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Military Telephone Instruments

By J. R. ERICKSON
Station Apparatus

As WAR became imminent, a survey indicated that the Armed Forces of the United States needed new and better telephone instruments for planes, tanks, and mobile ground forces operating under conditions differing greatly from those of the previous conflict. The rapid and coördinated movements of mechanized forces calls for good telephone communications under a wide range of extreme conditions. Military telephone instruments——microphones, headsets and loudspeakers—should be designed to pick up and deliver operating messages and orders with high intelligibility under the noise of battle; they should be convenient and easy to use with a wide variety of equipment; and they should withstand the rough and varied usage of modern warfare. These conditions impose requirements that differ greatly from those imposed on the telephone handset in the office and home where there is relative quietness, freedom from vibration, and protection from extremes of weather and temperature.

Noise is one of the chief problems which has to be overcome in devising instruments suitable for the Armed Forces. Another consideration is that of varying climatic conditions. This war is being fought all over the globe, in the Arctic and in the tropics, over the seas, and under them, and consequently wide ranges and combinations of temperature, humidity and barometric pressures are encountered. In the tropics there is the added problem of rapid fungus growth which has to be overcome. Furthermore, some of the temperature and pressure changes are very rapid, as with a plane rising or descending at a high rate. Instruments for such purposes should be designed, therefore, to compensate for these rapid changes as well as to operate over the wide range of ambient conditions encountered.

Another problem is that of designing the instruments to fit into the paraphernalia used by the Armed Forces. Microphones, for example, have to fit into and become an integral part of oxygen masks, and to be used with noise shields, under gas masks, and other similar equipment. Receivers are used in tank helmets, aviators' helmets, and under the steel helmets worn by the Signal Corps men.

With all these instrument demands, it is highly important from the manufacturing and supply standpoints to employ a few basic transmitter and receiver units which can be adapted to all of the military uses.

One of the first steps was to study the conditions under which the telephones were to operate, and to determine the response characteristics which would provide the best performance with the noise spectra encountered. Models incorporating the desired characteristics were then built and tested under simulated noise conditions. The knowledge gained in designing instruments for the Bell System made it possible to carry out rapidly this intensive program.

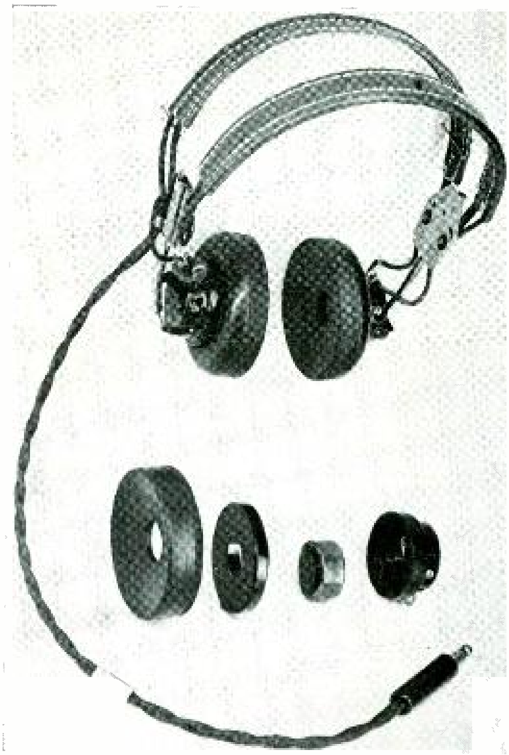

Fig. 2—The Army, Navy, British standard receiver designed by the Laboratories

How a problem of this sort is approached at the Laboratories is indicated by the steps taken in overcoming extraneous noise in a head receiver. No attempt will be made here to provide accurate quantitative information. If the output of a receiver is listened to in a very quiet room while a 1,000-cycle input is gradually increased from zero, a point will be reached, marked A in Figure 1, at which the sound is just audible. As the intensity is further increased, a point, B, is reached at which the output can be felt, that is, the sound actually begins to hurt the ear. If this is repeated over a wide range of audible frequencies, and the points at which the sound can just be heard and at which it begins to be felt are connected together, two curves which resemble HAH′ and FBF′ of Figure 1 will be obtained. The lower of these defines a region called the threshold of hearing, and the upper, the threshold of feeling.

