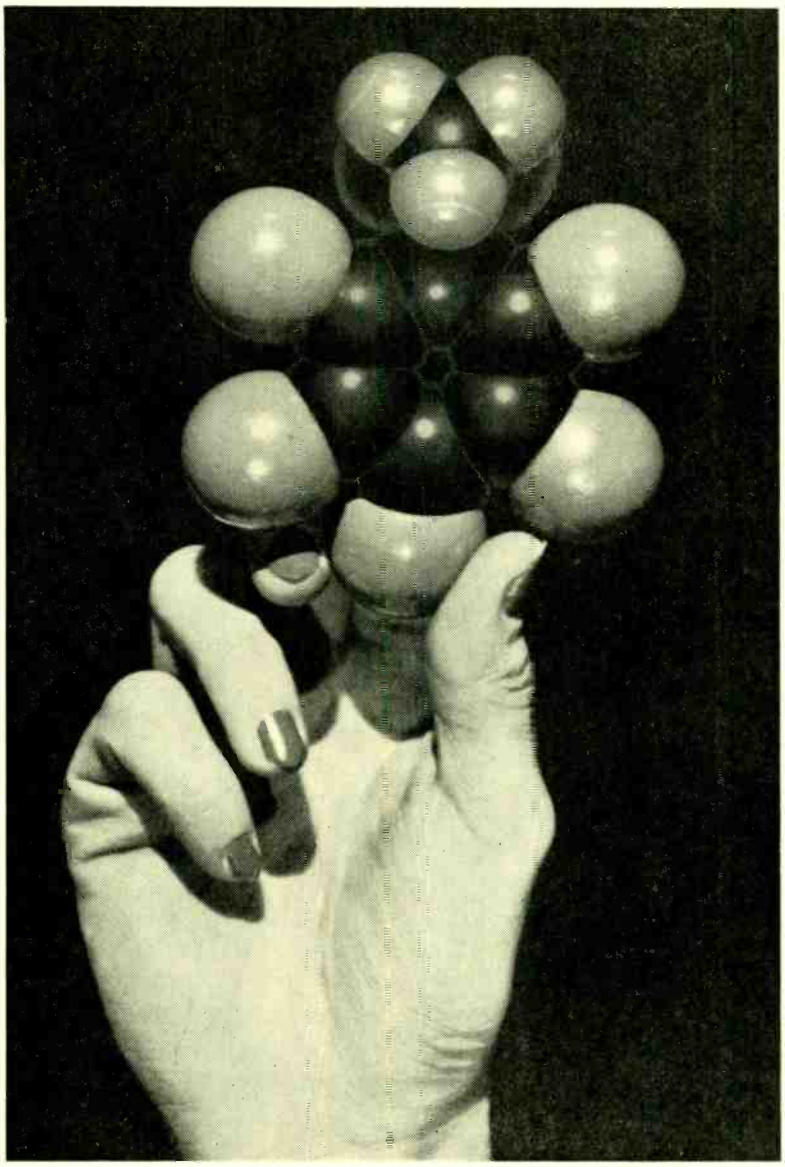
BELL LABORATORIES RECORD



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Rotation of molecules in solid dielectric materials investigated to determine effect on dielectric constant

Acme Photo

A Super PBX for War Service

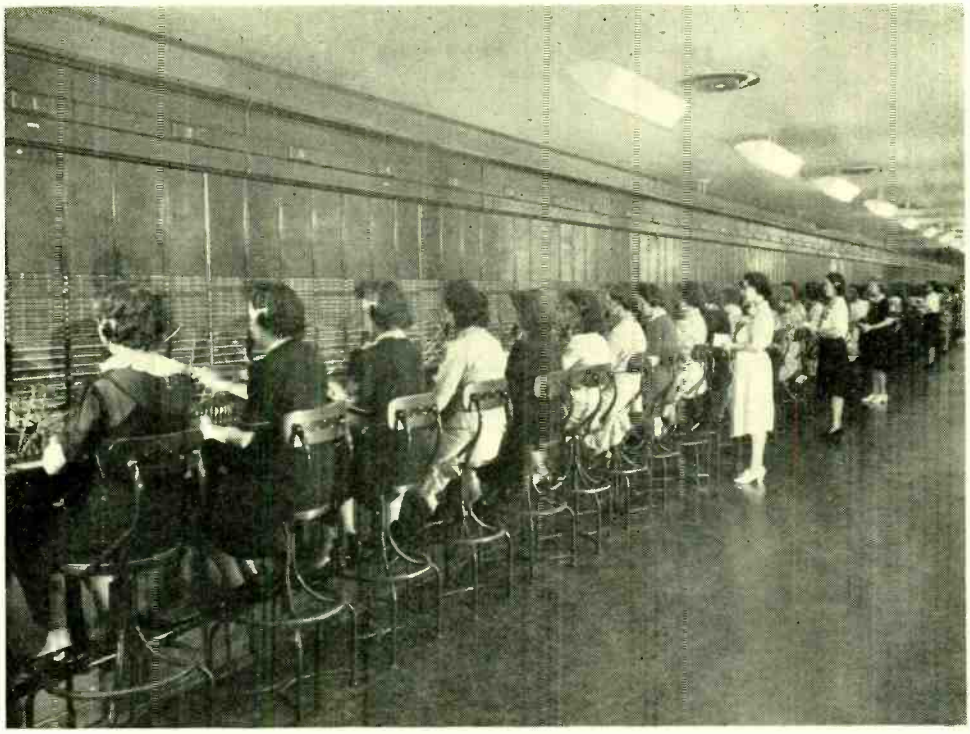
By J. W. WOODARD
Equipment Development

The expanding load on our War Department, particularly in the tense months since Pearl Harbor, made it necessary a short time ago to provide a dial PBX with an ultimate capacity of 15,000 lines. Although local calls within the PBX do not require the assistance of an operator, all incoming calls pass through a manual switchboard, and the operators here must be able to reach any of the projected 15,000 lines.

The method adopted not only meets the present requirements but could be used for a PBX of greater size. The principle involved is simple, and only basically standard equipment is used. Between the jacks in the switchboard and the station lines, step-by-step attendant connectors are interposed. The extension lines are usually arranged in groups of 100, and the lines of each group are multipled to the banks of a set of ten attendant connectors. Each of these connectors has jacks in the switchboard multiple, and may thus be reached by any of the operators.

To complete a call, an operator plugs into one of the ten jacks associated with the connectors serving the particular 100 group that includes the extension called, and then dials the last two digits of the number. The

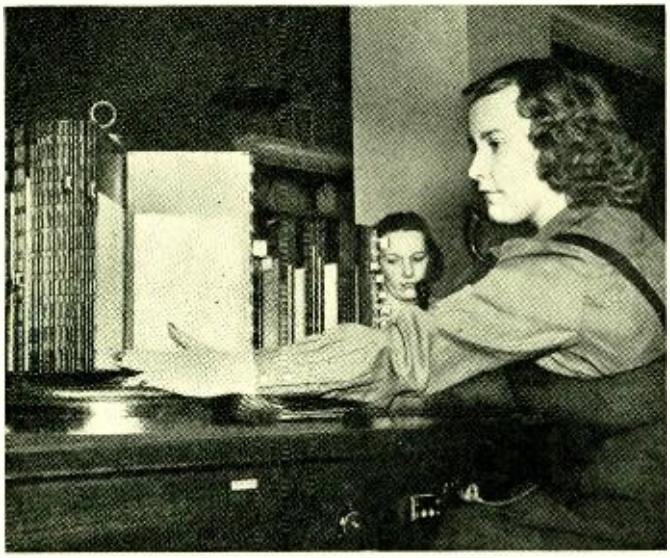
BETWEEN the length of an operator's arms and the size of a manual central office there might seem to be little relationship, but, actually, the one determines the other. An operator must be able to reach the jacks for all the lines in the office, and thus the distance she can reach definitely limits the size of the office. With present equipment and construction methods, only slightly more than 10,000 jacks can be placed within normal reach. This limitation has had little influence on PBX design because, until this year, the largest PBX has not required more than 6,000 lines.



Acme Photo

A section of the switchboard at the private-branch exchange in the War Department's new office building in Washington. The information section is shown on the opposite page

War Department's PBX has regular central-office testing facilities



Close-up of an information center

jacks have idle-trunk indicating lamps and thus no time is wasted in busy testing. Ringing is applied automatically from the operator's cord circuit. At the termination of conversation, a supervisory lamp lights in front of the operator, and when the cord is removed, the equipment is restored to normal to be ready for the next call.

This arrangement is not the only novel feature of the new War Department PBX. In any large PBX it is necessary to provide both information and intercepting service. The former provides users of the system with a ready means of getting the numbers of new extensions or other assistance, and the latter insures that changed or abandoned numbers or errors in dialing or equipment do not result in wrong connections or wasteful delays. With smaller installations, information service is usually provided by operators, either at key equipments such as the 101 type* or at some of the switchboard positions, while intercepting service is usually handled over jack-ended trunks in the switchboard multiple.

These methods seemed unsuitable for this new PBX. To handle even the regular traffic of a PBX of this size required an exceptionally large switchboard, and it did not seem desirable

*RECORD, *August*, 1937, *page* 370.

J. W. WOODARD's telephone career began in 1911 with an independent step-by-step dial system operating company in New England. In 1913 he spent nine months with the New England Telephone and Telegraph Company and then returned to the independent field. He entered the Hawthorne plant of the Western Electric Company late in 1917 and here was concerned with central-office equipment engineering. Since 1920, when he came to West Street, Mr. Woodard has been in the Equipment Development Department where he is now in charge of the current development group. This group provides engineering services to the Western Electric Company and the Associated Operating Companies in connection with central-office equipment. This work now involves many war projects.

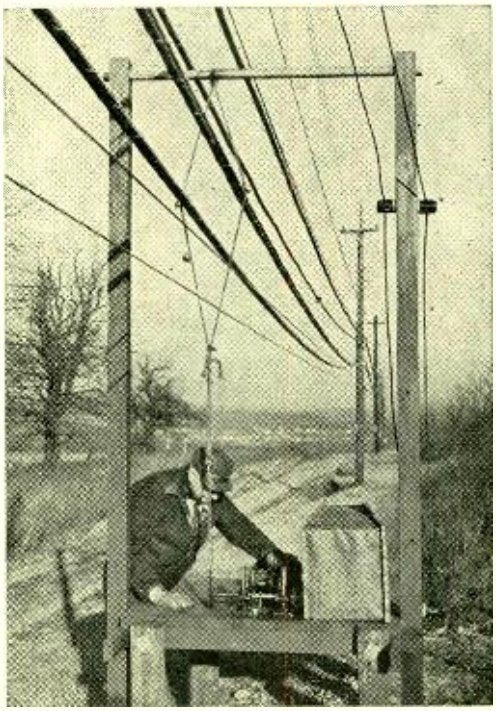
to increase the size of the board further by requiring it to handle the other services. Moreover, it was expected that the number of changes caused by a rapidly changing personnel would place more than the usual load on both the information and intercepting operators. Particularly fast service was also desired, and in view of these various factors, a combined information and intercepting system was developed based on arrangements tried in the field.

Each attendant at the combined information and intercepting desk has a step-by-step trunk finder associated with her position, and incoming traffic of either type is distributed automatically to the various attendants as they become idle. The position equipment makes use of colored lamp caps and tones of different pitches to indicate the class of the incoming call. The desk consists of 36 operator positions, and is equipped with rotary files provided by the customer. This system provides the high grade of service required, and was made available in a very short time.

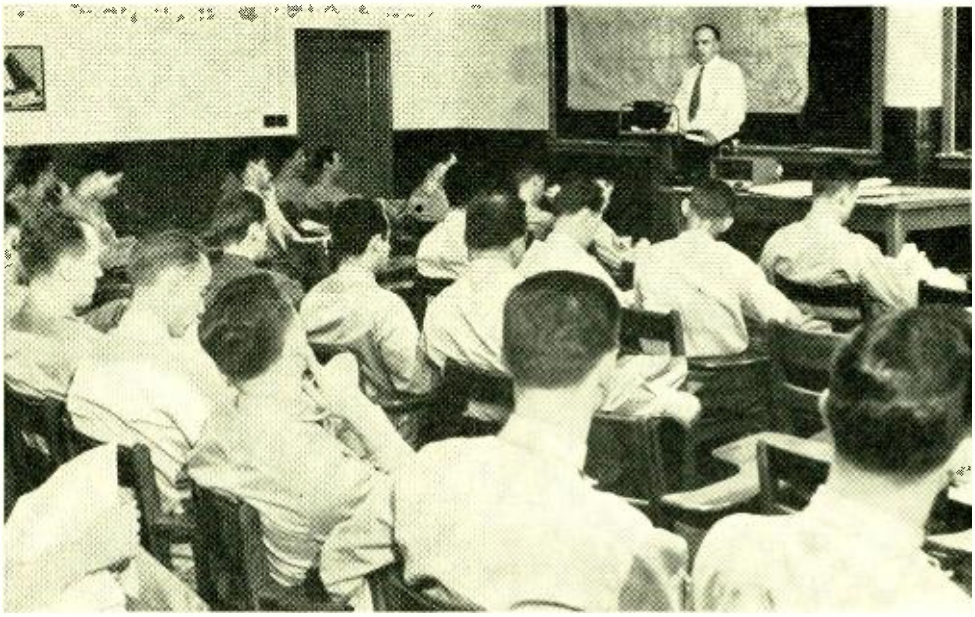
Still another unusual feature was the provision of the same type of testing facilities that is used in regular central offices.

The PBX has a large number of direct circuits to the toll boards in Washington. Because of the long loops involved, these circuits are provided with 96-volt talking battery supply at the toll office, in order to provide adequate current to the station transmitters on toll calls.

This new PBX was put in service early last September and has met the unusual requirements encountered.



To find out if wind sway causes sheath abrasion when two cables are lashed to one suspension strand, accelerated tests are conducted at the Chester Field Laboratory by swinging cables with ropes which are attached to a motor-operated crank. D. C. Smith of the Outside Plant Development Department is the engineer.



School for War Training

AN IMPORTANT adjunct to the war effort of Bell Telephone Laboratories, and an outgrowth of its development and research activities, has been the creation of a school for war training. This new unit has been organized to train Army and Navy personnel in the operation and maintenance of special communication and other electrical equipment manufactured by the Western Electric Company for use in various phases of the war activity. While the school is only six months' old, it already boasts an alumni list of eleven hundred men drawn from the Army, Navy and civilian life.

The school occupies two floors of a modern loft building and is laid out with well-equipped laboratories, lecture and study rooms. Its "faculty" is composed entirely of members of the Bell Laboratories technical staff. They have had years of training and background in problems associated with communication activities and have eagerly accepted the challenge to carry out this important assignment. So new is the information to be imparted that the "faculty" has already had to write nearly 2,000 pages of textbook material.

Organized several months ago as the result of a request of the Signal Corps, the first class began on April 27 of last year. Instruction now goes on eight hours a day and six days a week, and students from the Navy and other branches of the Army are included.

