves to transmit in one direction and the other pair in the opposite direction. The cable may be strung aerially, laid on the ground, or may be buried by means of a plow developed by the Laboratories Outside Plant engineers. For long systems, most of the cable will be buried to minimize line trouble and the effects of temperature changes.

The equipment used with this system comprises four types of units which are designated by the Signal Corps as Telephone Terminal CF-1-A (Carrier), Telegraph Terminal CF-2-B (Carrier), Repeater CF-3-A (Carrier), and Ringing Equipment EE-101-A (Voice Frequency). In addition to spare fuses, tubes, and telegraph relays, the units include the testing arrangements and adjusting tools needed in lining up the

*RECORD, *April*, 1943, *p.* 251.

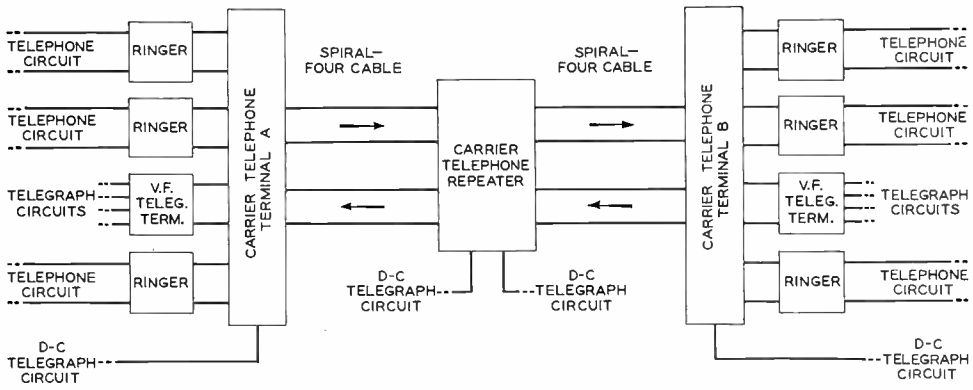

Fig. 1—Block schematic of complete spiral-four carrier system

system and in maintaining the equipment. The Signal Corps supplies the field forces with necessary auxiliary items which include engine generator sets, storage batteries, connecting cables, ground rods, telephone sets, tools, volt ohmmeters, and a limited quantity of replacement parts. The field maintenance depots also are being provided with testing equipment and a comprehensive supply of parts for replacement needs.

Repeaters are required at about 25-mile intervals. As shown in Figure 1, a complete system will consist of carrier telephone and telegraph terminals, voice-frequency ringers at each end, and repeaters as required. Each of these units is mounted in a portable wooden cabinet and arranged for operating on 115- or 230-volt, 50- or 60-cycle a-c power supply. Except for the telegraph, they are also arranged to operate from 12-

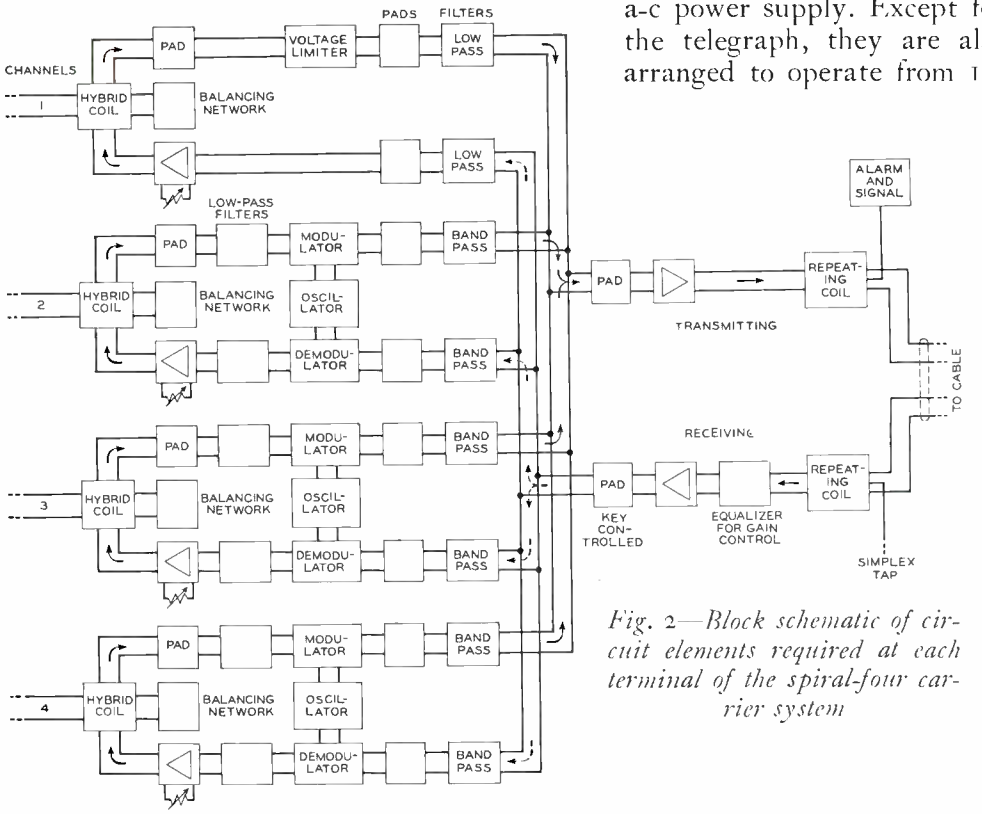

Fig. 2—Block schematic of circuit elements required at each terminal of the spiral-four carrier system

volt storage batteries with automatic transfer to the batteries if the a-c supply fails. Thus with a suitable engine-driven generator the carrier telephone and signalling equipment may be operated alternately on batteries and a-c power, the batteries being charged while the engine is running. Battery operation for the carrier telegraph terminals is not provided because the associated repeaters and printers also are dependent upon a-c supply.

The circuit elements of the carrier telephone terminal are shown in block form in Figure 2. Each telephone channel includes a low-pass filter in the voice frequency circuit. For channel No. 1, which is operated at voice frequencies, the receiving and transmitting low-pass filters are the only ones employed, while in the three-carrier channels band-pass filters also are required to select the desired frequencies and suppress others. One oscillator per carrier channel supplies carrier for both the modulators and demodulators, which are of the copper oxide type arranged to suppress the carrier. The band-pass filter, following each modulator, selects the lower side band. The three lower side bands from channels 2, 3, and 4, together with the voice frequencies from channel 1, are passed together to the transmitting amplifier, and thence through a repeating coil, center-tapped for the simplex, to the transmitting pair of the spiral-four cable.

The receiving side, associated with the incoming pair, includes a simplex repeating coil, a receiving amplifier common to all four channels, and an equalizer for controlling the receiving gain. The loss which this equalizer introduces at various frequencies is adjustable by dials in such a manner that the output of the amplifier may be made approximately the same at all frequencies. Following the low-pass filter in each channel is a voice-frequency amplifier with a gain control to permit adjusting the overall net loss of each channel to the value desired. As shown in Figure 3, the complete carrier telephone terminal is housed in a cabinet about 5-ft. 6-in. high, 2-ft. 4-in. wide, and 1-ft. 7-in. deep, which weighs about 475 pounds.

The repeater unit, as shown in Figure 4, is housed in a cabinet 2-ft. 4-in. wide and 1-ft. 2-in. deep, weighing about 225 pounds. It has two amplifiers with

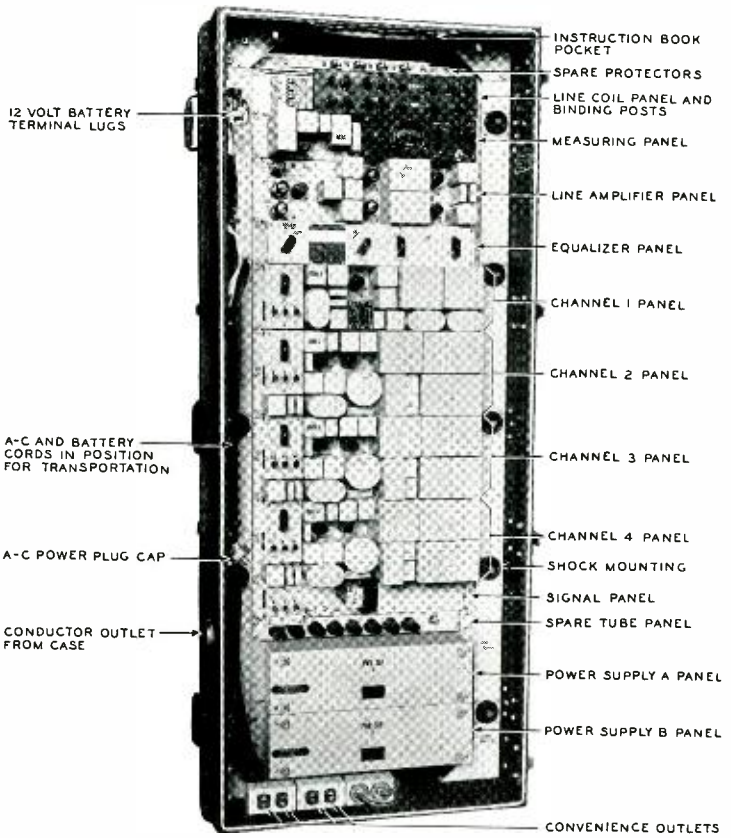

Fig. 3—The carrier telephone terminal with cover removed

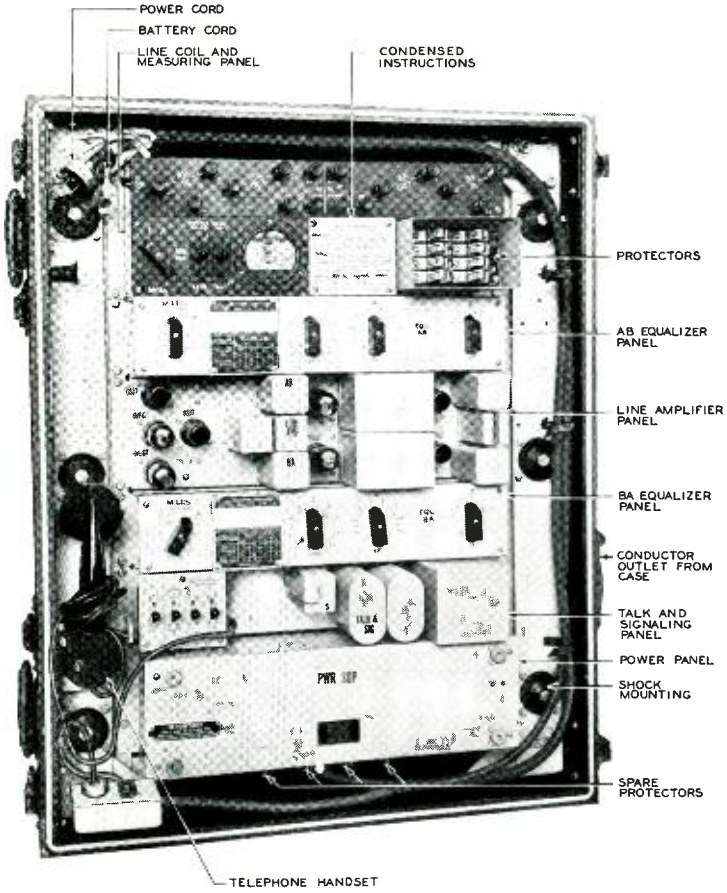

Fig. 4—Repeater unit used for the spiral-four carrier system

associated gain-control equalizers, one for each direction of transmission. These are similar to the common receiving amplifier and gain-control equalizers at the terminals, and are adjustable in a similar manner.

Ease of installation and simplicity of maintenance are of particular importance in view of the conditions under which the equipment will be used. It is designed, therefore, for all external wiring connections to be made at binding posts; all adjustments and tests are made by switches or keys. The built-in testing facilities permit 1,000-cycle power to be sent over any channel, and the output of each channel may be measured on a meter at each repeater and terminal. Initial gain adjustments and subsequent changes to compensate for variations in the attenuation of the cable, due to temperature effects, are made by turning dials on the gain control equalizers to obtain the desired output at each repeater in succession and at the receiving terminal. In making this adjustment only one channel at a time need be removed from service. A d-c signalling system operating over one of the simplex paths is provided whereby the attendants at the terminals and repeaters may signal each other. In addition, means are provided so that the maintenance men at each terminal or repeater location may talk with one another over the voice-frequency channel.

Since a low-frequency (16 or 20 cycles) ringing current is not transmitted efficiently by carrier systems, a voice-frequency ringing system is provided. In this system a 1,000-cycle current interrupted about 19 times a second is generated and transmitted over the carrier circuit. At the receiving end it causes low-frequency ringing current to be sent toward the switchboard. Ordinarily, 60-cycle a-c will be used to ring bells or operate switchboards' signals, but other low-frequency ringing current can be used when available. Equipment for two circuits is mounted in a portable unit approximately 21¼ inches by 14¾ inches by 11⅝ inches, and weighing about 95 pounds.

The voice-frequency telegraph equipment ordinarily is connected to the two-wire terminals of one carrier telephone

channel. If necessary, voice-frequency telegraph may be operated over more than one of the carrier channels. At the sending end, the signals received from the four d-c telegraph circuits connected to the telegraph terminals are converted to voice frequencies; and at the receiving end the latter are reconverted to d-c telegraph signals in the respective four connected circuits. Different carrier frequencies are employed in each direction of transmission for each telegraph channel. The terminals for the two ends of the telegraph channel are alike and are convertible by means of a switch to serve as either west or east terminals. The carrier telephone terminals require no change to make them suitable for use at either end of the system, since the transmission bands are the same in both directions.

The wide variety of climatic and physical conditions to which the new carrier system may be subjected has been kept in mind throughout the design. Field trials indicate that the objectives of dependable and simple operations have been obtained.

THE AUTHOR: O. B. JACOBS graduated from Worcester Polytechnic Institute in 1910 with a B.S. degree, and at once joined the A T & T as an equipment maintenance man at Buffalo. In 1912 he transferred to the plant engineer's organization in New York City to prepare specifications for toll installation. In 1917 he joined the Signal Corps, and a year and a half later, after considerable overseas service, was mustered out as a Captain. Returning to Long Lines, he became Transmission Engineer of Division 1. In 1921 he transferred to O & E where at various times he was in charge of groups working on toll transmission, toll cables, repeaters, loading, electrolysis, and protection. In 1929 he joined the technical staff of these Laboratories and engaged in submarine cable development. More recently Mr. Jacobs has carried on liaison work between the Laboratories and the Signal Corps of the U. S. Army.

Historic Firsts:

The Negative Feedback Amplifier

IN THE early days of vacuum-tube amplifiers it was recognized that more gain could be obtained if some of the output was fed back as additional input; but the result if the process was carried too far was "singing." Stable operation, it was commonly supposed, required a net loss in the loop form by amplifier and feedback circuit. It was also believed that feedback in reversed phase afforded no advantage compensating its accompanying reduction in net gain.