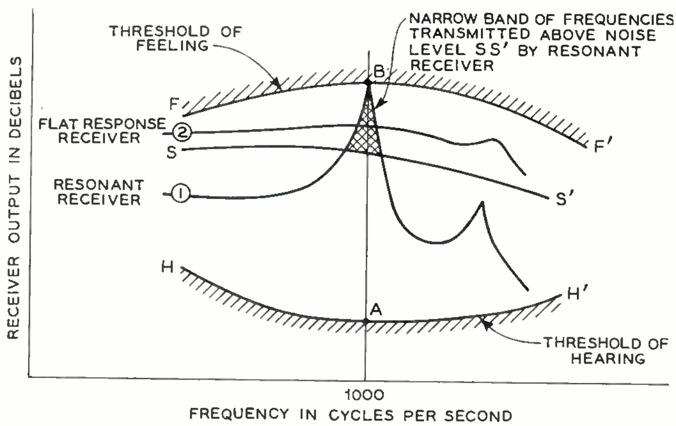

Fig. 1—Characteristics of resonant and flat-response receiver plotted on the auditory sensation area

At the time of Pearl Harbor, the Armed Services had available a receiver of the resonant type. Its response characteristic, Curve 1 in Figure 1, shows a sharp diaphragm resonance peak in the region of 1,000 cycles and a secondary resonance at a higher frequency due to a cap grid. In this war, the noise levels are extremely high, roughly as indicated by the Curve SS′, and only a narrow band of frequencies in the neighborhood of the diaphragm resonance is heard above this general level. If the output of this type of receiver were amplified to bring a wider range of frequencies above the noise level, the resonant frequency at 1,000 cycles would soon reach the threshold of feeling, and nothing would be gained by amplifying the sound further because it would hurt to listen to it. Even with this amplification, however, the greater part of the receiver output is still below the noise level, ss′, and still only a narrow band of frequencies in the region of 1,000 cycles is effective. The transmitted speech, therefore, is not intelligible. What is needed is to flatten the receiver response characteristic, and then to amplify the output so that the major portion of the response will be above the noise level as indicated by Curve 2, Figure 1. This is what actually was done, with the result that the important range of output frequencies was above the noise, and the speech received was intelligible. To take care of external or room noises existing at the listening station, the receiver is equipped with soft-rubber ear pads, which effectively shut out these noises, and also provide a comfortable cushion for the receiver.

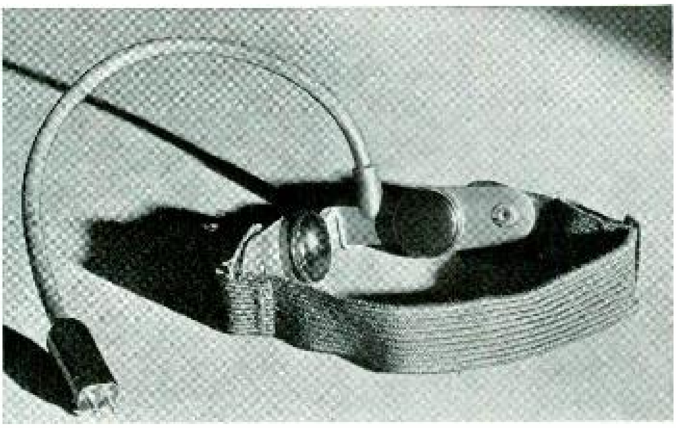

Fig. 4—The throat microphone is a granular carbon inertia device which presses against each side of the throat

A receiver unit embodying these principles was designed by the Laboratories and was designated by the Joint Radio Board as an ANB (Army, Navy, British) standard. The receiver unit, shown in Figure 2, was equipped with a molded phenol-plastic case having stepped contours so that it would fit the various headbands of the Armed Forces. The headset is used by ground forces, bomber crews, and wherever protective helmets are not required. The same receiver without a headband is placed in aviators' helmets.

Fig. 3—Small headset receivers of the audiphone type designed for fitting under the steel helmets used by servicemen

A small headset was required to fit under the steel helmet of the servicemen. For this purpose, a headset with small receivers of the audiphone type was made available. The receivers are only seven-eighths of an inch in diameter and are equipped with soft-rubber ear plugs and a wire headband as evident in Figure 3. A flat response was also built into this instrument. The wire headband can be bent to fit the user's head so it will readily go under the steel helmet, and the headset cord has a clip for fastening to the clothing to relieve any strain on the ear should the cord become entangled during movement of the wearer. Because of the limited winding space on the pole pieces, the impedance of this small receiver is relatively low, and so a transformer has been built into the cord to adapt the instrument to the circuits on which the larger headsets are used.

The problem of the microphone is more involved, but a comparable method of approach was used. Microphones must exclude from the telephone line or radio transmitter as much as possible of the noise that is present. Three methods have been used to obtain this exclusion. One, exemplified by the throat microphone, is to make the instrument relatively insensitive to noise. The throat microphone is a granular-carbon inertia device consisting of two transmitter units on a harness as shown in Figures 4 and 5. It is worn high up on the neck with a unit pressing against each side of the throat, and speech vibrations are transmitted to the microphone through the neck tissues. In as much as the microphone is designed to pick up the mechanical vibrations of the throat rather than the acoustical vibrations in the air, a fair degree of discrimination between noise and speech is attained. The overall response of the throat microphone, however, is not all that is to be desired, because chiefly the low-frequency throat sounds are transmitted; the high-frequency sounds which are formed in the oral and nasal passages are not included in the proper proportion.