Tides of battle are very largely influenced by the maintenance of adequate communication facilities. The Laboratories are glad to be able to supplement their war effort with this program of training to assist in making sure that the intricate technical

devices used in modern warfare shall be kept in a high state of usefulness by adequate maintenance. Registration for the school is handled entirely by the armed forces. Applications through the Bell Laboratories cannot be considered.

After a lecture students gather around the instructor, M. C. Goddard, to clear up their individual difficulties

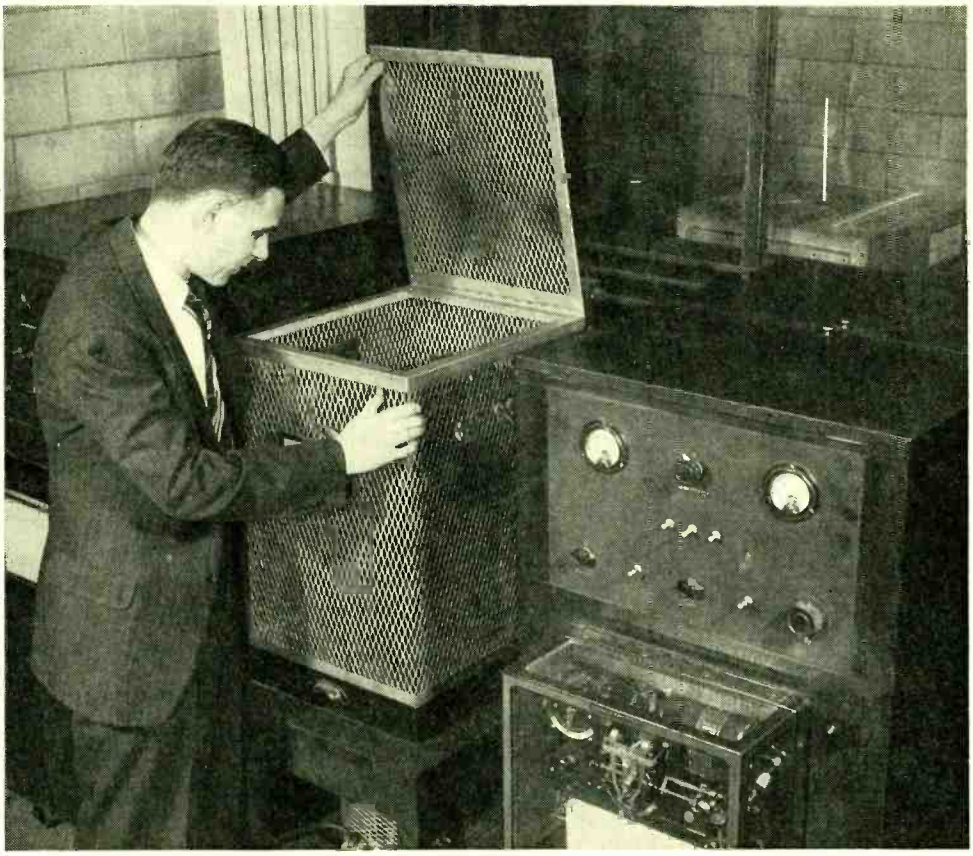
In the tank radio laboratory session, Armored Force officers and enlisted men work side by side, plumbing the intricacies of the rugged, compact and versatile radio set that rides in America's tanks, helping to coördinate mechanized operations. Manufactured by the Western Electric Company at rates appropriate to the output of the nation's tank arsenals, the set employs the principles of FM (frequency modulated or "staticless") radio.

Personnel of some of the courses is predominantly civilian employees of the Signal Corps. These students in age range from recent trade school graduates to gray-haired men. Many have had experience as radio "hams," station operators, or as radio repairmen. Two were merchant mariners with memories of recent torpedoings.

Director of the school is R. K. Honaman. Mr. Honaman describes the radio students, civilian and military, as uniformly earnest and diligent and with a full knowledge of the responsibility they will assume on their return to active service.

A private and two officers work together in the laboratory on a Western Electric radio telephone set for tanks

E. J. Thielen is Assistant Director and P. W. Spence is registrar of the School for War Training. The instructing staffs are under the direction of R. N. Hunter, J. Meszar, R. I. Wilkinson, R. E. Collis and R. F. Massonneau. Thirty-six engineers of the Laboratories are engaged in instruction.



Acid Neutralization in Insulating Papers

By D. A. McLEAN
Chemical Laboratories

IN THE manufacture of condensers with paper insulation, impregnating materials are used to eliminate air pockets and to increase the dielectric capacity of the paper. With long use, particularly at high temperatures and under high voltages, traces of hydrochloric acid are liberated from chlorinated impregnants. The acid, and the salts formed by its reaction with the metal electrodes, ultimately decompose the paper and break down the condenser. This destruction is delayed by calcium, magnesium and other metals combined chemically with the paper. They neutralize the hydrochloric acid by exchanging places with the hydrogen of the acid. This reaction takes place in some insoluble solids and is called base exchange, because metal ions are involved.

Investigations by the Laboratories indicate that exchange reactions in cellulose materials do not take place in the principal constituent but in other organic materials with which cellulose is always associated includ-

ing lignin, pectic substances and pentosans. The first two are probably of primary importance. Differences in content of these minor components explain why papers differ so greatly in exchange capacity. Kraft paper, which is much superior to linen for condenser insulation, has several times the exchange capacity of linen tissue. The headpiece shows the apparatus with which accelerated life tests of condenser papers are carried out. Condensers are heated in an oil bath and a continuous record made of the leakage current until the paper under test breaks down.

When aluminum electrodes are used in condensers made with paper impregnated with chlorinated compounds, decomposition of the dielectric proceeds from central nuclei about which the paper becomes partially carbonized. If the sample is dismantled after accelerated tests at high temperature and with d-c voltage, these areas can be seen as brown spots. Under ordinary artificial light a photograph shows dark spots on a light background as illustrated in Figure 1, left. With ultraviolet light, however, these spots fluoresce brightly and make the same sample appear like Figure 1, right. Comparison of the two photographs shows a similar pat-

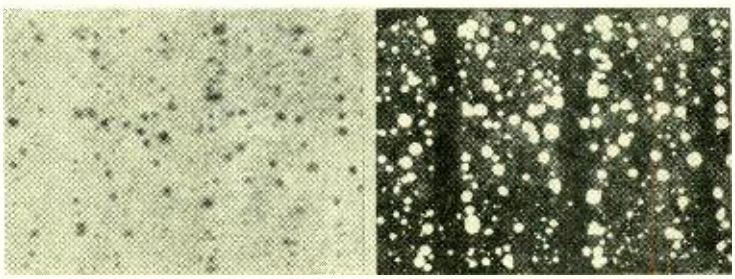


Fig. 1—Photographs of condenser paper broken down by acid liberated from the impregnant: (left) illuminated by ordinary light, (right) with ultraviolet light

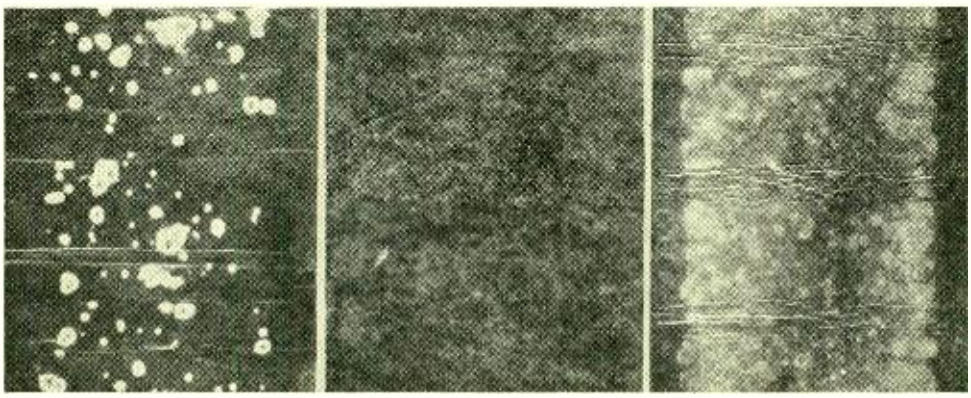


Fig. 2—Effect of exchange capacity of condenser paper on its service life. The two samples at the left were subjected to the same life test conditions at 120 volts. The linen paper (left) shows many decomposed spots scattered throughout the sample but Kraft paper (center) shows only slight evidence of decomposition. When the voltage was increased to 400 volts the Kraft paper (right) began to decompose

tern of spots but ultraviolet light provides much greater clarity and detail.

Papers of high exchange capacity are capable of suppressing the formation of decomposed areas. The two samples at the left of Figure 2 were taken from a condenser after approximately equal periods of test at the same voltage. The linen paper is thickly populated with decomposed areas which have grown from minute centers seen scattered through the sample, but the Kraft paper shows only slight evidence of decomposition. It requires more severe conditions of test as indicated in the photograph at the right to produce serious deterioration in the Kraft paper.

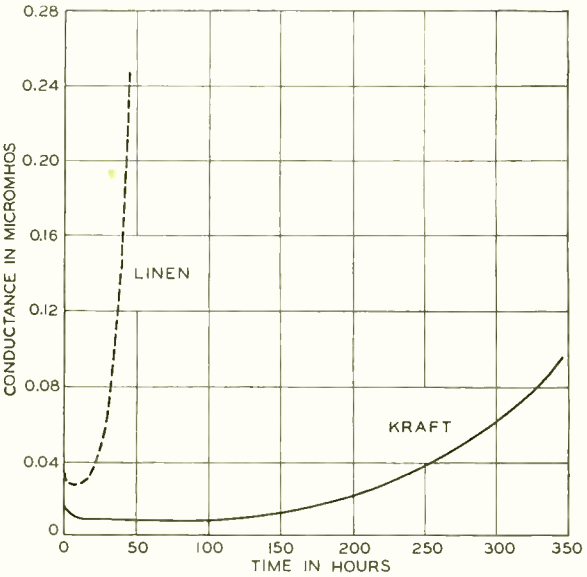


Fig. 4—Leakage current in condensers under accelerated life test remains small much longer with Kraft paper than with linen paper insulation

Superiority of Kraft paper as a dielectric is illustrated in Figure 3, by comparing the energy losses at elevated temperatures in condensers made with this material and with linen. The lower power factor in Kraft paper is due to the binding of ionic material by its base exchange properties which decreases the a-c losses. These values were determined at low potential gradients, under which conditions ionization is most readily detected by alternating current measurements.

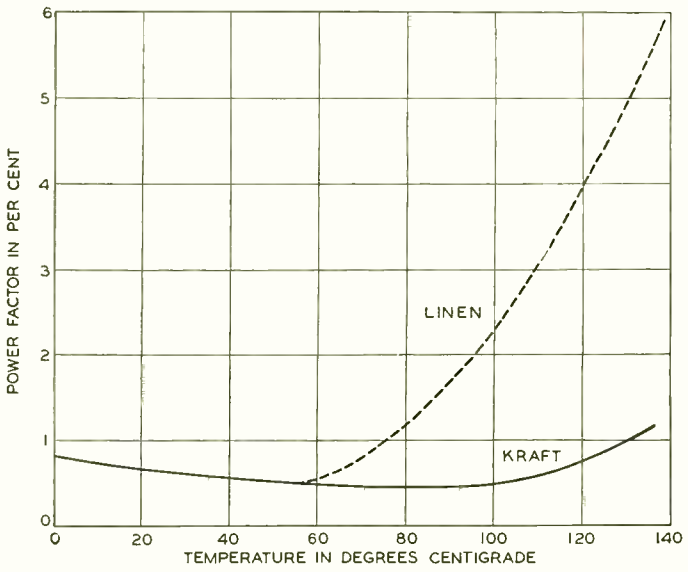


Fig. 3—Energy loss at high temperatures is less in condensers that are made with Kraft paper than it is in those in which linen paper insulation is used

The advantage of using condenser papers of high exchange capacity to reduce leakage current is shown in Figure 4. Typical results obtained with linen paper under accelerated test conditions show a rapid increase of leakage and

dielectric failure after 40 hours. In contrast Kraft paper has a much more stable leakage current and a life of 350 hours, as its high base exchange capacity suppresses decomposition.

These studies of exchange reactions in condenser papers impregnated with chlorinated compounds have led to the development of stabilizers which extend the life of condensers, under the severe test conditions of Figure 4, to several thousand hours.

IMMEDIATELY after receiving a B.S. degree in chemical engineering from the University of Colorado in 1929, D. A. McLEAN joined the staff of the Chemical Laboratories. For the following three years he was interested chiefly in problems of plasticity, viscosity, and the wetting of solids by liquids. While working on these problems he contributed to the theory of capillary penetration of liquids into fibrous solids. More recently he has been engaged in studies of dielectric breakdown and has given particular attention to paper condensers. Part of this work has been carried out in the Apparatus Development Department.

WILLIAM WILSON HONORED BY I. R. E.

The Medal of Honor of the Institute of Radio Engineers has been awarded to William Wilson "for his achievements in the development of modern electronics, including its application to radio telephony, and for his contributions to the welfare and work of the Institute."

The medal was established in 1917 *and is the senior medal of the Institute. It is awarded annually in recognition of noteworthy inventions and developments in electrical communication. Earlier recipients were Lee de Forest, M. I. Pupin, A. E. Kennelly, J. A. Fleming, G. A. Campbell and Lloyd Espenschied.*

and the adjacent contact springs. Field trials of a large number of experimental brushes incorporating these design features indicate that their use will greatly reduce the effort required to maintain satisfactory noise levels in panel offices.

Vertical drive shafts on panel selector frames are usually equipped with iron discs which function in magnetic circuits to drive other discs on the sequence switches by friction. These shafts are supported on the frames by means of five or six bearings with a graphalloy bushing assembled in a die-cast housing of two pieces. The bearings provide a radial support for the vertical shafts, maintain a relatively uniform air-gap between the driving and the driven discs, operate without the aid of lubrication and, in addition, are readily replaceable.

The original design provided a rigid cap, shown in Figure 2 at the right. The outside bearing surfaces of the bushing are spherical to engage the spherically shaped clamping surfaces of the die-cast bracket and cap. This permitted the bushing to be self-aligning before it was firmly clamped in place with respect to the vertical drive shaft. Manufacturing variations, however, sometimes made the clamping pressure of the rigid cap great enough to distort the shape of the hole in the relatively soft bushing and cause it to bind with the associated shaft. To prevent this it was necessary to ream the hole in the bushing after assembly during manufacture and exercise considerable care when installing the bearing assembly with the shaft.