Harold S. Black

The paradox of amplifier design was announced, however, in the early 1930's by Harold S. Black. His work in Bell Laboratories had led him to an epoch-making invention in electronics. He showed that many remarkable properties inhere in amplifier operation with a negative feedback which reduces the gain. Following his technique one designs an amplifier for more amplification than is required; and then, by properly sacrificing some of this potential gain, one obtains amazing constancy of amplification and stability of operation.

The resultant amplifier has increased linearity of characteristic with a hundredfold reduction in harmonics. Tube noises are greatly reduced. There is improvement in phase distortion, in the gain-load characteristic and in the amplifier's impedance relationships. These important advantages are obtained economically without excessive refinements in the designs of tubes and in the constancy of their power supplies.

Negative feedback also facilitates the equalization (within reasonable limits) of frequency distortion due to apparatus in the direct path of the signal current. Previously it had been necessary to introduce a network of inverse characteristic. In construction such networks range from difficult to impractical. With negative feedback, however, they are unnecessary because usually the desired result can be produced by inserting in the feedback circuit apparatus with the characteristics which are to be equalized and then properly increasing the amount of feedback.

The stability of negative feedback amplifiers is well illustrated by long carrier-current circuits in coaxial or other cable. They permit the operation of hundreds of high-gain repeaters in tandem. The gains can be made so independent of ordinary variables that insuring the stability of the circuit is essentially a matter of regulating against transmission variations in the line itself.

Black's invention has been widely utilized wherever constancy of amplification with freedom from distortion is a requirement — that is, in practically all types of communication circuits, audiofrequency, carrier and radio.

Telegraph-Transmission Measuring Set

By W. T. REA
Telegraph Development

IN BELL SYSTEM teletypewriters a character consists of a "start" pulse, which is always "spacing," a "stop" pulse, which is always "marking," and five equal-length intermediate pulses, each of which may be either "marking" or "spacing." The code for the letter "Y" is shown in Figure 1 as an example. Including the beginning of the start pulse and the beginning of the stop pulse, there are seven equally spaced points where a transition may be made, either from mark to space or from space to mark. Every form of time distortion either retards or advances one or more of these transitions from its proper position with respect to the beginning of the start pulse.

Distortion may be determined, therefore, by establishing a series of reference points, initiated by the start pulse and spaced exactly one pulse interval apart, and by then measuring the interval from these reference points to the transitions at the ends of the pulses. With the 118A1 telegraph transmission measuring set,* which has been extensively used for measuring distortion, these measurements are made by beginning to charge a condenser at a constant rate at each reference point and then comparing the voltage it has attained at the following transition with a fixed voltage equal to that which would have been reached by the condenser had the transition occurred at the proper point.

*RECORD, *March*, 1939, *p.* 224.

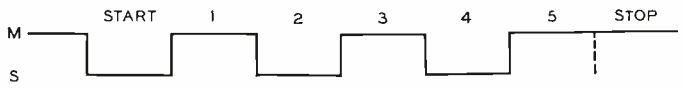

Fig. 1—*The teletypewriter code for the letter* Y

In this set the reference points are determined by a mechanical distributor, which is set in rotation at the beginning of the start pulse for each character. The distributor face has seven short equally spaced grounded segments separated by longer ungrounded segments. As the distributor brush passes over each grounded segment a condenser is

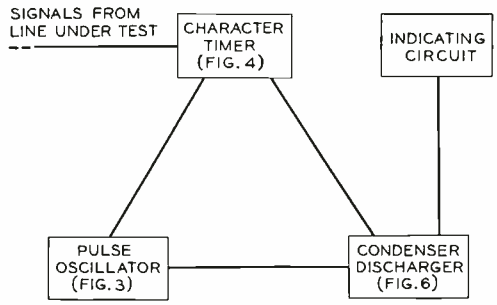

Fig. 2—*Block schematic of the* 118C1 *telegraph-transmission set*

discharged, and the end of the grounded segment forms the reference point, since it is here that the condenser begins to charge from a constant-current source. Two condensers are employed; one alternates with the other in timing successive transitions. The method of measuring the voltage attained by the condensers and other operating details are described in the article already referred to.

The mechanical distributor for timing the reference points was adapted for the 118 measuring set from similar distributors used in teletypewriter equipment. This distributor requires very careful maintenance to produce the necessary pre-

cision of timing. To avoid this maintenance work, a substitute for this mechanical distributor has been developed. This new arrangement utilizes a vacuum-tube oscillator for determining the reference points and gas-filled tubes for the condenser discharge circuit. To include this new timing arrangement, the code number of the 118 set has been changed from the 118A1 to the 118C1 and this new set is now being manufactured by the Western Electric Company.

This new measuring circuit, as indicated in Figure 2, has functionally four parts: A character timer, a pulse oscillator, a condenser discharger, and an indicating circuit. The last-mentioned is essentially the same as in the previous set and need not be further described here, but the other three circuits are different. The character-timer circuit includes a polarized relay that receives the telegraph signals to be measured. When the armature of this relay moves to its spacing contact at the beginning of the start pulse, the oscillator is started, and a timing circuit is set in action that will cause the oscillator to stop at the beginning of the stop pulse. The pulse oscillator circuit sends a pulse to the condenser discharger circuit at a fixed point of each cycle, and this circuit then discharges the condenser and opens the discharge path so that constant-current charging may begin. At the next transition this condenser will then be connected to the indicating circuit.

The pulse oscillator circuit is shown in somewhat simplified form in Figure 3. Lead X runs to the marking contact of relay B of the character-timer circuit, shown in simplified form in Figure 4. The lower winding of this relay, if acting alone, would hold the armature on the spacing contact. With relay A on its marking contact, however, current through tube B holds relay B also on its marking contact. This applies negative voltage to the oscillator circuit, causing current to flow in the coil of the tuned

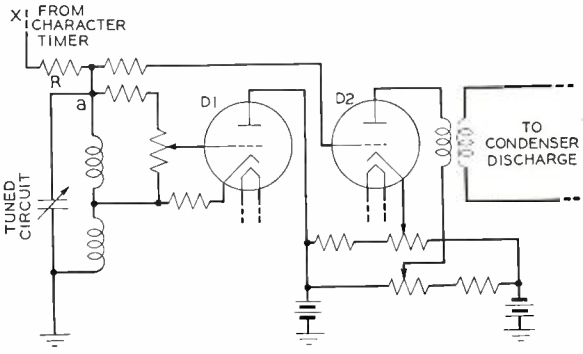

Fig. 3—Simplified schematic of pulse oscillator circuit of the transmission set

circuit of Figure 3, where it stores energy in electromagnetic form. When relay A moves to its spacing contact at the beginning of the start pulse, current through tube B is blocked by the application of negative voltage to its plate. As a result relay B moves to its spacing contact, and the energy stored in the coil oscillates between coil and condenser. The oscillations are sustained by energy supplied by tube D1.

While the circuit of Figure 3 is oscillating, voltage at point "a" varies as shown at B in Figure 5, and as it reaches some small positive value, tube D2 starts to pass

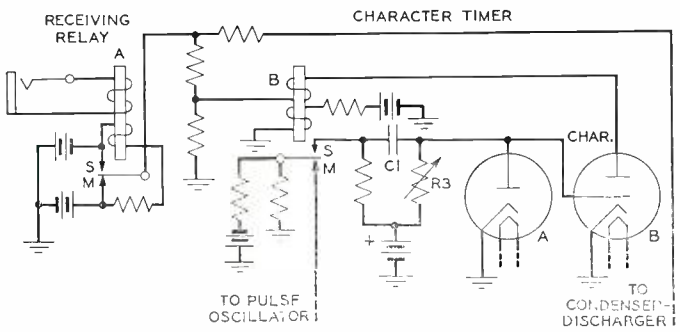

Fig. 4—Simplified schematic of character-timer circuit

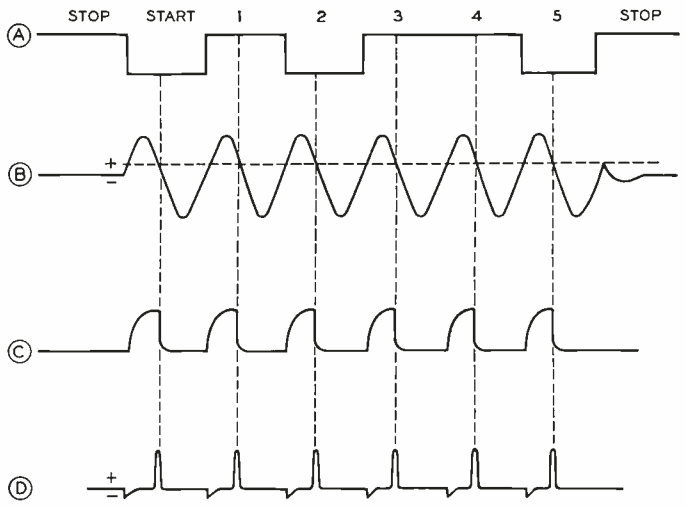

Fig. 5—Voltage or current curves at various points of the measuring circuit: A, *the incoming signal;* B, *point "a" of Figure 3;* C, *plate current of tube* D2 *of Figure 3;* D, *voltage across secondary of transformer connected to output of tube* D2

current. This current increases until the voltage at "a" drops to the cut-off potential for D2 and then abruptly ceases. These current pulses, through D2, are shown at C in Figure 5. At the beginning of current flow a small negative potential is generated in the secondary winding of the transformer in the plate circuit, and at the abrupt termination at the end a much larger positive potential is generated. These are shown at D, Figure 5. These positive pulses start the discharge circuit.

While the armature of relay B of Figure 4 was on its marking contact, the right-hand plate of condenser C1 was held slightly positive by the flow of current through resistance R3 and the rectifier A. The left-hand plate of this condenser was held at +130 volts by the battery. When relay B moved to its spacing contact, thus applying negative voltage to the left plate, there was no immediate change in the charge on the condenser, but the potential of the right plate dropped proportionately to maintain the same voltage across the plates, and thus became negative. As a result current through the diode A ceases, and the grid of tube B becomes sufficiently negative to prevent plate current flowing even when subsequent operations of relay A, in response to signal pulses, make the plate positive. As a result the armature of relay B remains on the spacing contact for the subsequent signal pulses of the character.

Condenser C1 charges through resistance R3, however, and its voltage slowly rises. The sizes of the C1 condenser and the R3 resistor are so chosen that the voltage on the grid of tube B reaches a value that will permit plate current to flow when the plate is positive by the time the sixth signal pulse is due. If the relay A is on the marking contact at this time or subsequently operates to this contact to form the beginning of the stop pulse, plate current flows in tube B, operating relay B to its marking contact, and thus stopping the oscillator by supplying direct current to the coil. The

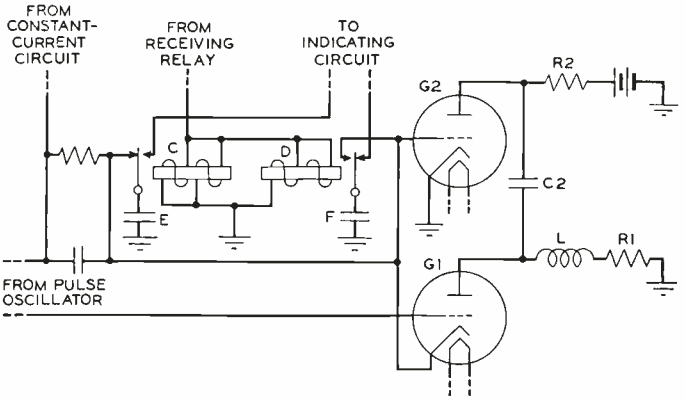

Fig. 6—Simplified schematic of condenser-discharge circuit

value of resistance R is so chosen that the oscillator stops quickly. This character-timing circuit thus starts the timing oscillator, keeps it operating for the period of one character, and then stops it.

The circuit that controls the charge and discharge of the two measuring condensers E and F is shown in simplified form in Figure 6. Relays C and D are operated by relay A of Figure 4 in response to the signal pulses received. During a marking pulse, condenser E is connected to the charge-discharge circuit, and condenser F to the indicating circuit, and during a spacing pulse, the condensers are interchanged, F being connected to the charge-discharge circuit and E to the indicating circuit. The alternate charging and discharging of these condensers follows exactly the same cycle as with the 118A1 set already described, but their discharge is accomplished by the circuit which is

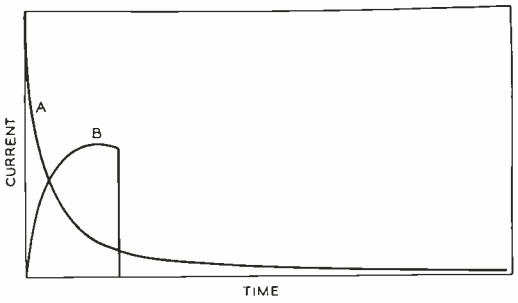

Fig. 7—Typical forms of condenser discharge, through a resistance, A, *and through a tuned circuit,* B

associated with gas-filled tubes G1 and G2, Figure 6, instead of by a grounded segment on a distributor.

Neither of these tubes is normally passing current, but when the plate current of tube D2 of Figure 3 is abruptly cut off, the large positive pulse generated in the secondary of the transformer is impressed on the grid of the gas-filled tube, G1 of Figure 6. This fires tube G1, and plate current flows through the tuned circuit consisting of R1, L, and either condenser E or F, depending on which is connected to the circuit at the time. This current rapidly rises to a maximum, and then falls. Shortly after the maximum current has been reached, the condenser voltage, which was a maximum at the beginning of discharge, reaches zero, and, at this point, the grid of the tube G2, which had been held negative before by the charge on the condenser, becomes zero, and plate current flows. The upper plate of condenser C2 had been held at +130 volts previously, but since the impedance of tube G2 is low, this voltage drops suddenly, carrying the lower plate negative, and thus extinguishing the current flow in tube G1. This opens the discharge path of the measuring condenser, and forms the reference instant at which the charging from the constant-current circuit begins. With plate current through G1 blocked, an oscillating circuit through tube G2 and including R1, L, and C2 is

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THE AUTHOR: W. T. REA specialized in physics at Princeton University, and received a B.S. degree in 1926. He joined the Department of Development and Research of the A T & T that year, and worked on the engineering requirements and design of carrier telegraph systems for the next eight years. Transferring to the Laboratories in 1934, he was concerned until 1941 with d-c telegraph systems, telegraph-distortion measuring devices, and teletypewriters. Since 1941 he has been in charge of a group which originally worked on the application of electronic circuits to telegraph and teletypewriter systems but is now exclusively engaged in the design and development of apparatus for the Armed Forces.