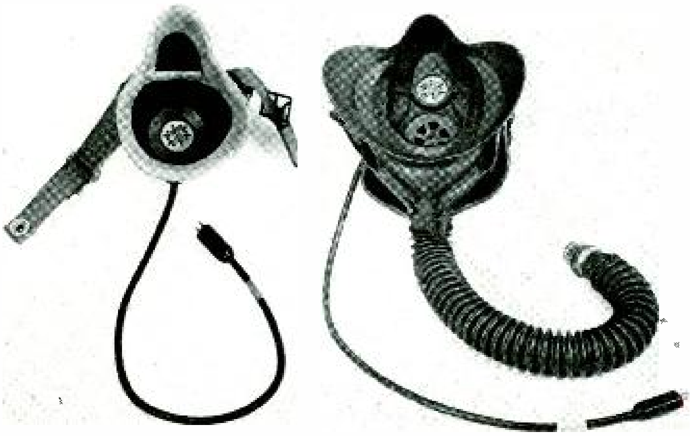

Fig. 6 (left)—A shield is used to exclude noise from the transmitter. Fig. 7 (right)—Aviator's oxygen mask also serves as a noise shield

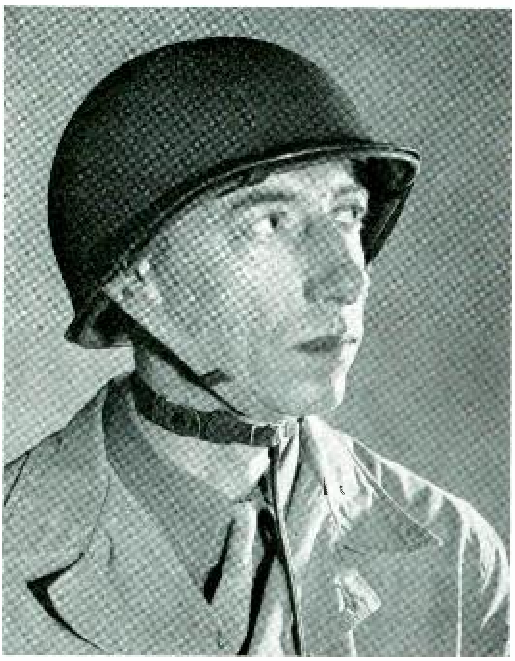

Fig. 5—The throat microphone as it appears in use

Another way of excluding noise in the microphone is illustrated by the noise shield, Figure 6. This shield has a granular-carbon microphone unit built into it, and is worn over the mouth and nose. A good degree of noise exclusion is obtained, and at the same time the speech transmitted is of a high order of intelligibility because sounds from both the nose and mouth reach the microphone. The aviator's oxygen mask, Figure 7, is similarly a noise shield, and actually forms the mouthpiece for the microphone. The microphone design was coördinated with the design of the oxygen mask so that the response char-

Fig. 8—Standard transmitter for oxygen masks

acteristics found desirable for the transmitting end of the circuit combine the acoustical characteristics of the microphone and mask cavities. The transmitter unit which was made available for this purpose was standardized for the Army, Navy, and British oxygen masks and is shown in Figure 8. It is supplied either as a granular-carbon or a magnetic unit.

The third method of restricting noise from the microphone, and one which provides a good degree of discrimination between speech and noise, is by the use of the pressure differential or lip microphone, shown in Figure 10. The principle of this microphone is very simple, as illustrated by Figure 9. If a diaphragm, D, is open on both sides, the noise will reach it with substantially the

Fig. 10—The lip microphone secures quiet transmission by balancing out the noise

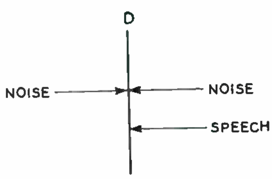

Fig. 9—With the lip microphone, noise in equal amount falls on both sides of the diaphragm, D, and thus cancels, while speech, falling only on one side, is transmitted

same intensity and phase at each side, and therefore will tend to cancel out, and consequently there will be little motion of the diaphragm. Then if one talks very close to one side of the diaphragm, the speech will actuate the diaphragm principally from that one side, and hence the ratio of speech to noise transmitted will be high.

The pressure-differential microphone is equipped with a harness so that it can be worn on the lip as shown, making the speech path to one side of the diaphragm very short. This microphone cannot be used at a distance from the lips, since the speech would then reach both sides of the diaphragm with the same intensity and phase, and thus would cancel out. The lip microphone also can be used with many of the devices provided by the military services, and has been standardized for Army and Navy use.