An improved cap, Figure 2 at the left, has a rectangular opening in the central portion and bosses at each end to connect the two narrow portions with small centrally located bearing pads, which apply clamping pressure to the bushing. When a bushing is tightly clamped in a bearing assembly, with maximum manufacturing vari-

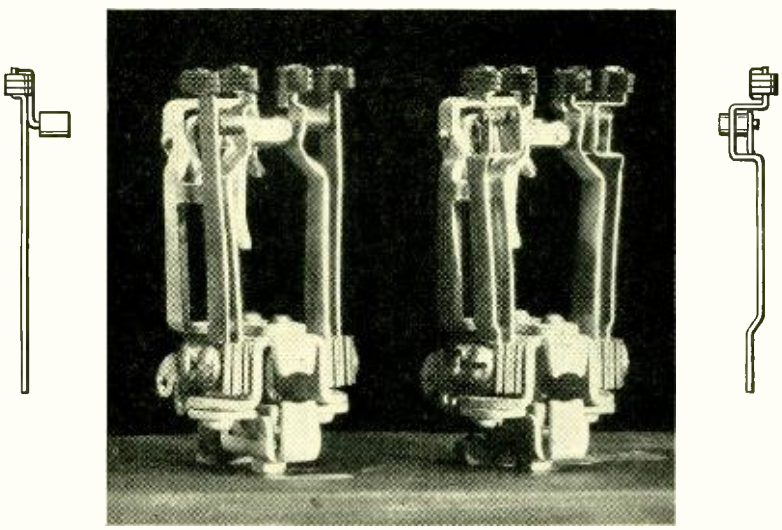


Fig. 1—Selector brushes with flexibly mounted shoes (right) cause less circuit noise than those with straight springs (left). The outside springs of the older type are straight while those of the new type have a U bend near the shoes

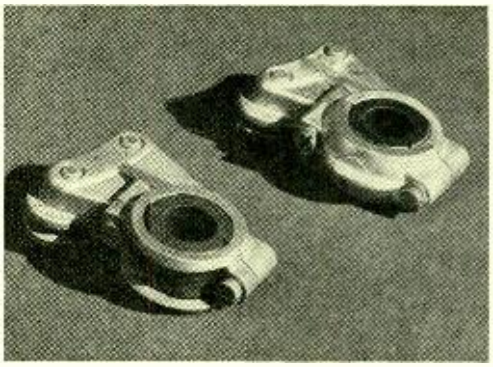


Fig. 2—A new bearing for vertical drive shafts of selector frames has a rectangular opening in its cap (left) to provide flexibility which prevents it from distorting the bushing. The rigid cap (right), formerly used, sometimes caused the relatively soft bushing to bind onto the shaft

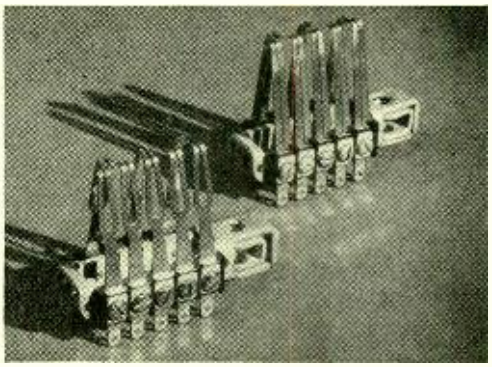


Fig. 3—Bifurcated springs are used in an improved assembly (left). The springs are clamped by a screw and can be changed separately. Previously the entire pileup (right) had to be removed and reassembled; all the connections also had to be unsoldered and resoldered

ations, the improved cap is sufficiently flexible to permit the bearing pads on the narrow portions to spread longitudinally with reference to the axis of the associated shaft. This prevents the clamping pressure on the bushing from becoming great enough to distort the bushing. The new cap is interchangeable with the former rigid one except for the shorter clamping screws. This improvement facilitates manufacture and also assures complete interchangeability when replacements are required in service.

The phosphor-bronze contact springs of panel commutator brushes are moved up and down with the selector-rod assembly and traverse the contact segments of the commutators. They have double leaves, Figure 3 at the right, and their life, under normal operating conditions, is approximately fifteen years. More severe service conditions than originally expected sometimes has caused excessive wear which necessitated replacing many contact springs. This involved considerable maintenance time because wires had to be unsoldered; also the entire spring pileup of double leaves, bushing, flat insulator, clamping plate and screw had to be replaced by the new parts before resoldering.

An improved contact spring assembly, Figure 3 at the left, has retained the desirable features of the double-leaf spring but the wires do not have to be disturbed when making a replacement. This was accomplished by providing a detachable single contact spring, one end of which is bifurcated and has sufficient flexibility at each contact tip to prevent both tips from breaking contact with the commutator when dust or foreign material lifts one tip. A "U" shaped slot at the other end of this spring is used in clamping the spring to a permanent soldering terminal. With this design it is only necessary to loosen the clamping screw of the pileup to remove a worn spring and replace it with a new one. This improvement saves maintenance effort and reduces the time the apparatus is out of service for replacements.

Need for more accurately timed pulses in certain circuits has necessi-

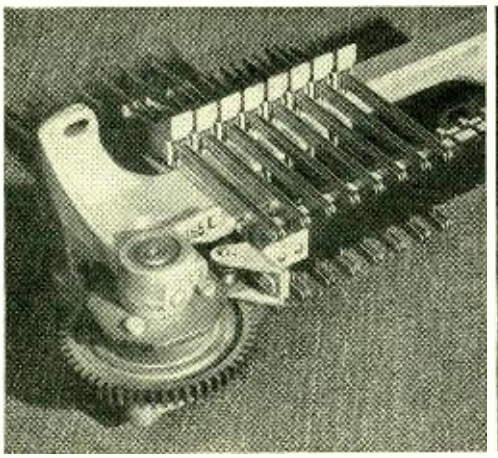


Fig. 4—The timing pulses from interrupters have been made more accurate by sturdier construction and by improving the cams and roller assembly

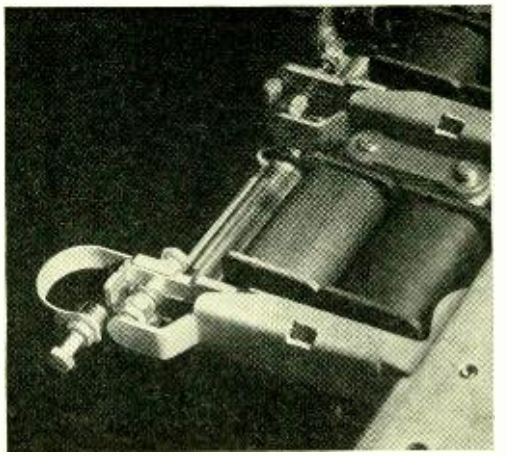


Fig. 5—To make the clutch on the elevators of the panel selectors release more quickly and thus reduce overthrow of the brushes, a U-shaped spring has been added

tated holding the time intervals of the make and break springs of interrupters to much closer time limits than heretofore. Studies of the effect on time intervals of changes in the dimensions of the moving parts of these interrupters led to the development of an improved design, shown in Figure 4. Time variations have been reduced by using more accurate cams, roller assemblies which assure full contact with the face of the cams at all times, improved mountings for the stationary back stop bars to preclude objectionable bowing and by cutting the gears to mesh more accurately.

A small "U" shaped spring, shown in Figure 5, has been added to the reed-spring clutches which move the elevators of panel selectors.* This spring releases the clutch quickly and thus reduces the overthrow of the multiple brushes at the selected terminals. It also permits adjusting the clutch while operating.

The improvements described here have been chosen as representative of many others. Taken individually they are of considerable importance and in the aggregate they make a substantial contribution to the performance of panel apparatus in central offices.

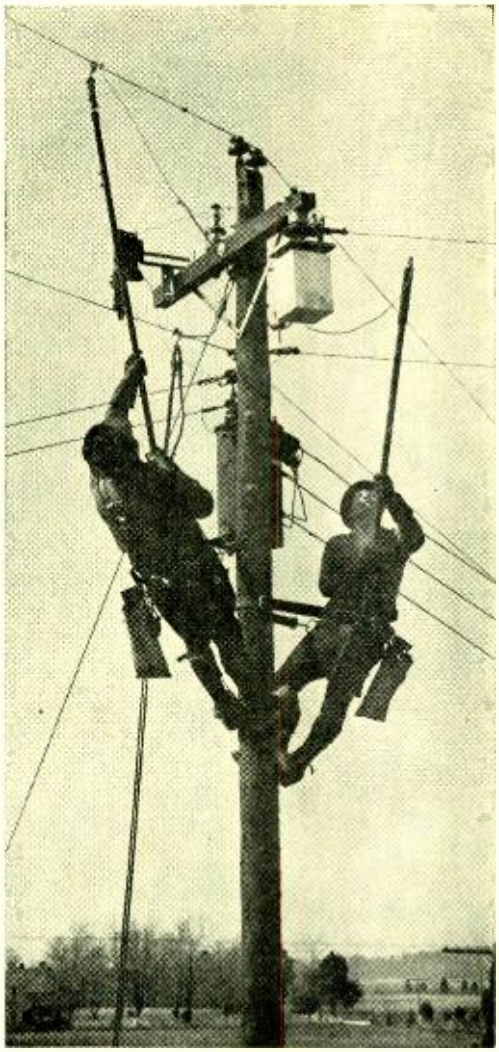
*RECORD, *October*, 1940, *page* 61.

The successful man, whether industrialist, merchant or farmer, is successful because he is curious about the things around him and is continually striving to satisfy that curiosity by reading, thinking, and coöperating with his fellow-men in discussion and in action. If one builds a wall about himself which keeps valuable knowledge from getting out, that same wall keeps valuable information from coming in.

Coöperation, curiosity, knowledge, and action, individually and collectively, lead to success.—A. F. Dixon.

Rural Telephone Service Using Carrier on Power Lines

Present status of this development project as outlined jointly by M. M. Samuels of the Rural Electrification Administration and R. G. McCurdy of the Bell System.



DURING the past two years the Bell Telephone System and the Rural Electrification Administration have been carrying on development work coöperatively to determine the technical possibilities of furnishing telephone service to rural communities through channels derived from power distribution lines by carrier methods. This study is a continuation of work that the Laboratories had started about two years earlier with the same objective.

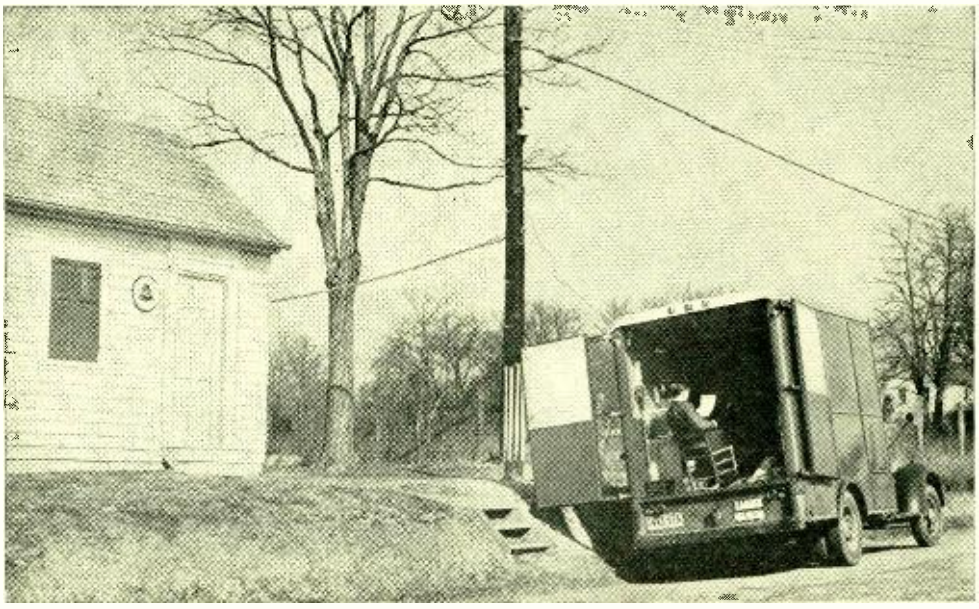
In the earlier work, theoretical studies supplemented by some field experiments had been made to determine the transmission losses at high frequencies over power distribution lines of the type used in rural communities. Measurements were made of noise, and investigations were started to determine the practicability of coupling the carrier telephone equipment to the power line through the distribution transformers. Various methods of operating the system were investigated including single frequency with push-to-talk operation of the transmitter or with voice-operated devices, and also using two frequencies. A single-frequency push-to-talk set was constructed and tested in the laboratory. Using this preliminary work as a basis, a joint development program was initiated to study the technical problems in further detail.

In initiating this joint work it was decided that separate frequencies for transmitting and receiving should be used, that multiparty-line operation should be provided for, and that the sets should be equipped with switches for interchanging the frequencies used for transmitting and receiving so that

calls might be made to or received from another party on the line without complicated apparatus at the central office.

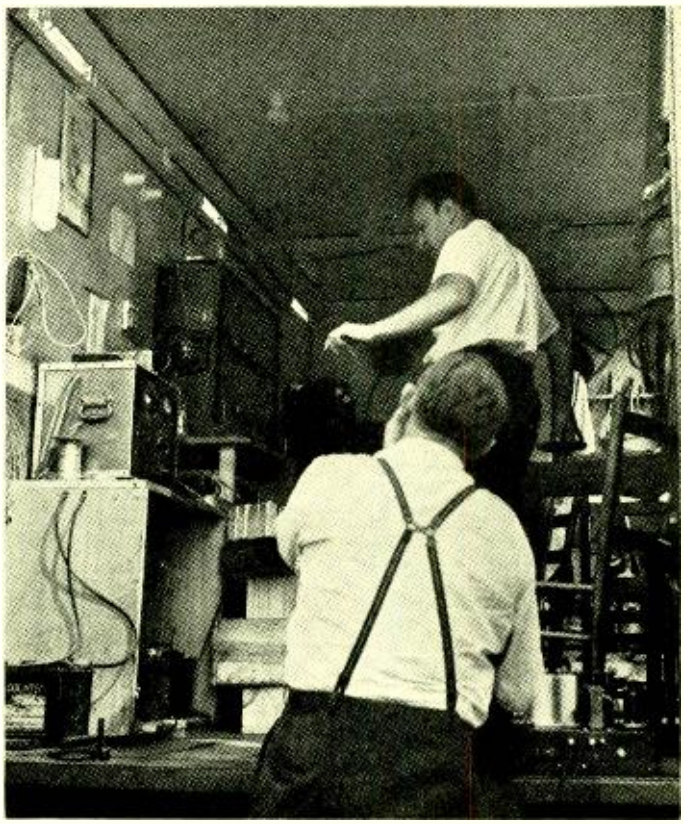
Measurements were made on two REA distribution projects in the field to supplement the information available on transmission losses and noise levels. Near Martinsville, Indiana, a section of power distribution line was tested prior to its 60-cycle energization in order to determine the carrier-frequency transmission properties of the bare line. The transmission properties of energized lines, the characteristics of transformers as coupling devices, and noises were measured on a project near La Plata, Maryland. These measurements indicated that the controlling losses were those experienced in going through the distribution transformer, and that if an adequate transmission was to be obtained with a reasonable amount of transmission power some better means of coupling carrier equipment to the line was required. The work also indicated that measures would need to be taken to reduce the effect on high-frequency transmission of branch lines and bridged transformers.

While these line transmission and noise studies were in progress, development work was continuing in the Laboratories on suitable subscriber sets. Models were built of a set designed to work on separate frequencies for transmitting and receiving, and arranged so that the circuit could be interchanged by a switch to permit the set either to make calls to or receive them from another party on the line of a central-office operator. Automatic volume control was provided to compensate for the varying losses in the line, and coupling devices and appropriate signaling means were included. A carrier-terminal set was also built for connecting the power line to the telephone central office.