W. T. REA

formed. When the current in this circuit starts to reverse, tube G2 is extinguished, and the entire circuit returns to normal.

As in the 118A1 set, other means not indicated by Figure 6 fix the potential of the E condenser during a stop pulse or idle marking interval to prevent a false comparison when this condenser is transferred from the charging circuit to the indicating circuit on the mark-to-space start transition.

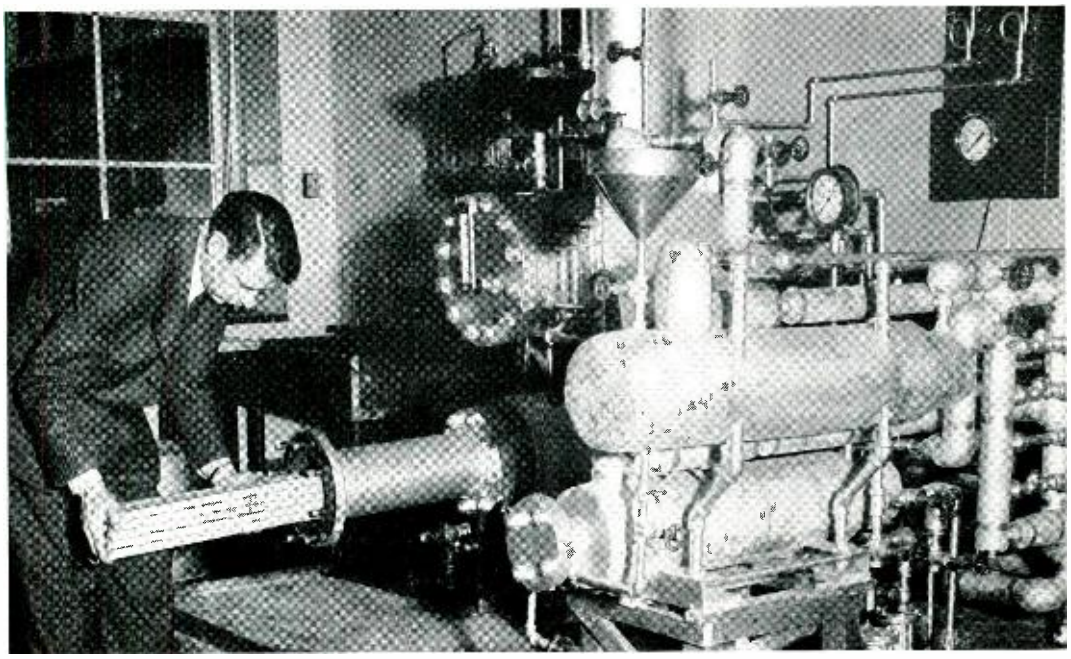
Besides eliminating the mechanical distributor, this method discharges the condenser in a shorter time and with a lower value of peak current. The reason for this is obvious from Figure 7. When the condenser discharges through a resistance alone, it follows an exponential curve as shown at A. When it discharges through a tuned circuit, however, it follows a sine curve as at B, and is stopped shortly after its maximum value when the voltage across the condenser, and thus its charge, is zero. The area under these curves, which represents the original charge on the condenser, is the same for both, but the maximum current value of B is only about half that of A, and the current becomes zero after a short definite time interval, while, with an exponential decay, the current is asymptotic to the time axis.

Another advantage of the new set is that it may readily be operated at any of several speeds of transmission, merely by changing the value of the adjustable condensers in the oscillator and character-timing circuit. With the circuit adjusted for a transmission speed of 60 words a minute, it may be changed to either 40 or 75 words without recalibrating by changing the condenser value, which may be done by remote control.

Other improvements are a stabilized power-supply circuit and better calibrating arrangements. These give the set greater stability, as shown by the fact that the trial model of the 118C1 set operated satisfactorily for four months without recalibration, while the earlier set required calibration at least once a day and readjustment of the mechanical distributor about once a week.

Franklin Institute Honors Walter S. Gifford

The Vermilye Medal was presented to Walter S. Gifford on November 9 for outstanding achievement in the field of industrial management. The citation accompanying the medal was: "To Walter S. Gifford, President of the American Telephone and Telegraph Company, who throughout the past two years of war has directed the managerial affairs of the Bell Telephone industry in such a way as to afford singular satisfaction to the users of the service, to the employees of the organization, to the owners of the property and to the public at large; admirably meeting a greatly increased demand for the telephone service in face of sharp limitation of priorities on materials and men, and devoting the entire resources of his company's research laboratories as well as the great part of its manufacturing establishment to the special requirements of the armed forces of this country and of its allies."



Outdoor Tests of Wood Preservatives

By J. LEUTRITZ, JR.
Chemical Laboratories

SERVICE tests are impractical on all the many materials advocated by suppliers for preserving wood because of the cost of experimental treatments on a commercial scale and the time required to obtain results when large-size timbers are used. Two qualities are of importance—preservative value and permanence. A laboratory technique for the evaluation of preservative properties has been described;* pure strains of several fungi are planted on blocks of wood whose decay is measured by their loss in weight. Permanence, however, can be predicted only from actual exposure outdoors of specimens impregnated in a manner similar to commercial practice.

Round saplings of southern pine have been used as test specimens until recently, but variations in their physical properties as well as chemical differences between the wood of these young trees and the mature growth required for poles made comparisons difficult. To overcome these objections, sticks three-quarters of an inch square and about three feet long are now cut from boards of southern pine sapwood. Clear specimens are classified according to density and, for a single treatment with one concentration of a preservative, those are selected which are distributed uniformly throughout a chosen density range. The uniform size of these samples also facilitates calculation of the density of the wood and the amount of preservative retained, because both are based on volume. Since sapwood is the only part of a telephone pole which treats readily, sapwood sticks from matured trees are more nearly comparable to poles than are round saplings.

Round saplings were generally treated with undiluted creosote prior to 1934.

*RECORD, *May*, 1938, *p.* 324.

This resulted in much higher retention of the preservative than was specified in commercial practice at that time and made rapid comparisons between different creosotes impossible because the quantity absorbed protected the wood far beyond a test period of reasonable duration. Lower retention of the preservative by the specimens followed the development of better treating methods, but there was still considerable variation after the same treatment.

Laboratory tests on preservatives are now carried out in an experimental cylinder, shown in the headpiece, by either full or empty cell methods. For the full cell treatment the specimens are placed in the cylinder, from which the air is then evacuated. After a specified time the cylinder is filled with preservative and air pressure is applied to force preservative into the cells of the wood. By this procedure about thirty pounds of preservative may be injected per cubic foot of wood. If less retention is desired the preservative may be diluted with a volatile solvent which evaporates rapidly after the treatment. By using an appropriate concentration of preservative, any desired retention may be obtained; furthermore, the amount of preservative held by the specimens in a single charge is very uniform.

In the empty cell treatment the specimens are put in the cylinder and the pressure is raised from atmospheric to from 25 to 50 pounds. Then the preservative is pumped in and the pressure is raised still higher, to force the preservative into the wood. When this pressure is released, the expansion of the initial air entrapped by the preservative forces out the excess from the wood and theoretically only the cell wall is coated —hence the name, empty cell treatment. Vacuum is also applied after the pressure is released to empty the cells more completely. In the treatment of specimens such as the sticks, the initial air pressure largely determines the amount of preservative which will be forced out of the cells after treatment, while the difference between the initial and final pressures controls the distribution and penetration.

About twenty to twenty-five sticks are selected for each single charge and laid side by side. These are marked with crayon seven inches from each end, at the midpoint and two inches on either side of the midpoint. Identification tags are affixed at the top inch marks and the sample is weighed. After treatment it is weighed again and the gain is taken as the basis for calculating the amount of preservative retained. Then the sticks are cut at the midpoint line. This gives specimens treated under identical conditions for comparison by the laboratory rot test and by field exposures. Some exposure tests are conducted at Chester and at Deal, New Jersey, but the largest number of specimens is exposed at Gulfport, Mississippi, where climatic conditions insure severe rotting practically all the year round. The usual procedure is "spring planting" of the selected specimens. Generally one-half of the

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THE AUTHOR: JOHN LEUTRITZ, JR., received the B.S. degree in Chemistry from Bowdoin College in June, 1929, and the ensuing fall became a member of the rubber group in the Laboratories. After a few months' work on rubber he began biological research on wood preservation. Meantime he continued his studies at Columbia University in the field of botany which led to an M.A. degree in 1934. Since the war, with its temporary curtailment of long-time research in wood preservation, his concern has been a variety of problems directly connected with the war effort.

JOHN LEUTRITZ, JR.

A section of the test plot at Gulfport, Mississippi, which shows square sticks under exposure test in the foreground and larger posts and pole-size experiments in the background

sticks are sent to the Gulfport plot and the remainder is divided between the New Jersey plots and laboratory tests.

For field-exposure tests the specimens are buried to the seven-inch mark in a uniform distribution throughout the test plot. Once a year they are examined and the amount of decay at and below the ground line is rated. Ten denotes a sound condition and zero is given to those specimens which are so completely disintegrated that they are found lying on the ground. Other ratings between ten and zero are used to denote the relative amount of decay or termite attack. Five is the critical point at which the specimen can easily be broken in the hands, denoting failure.

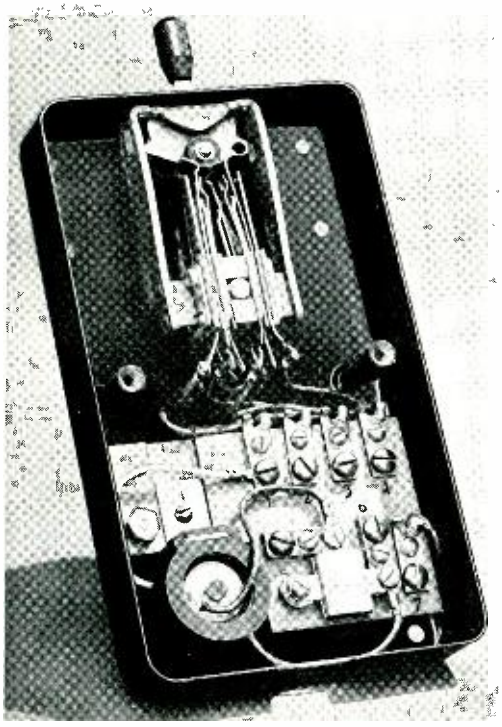
Since some specimens survive several years or do not fail under exposure tests, a time rating was devised which takes into consideration their past performance. At the end of each year's exposure the average rating for that year of a group of specimens is computed. This average is multiplied by the number of years the specimens have been exposed at that time. After the test has continued for several years the sum of these products is taken and divided by the sum of the years of exposure. For example: if the average rating of a group is 9.5 after one year of exposure and 8.3 after two years, the time rating would be (9.5) (1) plus (8.3) (2) and this sum divided by (1 + 2).

When a preservative shows promise in laboratory and field tests with small specimens, larger material of fence-post size called stobs is treated and exposed. If the preservative still meets all the desired requirements, an experiment on a commercial scale may be warranted with pole-size timber. For

this purpose ten-foot posts are cut from poles and exposed in test gardens. Valuable information is thus obtained on the retention of the preservative by the wood when heated by the sun or leached by ground waters. Simulated weathering of laboratory specimens also helps to determine the permanent qualities of a preservative but actual exposure to the elements is far more satisfactory.

Data obtained from these accelerated outdoor exposure tests have been of considerable use in evaluating both oil-type and salt-type wood preservatives. Perhaps the most promising of these is greensalt, which has been used in a limited way in place of creosote where clean full-length treated poles were required. In view of the emergency restrictions now in effect on the use of many of the metallic salts, the results of the studies on most salt preservatives cannot be immediately applied. The data obtained on oil-type preservatives are, of course, of aid in selecting substitute materials to supplement currently inadequate supplies of standard low-residue creosotes.

Amplifier for Subscribers With Impaired Hearing



The 6030A key is adapted to subscribers who wish to use a hearing aid with hang-up sets or with four-party full selective lines where the standard combined set with amplifier is not applicable. It has the same carbon amplifier as the combined set, when equipped with hearing aid, but it is installed in a separate housing with a control key. There are three key positions: one connects the set for normal operation; the others provide two steps of amplification. The degree of amplification depends on the voltage applied to the carbon element and gains of 14, 20 or 24 db are obtained by using one, two or three dry cells. Any of these steps is used according to the subscriber's needs. Operation of the key to its "on" position connects the receiver terminals of the subscriber's induction coil across the input of the amplifier and its output to the telephone receiver.

U. S. Navy Photo

Marking its course with a foaming wake, a U. S. destroyer speeds out into the strait off Guadalcanal in the Solomon Islands during a Japanese air raid. To the left and center, black ack-ack bursts mark the sky as American warships beat off the attack, launched during the early phases of the operations which saw American forces wrest possession of several strategic islands in the Solomon group from the Japanese

Minutes Mean Lives

TO FIGHTING men like Lawrence Bacon, Pharmacist's Mate, first class, there is nothing stranger than the wave of over-optimism that has recently swept over the home front and has already caused a serious let-down in the production of vital war material.

It would be rather hard to convince men like Bacon—he had many of the bones in his body broken when a Jap bomb exploded near his battle station on a destroyer—that the enemy is practically licked and it's all over but the shouting.

It would be pretty tough to convince him that time wasted doesn't matter—that minutes lost on the job can have no harmful effect on the boys on the firing line. He knows that every minute counts, because in the brief space of five minutes he saw his ship go down with more than half the crew and three-quarters of the officers.

This is the story of the battle in Bacon's own words:

The action that I'm going to tell you about was piled into five brief minutes, the longest, bloodiest, most unforgettable moments I ever want to know. Before I describe the engagement itself, you might like to know about the conditions those boys were facing when they went to their death.

Our ship was doing convoy duty and reconnaissance work in the South Pacific. It's hot down there, mighty hot. To give you an idea how hot it was, the temperature in our sick bay sometimes went over 110 degrees

and frequently we couldn't take our patients' temperatures because we couldn't shake the thermometer down far enough.

Although we seldom went ashore, when we put into Tulagi harbor we learned why it came to be called "Sleepless Lagoon." Between the actual air raids and the false alarms, sleep was indeed a rare blessing. The greatest luxuries we knew were the very infrequent occasions when we got near a ship service store that sold ice cream and coke. You really can't believe how much those little pleasures meant to us. We were like kids with a new toy.

One day our ship had finished refueling in the harbor and cruised around just outside to protect the ships that were still refueling from possible submarine attack. We were running on one engine so that our sound equipment would be even more effective in detecting submarines. There was a low overcast and clouds above us—which made the sky perfect for air attack.