When the lip microphone is used in combination with a headset in amphibious operations of the U. S. Marines, it very often is submerged in sea water. To render it submersion-proof, therefore, it has been equipped with an especially designed valve which will pass air but exclude water. This valve also permits equalization of pressures under altitude changes when the equipment is flown to the scene of operation in cargo planes. The headset used in these operations has also been equipped with this gland.

Fig. 11 (left) — Low range loud-speaker used for ship compartments. Fig. 12 (right) — Medium range ship loud-speaker used in large compartments

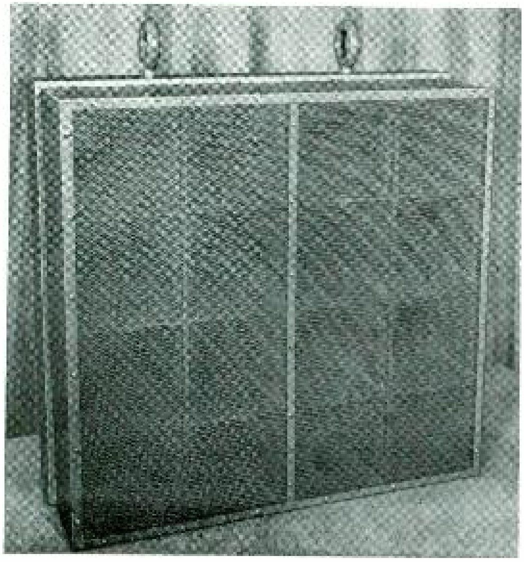

Fig. 13—The "bull horn" loud-speaker is used on flight decks of airplane carriers to override excessive noise of engines and sea

Loud-speakers are employed extensively aboard ship for issuing orders. In the design of loud-speakers, similar problems had to be overcome, and similar principles followed as in receivers. Three classes of speakers were developed: for low range, medium range, and long range. The unit shown in Figure 11 is used in small compartments aboard ship; that in Figure 12 is used in large compartments and some locations on the decks; and that in Figure 13, called the bull horn, is used on flight decks of airplane carriers to issue last-minute instructions to pilots who are in planes about to take off. In all of these loud-speakers the response characteristics have been so controlled that the speakers can be operated above the noise levels existing at the listening positions. The bull horn, for instance, must operate above the noise of the engines of the planes, the howling of the wind, and the roar of the sea, so that the pilot can get his instructions by sound through the air.

A high degree of standardization in loud-speakers has been obtained by designing a single unit which is used in all the speakers mentioned. The unit is adapted to the various purposes by the use of throats and horns of suitable design, and by using multiple units for the larger sizes.

Another group of military telephone instruments includes the sound-powered telephones. A sound-powered instrument is one which is dependent solely on the voice for its source of energy. No battery or other external power supply is used. The sound-powered transmitter is a generator consisting of an armature moving in a concentrated magnetic field, and equipped with a winding in which are induced the voice-modulated currents which are transmitted over the line. The armature is fastened to a transmitter diaphragm, which is actuated by the voice. At the receiving end there is a similar instrument in which the transmitted frequencies are reconverted into speech. Bell's original telephone was a sound-powered instrument.

Although the principle of sound-power is not new, the instruments of the type used in the present war have been improved by the use of high-grade magnetic alloys, which have permitted good efficiency with a substantial reduction in size of instruments.

Sound-powered instruments are built in a variety of forms such as handsets or head and chest sets. A sound-powered head and chest set is shown in the headpiece on page 193. Used extensively aboard ship for fire control and other command purposes, they replace speaking tubes, which in the old days ran from one end of the ship to the other, piercing bulkheads so that they were a hazard in giving entrance to water and gas and in preventing individual compartments from being effectively sealed. Furthermore,

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THE AUTHOR: J. R. ERICKSON joined the Transmission Department in 1920 as a technical assistant, and in 1924 obtained a leave of absence to attend the University of Wisconsin, where he received the degree of B.S. in Electrical Engineering in 1927. Upon his return to the Laboratories he joined the Research Department, and engaged in transmitter and receiver studies. He is now engaged in special engineering in the Station Apparatus Development Department.

speaking tubes passed through noisy locations such as engine rooms, where they picked up noise, with the result that the speech transmitted was not very intelligible. Being entirely independent of an external power source, sound-powered instruments supply effective emergency communication even though the ship's power has been entirely crippled.

Another use of sound-powered instruments, which is rapidly gaining favor, is in portable field telephone sets for locations where dry cells, with which most of these sets are now equipped, either do not operate effectively, or have a very short life. In Arctic regions, for instance, dry cells are likely to have their chemical action impaired by the cold, while in the tropics, the very rapid aging of batteries reduces their life to a period of a few hours. With Army field wire in good condition strung along the ground, sound-powered instruments operate satisfactorily up to eight or ten miles.

The development of these military telephone instruments was based on the skills, methods, and experience acquired over the years in designing telephones for the Bell System. Here, as in many other cases, are shown the important contributions to the war of an industrial research and development organization which is experienced in "design for service."