Bell Laboratories test truck making transmission measurements on power-line carrier circuit just outside a rural central office

Choke coils and networks were devised for connecting in series with branch lines and transformers to reduce transmission losses. Improved coupling devices involving high-voltage condensers rather than distribution transformers were provided. These various devices were connected to a section of the distribution line near La Plata on which the earlier tests had been made so as to provide a channel suitable for carrier telephone transmission.

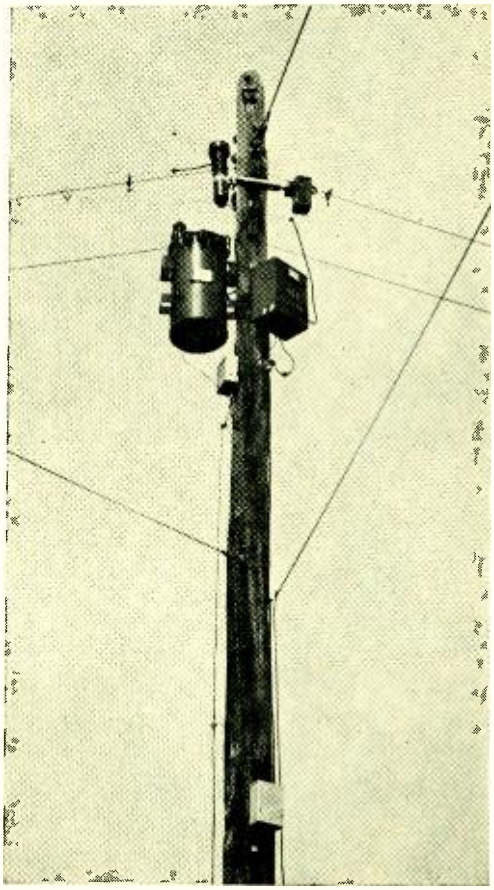


Interior of Bell Telephone Laboratories' test truck used for transmission measurements on power-line carrier channels

This modified line afforded an opportunity to make field tests of the experimental carrier telephone sets referred to above. Two subscriber sets and a terminal set for connecting the system to a dial telephone central office of The Chesapeake and Potomac Telephone Company were provided. Arrangements were made so that these two sets could be connected to a number of different coupling devices provided at various points in the system so as to simulate a multiparty system. The transmission performance was measured for communication between two of the subscribers and also from either to the central office. Measurements were made of transmission loss and noise, and the performance of the ringing and signaling system was investigated under various static and lightning conditions. Observations were also made to determine possible interference from the power-line carrier system to radio reception. These experiments indicated that further modifications in the sets were required to improve voice transmission and to reduce interference to signaling from nearby thunderstorms. Accordingly, development work was undertaken to accomplish these results and also to simplify the sets so as to reduce the amount of apparatus required and thus the cost.

The work involved has been carried forward to the point where experimental models of new sets have been constructed and tested in the laboratory both as regards transmission performance and susceptibility to lightning interference using sources of

artificial lightning. Modifications have been made in the operating methods so as to reduce the amount of equipment required both at the subscriber



Subscribers would be connected to the power line through a coupling unit consisting of condensers and a transformer installed on a cylindrical core as shown at the left near the top of the pole beneath the power-line lightning arrestors

set and in the central office. Work has also continued on reducing the cost of the coupling condenser, and models of a new design have been delivered. Further study of the models will be required to determine whether they will provide satisfactory coupling economically.

Under normal conditions the next step in the development would be to make up a number of these sets in good mechanical form suitable for installation in the field and conforming to commercial designs and protection standards. These could then be tried out over a period of months and a determination made of the reliability of the transmission, the ability of the signaling and ringing system to work through lightning and other disturbances, and the adequacy of the operating features. An evaluation could also be made of the maintenance effort required to keep the subscriber sets and central-office apparatus adjusted and in working order.

In view of the demand for engineering talent and strategic materials during the war period and of the general restrictions now in force on telephone service for the general public, it appears wise at this time to lay aside the work for the duration of the war unless it should appear that service of this type should be needed by the Armed Forces. If such problems arise, methods of meeting them will, of course, be worked out coöperatively. After the war it is expected that work will be resumed, and that further studies and trials will be begun for the purpose of evaluating the technical and economic questions which must be resolved in determining the general field of application of this system.

Alarm and Comparison Circuits for Reference Frequency Equipment

By F. R. DENNIS
Transmission Apparatus Engineering

IN DESIGNING the reference frequency equipment described in the last issue of the RECORD, every precaution has been taken to insure the constancy of the various supplies, both in frequency and level. Since these frequencies are used for standardizing purposes it was felt desirable to provide an alarm system that would give immediate indication of any appreciable deviation from the nominal frequency. This function is served by the frequency-checking bay, which may also be used for determining at what primary frequency the trouble first appears.

Two reference frequency bays are provided; and both are operated continuously. Since there is very little likelihood that any trouble would affect the frequency of both bays alike and at the same time, it is possible to use the difference in frequency between their outputs as an indication of constancy. So long as the frequencies do not differ by more than a very small amount, it may safely be assumed that each is operating at its correct value. The frequency-checking bay provides a continuous comparison of the two frequencies, and also is arranged to give both visible and audible alarms should the difference exceed a very small amount. In addition, arrangements are included to compare the frequency from either of the frequency generators with the standard frequency from the Bureau of Standards, which is sent out over Station WWV.

Each of the basic 100-kc oscillators maintains its frequency constant to within one part in ten million for long periods of time; and it was decided to have the alarm operate when the difference between the two 100-kc frequencies was as much as 2 parts in ten million. At 100 kc, however, a deviation of two parts in ten million is only 1/50 of a cycle, and it is difficult to design an alarm circuit to operate on such a small difference. It seemed preferable to raise the basic frequency to some higher value before determining the difference. Since the basic oscillators were also to be checked against the 5000-kc signal from Station WWV, it was decided to raise their frequencies to 5000 kc for comparison in the checking circuit.

A block schematic of the various circuits of the checking bay is shown on Figure 1. These circuits are all on bay 2. Bays 1 and 3 are the reference-frequency bays. A tap from the 100-kc supply of each reference-frequency bay is brought to a 100-kc to 5000-kc frequency converter. Leads from the converters, as well as those from the antenna used for picking up the signal from WWV, are brought to a switch that permits any two of these 5000-kc sources to be connected to what are essentially two radio receivers supplied by common heterodyne and beat-frequency oscillators. The heter-

odyne oscillator is at 4,535 kc, and the modulation of this frequency with the 5000-kc input gives an intermediate frequency of 465 kc. This frequency, modulated with the output of the 464-kc beat-frequency oscillator, results in an audio output of 1 kc from each receiver. Since the same oscillators supply both receivers, the difference between the two output frequencies will vary only with variations in the two input frequencies; variations in the modulating frequencies will not affect it. These two 1000-cycle frequencies are carried to the indicator panel, where the difference is indicated, and gives an alarm if it exceeds a given amount.

This alarm and indicating circuit is shown schematically in Figure 2. The 1000-cycle outputs from the two receivers connect to the corners of a resistance bridge, which with the following vacuum tube acts somewhat as a modulator, and the usual sum and difference frequencies appear in the output circuit. A d-c meter in this output circuit will not respond to the sum of the frequencies or to any of the higher frequency products, but it will respond to the difference frequency: it will swing back and forth at the rate of the difference frequency. If the two 100-kc frequencies differ by 1/50 of a cycle, the two 5000-kc frequencies will differ by 1 cycle, and at the outputs of the two radio receivers, the two 1000-cycle frequencies will also differ by 1 cycle. Under these conditions, the meter pointer swings back and forth once each second, thus giving a direct indication of the difference in frequency between the two basic oscillators.

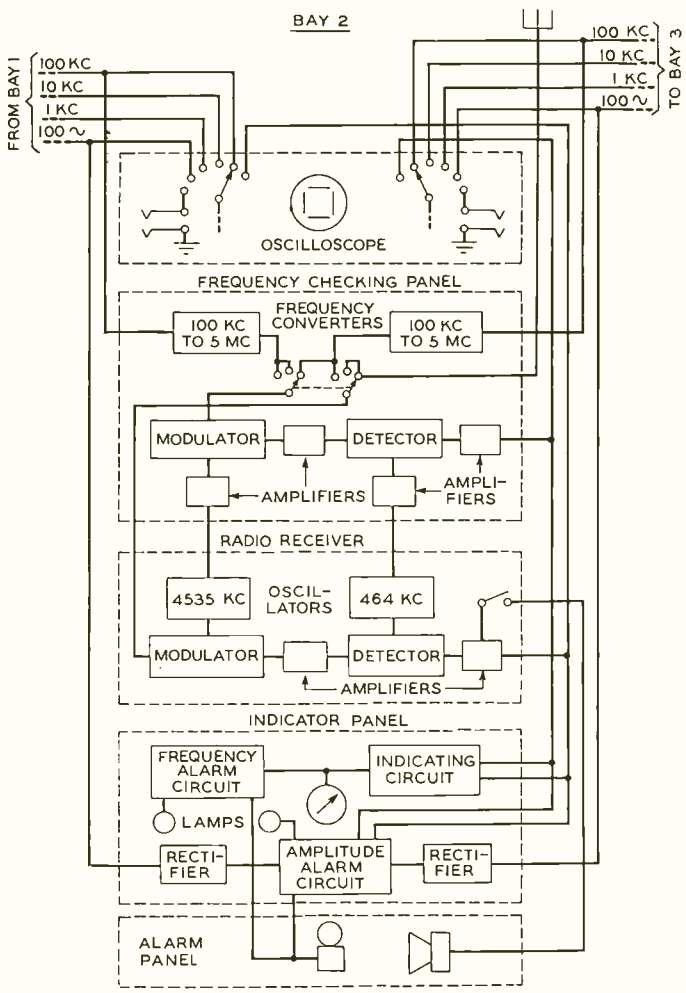


Fig. 1—Block schematic of circuits of checking bay—bay 2 in the actual line-up

In addition to the meter, the control electrode of a cold-cathode gas-filled tube is connected to each plate circuit of V7. At some point in the difference-

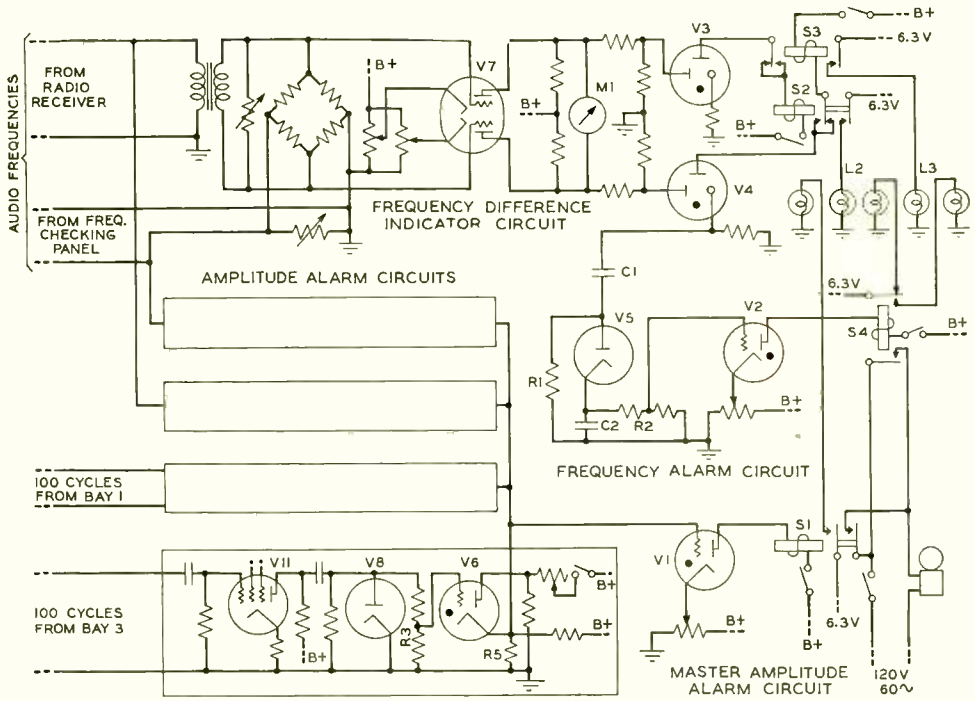


Fig. 2—Alarm and comparison circuit

frequency cycle, depending on the adjustments of the circuit, each tube will become conducting because of the voltage on its control anode, and will pass current to an associated relay. One tube flashes just ½ cycle of the difference frequency after the other. The flashing of V3, for example, will operate relay S2 through a back contact of relay S3, and the operation of S2 lights lamp L2. When V4 flashes ½ cycle later, the operation of S3 through the front contact of S2 will light L3. When S3 operates, it momentarily opens the circuit of S2, and since the control voltage of V3 is below the flash point at this time, S2 will release, extinguishing L2. The release of S2 momentarily opens the circuit of S3, but since the control voltage of V4 is above the flash point, S3 will not release. Lamps L2 and L3 thus alternately flash at the rate of the difference frequency, and give a continuous visual indication of the frequency difference.

To provide an alarm when the difference exceeds a certain amount, a connection is taken from the cathode circuit of V4 to a small condenser C1. The other side of this condenser is connected to ground through a high resistance R1, and also through a rectifier. The charging current of C1 passes through the rectifier to a much larger condenser C2. Since the rectifier passes current in one direction only, C2 cannot discharge through it, and must discharge through the high resistance R2. A tap from this resistance is carried to the control anode of the gas-filled tube V2. When the discharge current of C2 reaches a predetermined value, the voltage on the control grid will be high enough to cause V2 to become conducting, thus

passing current to relay S4, which sounds an alarm and lights a lamp. The voltage on the control grid of V2 depends on the rate at which C2 discharges, and this, in turn, depends on the rate at which it charges. This latter rate is proportional to the charge on C1 times the rate, or number of times a second at which it is charged. Since C1 charges once for each cycle of the difference frequency, the voltage on the control grid of V2 is proportional to the difference frequency, and the circuit may be adjusted to operate the alarm at any desired difference frequency.