The Jap planes came in at us without warning—eighteen dive bombers. It takes only a few seconds for us to man our battle stations when General Quarters sounds, yet the planes were in on us almost before we could fire. The first bomb scored a lucky hit on the one engine that was running and from then on we were a perfect target—a sitting duck. The second bomb hit almost at the same time and exploded a magazine—it made an accordion out of the front end of the ship.

I wish I could describe those terrible minutes more clearly and yet, at the same time, I'm glad I can't remember too much about it. The bomb hits put our control panels out of commission and one after another our guns jammed. The bomb that exploded the magazine picked up an entire 20-millimeter gun and its crew, some still strapped to their seats, and hurled them into the sea. One scream and they were gone. Another fellow I knew quite well was blown from the forward part of the ship clear over the superstructure and landed aft near the fantail.

I was at the after battle dressing station when the first bomb hit. The wounded came staggering over to me—some of them

U. S. Navy Photo

A group of survivors of the "U.S.S. Helena," picked up by an American destroyer, are transferred to another warship at sea. A wounded sailor is being carried across the gangplank between the two ships

screaming from flash burns, which are powder burns from the bomb explosion and the nastiest and fastest burns you can get. I took the worst cases to emergency operating station amidships, making a couple of trips—it's hard to remember just how many—when the third bomb hit just as I was passing a bulkhead. So help me, I didn't hit the bulkhead—it came out and hit me. The catwalk from above fell over my body and that's what saved my life because it protected me from other falling débris.

When men are wounded, their first thoughts are always about home—of wives or mothers or children. In the greatest agony, they call out the names of someone they love. Lying there on deck my thoughts too were of home. The Jap bomb had set up so much smoke that it was dark all around me and I thought the deck had been blown away and that I was trapped below. I said good-bye to my wife and child, rested my head on my hands, and for a moment I guess I gave up. Then suddenly through the smoke I saw daylight and realized that I still had a chance if I could crawl out from under. All this happened in less time than it takes to tell you about it.

I managed to crawl out and jump overboard. I had on a life belt but it wasn't inflated and I couldn't get it blown up in time. So I just went over the side anyway and started to swim.

Since we had just refueled, we had a lot of oil aboard. The water was thick with it. Trying to swim was like putting your arm in a barrel of axle grease. You just couldn't make headway. I tried swimming under water, but the oil and salt water got in my eyes. As the ship went down, I looked over my shoulder. I was afraid the suction might pull me under and I rolled over on my back to minimize the concussion if depth charges went off—we were all trained to do that in such an emergency. But the *De Haven* slid quietly under in a graceful swan dive, with the only explosion occurring so far under water that it harmed no one.

When I tried to roll over again, I became conscious that I was hurt. My leg just buckled under and I couldn't move it. Actually I had a fractured foot, hip, pelvis, and all my upper and lower ribs on the left side were fractured too.

Our skipper wasn't one of the men who survived. But his last act saved a lot of our lives. As soon as the attack started, he radioed Guadalcanal for air support and our planes arrived in time to drive off the Jap bombers and prevent them from machine-gunning us as we swam.

There were men all about me in the water. We were all black with oil—the only white thing about us were the whites of our eyes. It seemed that we were out there an eternity, but actually it was less than an hour later that we were picked up by Higgins boats. I was taken directly to the hospital on Guadalcanal, the first of five hospitals I've been in since then.

That's my story. It isn't a very glamorous tale but believe me, there's nothing glamorous about this war. Our boys are going through Hell out there and the worst is yet to come. Don't kid yourself about that. This war isn't won by a long shot and it isn't going to be over in the near future. Sure we're on the offensive, but the farther we push into Jap territory, the tougher the sledding is going to become.

When you ask how long the war is going to last, your guess is as good as mine. But you people who are making the equipment we need so badly out there can play a big part in answering your own question. The sooner you send the boys all the supplies they need—and they're going to need more and more of 'em—the sooner they'll be coming back.

Remember, this war is a matter of hours and minutes as well as days and weeks. If we could have only known two minutes earlier those Jap planes were coming it might have been a different story. But certainly you can see from what happened to the *De Haven* that in this war every minute counts. And that goes on your job as well as ours and the purchase of War Bonds also counts.

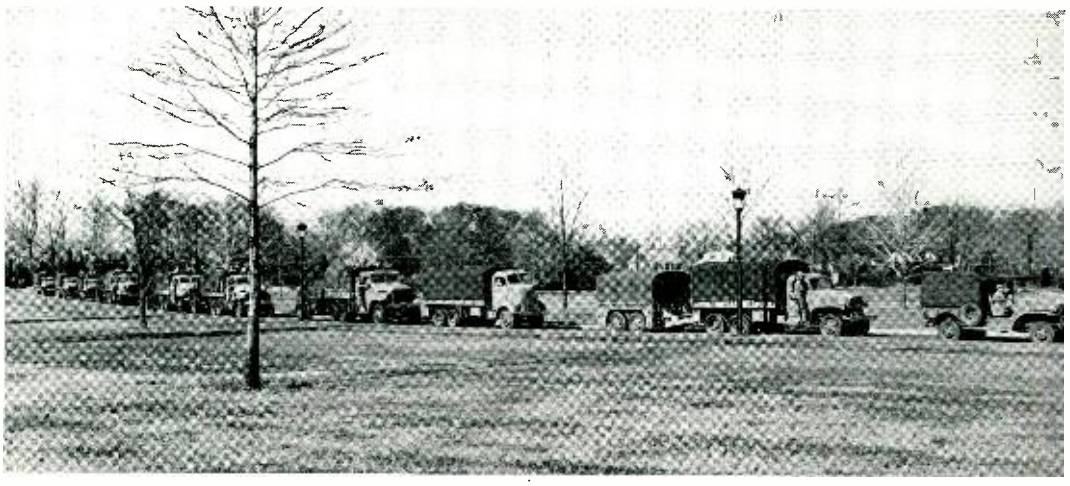
News and Pictures of the Month

The Gun Director Demonstration

Back of the demonstration described on pages 157 to 167 of this issue was a considerable amount of preparation, coördinated by R. K. Honaman, which began some weeks earlier. After the Ordnance Department indicated its interest in the show and its willingness to coöperate, a generous offer came from Eastern Defense Command to provide an entire working unit—an anti-aircraft battery equipped with a Director and personnel thoroughly trained in its use. The guns with their attendant trucks arrived on Sunday afternoon and presented an impressive sight as they were lined up on the entrance road for a photograph. As they were unlimbered and prepared for action on the South Parking Field, the small group of Laboratories people present watched with great interest the speed and precision of the crews. Each night all but the guard returned to their barracks.

Since this was to be the first "public" demonstration, considerable interest by the press was anticipated. A press release was prepared by P. B. Findley, and explanatory drawings by Christopher Hartley of Systems Drafting, following sketches worked out by Henry Kostkos, assistant to Mr. Honaman. These were sent to Washington and approved by Army Public Relations, then duplicated in quantity. Invitations were sent to all the metropolitan and nearby New Jersey dailies and the press associations, to various magazines, newsreels, and to radio commentators. For the convenience of New York writers, arrangements were made with the Lackawanna to attach a suburban club car to one of its regular trains, and to serve refreshments en route. Those arrangements were made by R. L. Shepherd, who, with Mrs. Helen McLoughlin, registered visitors on the train and issued identification tags. The group, with a number of Bell System people from New York and Newark, were transported from Summit to Murray Hill in busses. Registration of others who came to Murray Hill was handled by F. L. Hunt.

The distinguished guests from Washington were met in Newark and transported to Murray Hill over a route marked and manned by military police at important intersections. There they were entertained



Part of the Anti-Aircraft Battery as it entered the grounds of the Murray Hill Laboratory for the Electrical Gun Director demonstration held on November 9

Distinguished Army Guests Who Attended the Gun Director Demonstration

Major General L. H. Campbell, Jr., Chief of Ordnance.

Major General G. M. Barnes, Chief, Technical Branch.

Major General T. A. Terry, Commanding General, 2nd Service Command.

Brigadier General C. B. Hines, Anti-Aircraft Artillery.

Brigadier General R. K. Robertson, Commanding General, District 1, 2nd Service Command.

Colonel L. L. Barrett, Ordnance Branch, 2nd Service Command.

Colonel J. G. Booton, Office of the Ordnance Officer, Eastern Defense Command.

Colonel L. A. Codd, Executive Assistant to Chief of Ordnance.

Colonel H. B. Ely, Frankford Arsenal.

Colonel P. W. Lewis, President, Anti-Aircraft Board.

Colonel F. Mitchell, Frankford Arsenal.

Colonel J. S. Muirhead, British Army Staff.

Colonel J. B. Rose, Commanding Officer, Frankford Arsenal.

Colonel G. I. Ross, District Chief, New York Ordnance District.

Colonel C. F. Stanton, Army Supply Forces.

Lieutenant Colonel C. H. Armstrong, Coast Artillery Corps.

Lieutenant Colonel Chester Mueller, New York Ordnance District.

Lieutenant Colonel A. H. Musson, Inspection Board, British Army.

Lieutenant Colonel R. F. Ranges, Eastern Defense Command.

Lieutenant Colonel C. E. Thwaite, Jr., Coast Artillery Corps.

Lieutenant Colonel D. B. Willets, Ordnance Department.

Major V. G. Hart, 2nd Service Command.

Major J. Gould Remick, New York Ordnance District.

Major R. G. VanNess, Ordnance Department.

Captain A. H. Lane, Frankford Arsenal.

Captain T. S. Tailer, 2nd Service Command.

Major Richard Powell, War Department.

Captain C. E. Nelson, Frankford Arsenal.

Lieutenant E. R. Atchinson, Coast Artillery Corps.

by Dr. Buckley and his staff at a luncheon of 68 covers served by the Restaurant staff under F. E. Dorlon.

Arrangements at Murray Hill were coordinated by M. B. Long and carried out by E. V. Mace, Philip Venneman and G. W. Lees, Jr. A camp site was selected on Laboratories property for the overnight guard; a path was cleared to it from the nearest gate, and water and telephone service provided. Platforms were built for the speakers and for the tracker; signs designating the various units were painted and placed, and passes were issued to those who had need to enter the military area. Messengers were secured from General Service to escort guests from the main entrance to the lounge, and checking facilities provided.

Rail and bus transportation were arranged by Mr. Lees for about 400 members of the Laboratories from New York, so that most of those who had contributed to the development could attend. A special train was in charge of L. S. O'Roark with Dennis Cronin assisting the conductor to count noses. In addition, the entire force at Murray Hill was invited to see the show. A powerful mobile public address system, designed by G. G. Muller's group for military use, was operated by L. J. Cobb and H. Eckardt for reinforcement of the speakers' voices. By a connection to the local artillery network, the commands and reports incident to the operation of the guns were heard by

the audience, adding greatly to their interest in the proceedings.

Pictures of the demonstration in this issue were taken by newspaper photographers, by a professional cameraman and by several members of the Bureau of Publication. Motion pictures of the event were taken by H. G. Arlt, J. H. Waddell and H. J. Smith. After release by the Army, it is planned to show them to all who did not see the show itself. Movies were also taken by an A. T. & T. cameraman for possible Bell System release.

About 35 press representatives attended, and all the metropolitan dailies as well as the wire services carried the story.

The Anti-Aircraft Battery, commanded by Captain Karl Monson with Lieut. R. E. Rohleder as Executive Officer, by their fine skill and training in the handling of their equipment, contributed notably to the effectiveness of the demonstration. By their appearance and deportment they demonstrated that they are as fine and upstanding a group of young men as are serving with the Army. Since the demonstration, Captain Munson has been advanced to the rank of Major and transferred to other duties.

New Pioneer Chapter to Hold First Meeting

The recently organized Bell Telephone Laboratories Chapter No. 54 of the Telephone Pioneers of America will hold its first meeting in the main ballroom of the Hotel Commodore on Wednesday evening, December 15. The Entertainment Committee, under M. B. Long, is planning a timely program for this initial meeting. Following dinner, which will of course be preceded by the usual "get-together," the Pioneers will have an opportunity to see and hear about some of the contributions of the Laboratories to the war effort. Dr. Jewett will address the meeting on *Science Organizes for War* and Dr. Buckley will speak on *Bell Laboratories in the War*. Dr. Buckley's talk will be accompanied by an exhibition and demonstration of some of the many developments made by Bell Telephone Laboratories as its contribution to the war effort.

* * *

Members of the Laboratories who are eligible, but not yet members of the Pioneers, may expect a call from the Membership Committee in the near future. This Committee, headed by R. H. Wilson and as-

U. S. Navy Official Photo

The "Normandie," now the "U.S.S. Lafayette," caused excitement at West Street as she sailed past the Laboratories on her way to be refitted down the bay. Because she had not been commissioned by the Navy before the fire, Navy protocol decreed that she fly no flag

Speakers' table at the annual installation dinner of the Western Electric Post of the American Legion. Left to right: F. T. Meyer; A. G. Bouton, Post Commander of New York State Department; W. A. Bollinger; H. R. Allen, retiring Commander; O. H. Danielson, incoming Commander; Stephen Kearns, present County Commander; and J. C. Kennelty

sisted by the Publicity Committee, is about to launch a full-scale membership drive.

* * *

RECENT appointments include A. B. KVAAL to the Publicity Committee and H. S. SHOPE to the Membership Committee.

The National Better Business Bureau

As a consumer, you can avoid many costly experiences by making use of the free service offered by the National Better Business Bureau. This is a non-profit organization supported by legitimate business firms as an agency to fight fraud, chicanery, and deception in advertising and selling. The Bureau offers protective services to the general public and is located in the Chrysler Building, 405 Lexington Avenue. The Telephone number is Murray Hill 6-3535. Consumers are encouraged to call upon the Bureau for fact information regarding organizations or individuals with which they contemplate dealing and which are engaged in the sale of goods, services or securities. The consumer, upon request, may obtain a report from the Bureau, and, where the Bureau finds the facts unfavorable, save himself needless expense. Consumers may also enter complaints involving unfair trade practices, and, where justified, the Bureau will endeavor to obtain adjustment of the complaint.

Yankee Resourcefulness

When the supply of wiping solder ran low in Iceland, not so long ago, Signal Corps technicians there used melted tooth paste tubes which they salvaged from their buddies in order not to delay the construction of communication facilities. This was the story brought back to the United States by First Lieutenant Heliodor A. Michalowski, Signal Corps, who spent more than a year in Iceland, having arrived with the first American troops.

Solder—molten tin and lead—is used to connect electrical circuits in fragile radio

wiring as well as wrist-thick telephone cables. It was to splice a cable line that the tooth paste tubes were used. This permitted the signal men to continue construction. The next convoy brought additional supplies of solder.

American Legion Post Annual Dinner

On the night of October 19, a group of eighty-one veterans of World War I and four veterans of World War II met at the Holley Hotel on Washington Square. The occasion was the annual dinner and installation of new officers of the Western Electric Post of the American Legion. This Post was formed in 1919 by members of the Western Electric Company at 463 West Street. The presence of the four new veterans seems to indicate that there will probably be members still around when the 21st century curtain rises.