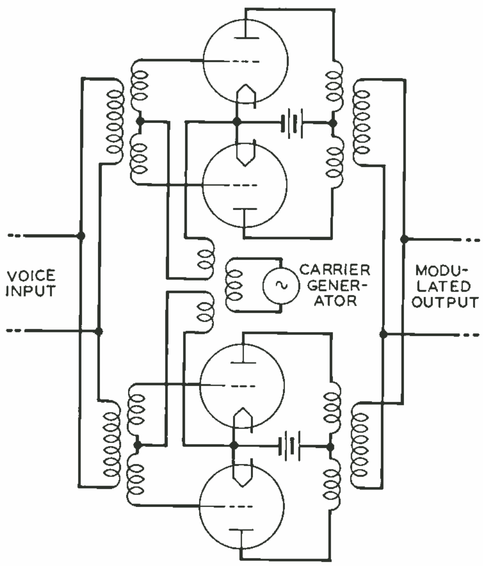
Acme photo by Charles Haacker

A sergeant in the Psychological Warfare Branch of the Army tells the few Nazis remaining in Coblenz what awaits them if they don't surrender. His voice is picked up by tiny microphone which he wears clipped to upper lip. This is the lip microphone described in the above article. Speech is amplified by sound truck rolling through city streets. A great many Nazis gave themselves up shortly after broadcasts

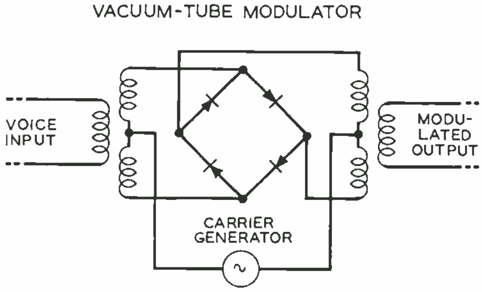
Historic Firsts: Copper-Oxide Modulators

IN THE earlier carrier systems, vacuum tubes were used as modulators and demodulators. The variation in instantaneous loss or gain with changing amplitude of the carrier or signals, which is essential to modulation, was achieved by biasing the tubes nearly to the plate-current cut-off point. Where carrier suppression was desired, balanced tube arrangements were employed. This commonly used vacuum-tube modulator required, in addition to the two tubes, a balanced input transformer, a similar output transformer, and power sources for the A, B, and C voltages. In addition, variation in tube characteristics required selection of tubes to obtain adequate balance, and tests and adjustments to maintain the balance.

Because of this complexity, searches for something simpler, yet dependable and stable, were made from time to time. Crystal detectors, magnetic modulators and numerous other things were explored but found wanting. C. R. Keith, who had worked with Dr. E. Peterson on studies of copper-oxide rectifiers, saw that they could be employed simply and effectively as modulators for carrier systems. He built a number of copper-oxide modulators and employed them experimentally in a carrier system. In April, 1929, he applied for a patent, and in April, 1932, Patent No. 1,855,576 was granted him for circuit arrangements that utilized copper-oxide rectifiers as modulators.



VACUUM-TUBE MODULATOR



COPPER-OXIDE MODULATOR

In the meantime Frank A. Cowan, of the American Telephone and Telegraph Company, without knowledge of the previous work but aware of the difficulties with vacuum-tube modulators, became interested in the possibility of using non-linear resistances. He explored the characteristics of the newly available thyrite, as well as copper-oxide, and demonstrated the operation of a copper-oxide modulator on a Type-C carrier system. On May 22, 1934, Patent No. 1,959,459 was issued to him on the bridge-type modulator employing non-linear elements such as copper-oxide. On December 24, 1935, Patent No. 2,025,158 was also issued to him covering the ring-type modulator. These two modulator circuits, simpler in form than the Keith circuit, have found a wide field of use in this country and throughout the world. The simpler bridge arrangement, which suppresses the carrier but permits the modulating signal to pass, is used principally for individual channel modulation and demodulation. The ring type is used where suppression of the modulating signal as well as of the carrier is desired, such as in group modulators.