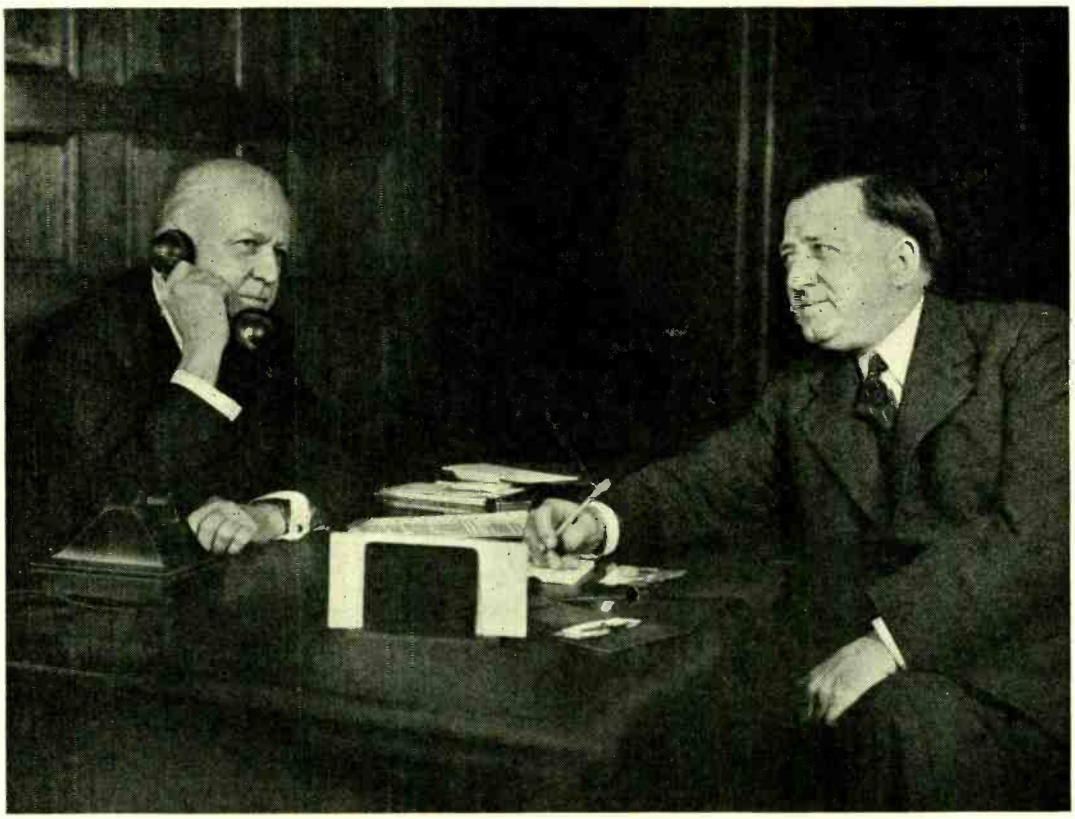
An alarm is also sounded and a lamp lighted when the output level of any of the frequency outputs falls below safe values. Such a reduction in level of the 100-kc, or of the 100-cycle frequency of either of the reference-frequency bays, will cause sufficient potential to appear on the control grid of tube V1 to cause current to pass and operate relay S1. This rings the bell and lights an alarm lamp as does the operation of relay S4. The use of the 100-cycle frequency gives an overall check on the system.

The amplitude alarm circuits associated with the four frequency supplies are essentially alike. Only that for the 100-cycle frequency from bay 3 is shown in Figure 2. The input, after being brought to a suitable level, is impressed across the diode V8, which passes only the positive half cycles. The negative half cycles, flowing through resistance R3, bias the grid of tube V6 sufficiently so that no current flows. Should the input level drop sufficiently, however, the negative bias on V6 will be reduced enough to permit current to flow. This current, flowing to ground through R5, provides a positive bias for the grid of V1, which passes current and operates the alarm. For all four amplitude alarm circuits the tubes corresponding to V6 are grounded through R5, and the operation of any one or more of them will give an alarm.

Besides alarm and comparison circuits, the checking bay also carries the cathode-ray oscilloscope for comparing frequencies. It can be used for comparing the two 1000-cycle outputs from the radio receivers, or any of the four reference frequencies from bays 1 and 3. Jacks permit comparison, also, of frequencies from outside sources. Through these various provisions, the accuracy of the basic sources is under constant supervision; and any significant abnormality sounds an alarm.

F. R. DENNIS received the B.S. degree in Electrical Engineering from the State College of Washington in 1929 and joined the Apparatus Development Department of the Laboratories in September of that year. He was engaged in the development of radio frequency attenuators and attenuation measuring circuits until 1936 when he transferred to the group designing vacuum tube operated measuring apparatus where he specialized in the design of self-tuned detectors for automatic recording measuring systems. More recently he designed the equipment described here. For the past year he has been engaged in war work.

NEWS AND PICTURES OF THE MONTH



Walter S. Gifford, President of the American Telephone and Telegraph Company, officially opens the new Transcontinental Cable between New York and San Francisco. Frank P. Lawrence, Vice-President in charge of the Long Lines Department, also participated in the opening

THE new $25,000,000 transcontinental cable of the Bell System, completed after two years of steady construction work across the plains and mountains of the West, was officially opened for service on December 21 when President Walter S. Gifford of A T & T, in New York, talked to President N. R. Powley of The Pacific Telephone and Telegraph Company in San Francisco.

Mr. Gifford told Mr. Powley he was particularly glad to hear his voice, "because it is coming to me over a line which we decided to build three years ago against the possibility of war with Japan. Because of that decision, you and I at this moment have the privilege of opening to regular service the new Transcontinental Cable of the Bell System. Now, for the first time in history, a telephone conversation can be carried all the way from coast to coast over a telephone cable, instead of going part of the way over open wires." The new line runs underground

for 1,600 miles from Omaha, Neb., to Sacramento, Cal., connecting at these points with existing cable networks of the East and Pacific Coast. For most of its length the twin cables used were buried in the soil by giant tractor-drawn plow trains which dug the furrow, laid the cables and covered them with earth in a continuous operation.

The new line is arranged for "K" carrier operation, providing twelve speech channels over each two pairs of wires. That is why twin cables are used—one for each direction of transmission, to prevent crosstalk.

Because of the urgency of the job, the plow trains worked many nights under floodlights to further their daytime progress. Construction began in the late autumn of 1940, when crews of A T & T began pushing west from Omaha. Later, Pacific Company construction forces started east from Sacramento. The terrain crossed included farm lands, swamps, desert sands, the rocky declivities of mountain passes and the salt plains of Utah. In some parts of the route through the mountains it was necessary to blast a trench in the rock for the cables. Also, steep grades were encountered in many sections of the route where roads had to be built to provide a footing for the heavy cable-laying trains.

The Transcontinental Cable represents a job well done—an accomplishment in which telephone people everywhere can take pride. As Mr. Gifford said in concluding the opening ceremony, "May it speed our victory and serve us well in the peace to which we confidently look forward."

Long Lines and Pacific Company men work together on a splice for the transcontinental cable at the Nevada-Utah line

"Information Operator, Please"

Mounting costs resulting from the increasing volume of Information traffic, which has doubled for the New York Telephone Company in the past twelve years, with a rise of 13 per cent in 1941 over 1940, prompted a broad scale study by that Company to determine *who* calls "Information" and *why*.

This recently completed survey revealed that public telephone users make one-fourth of all Information calls; that women use the service twice as much as men; that only 40 per cent of residence users keep directories near their telephone; and that 12 per cent of business users call Information habitually.

Acting on these findings and confronted with the fact that facilities cannot be enlarged in wartime, the New York company began an attack-at-the-source campaign to reduce Information calls in New York City. A series of newspaper advertisements, one of which appeared in the Record for January, a special bill insert, window displays and posters, made a strong bid for customer coöperation in not calling Information unnecessarily. Two sizes of personal number books, one of purse-size especially designed for women, are offered free, and customers are encouraged to write down numbers obtained from Information to avoid recalls.

A two-phase attack on the problem is being made—one of general education and the other of specific action to correct conditions disclosed by the survey. Thus, steps are being taken to enlist the coöperation of PBX attendants; to have Information operators suggest writing down those numbers most frequently requested; and

to provide more and better directory facilities at public telephone locations.

The first advertisement appeared November 2, and an insert went to New York City customers with November bills.

The daily average of calls to Information in New York City for four weeks in December was reduced nearly 30,000 over the corresponding period last year, and in the fourth week of December, with a rise in overall traffic of 2.6 per cent compared with a year ago, Information calls decreased 8.4 per cent.

This campaign by the New York company for Information control is administered by a steering committee from Commercial, Traffic, Directory and Public Relations, with a working committee devoting virtually full time to this job.

Telephone Pioneers

During the fourth quarter of 1942 the following members of the Laboratories have been enrolled as members of the Telephone Pioneers of America:

L. H. Allen
Joseph Bell
S. J. Brymer
J. F. Busch
S. I. Cory
Philip Curran
L. W. Drenkard
H. F. Gartner
Harry Gessner
R. D. Gibson
A. C. Goebel
C. A. Grant
A. F. Grenell
H. A. Hay
Fay Hoffman
W. H. T. Holden
A. O. Jehle
Howard Kreft
A. G. Laird
B. F. Lewis
W. E. Marousek
J. S. McDonough
B. A. Nelsen
T. N. Pope
W. T. Pritchard
L. C. Roberts
H. W. Wightman
L. F. Wright

A. F. Dixon, Dairyman

Nearly two years have passed since A. F. Dixon retired from his responsibilities as Director of Systems Development of the Laboratories. When writing to Dr. Buckley recently he said:

"As men of the Laboratories reach the afternoon of life, many wonder just what the journey into and through the unknown land of retirement will be like.

"To me it has been a pleasure, a really great pleasure filled with new experiences and opportunities to learn new things. Yes, I have retired, but I am not resting or rusting. May I convince you of this by enumerating some of my obligations and pleasures:

Operator of a 400-acre dairy farm with 70 head of cattle.
Chairman of the Township Committee.
Director and member of Executive Committee of the New Jersey State Farm Bureau.
Director of the Sussex County Milk Producers' Association.
Director of the County Board of Agriculture.
Director of the Newton Rotary Club.
Chairman of Sussex County Farm Labor Committee.
Chief Registrar for Selective Service for this district.
Crop reporter for United States Department of Agriculture.
Member of numerous committees of above organizations.

"Recently, Mrs. Dixon and I spent a week in Chicago where I was sent as a delegate from the State of New Jersey to the National Convention of the American Farm Bureau Federation. I have been to a lot of conventions but never attended one where they worked as hard as they did here. It was an eye-opener to me and much enjoyed."

The Western Electric Microphone held in the soldier's right hand is widely used not only in field intercommunicating systems but also for radio communication between aircraft, tanks and their ground stations. There is a push-to-talk switch in the handle

LIEUTENANT LAURENCE G. FITZSIMMONS

AVIATION CADET HERMAN E. MANKE

Lieut. Laurence G. FitzSimmons

"YOUR DECEMBER COPY arrived just before Christmas. That first page of the RECORD is certainly a grim reminder of what is happening in this war. I like it. Tell the gang back at the Labs that it is their work that helps us, out here, to fight and win. Without their help we would be sunk in short order. Don't let the Labs forget for one moment that we are fighting a war of survival.

"My ship is engaged in patrol and convoy work. Beyond that, there is little that I can tell you. I do know that it's a grand feeling when we have that last ship safely inside of the submarine nets. Then we feel that thrill of doing a job successfully. It's a tingle up and down the spine."

Major William W. Sturdy

"I AM BACK in Washington with the Chief Signal Officer devoting my time to coördinating the equipment requirements of Signal Corps Schools and Replacement Training Centers. I enjoyed the course at the Command and General Staff School in spite of the pressure of duties."

Aviation Cadet Herman E. Manke

"I AM HERE at Cal-Aero Flight Academy, Ontario, California. The rooms and quarters are fine. We get good food and all of the cadets are in good health, are treated as officers and live on cadet honor.

"I like flying more than eating. You haven't enjoyed flying until you're all alone in an airplane. I passed my 40-hour check ride with the Flight Commander and now have 20 hours dual and 22 hours solo time.

"Usually we have three hours of ground school and one hour of athletics. Our studies cover engines, theory of flight, air navigation, weather reports and aircraft identification."

Gerard F. Hall

IN A LETTER to W. J. FULLERTON of the Radio Development Department at Whippany, MR. HALL wrote from Camp Maxey, Texas, saying in part:

"Before I arrived here, I spent a week at my west coast seashore resort, Fort MacArthur, where, just to be sociable I took my uniform and ten-pound shoes and two injec-

Grace Wagner, the first young woman of the Laboratories to be sworn in as one of the WAVES, is in training at the University of Wisconsin, Madison

Walter G. Stroehmer, formerly one of the Western Electric installers assigned to the Laboratories, at Christmas visited his friends here. He is pictured with G. H. Lyons, Western Electric foreman in charge of the group. Mr. Stroehmer was inducted last March, entered a Signal Corps Officers' Training School in October, and now wears the gold bars of a second lieutenant. He will be stationed at Patterson Field, Ohio

tions with my guests. Friday night I decided to see how my ranch was making out so we took a Pullman and a dining car and set out for Paris. Arriving here at 2:00 P.M. our chauffeur met us. Also the Captain. I call him the foreman. I found things in bad shape. Mud on the ground, officers all around the place. No heat in my bunk house. Naturally I complained. You should see the place now! It hasn't changed a bit.

"Honestly, Bill, this Army life is swell. We get up at 6:30 A.M., clean up, have breakfast, and walk around 'til 9:00 A.M., at which time we wake up. Today the Captain actually came up to me and checked on my civilian occupation. Then it happened. Ten minutes later I was working under a supply sergeant as the first expediter in Camp Maxey. I'm doing the exact same thing as I was back at the Labs. No cracks please. It's practically the same only in larger quantities."

Joseph F. Daly

(Mr. Daly is Technical Sergeant of a Signal Reporting Company, Army Air Forces.)

"CONGRATULATIONS! It is an honor to receive the Army-Navy Production Award. I only wish I could congratulate the Laboratories' personnel individually. It makes me feel very proud to know our company flies the 'E.'

"We aren't confronted with the coal problem on this South Seas Island but we worry about how to keep cool. Besides the cooling problem, we have insects. Now there is a situation! The mosquitoes and ants are panzer and air force outfits. Even through our mosquito bars, we are dive bombed and flanked. Hence a night's sleep consists of a strong defensive until exhaustion sets in. When we arise in the morning, our bodies look like a siege of the mumps. Oh, well! it's all in a day's work on the island where romance still lives. Some romance, if you ask me!"

Lieut. Col. Malcolm A. Specht

"RECENTLY the War Department promoted me to the rank of Lieutenant Colonel. Needless to say I am elated over this promotion and hasten to share the good news with my friends at the Labs.

"The award of the Army-Navy 'E' to the Labs is also a source of pride for me. I knew, of course, that the Labs' contribution to the war effort was always considerable. Now I have an idea that if I only knew its full extent, I would be even more proud and heartened.

"My assignment to the Gunnery Department of the School at Fort Sill has not changed since my last writing. To vary the routine (which, however, is never tiresome), I have recently been technical adviser to a civilian writer from Hollywood whom the government has asked to do

Lieut. Daniel F. Hoth is now in the Signal Corps and is engaged in development work at Arlington, Va.

the spade work on several training films on Field Artillery subjects. This has been a pleasant interlude but I hope that my part does not draw such favorable attention that my services are requested for more work of this nature or for adviser to the director of the project. I will be content to continue my teaching work until such time as the Commandant sees fit to make me 'available' for other assignments. Usually he does this at the end of a year at the School. My year is up in March.

"Last week I was privileged to witness a demonstration of massing fires in which 96 guns and howitzers participated. Such concentration of artillery is rarely seen off the battlefied and then, of course, not from the vantage point which we occupied close to the impact area. So unusual was the demonstration that many distinguished visitors, including Lt. Gen. McNair, Chief of the Army Ground Forces, attended."