A feature of the evening was conducted by Past Commander Harry A. Doll, the Post's smallest member when measured solely by the number of pounds he displaces. He had a personal message from each one of the Post's seventeen members "who are in it again." The messages came from many parts of the world. Their comments were equally divided as to whether this trip is easier than the last. Two of these members were able to be present: Lieut. V. M. Meserve of the U. S. Navy, from the Laboratories, and Lieut. Col. E. I. Pratt, from Western Electric, 195 Broadway.

The officers for the 1943-44 year were installed by the New York County Commander of the Legion, S. H. Kearns. Newly installed officers from the Laboratories are: Commander O. H. Danielson, First Vice-Commander L. B. Eames, Third Vice-Commander J. R. Bardsley, Adjutant J. E. Ranges, Assistant Adjutant L. H. Allen and Chaplain F. J. Prachnaik. Officers from the Western Electric Company are: Second Vice-Commander J. F. Beattie, Finance Officer M. F. Travers, Service Officer H. Bongard, all from 395 Hudson Street, and Sergeant-at-Arms S. L. Leverone from 1495 Herkimer Street in Brooklyn.

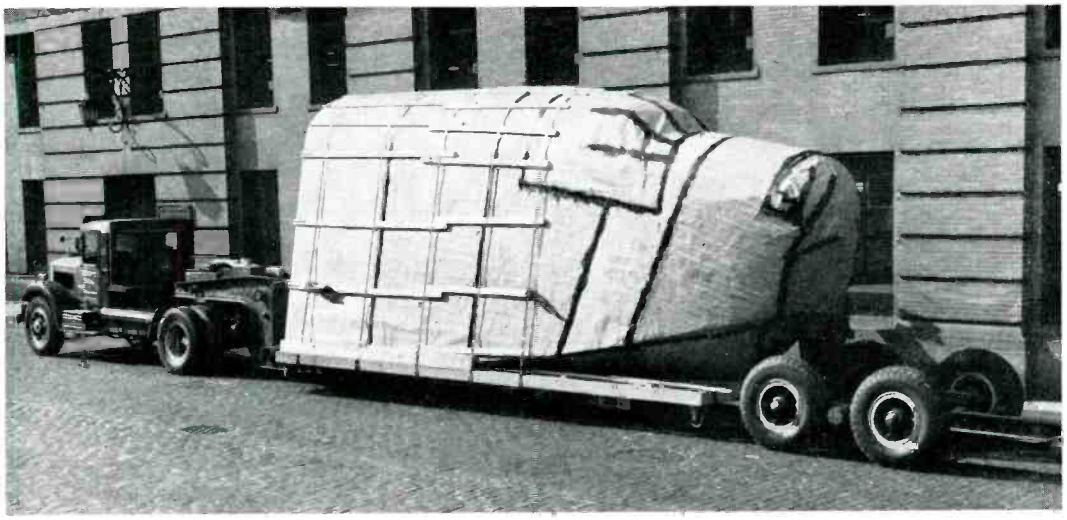
Telephone Speeds Ship Repairs

At a friendly port in the South Pacific not so long ago a United States naval vessel was on the inactive list, needing repair parts which were halfway round the world in a United States factory.

Across the Pacific a radio signal beamed to the naval base at San Francisco . . . "repair parts needed soonest . . . contact factory . . . specifications as follows . . . "

Above—H. A. Richardson, L. H. Allen, Lieut. V. M. Meserve and E. L. Meserve

Stephen Kearns (second from right), County Commander, congratulates O. H. Danielson upon becoming Commander of the Western Electric Post of the American Legion. A. G. Bouton, Post Commander of New York State Department, is at the left, and H. R. Allen, retiring Commander, is at the right



A wartime development leaves the Laboratories for active service

Picked up on the west coast, the message jumped by phone at 6 P.M. to plant officials whose factory was already running full blast on three shifts a day. Immediately, key men were rounded up, parts pulled off assembly lines, crated and shipped.

Wires hummed as San Francisco began checking up, and arrangements were made for Navy clearance and naval planes. Finally, less than thirty-six hours after the first call, repair parts were winging westward. Within six days from the time the worried crew had asked for aid, supplies were in their hands.

This isn't exactly a telephone story. It's the story of men who produce in war plants on the home front. *But this one incident illustrates why the Government wants unnecessary calls off the wires.*

Western Electric Sub-Contractors

Western Electric Company, in a report to the War Production Board and the Smaller War Plants Corporation, disclosed that 50 per cent of the Company's total sales of war materials to the Government since the United States' entry into the war had been produced by sub-contractors. In meeting its commitments to the Government, Western Electric Company currently does business with more than 6,500 sub-contractors and suppliers.

The Company's sub-contracting rate of 50 per cent exceeds by 10 per cent the rate which the War Production Board requested

Madelyn Flynn receives from G. A. Brodley, Assistant Treasurer, the 100,000th war bond purchased through Bell Laboratories on the payroll allotment plan for United States Savings Bonds

prime contractors to establish in an effort to step up the output of munitions and provide business for smaller manufacturers whose pre-war production has been shut off through the diversion of strategic materials into war production.

A full year before the United States entered the war a war production planning board was set up by the Company to devise effective means of speeding production, should war come. A part of this planning took the form of a nation-wide survey to catalogue those allied communications factories that could be utilized as sub-contractors. Hundreds of such smaller factories were classified as to their manufacturing facilities, skilled personnel, location and probable production capacities.

With the declaration of war, Western Electric was named prime contractor for large numbers of aviation radio sets. It immediately assigned part of this production to its catalogued list of potential sub-contractors, conserving a part of its own facilities for the manufacture of more complex military equipment.

The effect of the sub-contracting of war orders by prime contractors is a dual one. It increases production and at the same time enables smaller companies that have successfully met sub-contract orders to become prime contractors, dealing directly with the Government on further war orders.

Telephone Center for Service People

For the convenience of members of the Armed Forces, the New York Telephone Company has opened a telephone center in the heart of the Times Square area on the second floor of the building on the northeast corner of Broadway and Forty-third Street, with windows overlooking Times Square. The center will offer the same general type of attended telephone service as do the Company's stations at Grand Central and Pennsylvania Station and at other locations in the city. Members of the Armed Forces now visiting New York in very large numbers have a great need for public telephone service, particularly for long-distance calling. When they are in the Times Square district they must make their calls from public telephones which are already the busiest in the city. This heavy use of public telephones

Members of the Armed Forces visiting New York now have this telephone center at Times Square

often causes undue waiting because booths are busy when it is necessary to call back on any long-distance call delayed by busy wires. The facilities at this new center, together with the help of the attendants, should save waiting time and make for a more efficient use of long-distance circuits.

Who Wants to Murder the Dollar?

By Wendell L. Willkie

Wendell L. Willkie

Who wants to murder the American dollar? No American does, of course. But whether we want to or not, that's what we'll do—murder the dollar by dosing it with the deadly poison of inflation—unless we realize what we're doing and then stop doing it.

We can easily save the dollar, not only from death, but even from serious disease, if each of us will start each day like this:

1. Ask yourself, "What am I going to buy today that I don't really need?" Give yourself an honest answer, no fudging, and then—*don't buy it.*

2. Ask yourself, "Can I possibly spare the cash to buy war stamps, or a bond, or buy life insurance, or pay a debt?" If you can, do it that day.

3. Ask yourself, "Am I a good citizen? Or am I a black market sucker—a ration chiseler—a scarce goods hoarder?" Answer that one with deeds, not words!

News Notes

Long-distance telephone lines of the Bell System are expected to have to carry a record load of 809,000,000 toll board messages next year—an increase of 80,000,000 over the anticipated total for 1943 and almost double the figure for 1939. To handle this volume of traffic at the same speed of service given this year, the System would require over 25 per cent more circuits than it can hope to get under prevailing material and manufacturing limitations.

Four members of the Laboratories volunteered to spend part of their vacations as harvest workers. They are Marie F. Greene and Mary Di Giacinti, who spent a week at Shelter Island picking lima beans; Edward Byrne of Graybar-Varick, who went to Dansville as a corn harvester, and Michael Conzani, a draftsman, who picked apples for a week at Tivoli and helped save the crop. Harvesters were paid the prevailing wage for their work, and in turn paid ten dollars a week for their board at camps selected by the War Manpower Commission. Living conditions in all cases were adequate and in many cases, where exclusive children's camps had been taken over, conditions were delightful. The War Manpower Commission, in a letter to George B. Thomas, Personnel Director, said that the Laboratories should be extremely proud of these members. It is hoped that next year more will volunteer to spend part of their vacations harvesting.

During the month of October the United States Patent Office issued patents on applications previously filed by the following members of the Laboratories:

G. E. Atkins
S. M. Babcock
H. M. Bascom
J. Baumfalk
U. S. Berger
C. J. Calbick
E. L. Erwin
W. W. Fritschi
C. A. W. Grierson
A. E. Hague
G. Hecht
A. W. Horton
A. H. Inglis
S. B. Ingram
K. S. Johnson
J. F. Keithley
G. J. Knandel
J. J. Kuhn
M. A. Logan
A. A. Lundstrom
T. A. Marshall
W. P. Mason
L. E. Milarta
G. L. Pearson
R. L. Peek, Jr.
W. T. Pritchard
M. D. Rigterink
W. H. Scheer
O. A. Shann (2)
A. M. Skellett
G. R. Stibitz
R. A. Sykes
E. R. Taylor
E. Vroom
M. K. Zinn

D. R. Brobst and T. L. Tanner in Chicago considered apparatus assembly problems.

R. G. McCurdy and E. L. Schwartz, accompanied by members of the Western Electric Company, recently visited the new Western Electric plant at Haverhill, Mass., where transformers and coils will be manufactured from now on.

In the Nation's Service

T. M. Pepe

Major Wm. Kes

W. J. Schneider

E. H. Jockel

Thomas M. Pepe

Thomas M. Pepe, naval aviation cadet at Pensacola, hopes to become a Marine Corps pilot when his training is completed. "They're tops," he claims. His brother is a Marine at Guadalcanal. On the day Tom visited West Street he met a Marine, Mabel Sconhoft's husband, who had been with his brother at Guadalcanal.

Major William Kes

Major William Kes has been assigned as Plans Officer and Assistant Executive of the Cavalry School, where he expects his overseas experience will be a valuable asset to him. During the year he spent abroad Major Kes attended the Royal Armored Corps Tactical School at Oxford University. He hopes to take up permanent residence at the officers' quarters when Mrs. Kes, the former Florence Frederickson of the Laboratories, joins him.

William J. Schneider

William J. Schneider of the Marines, a visitor to West Street in November, is an aviation mechanic at the Cherry Point Air Station, North Carolina.

Eugene H. Jockel

Eugene H. Jockel, one of three brothers in the Armed Forces, is a radio mechanic with a fighter squadron of P-47 Thunderbolts. Just now he is at Mitchel Field; one of his brothers is in Africa; the other in Texas. Eugene paid a call on friends at the Laboratories recently.

Ernest Neubert

"Dear Folks: This is just a line to say 'hello' to my friends at the Labs. At present I'm stationed in England and like both the country and people immensely.

"You know better than I the extent to which Labs and W. E. equipment is being used by the Armed Forces. But one piece of equipment that we in the AAF cannot do without is the *throat mike* developed by the Labs. Incidentally, I had a very pleasant experience with the throat mike. Just recently I was issued a new one. The box it came in had a pamphlet of instructions prepared by the Labs. You can imagine how good it was to see the Labs name on anything while so far from home, but the big thrill was seeing a picture of Al Vabulas on the cover of the pamphlet, illustrating the correct way to wear the mike. Al and I went through school together and began work at the Labs on the same day. (*Mr. Vabulas is a cadet whose picture is on page* 197 *of this issue.*)

"I've been flying quite a bit lately, getting 'flak' happy, I suppose, but having a great time. Have finally made staff sergeant, have

just received the Air Medal and expect an Oak Leaf Cluster in a few more days. If everything goes well I'll be eligible for another Cluster later. I suppose most of my friends at the Labs think I've forgotten them, but honestly it's not true. It's just that there's so little time. Please give everyone my regards. I'll appreciate hearing from any of you who might have a spare moment."

Lieut. Giertsen Missing in Action

On November 11 LIEUT. OWEN N. GIERTSEN of the Plant Department was reported missing in action over New Britain on November 2. He was the pilot of a P-38 fighter plane and had been in the theater of war for two months. Lieut. Giertsen visited his friends at the West Street Development Shop in July when he was on leave after receiving his commission. He reported to California for advanced training and was then ordered overseas.

LIEUT. O. N. GIERTSEN
The first member of the Laboratories who has been reported missing in action

Charles R. Storin

"I've really done some traveling since I left Department 1930. I'm now in North Africa—where or what I'm doing I can't say, as you can understand. It is really fascinating here—the native men, with their turbans and robes; the native women with their bare feet. Their average vocabulary consists of 'Hey, Joe, give me smoke,' and 'Hey, Joe, give me candy.'"

Marie Vincent

"I'm working in the Waves Personnel Office in Anacostia, but expect to be transferred to the Art and Animation Division by the end of this week. Yes, I've had my share of deck-swabbing, polishing brightwork, night watches and patrols.

"This shore duty is dangerous, too—we live in constant danger of getting extra duty for a wrinkled bedspread or for having articles adrift. Most of us are disappointed that we won't be permitted overseas."

Raymond Yerden

"Received another letter from you all in Apparatus Drafting and it was good to hear from you. (*Apparatus Drafting sends its men a regular mimeographed departmental letter prepared by* IDA WIBERG.) I appreciate this news more than you realize. Since coming to Camp Pendleton where I'm awaiting shipment I have had a chance to go swimming away up in a mountain pool. One week I caught thirty trout; they were good cooked

Among the many members of the Laboratories on leave during mid-semester from Military Training Programs were John M. Woitovich (left) and John J. Sweeney. Both men are studying at Cornell. Woitovich is taking mechanical engineering, Sweeney electrical engineering

James B. Newsom (left) was recently commissioned a Lieutenant Commander in the U. S. Navy

Capt. William J. Flavin has been an instructor at various fields, including West Point. He is at present at Groton Field taking advanced training in a fighter squadron. Capt. Flavin, calling on friends at West Street, hoped to go overseas shortly

in butter à la Yerden. I also shot a deer, butchered and skinned it, and gave the meat to homesteaders in the hills. In turn they cooked a swell meal and of course venison steak topped the menu.

"While I was out in the hills, they were filming 'The Fighting Seabees' a little way from my tent. John Wayne, Dennis O'Keefe, Rita Hayworth and the Mad Russian were there and we were talking to them.