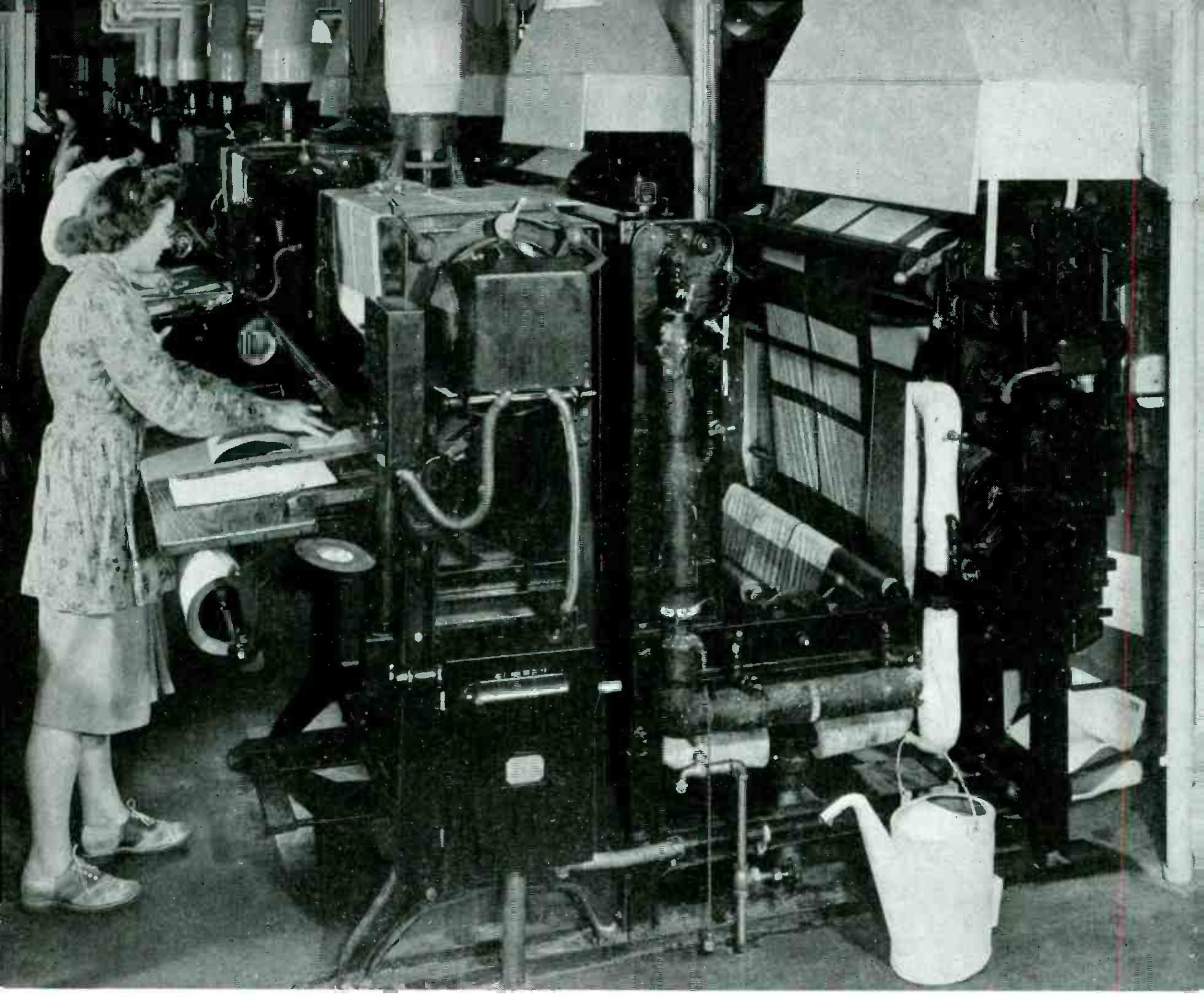
The copper-oxide units originally available were not well suited to use as modulators, and W. F. Kenenberg spent the better part of a year in intensive research to determine how to make satisfactory copper-oxide units. Still further improvements were made in the Research Department under the direction of Dr. J. A. Becker. As a result of these extensive efforts, the copper-oxide modulator was made not only acceptable, but also very simple, stable and dependable. It has displaced vacuum-tube modulators in practically all new carrier systems in the Long Lines Department and in the Associated Companies, and is used at frequencies from zero up to several million cycles per second. Over 50,000 such modulators are now in use in the Bell System.

"I have referred to our intention to improve and expand telephone service. Primarily this objective, together with any possible reduction in the cost of service, can be obtained in the long run only through improvement in the art and improvement in the technique of management, in which the suggestions and help of the entire personnel play an important part. . . .

"Our laboratories are better than ever before. I am sure we can count on improvements as certainly in the future as we ever could. They will lessen the real cost of telephone service and at the same time will continue to make possible further increases in the real wages of the employees. Bell System wages were never higher than they are today and telephone service today, even in the face of wartime difficulties, is very much faster, more reliable and vastly more extensive than it was twenty years ago in peacetime. Likewise, while the price of practically everything has increased in wartime, telephone rates have not increased. On the contrary, long distance rates have been reduced.

"This business, since I first presided over a stockholders' meeting twenty years ago, has successfully carried on through a boom and a depression and ever since the war began has successfully met all war demands upon it in spite of extreme difficulties. We in the Bell System shall have more than enough to do after the war and I am optimistic about the future. It is true that the years to come will present their challenges but, based on the record of the past, there is every reason to believe that they will continue to be met successfully."