Major Albert G. Kobylarz

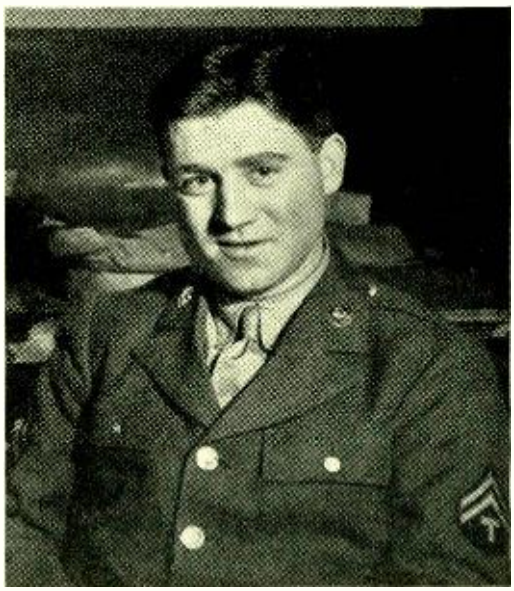
"AT PRESENT I am assigned to the Signal Section, Air Service Command, at Patterson Field, Ohio, where I am Officer in Charge of the Ground . . . Branch. Our function consists of the installation and maintenance of aircraft warning systems. The position calls for considerable travel all over the United States and it is certainly pleasant to meet the many Bell System employees now in service in every section of the country. Whether in California, Maine, or Florida, they're there, and never hesitate to make one's stay more enjoyable."

Major Charles H. Greenall

"I AM STILL STATIONED at Frankford Arsenal here in Philadelphia where I am now officer in charge of the Laboratory Division. Our work, as the name indicates, is chiefly development and research for the Ordnance Department as well as general laboratory work for the Arsenal such as inspection, testing, shop problems, etc."

Lieut. James E. Zendt

"I AM A FIRST LIEUTENANT assigned to the Signal Corps and have been carrying out the duties of Registrar at the Signal



Corp. Ambrose Vallely is now attending the Wire School of the Signal Corps at Fort Monmouth where he is specializing on repeaters. He reported to Camp Dix on October 9 and then spent five weeks at Camp Edison, Sea Girt, where he received his basic training in the infantry before going to Fort Monmouth

Corps . . . School at Camp Murphy, Florida, since last May. All the students who enter the School to study the maintenance or operation of the equipment are processed by my group. This involves the giving of placement and intelligence tests, the maintaining of all the basic records of the School as far as the students are concerned, and the clearing of students out of the School to tactical assignments upon completion of their courses of instruction. We have been extremely busy as we have built up the enrollments of the School from practically nothing in May to more than full capacity by the first of December while still continuing to graduate increasingly large groups every week. There are a number of Officers on our Staff and Faculty who were trained by the Bell Laboratories last spring and praise the instruction received."

FROM ONE NAVAL RESERVIST TO ANOTHER
Lieutenant Charles A. Hebert, U.S.N.R., en route from training at the Navy Sound School to his new station aboard a destroyer tender, came into Equipment Development to exchange greetings with his former associates. Pictured with him is Ralph H. Miller, a Lieutenant Commander in the Naval Reserve, who has an assignment as liaison between the Navy and certain departments of the Laboratories

Emmett Noe

"I HAVE finished three months' training in the Fire Control School of the Navy here at Newport and have another month to go before graduation and sea duty. The training comprises the entire system of directing and controlling the operation of the offensive weapons of a vessel and includes materials, personnel, methods, communication systems and organization."

Charles M. Voss

THE THINGS THAT CHARLES M. VOSS enjoys most about the Army Air Corps are his work as Base Inspector of radio transmitters and receivers, many of them of Western Electric manufacture, and all the coffee, butter and sugar he wants in the Mess Hall at Bowman Field, Kentucky. Charlie also enjoys a furlough long enough to allow him to return to the Laboratories to visit his old pals in the Research Drafting Department.

Frank Fleischer

DURING a recent visit to the Laboratories MIDSHIPMAN FRANK FLEISCHER, of the U. S. Merchant Marine, had much to tell his friends about his seven-month trip to Archangel and his stopover in Glasgow. He found Russia not so interesting as Scotland, where on a sightseeing trip he went rowing on Loch Lomond. Frank was formerly in the Power Plant and he is known to many because, as a power service maintenance hand, he changed lamps and fuses throughout the building.

Carl E. Stone

CARL E. STONE, First Class Signalman, has been assigned to teaching embryo signal-

TO THE MEN IN SERVICE

We would appreciate in your letters to us any information or experiences you may have on the use of Western Electric apparatus for war purposes, providing, of course, that such information does not violate censorship regulations.

men at the Fort Hancock Navy Signal Station. Mr. Stone was in Newfoundland on the day war was declared and since then he has seen active service on escort duty in the North Atlantic and the Caribbean. His new assignment allows him to visit his friends in the Paint Shop and the chemical group more often.

Sergeant William T. Quinn

"I AM AN AERIAL GUNNER on a B17 (Flying Fortress) at an Army Air Base in California. I don't think there is another job in this Army with more thrills. I wouldn't want to do another thing but be a gunner. I travel about quite a bit which makes my experience even more interesting."

* * * * *

AVIATION CADET RALPH D. HORNE, JR., is now with the Army Air Force Flight Training Detachment at Phoenix, Arizona.

G. A. SCHIEHSER, Infantry Sergeant, who made a Christmas call on his friends in the Complaint Bureau of the Quality Assurance Department, is still stationed at Fort Benning, Georgia.

FREDERICK J. HURT has been commissioned a Second Lieutenant in the Signal Corps. He is now at the Army Electronics Training Center, Harvard University.

CORPORAL JOHN NICHOL from Camp Livingston, Louisiana, writes: "I am with the Medical Corps and like the work very much as it is quite interesting. Only, like many others, I am wishing for the day it'll all be over so that I can return to the Labs."

LIEUT. VINCENT M. MESERVE, U.S.N.R., returned to the Laboratories during the Christmas holidays to visit his friends and former associates. Lieut. Meserve has been at Cornell University. He has orders to proceed to Harvard University for further study.

PETER F. MCGANN is with the Engineers at Fort Kearney, Rhode Island.

ROBERT A. DRYDEN is a Technical Corporal in a Signal Service Regiment at Fort Monmouth where he is in the Radio School.

LIEUT. WILLIAM J. FLAVIN of the Air Corps visited the Laboratories during the holidays to wish a Happy New Year to his many friends, particularly those in the Systems Drafting Department. "Bill" is now a flight instructor in the Army Air Corps at Stewart Field, West Point.

PERSONAL LEAVES OF ABSENCE have been granted to the following:

JOHN M. ACKER and CHARLES H. PRESCOTT, to accept positions with the National Defense Research Committee;

MEMBERS OF THE LABORATORIES GRANTED LEAVES OF ABSENCE TO ENTER THE ARMED FORCES SINCE THE LAST ISSUE OF THE RECORD

UNITED STATES ARMY

George G. Bailey
Leon Blackman
Robert H. Canton
George A. Carlson
Howard W. Creuziger
Robert W. Dawson
Herbert C. DeValve
Robert T. Duffey
Thomas Fox
Thomas Fratello
John E. Galbraith
Andrew J. Hannan
Peter V. Lodato
John J. McCallion
Robert I. Nolan
Thomas J. O'Neill
William T. Reck
Joseph J. Rosato
Edwin J. Schnabel
Frank G. Scudner
William Von Glahn
Roger W. Walter
G. Warren Wheeler
George J. Wolters

UNITED STATES NAVY

Thomas E. Bailey
Howard C. Bell
John R. Boyle
Joseph A. Ceonzo
William H. Christoffers
Donald F. Cuneo
Miss Frances Elstein
Sigmund Fronczak
Robert H. Funck
Helmut J. Geisler
David F. Greenhagen
Robert A. Hauslen
Alfred W. Johnson
Richard H. Koehn
Charles R. Leutz
Henry S. Loeber
Donald W. Mack
John F. Martin
Robert D. Nostrand
Thomas M. Pepe
Warren M. Prall
Benjamin P. Ransom
Willard A. Reenstra
John M. Reuter
Arthur W. Schmidt
Fred J. Schwetje
Cedric W. Sheppard
Robert C. Shopland
Carl E. Smedberg
Gilbert J. Stiles
James C. Stuhlman
John A. Whitaker

CALVIN S. FULLER and RUSSELL H. LINDSAY, U. S. Government work in civilian capacity;

JOHN H. DEWITT, Radio and Electronics Division, Office of Chief Signal Officer, Washington;

WILLIAM C. BROSSOK, HAROLD H. HOFFMAN, EDWARD W. KARPEN, HANS W. MENZEL and CHARLES R. STORIN, Signal Corps Training School; and

JOSEPH V. DAVIS, cadet, U. S. Merchant Marine.

NEWS NOTES

F. B. JEWETT spoke on *The Mobilization of American Scientists for War* at the annual meeting of the New York Academy of Sciences.

O. E. BUCKLEY has been appointed a member of the Advisory Committee of Physicists under the Professional and Technical Employment and Training Division of the War Manpower Commission. He attended a meeting of the Committee held in Washington on December 10.

Dr. Buckley also addressed the Patent Department luncheon at the Hotel McAlpin on December 23.

R. M. BURNS visited Worcester and talked to the American Society for Metals on *Corrosion Protection by Metal Surface Treatment.*

K. G. COMPTON visited the Western Electric Company at Hawthorne and the Dow-Chemical Company at Midland, Mich., on matters relating to finish and corrosion studies.

JOHN L. BARNES, a "duration" member of Mathematical Research, is a joint author of *Transients in Linear Systems, Volume* 1, which has just been published by John Wiley and Sons. It is a text based on Dr. Barnes' teaching experience at Tufts, from which he is now on leave of absence.

D. H. GLEASON and R. NORDENSWAN visited the Haydon Manufacturing Co., Forestville, Conn., in regard to timer motors.

"THE TELEPHONE HOUR"

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

FEBRUARY 8, 1943

Overture to The Secret of Susanna — *Wolf-Ferrari*
Orchestra

Slavonic Dance—E Minor — *Dvořák-Kreisler*

Spanish Dance from
La Vida Breve — *de Falla-Kreisler*
Jascha Heifetz

Excerpt from Romeo and Juliet
Fantasy — *Tschaikowsky*
Orchestra

Introduction and Rondo Capriccioso — *Saint-Saëns*
Jascha Heifetz and Orchestra

FEBRUARY 15, 1943

Yours Is My Heart Alone — *Lehár*
Charles Kullman

The Old Gray Mare — *Traditional*
Orchestra

Júrame — *Grever*

Il Est Doux, Il Est Bon from
"Hérodiade" — *Massenet*
Grace Moore

E Lucevan le Stelle from "Tosca" — *Puccini*
Charles Kullman

Paladin from "The Masquerade" — *Laurens*
Orchestra

Will You Remember from "Maytime" — *Romberg*
Grace Moore and Charles Kullman

FEBRUARY 22, 1943

Begin the Beguine — *Porter*
James Melton and Orchestra

American in Paris — *Gershwin*
Orchestra

Ballad for Americans — *Robinson*
James Melton, Chorus and Orchestra

MARCH 1, 1943

Rosenkavalier Waltzes — *Strauss, R.*
Orchestra

Group of Piano Solos
Josef Hofmann

Concerto No. 4 in D Minor—
Last Movement — *Rubinstein*
Josef Hofmann and Orchestra

MARCH 8, 1943

Furiant from "The Bartered Bride" — *Smetana*
Orchestra

None But the Lonely Heart — *Tschaikowsky*
Lawrence Tibbett

Frankie and Johnny — *Traditional*
Orchestra

In the Gloaming — *Harrison*
Lawrence Tibbett and Chorus

Finale from "Mlada" — *Borodin*
Orchestra

Johnny the One — *Sacco*
Lawrence Tibbett and Chorus

Chosen by Lot

THIS MONTH the RECORD presents the following biographies of members of the Laboratories chosen by lot.

* * * * *

FRED KAUSCH, draftsman at the Whippany Laboratories, humorist by nature and father of an infant child, is quite happy about it all. His north window location may

FRED W. KAUSCH

be due to his early arrival there, for he can remember when the telephone operator was able to call any man in the room by coded ring. He came to Whippany directly from a Fort Hancock assignment 'way before Pearl Harbor. The stepped-up program had already begun, and Freddie was—and is—right in the middle of it.

Entering the Laboratories' employ about eight years ago, Mr. Kausch immediately took up drafting. His time was partly used on general apparatus design and partly on commercial products. Telephone booths, loud-ringing telephone bells for special locations, and radio broadcast equipment were some of the things that came within his purview. At present he is engaged in war work.

With his wife and daughter, Fred has now resided at Basking Ridge, N. J., for nearly a year, having moved there from Jersey City. A very busy life leaves almost no time for his piano, which he loves to play; nor for photography. Noon baseball has naturally followed his many athletic achievements of the past: he was Atlantic Coast canoe sailing champion, winner of B-League table tennis tournament at West Street and a "Y" swimmer of some note. More than ten per cent of his salary goes for War Bonds, and he has repeatedly donated blood to the Red Cross blood bank.

* * * * *

STAMPING DRAWINGS, ordering prints and distributing them are among HELEN FINLEY's duties in the 9B file room at West Street. Immediately after graduation from St. Peter's High School, Staten Island, in 1939, she came to work at the Laboratories, starting as a messenger. Her uncle, George Ryan, is a cabinet maker at West Street.

Mrs. Finley, a six months' bride, visits her husband, a Staff Sergeant in the Military Police at Hackettstown, every week-end. Her favorite pastime being dancing, she does quite a bit of it with her husband.

MRS. HELEN R. FINLEY

JIM MCGOVERN, as befits a guardian of the Laboratories, takes a serious view of all the passes which members of the organization must show him before being admitted. But the three rays of sunshine in his home—Elaine, nine; Jimmy, four; and Mary Jane, one year old—can easily charm a good Irish smile out of their dad.

A real son of the Old Sod, Jim came to this country when he was 24. After several years as a baggage handler at Grand Central, he entered the Laboratories as a night cleaner in 1925. From 1929 to 1933 he was employed in Providence. Returning, he became a night watchman, and now to his pride he wears the blue-gray of a uniformed watchman.

The McGoverns live in eastern Bronx where Young Jim occasionally gives his father a chance at his favorite sport of baseball.

* * * * *

BY THE END of 1942 approximately 17 billion feet of telephone wire had been placed by the Bell System in equipping some 2,500 military and other government war establishments requiring new or greatly enlarged facilities. This does not include a large number of privately owned war-manufacturing plants similarly served.

IN SAVING critical materials needed for war purposes the Bell Telephone System has cut its use of aluminum from 1,000 to 70 tons annually; zinc from 7,500 to 1,000 tons; rubber from 1,900 to 200 long tons; tin from 980 to 130 long tons.

UNDER THE CAPTION *Some Fundamentals of Sound*, a comprehensive chart, the important numerical values in acoustics has been published in connection with the January issue of "Electronic Industries." Along a circular arc at the left of the chart are plotted sound intensities from "Threshold of Hearing" to "12-inch cannon." At the right is a combination of the charts showing pitch of musical instruments, characteristics of the ear, and frequencies of notes on the musical scale. Below are basic formulas and constants. Acknowledgment is made to the Laboratories for coöperation.