"I am with the finest group of fellows you'd want to know. We're a pretty salty bunch, proud to be East Coast Marines, even though the Pacific will be our stamping ground from now on."

Lieut. Patricia M. Illingworth of the Marines formerly did cost analysis in the Commercial Relations Department

Albert J. Leimer

ALBERT J. LEIMER of the Central Service Department has returned from an eleven-month assignment in Africa where he was awarded the French Good Will Medal and the Purple Heart. Mr. Leimer was engaged in four major encounters. An aviation ordnance mate, he was acting bombardier on a plane which crashed when its pilot was killed. In the crash landing he received leg injuries which hospitalized him for five months abroad. He was recently flown to a Washington naval hospital where he was granted leave for a visit home, during which time he called on his friends at West Street.

Thomas S. Diab

"Camp Crowder, my present station, is located in the heart of the picturesque Ozark Mountain region and is the home of the Central Signal Corps Training Center. The post was named for General Enoch H. Crowder, a native Missourian, who attained fame as the author of the World War I Selective Service Act and who, as Provost Marshal General, was responsible for its successful administration. He served as Judge Advocate General and was for a time professor of military tactics at the University of Missouri. I am told that the General predicted, on the day of the first Armistice: 'We have stopped too soon. . . . We should never have stopped until we marched into Berlin.' "

John J. McCallion

"Well here I am in North Africa. You can see for yourself what happened to Mussolini and Hitler since I came here and McCallion is not finished yet. I am in the Motor Pool where I drive the officers as a steady job and I like it very much. It's good to hear the

news from Murray Hill. I'd like to hear from the boys at Graybar."

Lieut. John Marrero

"Algiers is as picturesque as you probably imagine it, but it is also quite a modern city. Constantine is beautiful in an Arabic sense. A deep gorge is right at the edge of the town, and the native quarter is at the brink of this deep chasm. It is something out of an entirely different world.

LIEUT. JOHN MARRERO

"I have been receiving the RECORD fairly regularly and receive an occasional letter from the Laboratories.

Military News

GREGORY CHABRA has come to an interesting part of his flight training, Acrobatics. "Loops are nice, but I still haven't gotten used to the sensation of flying inverted yet. It's a queer feeling, just hanging up there by your safety belt!"

ALEXANDER E. LAWSON, JR., is at Amherst College doing preparatory work for West Point.

MAXWELL C. ANDREWS has been promoted to Seaman 2/c.

"I'M IN THE instruments section of the outfit, which maintains and repairs the equipment used by the anti-aircraft batteries. We repair the height finders, range finders and nine different types of directors." From WALTER J. BITTMAN at Camp Davis, North Carolina.

ELIZABETH A. FITZSIMMONS is at the Naval Air Station at Milton, Florida.

AT CAMP COLUMBIA in Australia, GEORGE W. GALBAVY is attending Officers' Candidate School.

JEAN S. BREWER of the Waves was injured during an explosion in Norfolk when a window was blown in, cutting her back and arms. She has been home on leave recently and is fully recovered.

"BOB LYNCH and I are here in St. Louis attending a Long Lines Communication School. Living in a hotel certainly beats camp life," writes ROBERT F. RENNICK from St. Louis.

FOR JOHN A. ZWIEG "this man's Army is the real thing." He is now in San Antonio taking a Specialist Machine Shop Course.

WILLIAM J. TIERNAN, who has been on a military leave of absence since October, 1942, returned to the Laboratories on October 22.

WAYNE F. WILSON at Camp Crowder's School for Pole Linesmen says, "It takes an experienced man to walk around on the top of thirty footers, especially if he is being harassed by enemy fire. We certainly are being well trained."

ARTHUR V. FROLIC has been assigned to the Shore Patrol School at Camp Peterson, Farragut, Idaho. He has met a few Indians there, "but they're not so wild as the ones at Murray Hill," he adds.

WALTER B. ELLWOOD, who was on a personal leave of absence as a civilian employee in the Research and Development Division, Bureau of Ordnance, Navy Department, Washington, returned to the Laboratories on October 1.

At a training field in Florida, Albert L. Vabulas (left) is flying SNV's and has soloed in them. "They cruise around 130 m.p.h. and have 450 horsepower." Thomas S. Diab, who is training at Camp Crowder, gives an account of that camp on the opposite page

HARRY VERGES W. A. FARNHAM

FROM A BRANCH of Texas A. and M. College, where he is studying electrical engineering, CHARLES E. KLEIN finds the Army program very extensive and interesting.

Military Leaves of Absence

There were 669 members of the Laboratories on military leaves of absence as of Oct. 31

Army 437 Waves 22 Wacs 8

Marine Corps Women's Reserve 2

Navy, Marines and Coast Guard 200

RECENT LEAVES

United States Army

Clarence Anderson	Clinton A. Jaycox
John H. Anderson	Charles A. Kossmann
Edwin E. Birger	Walter E. Lichte
Joseph R. Davis	Martin C. Nielson
Arthur M. Doyle	Warren B. Sage
Eugene J. Flannery	John F. Schneider
Alexander E. Gerbore	William H. Tappen
August A. Hauth	Raymond S. Troeller
Jas. M. Hoagland, Jr.	Robert S. Williams

United States Navy

Louis J. Antonucci	Ensign George E. Oram
Louis A. Bergdahl	Alfred O. Schwarz
Rita H. Habes	Joseph Sciortino, Jr.
Anthony A. Luciano	Lt. Comdr. E. G. Shower
John H. McConnell	William Springer
Lt. Wm. J. Merchant	Michael V. Sullivan
Louis C. Munch	Louis W. Telfer

United States Marines

John P. Ahrens Guy F. Boyle

Daniel F. O'Sullivan

WALTER A. FARNHAM is an Air Corps instructor in Utah. He has been flying with the aerial engineers whom he teaches. While on a visit to his friends in the Apparatus Development Department he related his experiences training men how to repair planes in combat.

HARRY VERGES, a visitor to the Restaurant during his past furlough, hopes to be transferred from Camp Ellis to the permanent outfit with which he will serve as first cook.

This is Joseph U. Meats of the Seabees who has been transferred to Hueneme, California, since his recent leave

WORD has been received that the following members of the Laboratories have recently been promoted: KERMIT O. THORP to Lieut. Colonel; DEXTER T. OSGOOD to Major; ARNOLD R. BERTELS, WILLIAM H. LICHTENBERGER and EINAR REINBERG to Captain; ERNEST G. GRAF to Second Lieut.; ERNEST NEUBERT to Staff Sergeant.

JOHN M. O'NEILL has been transferred to Camp Claiborne, Louisiana, where he is serving with the engineers.

Spencer N. Foster is at his station in the Northwest Pacific now. He formerly worked in the Shipping Department

DONALD MACK of Murray Hill is taking his primary flying at Glenville, Illinois. "There are always about two hundred planes in the air at a time, and since this is also an operational base there are plenty of planes here that are being shipped out to carriers. I hope I don't tangle with them."

AUGUST UHL, on furlough from the Liberty Division, made several calls to West Street. While home he was married to SUSAN FEUERBACH of the Stock Control group. Mr. Uhl, an Army switchboard operator, has traveled sixteen thousand miles to various camps and maneuver grounds since he joined up a year ago.

LIEUT. ROBERT I. NOLAN called on his friends at West Street during his recent leave. He has since returned to Fort Bliss, Texas, to the Officers' Replacement pool for assignment to an anti-aircraft outfit.

HOME ON the first furlough since his induction in February, ROBERT F. FLINN recounted his experiences as an engineering student in the A.S.T.P. at De Paul University, Chicago. He has finished the first semester of his course.

Home on leave, after completing her training at Radcliffe, Ensign Claire E. Muller made the rounds at West Street, visiting her friends and former co-workers

WHILE AWAITING the completion of a new ship to which he has been assigned, JAMES S. DEVANNEY is going to a Specialists' School at Norfolk.

EUGENE A. STEPPHUN while on leave was another welcome visitor to West Street.

A NAVAL AVIATION CADET stationed at Corpus Christi, Texas, is FRED J. SCHWETJE who came to see MR. KVAAL and his department while on leave.

HAVING BECOME eighteen years old last month, ROBERT W. MCMURROUGH has been transferred from inactive reserve to active duty. He has completed the first term of a pre-engineering course.

FRANK OSOLINIK's job is to install special equipment to bring our aviator-fighters home. With a crew he goes out to set up this equipment, which was developed in England, gets it working and turns it over to the men who will operate it. He was home on furlough from Warner Robins, Georgia.

Rita E. Ray, who has completed her basic training at Daytona Beach, Florida, was formerly a member of the Stock Control Group

WILLIAM P. HARNACK made several trips to the Laboratories during his semester furlough from Virginia Military Institute, where he is taking a condensed electrical engineering course. Prior to joining up, he worked with the quartz crystal group.

AIR CORPS MEN take quite a kidding about their shoulder insignia. "We're usually called 'butterflies' because of it," L. CHARLES BROWN writes. He is in Greensboro awaiting shipment to a * * * school.

Frank A. Koditek has been assigned to an LST boat and is at present training with the amphibious forces at Solomons Island, Maryland

"RECENTLY I was transferred from Newport to Aviation Radioman's School at Jacksonville," WALTER BURKART writes.

RICHARD C. WILLIAMS, stationed at Blacksburg, Virginia, and participating in the Specialized Training Program, enjoys the Army very much.

JOHN MARKO of Equipment Development Drafting also visited the Labs during his semester furlough from Randolph-Macon College, Ashland, Virginia.

LIEUT. CHARLES R. LEUTZ of the Marines, who was graduated from Aviation Cadet School in Corpus Christi in October, is taking advanced training at the Naval Air School at Hollywood, Florida.

FROM NASHVILLE comes word that WILLIAM T. RECK is awaiting classification as pilot, navigator or bombardier.

LIEUT. JOSEPH P. KELLY, who left the Laboratories for the Army three years ago, is now with the Signal Corps in North Africa and has had quite a few hair-raising experiences. His father, JAMES E. KELLY of the Receiving Department, keeps him up to date on Labs happenings.

LIEUT. CHARLES A. HEBERT is with the Seventh Fleet.

ALBERT C. REYNELL is still at Fort Monmouth instructing in teletype maintenance.

FROM COLORADO SPRINGS, where she is working on the Air Forces radio net, KAY PARSONS of Building T writes that she's been an honest-to-goodness soldier since September when she took the Army oath. She has a T/5 rating.

EUGENE F. KRAUTTER is serving with a Signal Service Company in the Caribbean.

Paul P. Melkonian of the Murray Hill Laboratory is at Camp Claiborne, La.

"THANKS FOR a wonderful reception by the Labs while home on furlough. Best wishes to all my friends in MISS KIERNAN'S group who are doing a wonderful job by carrying on the fight on the home front." From MARCELLE LESIRE of the Waves.

FRANK G. SCUDNER is studying engineering at Ohio University.

THE ARMY keeps LAWRENCE O'DONOGHUE very busy at Camp Haan, California.

MICHAEL F. RUGGIERO has been transferred to Gulfport, Mississippi.

LIEUT. VINCENT M. MESERVE recently visited his friends in Room 963.

ANOTHER VISITOR was WILLIAM R. FREES, who came to the Chemical Department.

MANY OF the men with whom CHARLES S. GRAHAM worked at West Street are at Murray Hill so that he was unable to see them when he recently visited the Laboratories. He is at Ball State College, Indiana, where he is studying mechanical engineering under the A.S.T.P.

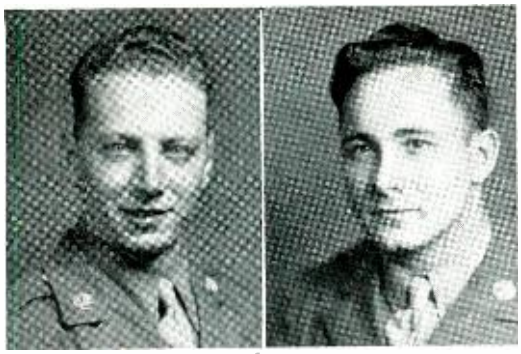
"THE ENGINEER'S JOB isn't over yet. The more we see of this war the more we appreciate the quality of our equipment and the craftsmanship of the fellows who are making it. . . . Our phones and guns, radios and trucks, heavy stuff and light, have all been tough as well as tops. All have been superb and are surprising even us Americans who take it for granted that the equipment will perform miracles. I hope the quality doesn't let us down at some critical stage of the battle, *and this is up to you on the Home Front.*" From Lieut. G. H. Short, N. C. NORMAN'S brother-in-law, who has seen action in Tunisia, Sicily and Italy.

FROM PRELIMINARY training in Helena, Arkansas, ARTHUR J. NOLAN writes: "We fly PT-23 trainers. After eight hours of instruction we solo. Altogether we will get sixty-five flying hours here, which includes two cross-country flights. In addition we spend five hours in the Link Trainer."

JOHN P. SLICKERS has completed his basic training at Greensboro, North Carolina.

WILLIAM V. HOSHOWSKY is at the Nashville Reclassification Center.

"WE FLY 220 HP Stearmans. They are fine little ships, maneuverable and rugged; they have to be especially rugged the way we bounce them around on landings." From FRANK R. HULLEY at Albany, Georgia.



J. M. Sullivan H. C. De Valve

James M. Sullivan has visited West Street recently. Before being stationed at Fort Monmouth he was at Camp Crowder.

Lieut. George Bukur has been assigned to the Yale School of Languages for a four-month course of study. Before his present assignment, Lieut. Bukur was stationed at Sea Girt, N. J.

On furlough from Santa Anita, Herbert J. Braun came in to the 4B Shop where he was a Junior Mechanic prior to his enlistment. He is in the Air Corps.

Major Thomas A. McCann also called at West Street to see his friends while on leave from the Office of Chief Signal Officer.

End of the semester furlough in the A.S.T.P. brought many Labs men home, among them H. C. De Valve, who is studying at the University of Missouri.

From State College, Pennsylvania, Robert Angle sends word that he is now an aviation student. He was formerly in an Anti-Aircraft Branch.

William J. H. Thoele is with the Signal Corps at Camp Crowder.

"Training while awaiting shipping orders from Long Island, and then comes the test," says John E. Sienko of the Seabees. "We have been preparing for it for all these months and I hope it will be a glorious adventure."

Philip W. Foy, a cadet now at Arcadia, Florida, was previously stationed at Maxwell Field.

Eugene A. Hults has been assigned to active sea duty.

John D. Olesko is with an Infantry Division at Camp Robinson, Arkansas.

Robert J. Drout has an A.P.O. address in care of the N. Y. Postmaster.

Eugene Miritello is in the Message Sender Group of the Signal Corps at Camp Van Horn, Mississippi. "New Orleans is some place around here. As soon as I get a chance I'm going to see what New Orleans has that Brooklyn hasn't."