—President Gifford at Annual Meeting of A T & T Stockholders.



Reproductions

By D. R. McCORMACK
Central Service Manager

ALL DEVELOPMENTS of Bell Telephone Laboratories, whether apparatus or circuits, complete communications systems or small mechanical parts, are recorded in part or in whole as drawings. Some of the larger ones require a very considerable amount of drafting time, and their cost may be reckoned in hundreds of dollars. Whether large or small, however, the original drawings are the basic record of the development, and thus cannot be jeopardized by being sent out to manufacturers. Copies in one form or another must be made. It is at this stage that the Central Service Department steps in. On the average, and excluding photographs, it made over 20,000 reproductions a day during 1944.

Probably the simplest method of obtaining copies of drawings is by blueprinting, shown in Figure 1 and above. The tracing is laid directly on the sensitized surface of the blueprint paper, and a print is made by light passing through the tracing. After its exposure to light, the paper is washed, then passed through a developing solution, and then washed again, and dried. The result of this process is a reproduction in white lines on a blue background.

Where many copies are to be made, the excessive handling of the tracing results in its rapid deterioration. To avoid this, very few working copies are made directly from the original tracing. Instead, negatives of the original are usually made on brown-print or

Vandyke paper, which is a thin paper that when printed from a tracing shows white lines on a dark brown background. The white spaces are very transparent, and even greater transparency is obtained by oiling the negative after printing, Figure 2.

In making blueprints from tracings, the tracing is placed in direct contact with the outer surface of a revolving glass cylinder carrying arc lights within it, and the blueprint paper is inserted over the tracing. The side of the tracing carrying the drawing is next to the cylinder and the emulsion side of the blueprint paper next to the tracing. With this arrangement, the print is "right reading"—all lettering appearing exactly as on the tracing. Because of the thickness of the tracing, however, which spaces the lines on it a short distance from the emulsion on the blueprint paper, there is a tendency for the light to diffuse slightly in passing through the tracing. As a result, there is some loss in sharpness, although the effect would be noticeable only in extreme cases.

If a Vandyke negative were made from the tracing in this manner, and then prints made from the negative in a similar manner, this diffusion of the light would occur twice—in making the negative and again in making the positive. As a result, there would be a loss of sharpness, which although still not great enough to be noticeable under good conditions, might be objectionable where very fine detail was involved. For this reason, it is common practice to turn the tracing over in making the Vandyke negative so that the lines on the tracing are in direct contact with the emulsion on the Vandyke paper. This eliminates the diffusion of the light, but because the tracing has been turned over, a reversed negative is obtained. It is no longer direct reading, and appears as in Figure 3. When a Vandyke negative is then used for making prints, it also must be turned over just as the tracing was so as to get a direct reading positive. Once again, diffusion of the light is avoided, and sharp copies are obtained, as shown at left in Figure 4. From Vandyke negatives, either blue-line or brown-line prints may be made. Blueprint paper is used for the former, and Vandyke paper for the latter. Besides being slightly sharper than blueprints, they have the advantage of being positives instead of negatives, and for many purposes are more desirable.

Instead of using Vandyke negatives for printing, reproduced tracings may be used as has already been described in the Record.* These reproduced tracings are made on waterproofed sensitized tracing cloth, and they are printed in a large printing

*Record, *November*, 1927, *page* 88.