A few extra copies are available on application to the Library.

K. K. DARROW attended a meeting of the American Physical Society at Chicago, on November 27 and 28, in his official capacity as secretary of the society.

JAMES MCGOVERN

H. R. CLARKE, K. E. HAMMER and F. E. ENGELKE visited Camp Cole in connection with government work.

R. E. POLK and C. L. KRUMREICH were at Hawthorne recently in connection with headset problems.

G. G. MULLER visited Newport News on government work.

L. J. COBB and C. E. MITCHELL were at Camden recently conducting tests.

F. E. ENGELKE and W. S. ENO were at Hawthorne recently to discuss instrument manufacturing problems.

C. A. WEBBER, at the Point Breeze plant of the Western Electric Company, discussed cables, and W. V. THOMPSON, cord development work.

H. H. STAEBNER was at Fort Monmouth in connection with cord problems.

A. R. D'HEEDENE and R. M. C. GREENIDGE were at Hawthorne describing to its engineers the effect of manufacturing deviations on performance of crystals.

W. L. CASPER and A. W. ZIEGLER went to Hawthorne to discuss quartz crystal designs with M. H. Cook and C. A. Wickstrom.

L. S. FORD, at Philadelphia, attended a conference on cables for Army use.

Members of Bell System Companies Transferred to the Laboratories to Aid in War Effort—Dec. 1, 1941, to Nov. 30, 1942

A. T. and T.

F. J. Bednarek....1700
A. J. Bond....1900
Alice M. Boyne....2600
G. R. Brady....2100
T. J. Broder....1900

Bond

Petersen

L. J. Burton....1900
K. J. Chichester....1900
Millicent E. Clough....7010
E. A. Das....1900
J. G. Fall....1700

C. G. Hylkema....1600
L. H. Keller....1900
E. J. Lennon....3200
R. R. MacGregor....2100
R. L. Mazarella....1900

Frank McFadd....1900
A. E. Petersen....3200
J. S. Pettit....1900
J. J. Rosenberger....1700
F. M. Ryan....2400

Crowell

Moore

H. J. Sheridan....1900
W. J. Steiner, Jr.....2100
A. W. Sylvan....1700

Bell of Pa.

C. R. Blazier, Jr.....1400
J. H. Cover....3200
H. E. Crowell....3500
M. T Cruikshank....2200
E. J. Quinn....3200

W. J. Rutter....2200
L. F. Sander....3200
J. W. Schneider....2200

* * *

S. E. Hardaway

Nickla

Illinois Bell

E. E. Crump....1700
M. G. Currier....1700
S. E. Hardaway....1700
W. E. Kuehl....2200
R. V. Lohmiller....1700

C. A. McJohnston....2100
R. F. Nickla....3200
W. H. Perry....1700
R. E. Prescott....2400
R. C. Romayne....3200

H. W. Soderstom*....1400
R. K. Thompson, Jr.....2400
H. B. Westman....2100

New Jersey Bell

J. W. Jones....3200
G. W. Lees, Jr.....7500
J. H. Moore....3400
F. J. Scaccia....7400
W. F. Scott....3200

Ohio Bell

C. J. Cancik....3200
G. G. Clark....3600
J. H. Hershey....1700
F. H. Knapp....2500
Wilfred Leemon....1700

O. W. Prasuhn....6000

Southwestern Bell

F. R. Arnoldy....2400
Byron McDermott....3400
W. C. Plumb....1700
W. H. Sipple....2100
R. S. Skinner....3200

Clark

Plumb

Michigan Bell

H. H. DeBoer....3200
G. A. Giddings....2100
M. L. Hensel....1700
L. J. LaBrie....1700
W. F. Luginbill....3200

D. H. Shell....1700
D. O. Slater, Jr.....3400
R. E. Smith....2500
J. A. Weller....3400

Giddings

H. Z. Hardaway

Southern Bell

R. W. Gillespie....2400
H. Z. Hardaway....1700
J. A. Miller....1400

Atwood

Leighton

Southern New England

R. C. Bradford....2200
John Leighton....1700
F. E. Wollensack....1700

New England Tel. and Tel.

P. G. Atwood....7400
A. E. Whitcomb....1600

Southern California

R. W. Grigg....3400

Chesapeake and Potomac

J. R. Harris....1700

Holmes Electric

C. L. Loudon....3400

*On Military Leave of Absence.

* * *

1100 Physical Research (H. Fletcher)
1400 Electronics Research (J. R. Wilson)
1600 Radio Research (R. Bown)
1700 Commercial Products (O. M. Glunt)
1900 Research Staff (H. R. Jeffcoatt)
2100 Transmission Apparatus (W. Fondiller)
2200 Switching Apparatus (H. A. Frederick)
2400 Station Apparatus (W. H. Martin)
2500 Quality Assurance (G. D. Edwards)
2600 Apparatus Staff (H. S. Sheppard)
3200 Equipment Development (H. H. Lowry)
3400 Transmission Engineering (R. G. McCurdy)
3500 Transmission Development (D. A. Quarles)
3600 Systems Administration (M. Sultzer)*
6000 Personnel (G. B. Thomas)
7010 Commercial Engineer (H. S. Sheppard)
7400 Commercial Relations (B. B. Webb)
7500 Plant (S. H. Willard)

EDWARD C. TAYLOR

CHARLES R. BARNEY

FRANK FRASCA

RETIREMENTS

ON THE THIRTY-FIRST of January three members of the Laboratories retired with Class A pensions in accordance with the Retirement Age Rule—CHARLES R. BARNEY with 38 years of service, FRANK FRASCA, 30 years, and EDWARD C. TAYLOR, 28 years.

After Mr. Barney received his M.E. degree from Cornell in 1904 he immediately entered the Western Electric Company. With the Engineering Department he worked in the equipment branch and then on the inspection of manufactured products. After the depression of 1907 he joined the sales organization to help dispose of overstocks by converting them into other types of apparatus or equipment. Later he served as the Hawthorne representative on matters pertaining to new and changed apparatus. In 1913 he came to New York as a member of the Advertising Department to take charge of the work on the card catalog. Because of the technical nature of the catalog and the need for close contact with the engineering activities, it was found that this work could best be done as a part of the engineering organization. When the Advertising Department was transferred to 195 Broadway, he remained at West Street where he has since continued the task of standardizing coding practices and issuing and maintaining up-to-date card catalog information on all coded apparatus which Western Electric manufactures for sale to Bell System companies and other customers.

Mr. Taylor joined the Engineering Department of the Western Electric Company in 1914 during the time when the semi-mechanical dial system, installed at central offices in Newark, was being developed. For several years he was engaged in the drafting work involved in the apparatus phases of this development. He also was concerned with the design of spiral gears and friction-roll drives for panel systems. Since then, in the drafting group of the Apparatus Development Department, he has been associated with the mechanical design of testing equipment and telephone apparatus. He has worked on apparatus used in the special laboratory for precision linear measurements.

Mr. Frasca started in 1912 as a repair machinist in the engine room of the Western Electric Company at West Street. From 1913 to 1918 he was in Newark as a mechanic on the first semi-mechanical central offices employing panel machine-switching equipment which were being installed in the Mulberry, Waverly and Market offices. Mr. Frasca then returned to the engine room where he remained until 1923 when he transferred to the tool room. Two years later he transferred to the millwright department in the Building Shop and in 1929 he became a lathe mechanic in the Development Shop. Early in 1935 he transferred to the crystal laboratory of the Commercial Products Development Department where he was engaged in cutting and grinding quartz crystals. Since 1937 he has been a lathe mechanic.

"Who's the Pretty Girl in the Telephone Ads?"

Sooner or later, everyone in the Bell System is asked "Who's the pretty girl in the telephone ads?" Her name, in case you are interested, is Carmel Fitzgerald. She is a

professional model in New York City, has posed for telephone ads and graces a poster produced by the Bell System. Miss Fitzgerald is twenty-one, stands five feet eight inches in high heels, weighs 125 pounds and has light brown hair and blue eyes. Her after-hours interest is a captain in the Medical Corps at New Orleans.

Coffee Making in Our Restaurant

Your coffee pleasure need not be rationed even though your coffee is, if you follow the Restaurant's suggestions for making good coffee while stretching it over a ration period. Before you can make a fragrant heavy-bodied brew you must buy the finest quality of freshly roasted coffee and keep it in a tightly sealed jar. Then, the Restaurant says, the rules are simple—scrupulously clean coffee-making equipment and accurate measurements of coffee and boiling water.

Coffee in the Restaurant is made in spotless glass-lined stainless steel urns, scoured daily with special cleanser to prevent rancid oils from collecting. A moist cloth filter, rather than a paper filter, is used because it makes the coffee clearer and stronger. Into this filter goes the best coffee on the market; the filter is hung in the urn and over it is poured boiling water. The water is allowed to filter through and then half of the newly made coffee is drawn off and poured through the grounds again to mix the blends in the coffee, to give it more consistency and to make it stronger. After the coffee has been allowed to settle, the filter cloth is removed and fresh piping hot coffee is ready to be served.

* * * * *

The Bell Chorus held its annual Christmas concert at Carnegie Chamber Music Hall on December 17. Following the annual carol sing in the lobby of 140 West Street on the afternoon before Christmas, the Chorus headed a group of Telephone employees who sang in the Servicemen's Lounge of Pennsylvania Station at the request of U.S.O. authorities. Three members of the Laboratories who sing in the Chorus are Hilda Muller, Edith Pappin and Miriam Pearce.

Arrangements are now being made for the Tenth Annual Spring Concert to be given during May. In preparation for this concert rehearsals are held at 140 West St. every Thursday at 6 P.M. All members of the Laboratories interested are welcome.

Mrs. Eleanor Orio pours boiling water over pulverized coffee in a glass-lined urn

Members of the Laboratories to Whom Patents Were Issued During the Month of December

H. A. Affel
H. S. Black
R. Bown
A. W. Clement
K. H. Davis
T. L. Dimond
T. L. Dowey
R. E. Graham
F. Gray
D. A. S. Hale
H. C. Harrison
R. B. Hearn
W. H. T. Holden (3)
R. G. Humphrey
T. S. Huxham
R. M. Kalb (2)
E. W. Kern
F. S. Kinkead
M. R. Kleist
G. J. Knandel
W. V. K. Large
B. F. Lewis (2)
J. B. Little
G. A. Locke
M. A. Logan
C. A. Lovell (2)
C. W. Lucek
R. F. Mallina
T. A. Marshall
W. P. Mason (2)
L. A. Meacham
A. F. Melhose
D. Mitchell
A. C. Norwine
K. W. Pfleger
W. A. Phelps
H. T. Reeve
L. C. Roberts
V. L. Ronci
A. L. Samuel
A. H. Schafer
W. C. Schmidt
A. K. Smith
W. B. Snow
R. O. Soffel
G. R. Stibitz
W. D. Stratton
R. A. Sykes
V. P. Thorp
E. Vroom
J. G. Walsh
E. C. Wente
R. O. Wise
J. G. Whytock

News Notes

At the Hawthorne plant of the Western Electric Company C. H. Sample discussed finishing and corrosion protection problems; J. E. Ranges, the design of a loading coil case for under water use; W. J. King, cable matters; C. E. Lane, the manufacture of crystals; D. D. Miller and C. W. McWilliams, some special work on selectors and relays; W. G. Laskey and A. W. Daschke, the manufacture of Western Electric meters; R. M. Moody, a quality survey of networks; and H. W. Heimbach, coin box equipment.

A. S. Windeler of Point Breeze was at Murray Hill for discussion of special coaxial cable problems.

R. H. Colley visited the Valentine Clark Corporation at St. Paul to continue studies on commercial production of northern pine crossarms. He also spent some time at the Forest Products Laboratory at Madison, Wisconsin, in conferences on veneer and plywood specifications.

R. J. Kent was in Los Angeles on the development of cable plows for Army use.

W. E. Whitworth visited Galion, Ohio, and Omaha on problems of relay performance in community dial offices. He also spent a day at Hawthorne discussing complaints on central-office equipment.

W. L. Heard, in the November issue of *Industrial Standardization*, reviews the A.S.A. Tentative Standards for radio, telephone and telegraph symbols for use on communication drawings. Mr. Heard is secretary of Committee Z32 which is responsible for this work.

W. G. Freeman visited the Long Lines office in Chicago and the Hawthorne plant of the Western Electric Company to investigate the quality of connections on cross-talk balancing units.

R. C. Koernig participated in a quality survey of reissued operators' transmitters at the Chicago distributing house of the Western Electric Company.

G. N. Queen, Laboratories' Field Engineer at Atlanta, assisted the Southern Bell Telephone and Telegraph Company in investigating reports of trouble in step-by-step switch banks in Miami.

W. F. Vieth visited Boston, Philadelphia and Cleveland on a quality survey of repaired No. 26 teletypewriters.

F. A. Korn was at Philadelphia to discuss the No. 4 toll crossbar installation.

V. T. Callahan tested engines at the Continental Motors Corporation at Muskegon, Mich.

H. M. Spicer discussed motor generator sets and associated control problems at the General Electric Company at Schenectady and Fort Wayne.

C. S. Knowlton visited Wright Field, Dayton, on power problems.

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

Bell Telephone Laboratories Employees Association

New Officers and Past President

Albert J. Stuart, President, above, and Eric Weil, Past President, upper right

David Anderson
Vice-President

Charles O. Brosch
Treasurer

Charles J. Hay
Financial Secretary

Margaret Glander
Recording Secretary

F. T. Forster observed battery tests at Philadelphia.

R. R. Gay visited the laboratories of M.I.T. at Cambridge and the General Electric Company at Lynn.

A. J. Aikens and J. L. Lindner made tests of winter atmospheric static in New Jersey.

J. F. Wentz reports that for the first time in twelve years the high frequency transmission group of the Transmission Development Department failed to have a Christmas Party in the Graybar-Varick building. The perennial party was impossible this year because of the enormous amount of work which is being done to further the war effort. In addition to immediate jobs which have called away a large percentage of people to various flying fields and the fighting forces, it was obvious when attempts were made to have at least one hour for the celebration of the Christmas Party that even the restaurants were unable to procure the necessary help to provide for a celebration. His department has, therefore, postponed its 1942 celebration until 1943, when it is hoped that the good work which is now being done will have brought to an end the unpleasantness which is now controlling every waking hour.

* * * * *

Juan R. Pagan, who joined the Laboratories last September, died on January 4. Since that time Mr. Pagan had been a night cleaner in the building service group of the Plant Department.

Peter Schmidt, formerly a building trades mechanic in the Plant Department who was retired in 1934 after twenty years of service, died on December 29.

James R. Thorpe, who retired with a disability pension last September after fifteen years of service, died on January 17.

* * * * *

At the Hawthorne Plant of the Western Electric Company W. Fondiller discussed plans for the introduction of improved designs of condensers, resistors, and quartz crystal components.

E. C. Molina, guest of honor at a luncheon, sits between Dr. Jewett and R. I. Wilkinson, toastmaster. Referring to his forty-four years in the Bell System, Mr. Molina said he was "graduating, not retiring"

The Laboratories were represented in interference proceedings by G. T. Morris before the Primary Examiner at the Patent Office in Richmond.