Lieut. Kenneth E. Waters is overseas again. He had recently been in this country taking advanced training.

Capt. Walter S. Gunnarson is taking an Advanced Officers' Course in artillery at Fort Sill, Oklahoma.

"It seems that we are receiving a modified 'O.C.S.' course here at Fort Benning because we are going into detail on all the subjects that we cover. When basic is over I will be sent to some college to study engineering." From Warren J. Boo.

"Maxwell Field is my last stop before Flying School and I can't wait to get there," writes Alfred Bertin. "So far it has been all I expected and I know that the greatest part is still ahead of me."

G. B. Taylor has been assigned to a submarine division in the Pacific.

Another visitor was Frank J. Fleischer, a midshipman at the Merchant Marine School on Long Island.

H. J. Braun Major T. A. McCann

John H. Devereaux and James B. Kennedy were on furlough from their training center in New York City. They joined the Enlisted Reserve Corps at the same time, took an eight-month radio course at New York University, were sworn into service and went to Camp Crowder.

Robert T. Duffey, another Equipment Development man in the Air Corps, while he had a few days' leave from Charleston, South Carolina, came to see his old gang.

News Notes

R. M. BURNS presided at the autumn meeting of the Electrochemical Society held in New York City from October 13 to 16. K. G. COMPTON, R. A. EHRHARDT and C. H. SAMPLE attended the sessions on plating and corrosion.

K. K. DARROW attended a meeting of the Optical Society of America at Pittsburgh on October 7 and 8, and a meeting of the American Physical Society at Evanston, Illinois, on November 12 and 13. He also attended three sectional meetings of the American Physical Society—the New England meeting at New London on October 16; the Metropolitan meeting in New York on October 23; and the New York State Section at Ithaca on November 6. At the Ithaca meeting Dr. Darrow spoke on *Entropy and Disorder at the Absolute Zero*.

AT A MEETING of the American Society for Testing Materials held at Franklin Institute, Philadelphia, on October 28, F. F. LUCAS spoke on the ultraviolet microscope and its application to important industrial problems.

ON OCTOBER 15, 1943, MISS A. K. MARSHALL gave a talk on *The Story of the Microscope* before a group of engineering students at Syracuse University.

THE OCTOBER issue of *The Review of Scientific Instruments* contains several commentaries on new technical books by members of the Laboratories. C. S. FULLER reviews *Trees and Test Tubes—The Story of Rubber*, by C. M. Wilson; J. B. FISK reviews *High Frequency Thermionic Tubes*, by A. F. Harvey; R. M. BOZORTH reviews *Magnetic Circuits and Transformers*, written by members of the Staff of the Department of Electrical Engineering at M.I.T.; and S. O. RICE reviews *Transients in the Linear Systems*, by M. F. Gardner and J. L. BARNES, now a member of Bell Laboratories.

K. G. COMPTON spent October 4 and 6 at the General Electric Company in Syracuse examining radio equipment with respect to moisture and fungus proofing. On October 12, at the Signal Laboratory of Fort Monmouth, he discussed general problems concerning moisture and fungus proofing. With C. C. HIPKINS he also made a visit to Point Breeze in connection with moisture proofing and fungus proofing on radio equipment.

GROUP GATHERINGS at suppertime in the Cafeteria are an innovation since the war. Frequently as many as ten tables are strung together by a department and its members eat in banquet style. The gatherings fill a need for social activity for people who work long hours of overtime and they also serve to help newcomers to become better acquainted with their fellow workers.

L. P. Bartheld, President of Bell Laboratories Club, congratulates V. L. Ronci, who was the first contributor to the National War Fund

J. W. MULLEN, II, was in Los Angeles for a month in connection with synthetic rubber research for WPB.

AT THE annual meeting of the Society of Rheology in New York on October 30, W. O. BAKER served as chairman during the session on high polymers.

E. E. SCHUMACHER attended meetings of the A.I.M.M.E in Chicago on October 16 and served as chairman of one of the technical sessions devoted to gas-metal diversion problems. He also visited Hawthorne to discuss metallurgical problems. Mr. Schumacher

The Bell System is furnishing adequate and convenient telephone service in Army and Navy hospitals. Men, many of them returning from combat duty, are naturally anxious to get in touch with their families. Here you see a serviceman provided with ward bedside service. Telephone service is also arranged for patients in wheel chairs, for the hard of hearing, and for those who require special assistance in making their calls

and W. C. ELLIS went to Philadelphia to take up metallurgical problems at the U. S. Government Mint.

D. A. McLEAN and F. J. GIVEN, on a trip to the General Electric plant at Pittsfield on October 18, were conducted through the capacitor plant and witnessed the making of glass bushings and other steps in the production of capacitors.

G.H. WILLIAMS went to the B. B. Chemical Company at Cambridge, Massachusetts, to consider adhesive problems.

C. J. FROSCH conferred with engineers at Hawthorne on plastics.

A. R. KEMP visited Hawthorne on October 18 for a conference on the introduction of synthetic rubber for miscellaneous uses.

F. S. MALM and J. B. HOWARD attended the November 1 meeting of the WPB Wire and Cable Technical Advisory Committee at Wright Field.

M. D. RIGTERINK studied ceramic production problems at Lenox Inc.

C. J. CHRISTENSEN has been at Hawthorne on crystal development projects.

Stability in High-Frequency Oscillators, by R. A. HEISING, was published in the November issue of the *Proceedings of the I.R.E.*

November Service Anniversaries of Members of the Laboratories*

10 *Years*

James McGovern

15 *Years*

F. W. Amberg
Margaret Bergen
W. L. Bond
E. W. Byrne
M. O. Fichter
Harriett Finn
G. E. Hanan
E. J. Hapgood
J. H. Harms
R. H. Humer
A. L. Jeanne
R. J. Kircher
Beatrice Koukol
J. F. Kraus
E. P. Liss
C. F. Mattke
O. J. Morton
H. O. Schroder
Harold Scott
F. J. Voinier

20 *Years*

J. L. Cyester
J. S. Edwards
George Head, Jr.
A. A. Huebner
Horace Jones
J. J. Martin
E. J. Murphy
G. A. Persons
Chester Slauson
James Sweeney
Ruth Tangen
L. T. Wilson
Alphons Wurmser

25 *Years*

G. F. Barleon
H. J. Battaglia
Alfred Muller
Leah Smith
C. V. Wahl

30 *Years*

A. E. Hague
E. B. Hinrichsen

35 *Years*

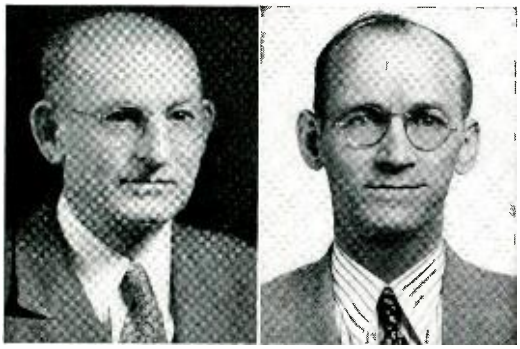
J. F. Hunter
Irving MacDonald

* Biographies of 25-year people that have not as yet appeared will be published in future RECORDS.

W. J. KIERNAN visited Point Breeze on moisture proofing and fungus prevention. From October 28 to 31 he visited the Thorderson Company in Chicago to study transformer impregnation problems and spent some time at Hawthorne on miscellaneous finish problems.

Obituaries

CLAUDE W. PAUL of the Apparatus Specifications Department died suddenly on November 3. Mr. Paul joined the student course of the Western Electric Company in 1912 after receiving the B.E.E. degree from the University of Arkansas. He also received the E.E. degree from the same uni-



C. W. PAUL
1887-1943

T. E. CASSIDY
1885-1943

versity in 1916. Following his student course experience, he came to the Transmission Branch of the Engineering Department in New York where for two years he was concerned with the design and development of telephone train dispatching systems.

Mr. Paul then transferred to the Systems Development Department where he analyzed manual, step-by-step and machine switching circuits and established electrical and mechanical testing requirements for the electromagnetic apparatus involved. From 1925 to 1929 he engaged in the designing and development of fundamental switching circuits, primarily for toll purposes. He then transferred to the Toll Development Department where he analyzed equipment orders received from associated companies and made specific recommendations for toll and associated circuits where non-standard arrangements were requested.

In 1934, in the Central Office Switching Development Department, Mr. Paul was engaged in the analysis and testing of switching circuits for toll operation. For the past year and a half he had been preparing engineering specifications in the Apparatus Specifications Department. These specifications cover electrical and mechanical components required by the Armed Forces.

* * * * *

THOMAS E. CASSIDY of the Plant Department died on November 6. Mr. Cassidy joined the Engineering Department of the Western Electric Company in 1918 as a paint sprayer. Late in 1919 he left the Company and on his return a year later became a metal and wood finisher in the Development Shop. Since that time he had been one of the most capable and experienced finishers the Laboratories had ever had. He assisted in the development of the aluminum gray lacquer which was later standardized by the Bell System for finishing telephone and radio apparatus. He was also associated with the development and application of color to handsets.

* * * * *

STEPHEN JASTRZENSKE, a former night cleaner in the Plant Department who was retired with a disability pension in 1938 after nineteen years of service, died on November 10.

* * * * *

CORD DEVELOPMENT problems were the special concern of H. H. GLENN and H. H. STAEBNER at Baltimore during October.

MISS E. J. ARMSTRONG of Murray Hill Laboratories will give a talk on Quartz as Used in Communication Instruments before the New Jersey Mineralogical Club at Plainfield on December 7.

E. B. FERRELL, in the October *Proceedings of the I.R.E.*, reviews the book *Applied Electronics*, written by members of the Department of Electrical Engineering of Massachusetts Institute of Technology.

C. A. WEBBER went to the American Steel and Wire Company at Cleveland. He also visited Baltimore to make special cable studies.

DURING OCTOBER H. A. LARLEE, J. F. CHANEY and E. B. WHEELER made a review of the repair of station apparatus for reissue to the Operating Companies. Accompanied by F. W. BERRY, repair methods

engineer of Western Electric Company, they visited Distributing House Repair Shops at Detroit, Chicago, St. Louis, Cleveland and Boston. A. B. Reynolds with H. R. Shelton of Western Electric participated in the review in Boston.

E. B. Wheeler and H. C. Curl, at Hawthorne and at the Underwriters Laboratory in Chicago, discussed safety requirements for special communication apparatus.

R. T. Staples visited the Boston Insulated Wire and Cable Company in Boston.

The Laboratories Club is sponsoring a symphonic orchestra to be conducted by a member of the Laboratories. At present, due to lack of musicians, only a string ensemble is now playing on Fridays in Section 1H, Women's Employment. However, if enough good instrumentalists can be assembled who have Friday evenings free, the orchestra will resume its rehearsals. The 'cello, string bass, tuba and A clarinet are Club property and will be supplied.

The group will play for the fun of it and for relaxation. If you enjoy ensemble playing and wish to become better acquainted with symphonic compositions, please call R. J. Podeyn on Extension 905.

"The Telephone Hour"

(NBC, Monday Nights, 9:00 P.M., Eastern War Time)

DECEMBER 6, 1943

Choral—Prelude:
We All Believe in But One God — *Bach*
Orchestra
Etude No. 5 in E Minor, Op. 25 — *Chopin*
Romance in A Flat, Op. 17 — *Fauré*
Jardins sous la Pluie — *Debussy*
Robert Casadesus
Concerto in E Flat Major— — *Liszt*
Last Movement
Robert Casadesus and Orchestra

DECEMBER 13, 1943

Evening Song — *Griffes*
Hear de Lambs A' Cryin' — *Spiritual-arr. Brown*
Marian Anderson
Caprice Viennois — *Kreisler*
Orchestra
He Shall Feed His Flock
from "The Messiah" — *Händel*
Marian Anderson
Intermezzo from "L'Amico Fritz" — *Mascagni*
Orchestra
Plus Grand dans Son Obscurite — *Gounod*
from "The Queen of Sheba"
Marian Anderson

DECEMBER 20, 1943

Christmas Fantasy
Chorus and Orchestra
O Rest in the Lord — *Mendelssohn*
from "Elijah"
Helen Traubel
March of the Toys — *Herbert*
from "Babes in Toyland"
Orchestra
When Children Pray — *Fenner*
Helen Traubel
Medley of Carols
Away in a Manger — *Spillman*
O Little Town of Bethlehem — *Redner*
Hark, the Herald Angels Sing — *Mendelssohn*
Helen Traubel and Chorus
Overture to "Hänsel and Gretel" — *Humperdinck*
Orchestra
A Miracle Came to Me — *Bos*
Helen Traubel and Chorus

DECEMBER 27, 1943

Mephistopheles' Serenade — *Gounod*
from "Faust"
Ezio Pinza
Le Veau d'Or from "Faust" — *Gounod*
Ezio Pinza and Male Chorus
Introduction to — *Rimsky-Korsakoff*
"Le Coq d'Or"
Orchestra
Within These Sacred Halls — *Mozart*
from "The Magic Flute"
Ezio Pinza
Intermezzo — *Mascagni*
from "Cavalleria Rusticana"
Orchestra
Farewell and Death of Boris — *Moussourgsky*
from "Boris Godounoff"
Ezio Pinza and Chorus

JANUARY 3, 1943

Medley:
Someone to Watch Over Me — *Gershwin*
Fascinating Rhythm — *Gershwin*
Orchestra
Phidylé — *Duparc*
Grace Moore
Skater's Waltz — *Waldteufel*
Orchestra
A Kiss in the Dark — *Herbert*
from "Orange Blossoms"
Grace Moore
Storm Music — *Rimsky-Korsakoff*
from "The Maid of Pskov"
Orchestra
Addio from "La Bohême" — *Puccini*
Grace Moore

Women of the Laboratories

CONVENIENT to the 55 Bethune Street entrance is the office of MURIEL RYAN, who was chosen by lot this month. The room is so located for the convenience of representatives of Federal, State and Municipal Governments who call at the Laboratories to carry on their business. It is Muriel's job, as secretary to G. F. FOWLER, Plant Relations Manager, to obtain all necessary licenses from the various government agencies required for the operation of the Laboratories. Besides this phase of her work she also prepares and notarizes, for Plant Department members who are subject to induction under the Selective Service Act, the required forms and affidavits for their draft boards; she prepares, as well, letters of release from the Laboratories.

While her husband serves with the Army, Muriel maintains their apartment on Long Island. Caring for their home after working hours leaves her little free time. Week ends she spends with her parents and the four lively youngsters of her family who are younger than she is. During the week, to fill in the evenings when she is alone, she likes to crochet things for her home and to write to her husband. Before her marriage horseback riding and swimming were her favorite recreations; now when her husband is on furlough dancing rates first with her.

MURIEL L. RYAN

* * * * *

PARTICLES that weigh as little as twenty-four millionths of an ounce and miniature size equipment are part of ELAINE BOSTICK's

ELAINE BOSTICK

work. In the microchemical laboratory, where she studies the specks of dust, grease, corrosion and other extraneous matter that collect on the head-of-a-pin-sized contacts used in telephone switching apparatus, it is Elaine's job to determine what the particles are, where they come from and how to get rid of them. She is particularly interested in the grease that gathers on the contacts. Her work in wartimes, however, is not confined to telephone problems. Since the microchemical laboratory specializes in handling minute quantities, its services—and Elaine's—are needed for analytical chemical work on many current war projects at the Laboratories.

Elaine grew up in Greenville, Mississippi, her birthplace. She was graduated from Evander Childs High School and from

Hunter College. After six months in a physical chemistry laboratory, she decided to do analytical chemistry instead and early in 1942 transferred to Bell Laboratories. Like many an only child, she is particularly fond of one of her cousins, an American pilot in England, and likes to feel that what war work she does will indirectly be helping him. Once a week she serves as hostess at the Broadway Tabernacle Servicemen's Center, and occasionally brings the boys to dinner at her home.

When her picture was taken she was removing grease from the brushes of an electric motor to determine the abrasive content of the grease.

* * * * *

STELLA SICORA is keenly interested in the work she is doing on transformers for experimental models of war projects because her work is helping the Army pilot in Tennessee who has first claim to her affections. Each assignment she is given is different and it requires dexterity to follow the instructions of the engineers' blueprints. Besides the experience she had gained doing radio work prior to joining the Laboratories, she has since attended a course in blueprint reading, shop practice and mathematics given during business hours.

STELLA V. SICORA

"Ronny," as she is called, is a graduate of Newtown High School and a resident of

These are a few of the many girls who attend the Wednesday luncheons of Technical Assistants in the conference dining room of the West Street Restaurant. Left to right they are: Roseanne Eadie, Jennie Damiani, Virginia Long, Emily Cairoli, Louise Lager and Katharine Prival. All T. A.'s and members of the Technical Staff are invited to carry their trays to the conference dining room and join the group. These luncheon conferences are arranged by Mrs. L. C. Hinrichs who is assisted by two hostesses each week

Maspeth, Long Island. Horseback riding is her hobby and when she doesn't have a Saturday night date she gets up early enough on Sunday to ride an hour or two before church time. Since Sunday is a family day she usually spends the rest of the day at home. Occasionally on a week night she goes to dinner and a show with the other girls in the Coil Department, with whom she is quite popular. She likes soft, sentimental music; lovely clothes; all kinds of books; and dancing—she won a loving cup for the Westchester. In the past few months she has become interested in concert music and the ballet.

* * * * *

WHILE HER husband flies from Morocco for the United States Ferry Command, NORMA WHITWORTH, a technical assistant at Whippany, helps to make secret devices which assure the safety of his flights. The confidential project on which she had been working was blocked out of her picture. Norma came to West Street as a draftswoman after her graduation from the New Jersey College for Women in 1942. Then she married Lieut. Joseph W. Whitworth and, like many an Army bride, followed him on his various assignments in this country until he was shipped overseas. Her return to the Laboratories at Whippany made her the third member of her family at that location; her father, SEWARD B. JACKSON, is an illustrator draftsman; her sister, GWEN ROWE, a draftswoman.

Now that winter is here Norma's pastimes are bridge, skating and writing on a schedule that calls for a letter a day to her husband and as much time as possible on a novel she has under way. Through his letters she lives an exciting second life—she shares the thrilling trips he makes and meets all sorts of people, including many celebrities who entertain at the front. His favorite stars are Bob Hope and Al Jolson, with whom he spent considerable time; his favorite author, John Steinbeck, who also visited the front lines. In a collection of gifts which her husband has sent from Egypt and India, Norma has Persian rugs, a crystal cocktail set inlaid with ruby dust, earrings from many places, embroidered slippers and a cigarette case.

NORMA J. WHITWORTH

Laboratories girls who keep house can play a double rôle in winning the war by abiding by ration regulations. Food is as essential as new military devices

This is Elizabeth Le Page, mail girl in Section 31. *Her work and the work of other girls like her may not seem too important to them, but without their assistance war work at Bell Laboratories could not be carried to completion*

Adelaide Sweeney of the Financial Department has helped to check in and acknowledge the 5,324 *National War Fund pledges and contributions of* $27,888.92 *made by members of the Laboratories as of November* 26

This is Muriel Cadmus, a Murray Hill stenotypist who recorded the speeches made by Laboratories executives and distinguished Army guests during the Electrical Director show. She was seated behind the speakers' platform. Muriel, a graduate of Central High School in Newark and La Salle Institute, formerly worked in the Stenographic Department at West Street

Mary Morrissey pins up a few sample pieces of junk jewelry on a display board in the Lounge at West Street. So far 110 *pounds of jewelry have been received by R. C. Fisher of the Salvage Department. The jewelry will be shipped to South Sea islands where servicemen will use it for barter with the natives*

Bell Chorus to Give Christmas Concert

The Bell Chorus will present its annual Christmas Concert in the New York Times Hall on Thursday evening, December 9, at 8:30 P.M. The group has prepared an interesting program which will be enhanced by the incidental solo work of Elsie Anderson Urban. Alexander Turnbull, tenor, will be the guest artist.

Tickets may be purchased for $1.75 from Miss Hilda Muller, Extension 1902.

The Chorus has been invited to give their program at the Princeton Club on Tuesday evening, December 7. This will be followed by convivial singing in the Grill.

News Notes

THE FOLLOWING members of the Laboratories attended conferences on quartz crystal at Schenectady: N. INSLEY, R. M. C. GREENIDGE and A. W. ZIEGLER.

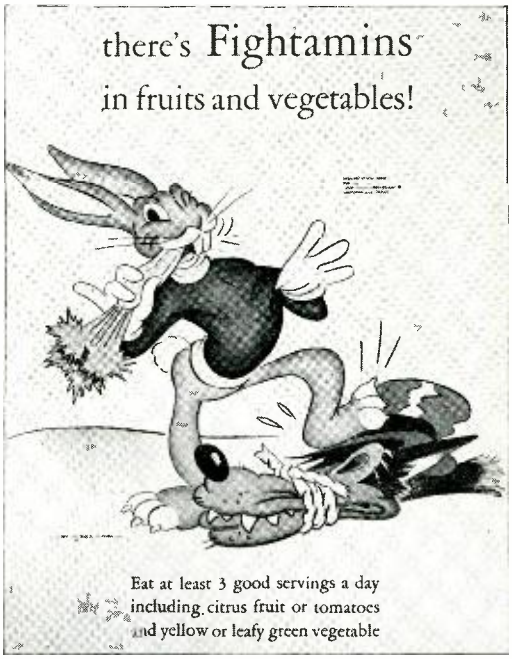
F. J. GIVEN visited the Tobe-Deutschmann Company at Cambridge, Massachusetts, on October 16, and the General Electric at Pittsfield, on October 18, on problems of capacitance.

C. A. JOHNSON took up problems relating to power transformers at the Magnetic Windings Company in Easton, Pennsylvania, during October.

M. WHITEHEAD visited the Magnavox Corporation at Fort Wayne and P. R. Mallory and Company at Indianapolis on matters relating to electrolytic condensers.

J. R. TOWNSEND was the first speaker in a series of lectures on synthetic plastics held at the New York Institute of Finance. *An Engineer Looks at Plastics* was his subject.

AT FORT MONMOUTH, J. H. GRAY discussed with members of the Signal Corps the plowing-in of rubber-covered cable.



Calif. War Council

A. P. JAHN took part in the inspection of metal-coated samples which are undergoing atmospheric tests at Sandy Hook for the American Society for Testing Materials. He continued in similar inspection activities at Pittsburgh and Altoona, Pennsylvania, and at Bridgeport, Connecticut.

B. C. BELLOWS spoke on *Toll Crossbar Switching System* at a joint meeting of The Franklin Institute and the Communication Group of the Philadelphia A.I.E.E. Section. The meeting was held at The Franklin Institute on October 27.

W. Y. Lang was the author of an article on *Teletypewriter Test Sets* which appeared in the November *Telegraph and Telephone Age*.

A. J. Wier, W. F. Malone and C. H. Achenbach were at Albany on K2 carrier installation problems.

M. M. Jones was in Baltimore three weeks making coaxial system power studies. He was joined by B. Dysart for the last few days.

B. Dysart and B. J. Kinsburg went to Princeton on October 28 to inspect a new repair center which the Long Lines Department is establishing for repairing coaxial amplifiers and regulators.

R. Marino and E. B. Cave appeared before the Board of Appeals at the Patent Office in Washington on patent applications.

The Laboratories were represented at the Patent Office in Richmond by H. A. Burgess in interference proceedings before the Primary Examiner.

R. Marino and C. Baraff were at the Patent Office in Richmond during October on patent matters.

Frank D. Leamer has recently been elected Chairman for Summit of the Community Manpower Mobilization Committee and also has been made a member of the Speakers' Committee of that organization.

Engagements

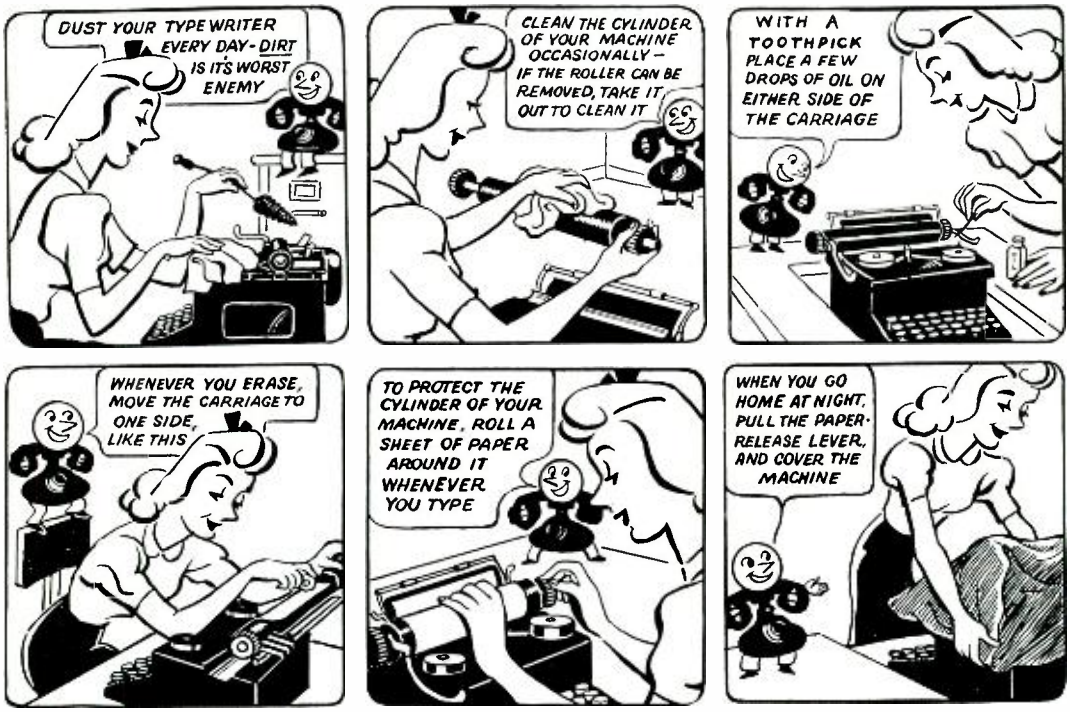
Albert Wolf—*Estelle Johnson
*Wm. P. Harnack, U. S. Army—*Janet Marceau
Harry Wrubel—*Anne Schiffman

Weddings

*August Uhl, U. S. Army—*Susan Feuerbach
John J. McCarroll, U. S. Army—*Madelyn Flynn
J. E. Rothe, U. S. Army—*Fenella Langenau
T. J. Corey, U. S. Army—*Mary Alice McGrath
*R. Shiels Graham—Ruth Opie
Lt. Kenneth Steen, U. S. Navy—*Frances Preston
Lt. Reed R. Porter, U. S. Navy—*Rose Purcella
Wilson M. Fay—*Elvira Smith
*Ernest Briechle—Lydia Urban
*Samuel Stoddard, Jr.—Jane White
*Frank J. Biondi—Virginia Willis

*Members of the Laboratories. Notices of engagements and weddings should be sent to Mrs. Helen McLoughlin, Women's Editor, Room 1103.

On October 22, 1943, L. F. Coon, J. S. Edwards and Ruth O. Robinson, as guests of the New York Telephone Company, attended a First Aid Supervising Instructors Conference conducted by Grant McCubbin, Red Cross Area Representative, at 140 West Street, for the purpose of qualifying for reappointment as supervising instructors under the Red Cross-Bell System agreement.



Common Principles—*an editorial by* John Mieg

QUIZ PROGRAMS ask questions like this: Which of these words, count, marqueé, duke, sahib, does not belong in the list? Obviously "marqueé," originally a tent used by the wife of a marquis; the rest are titles showing rank.

For the words telegraphy, telephony, radio, and television, that of the wrong category is radio, the modern term for wireless in contrast to wire; the others classify systems according to signals, e.g., letters, sound, or pictures and scenes. Television, for example, can be by wire or by radio, like telegraphy and telephony.

Signals are never transmitted only by radio; their electrical counterparts originate in wired apparatus and must be similarly recreated. Radio serves only for a portion of the distance; wire must cover the rest, whether the thousands of miles from a Hollywood microphone to an eastern broadcasting station or the few feet to the transmitter in a police-car radio.

These four words are widely but illogically used for classifying electrical communications. There is, however, some justification to be found in the historical sequence of the communication arts. But the use, nevertheless, obscures an essential unity. From the simplest doorbell circuit to the most advanced hyper-frequency wave guide, common principles underly all systems of electrical communication.

First, historically, was wire telegraphy; then wire telephony; next radio telegraphy — called wireless prior to 1917. Then came radio telephony which permits broadcasting. Meanwhile in a prolonged infancy was picture transmission to which television bears the same relation as do motion pictures to still photography.

In any communication system there must be means for producing an effect with characteristics always dependent upon the signal, that is, upon the information to be sent; a medium for transmitting this effect; and receiving apparatus for producing an equivalent to the original signal. The terminal apparatus must go in pairs. In telephony, for example, there is a source of current which is responsive to sound and one of sound responsive to current. In television, a light-actuated and a light-controlling device.

The effect may travel over wires just as produced; or it may be carried by a higher frequency effect between intermediate terminals, as in all carrier-current or radio systems. Between terminals it may be guided by wires or by wave guides or, less artificially, by more natural boundaries as in radio transmission. But a classification by transmission medium is independent of classification by type of signal.