L. J. Stacy was in Cleveland with W. Rupp of the A T & T to observe the operation of test lines in various crossbar offices.

R. M. Hawekotte participated in a series of inductive coördination tests in Arkansas.

Members of the Laboratories who completed twenty years of service in the Bell System during January were:

Research Department

E. T. Ball — Gertrude M. Keiningham
B. G. Bjornson — V. L. Lundahl

Apparatus Development Department

R. F. Elliott — J. R. Erickson
C. A. Webber

Systems Development Department

A. J. Aikens — I. M. Kerney
H. N. Christopher — E. H. Leonard
J. F. DeZavala — D. S. Myers
H. W. Heimbach — H. R. Vail

Patent Department

Ethel McAlevey — Dorothy Patchell

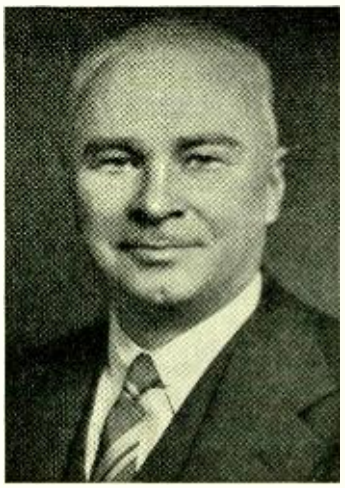
Financial Department: W. C. Burger

Commercial Relations: William Eichinger

General Service: Richard Haard

Plant Department: Erland Anderson

ROY A. SHETZLINE



HAROLD J. DELCHAMPS

EDWARD H. HASBROUCK

TWENTY-FIVE-YEAR SERVICE ANNIVERSARIES

ROY A. SHETZLINE received his B.S. degree from the University of Pennsylvania in 1915 and a B.S. in E.E. from the same University in 1917. He joined the Engineering Department of the A T & T in 1917 when he began making coördination studies between electrified railways, power transmission lines and telephone systems. From 1924 to 1929 he was in charge, for the Bell System, of a coöperative field study with the N.E.L.A., of the coördination of exchange telephone circuits and power distribution lines. Results are given in Engineering Reports of the Joint Subcommittee on Development and Research of the N.E.L.A. and the Bell System and have been of the utmost value in securing coördination of telephone and power distribution systems at reasonable cost.

Since 1929, in the Transmission Engineering Department, Mr. Shetzline has been in charge of studies to determine the requirements of telephone apparatus design to minimize noise and crosstalk, to evaluate the effects of noise and crosstalk on telephone service and to establish suitable noise and crosstalk standards. At the present time he is engaged in special war work.

Although the Shetzline residence is in Crestwood, Westchester County, their summers and many week-ends throughout the year are spent in a delightful cottage at Birch Groves, Lake Candlewood, near Danbury. They have two boys, one in his last year at Clark, a college preparatory school, and the other in grade school. Hunting, fishing and all kinds of water sports are Mr. Shetzline's main recreations. He is also considered an expert contract bridge player. He is a Telephone Pioneer.

* * * * *

FOLLOWING GRADUATION from Union College in 1915 and service in the Engineer Reserve Corps of the Army in 1917, HAROLD J. DELCHAMPS entered the Inspection Engineering Department of the Western Electric Company in December, 1917. Six months later he enlisted in the Navy and served as a Chief Petty Officer at the Naval Air Station in Brest. Returning to the Inspection Engineering Department in 1919 he became associated with engineering complaint work in connection with telephone apparatus and later supervised a group of check inspectors of household appliances and other supplies sold by the Western Electric Company. Following the formation of the Laboratories in 1925 he was associated with organizational matters connected with the re-organization of inspection engineering work under Laboratories' direction. In 1927 when the Outside Plant Development Department was organized he transferred to that department and in 1928 became Executive Assistant of the Apparatus Development Department. For the past six years he

has been Specifications Engineer responsible for the preparation of apparatus specifications and drawings, drafting and design standards. He has also been Chairman of the Laboratories' Drafting Committee since its organization in 1941.

Mr. Delchamps and his family live in Mountain Lakes, New Jersey, where Mrs. Delchamps is active in dramatics and in Red Cross work. Their elder son is also a graduate of Union College and is now attending Cornell University Medical College. Their younger son is an engineering student at Lehigh University and their only daughter attends the Public School in Mountain Lakes. Mr. Delchamps was a member of the Mountain Lakes Board of Education for five years and served as its president for four years. Currently he is chairman of the local Red Cross Branch and a member of the Borough Council. He has served as Program Chairman of the Morris County Engineers Club and is its First Vice-President.

LOUIS H. BACHMAN
of the Equipment Development Department completed thirty years of service in the Bell System on January 29

GEORGE F. FOWLER
of the Plant Department completed thirty years of service in the Bell System on January 20

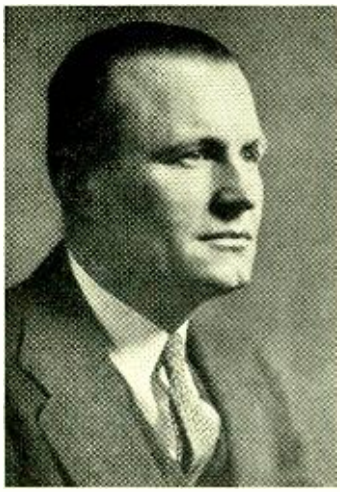
EDWARD H. HASBROUCK entered the Laboratories from Dickinson High School and within a short time became a member of the Research Drafting Department. In connection with the move of the Tube Shop from the West Street Building to 395 Hudson Street, he participated in the drafting work associated with the construction and installation of test equipment for high-voltage vacuum tubes. He also worked on the manufacturing tools for high-voltage tubes, as well as on the initial development of equipment for ship-to-shore radio and on apparatus used in frequency standard equipment.

In 1927, Mr. Hasbrouck was placed in charge of the Research Drafting group, and is responsible for the coördination of all drafting work for the Research Department. Two years ago, the supervision of the Drawing Files was added to his duties.

Mr. Hasbrouck has participated in all extracurricular activities of his group. He was an ardent indoor baseball player and bowler with

JOHN HUGHES
of the Plant Department completed thirty-five years of service in the Bell System on January 18

EDGAR W. GENT
of the Switching Apparatus Development Department completed thirty years of service on January 28



ERNST VON DER LINDEN

GEORGE A. MCNEILL

J. EDWARD ROSS

the Bell Laboratories Club, and for many years has bowled with a group of Bell Laboratories associates in Elizabeth. He is a member of the Telephone Pioneers. Mr. and Mrs. Hasbrouck, who live in Jersey City, have a daughter in second year high school and a son in grade school. In summer, they vacation at Lindy Lake in Northern New Jersey.

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TOLL CIRCUIT DEVELOPMENT and analysis has engaged most of ERNST VON DER LINDEN'S twenty-five years of service with the Bell System. Shortly after he joined the Engineering Department of the Western Electric Company he entered the toll circuit laboratory on wiring and testing work. He was associated with the testing of repeaters sent to Sweden and then with the trial of the first 1000-mile cable circuit using modified repeaters of the "Reading" type and the new pilot-wire transmission regulator.

Among the projects with which Mr. von der Linden has been concerned since then have been the circuit analysis and special development of program switching and transmission, toll testing circuits, toll transmission pad control in special switchboards, and toll signaling. During the past year he has been engaged with the analysis and special circuit design for toll facilities required by the U. S. Army Signal Corps.

Mr. and Mrs. von der Linden live in Chatham where they have a daughter in grade school. He is a member of the Laboratories Stamp Club. Before the war he also bowled and was a member of the Archery Club.

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GEORGE A. MCNEILL joined the Vacuum Tube Shop in 1917 as an assembler. During the war period he was a night supervisor on the production of vacuum tubes for the Signal Corps. About a year after the war Mr. McNeill transferred to the tube design group where he was engaged in the development of water-cooled types, particularly the 220B and associated tubes. Later he worked on the mechanical design of all types of tubes developed by Electronics Research. More recently he has specialized in the heat treatment of materials used in electronic devices and is at present engaged in the development of vacuum-tube packing methods.

The McNeills live in the Bronx. They have one son who is now in advanced training with the Army Air Corps in Utah; a married daughter; and a second daughter who is with the Butterick Publishing Company. His recreation is golf and vacations are usually spent in visiting relatives in Massachusetts and in Canada. He is a member of the Telephone Pioneers of America.

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SOON AFTER J. EDWARD ROSS joined the Engineering Department of the Western Electric Company in 1917 he went into the Physical Laboratory on general apparatus analysis which con-

sisted of analyzing new and redesigned telephone apparatus to determine its ability to meet service requirements. This work included accelerated aging tests to determine probable life. From 1921 to 1926 he studied at Cooper Union where he received his B.S. degree.

For the past fifteen years, in what is now the Switching Apparatus Development Department, he has spent most of his time on protection projects—alleviating effects in telephone lines of induced and direct voltages from power lines and lightning. He has been concerned with studies of the electrical and acoustical effects of high induced voltages and the development of high-voltage fuses and methods for recording transient induced voltages. He has also been concerned with high-tension tests of dielectric insulators and various protective devices used in the telephone plant and with studies of transient voltage phenomena and the effect of steepness of wave front on dielectric breakdown. For the past year and a half Mr. Ross has been on the development of equipment for the Armed Forces.

The Rosses live in Corona and during the past six years have spent pleasurable vacations and many week-ends out at Peconic Bay. He is an ardent surf-caster and is interested in music and photography.

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N. S. Ewing appeared before the Board of Appeals at the Patent Office in Washington relative to an application for patent.

F. W. Amberg, C. O. Cross, C. H. Gorman, W. E. Reid and E. S. Wilcox have been in Greensboro, N. C., on a crosstalk balancing trial involving type-K1 carrier systems.

C. C. Hipkins visited Hawthorne on two occasions during the month of November to discuss finish problems.

T. F. Egan made chemical tests on various types of relays at the Struthers Dunn Company, Philadelphia.

F. F. Lucas attended the meeting of the Buffalo Group of the Division of Rubber Chemistry of the American Chemical Society. He gave part of the program, a lecture on *Motion Picture Study of Balata and Hevea Latices with Some Observations on Buna S and Neoprene Latices.*

"We See by the Papers"

According to an article by A. R. Kemp (*Bell Laboratories Record, August*, 1942), savings in the rubber used for typewriter cylinders are now possible as a result of experiments recently carried on in the Bell System Chemical Laboratories.—*Nature* (London), *November* 28.

The impact of the war upon science is dealt with in a little pamphlet distributed gratis by Bell Telephone Laboratories. This is "The Mobilization of Science in National Defense" by F. B. Jewett, president of the National Academy of Science.—*Chicago Tribune, December* 6.

Ruth Edith Kalland of Brooklyn, N. Y., was united in marriage to Lieutenant Orving C. Olsen, who was employed at the Bell Laboratories in New York, until called to the Dayton Signal Depot, where he is stationed. He is an officer in charge of the Technical Identification unit.—*Chronicle Telegram, Elyria, Ohio, December* 9.

Mrs. Thomas P. Farrell of 15 Putnam Avenue has announced the engagement of her daughter, Mary Alice, to Private Wallace A. McCann, Army Air Forces. Miss Farrell attended Yonkers High School and Yonkers College and is employed by the Bell Telephone Laboratories, Inc., in New York City.—*Herald-Statesman, Yonkers, N. Y.—December* 23.

. . . Bethune Street for example. It is a quiet cross street leading off Hudson into West, just below Abingdon Square. At its foot stands the big Bell Telephone Laboratories busy with experiments for the Army and the Navy. Betwixt and between one sees homey houses with fine, dignified doorways that welcomed beaux and belles at Christmas eve parties. . . . —*Villager, New York City—December* 24.

Mr. and Mrs. E. A. Phelps announced the engagement of their daughter, Eleanor, to Robert Johnston . . . in the purchasing department of the Bell Laboratories in New York.—*Call, Paterson, N. J.—December* 28.

When a dinner at Manhattan's Waldorf-Astoria on December 10 replaced the annual Stockholm award of the Nobel prizes (discontinued since 1939), it was found that twenty-eight laureates now live in the United States, counting eleven who have

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Soldiers are just like us—after a hard day's work in field or classroom they need a good story to help them relax. Will you let some of them read a book you've enjoyed? They like Westerns, Detectives, Adventure, Travel—anything with a lot of action and excitement.

During February bring your books to any of the people listed below.

West Street....Mrs. C. A. Smith
G-V Building.....R. C. Hersh
Davis Building....C. A. Conrad
Murray Hill.....A. J. Akehurst
Whippany.....J. V. Kelly
Deal.....J. P. Schafer
Holmdel.....W. B. Angerole

recently arrived, most of them to escape Hitler. Eleven attended the dinner. (One of them was) CLINTON JOSEPH DAVISSON (1937), thin, soft-spoken electrophysicist at the Bell Telephone Laboratories in New York, who first showed (complementing Compton) that electrons are not purely particles but have properties of very short waves.—*Time Magazine, Chicago, Ill.—December* 28.

REMINDER FOR THE FIDGETY

From Bell Laboratories Record

ARE YOU CONSERVING by refraining from scribbling on paper, bending and breaking paper clips and pins and digging holes in erasers?—*Sun, New York, N. Y.—Dec.* 30.

RUTH PETZINGER becomes bride of CHESTER HYLKEMA. . . . The groom, who was graduated from Iowa State College and received his M.A. degree at Purdue University, is now employed as an engineer at the Bell Telephone Laboratories, New York City.—*News, Paterson, N. J.—December* 31.

MR. AND MRS. LLOYD ESPENSCHIED of 99 Newbold Place, Kew Gardens, today announced the engagement of their daughter, Carol Lovejoy, to Wendell Leroy Rehm. . . . Her father is a consulting engineer with the Bell Telephone Laboratories.—*Long Island Press, Jamaica, N. Y.—December* 31.

. . . THE GREATEST contribution to science has come from men who had no thought of the personal benefit which might come to them. The greatest privately owned laboratory in the United States today is operated on that basis, the Bell Laboratories, which are owned by the A. T. and T. . . . —*Omaha Unionist, January* 1, 1943

MR. AND MRS. WILLIAM KAHLER, 103 Ralph Ave., announce the engagement of their daughter, MISS SUSAN FEUERBACH, to PVT. AUGUST UHL of Astoria. Miss Feuerbach attended Grover Cleveland High School and is now working at Bell Telephone Laboratories. Private Uhl attended Bryant High School. He is now stationed in Fort Jackson, S. C. Before entering the service he also was employed by the Laboratories.—*Eagle, Brooklyn, N. Y., January* 8, 1943.

MRS. AND MRS. GEORGE DE BOER, of Clifton, N. J., announce the engagement of their daughter, Miss Ruth De Boer, to THEODORE G. BLANCHARD, son of Mr. and Mrs. Harry L. Blanchard, of Paterson, N. J. Miss De Boer was graduated from Newark State Teachers' College and is a member of the faculty of Florham Park School. Mr. Blanchard is a graduate of Stevens Institute of Technology and is with Bell Telephone Laboratories in New York.— *Herald-Tribune, New York, N. Y., January* 10, 1943.

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