Fig. 1—Rear of a blueprint machine showing sorting, trimming, and folding team

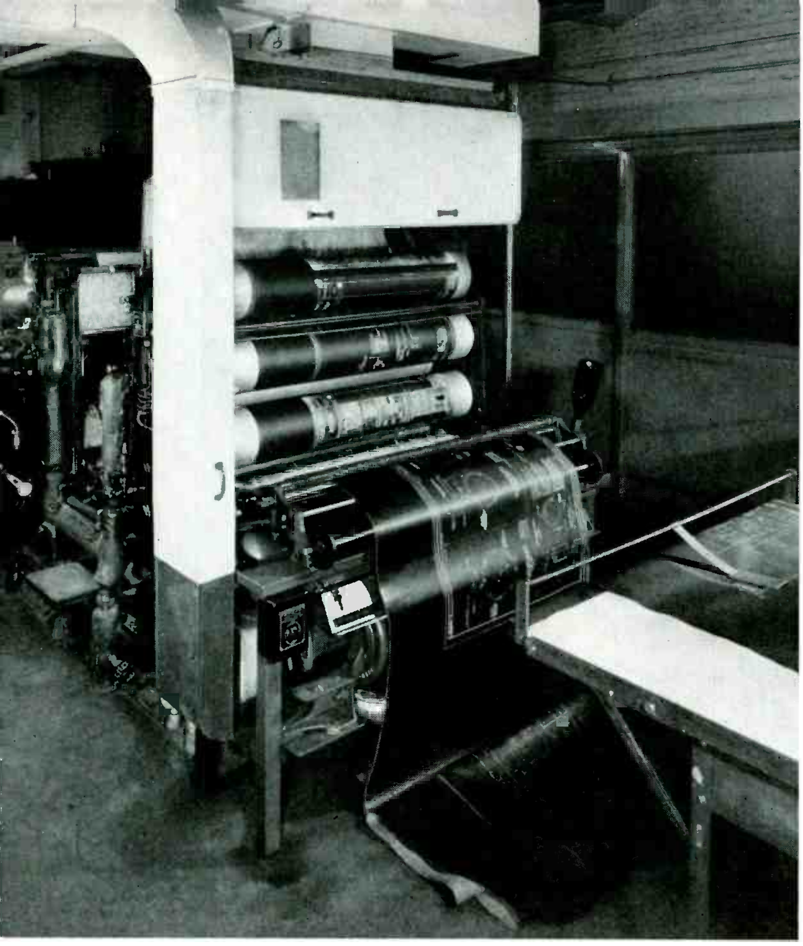


Fig. 2—Rear of blueprint machine used for making Vandyke negatives showing oiling rolls through which the negative passes as it leaves the drying rolls

prints are made from the negatives. Two photographic processes are used in the Laboratories. One employs the photostat machine, and the other the giant camera already described in the RECORD.*

The photostat machine is a self-contained unit that photographs through a prism to invert the image, and thus makes a negative that is direct reading. This negative is not made on film, but on a heavy paper, and shows white lines on a black background. By then photographing the negative in the same machine, a positive is secured that has black lines on a white background. In the giant camera, the negatives are also made on paper, but since no prism is used, they are reverse reading. The paper is thin, however, and reverse negatives made on the giant camera are used for reproducing prints in the same manner as are reversed Vandyke negatives.

Besides being required when a change of size is made, these photographic processes are also required when the original is opaque, such as a drawing or other illustration made on bristol board, or when copies are to be made of printed pages. For this latter purpose, the photostat machine is usually used because the negative, since it is direct reading, may be used directly, and a second step is unnecessary. The photographic process, particularly with the giant camera, is also advantageous in making copies of pencil draw-

frame as shown in Figure 5. Close contact between original and the sensitized tracing cloth is secured by a vacuum back, and the reproduced tracings are as good as the originals, and may be better if the originals are old or in bad condition. Either blueprints or Vandyke negatives may be made from these reproduced tracings.

If all originals were inked tracings, and all copies were to be of exactly the same size as the original, these processes of printing reversed Vandyke negatives or direct reading reproduced tracings, and then making either blue-line or brown-line prints from the Vandykes or blueprints from the reproduced tracings, would be all that was needed. One situation that cannot be met by these direct printing methods, however, is the need for copies either smaller or larger than the original. To obtain a change in size, a photographic process must be used in which the original is photographed, and then

*RECORD, *June*, 1943, *page* 356.

COPY PAPERS

Type of Paper	*Color*	*Machine Used With*
Blueprint	Blue	Blueprint Machine
Vandyke	Brown	Blueprint Machine
Litho	Black	Giant Camera, Contact Printer
Photostat	Black	Photostat
Reproduced Tracing	Black	Printing Frame

Reproduction Machines Used by Bell Telephone Laboratories

	Blueprint Machine	*Giant Camera*	*Dark Room Contact Printer*	*Photostat Machine*	*Printing Frame*
Process	Transmitted Light	Reflected light	Transmitted or reflected light	Reflected light	Transmitted light
Operation	Continuous	Intermittent	Continuous	Intermittent	Intermittent
Original	Tracing, Vandyke negative, photographic negative	Any	Any	Any within size limitations of photostat machine	Photographic or Vandyke negative
Product	Blueprint, blue-line print, Vandyke negative, Vandyke positive	Photographic negative	Photographic negative	Photostat negative or positive	Reproduced tracing

ings. Pencil lines are not as opaque as ink, and much better reproductions can be made by reflected light than by transmitted light. Since pencil drawings can be completed much more quickly than inked tracings,* the tendency for some years has been to use pencil drawings more and more as the originals, and this trend has been greatly accelerated by the war. Although better reproductions of pencil drawings can be made by the photocopy method than by blueprinting, the gain in quality with good pencil drawings is often not of great importance, and many copies are made by blueprinting or by making blue-line or brown-line reproductions from Vandyke negatives.

When no change in size is involved, photographic negatives may be made on a darkroom contact printer, recently acquired by the Laboratories, that makes reproductions more economically than the giant camera because the process is continuous. This machine is shown in Figure 6. It uses the same paper as does the giant camera, but since it operates as a continuous process as does the blueprint machine, the length of the tracing it can handle is limited only by the developing arrangements, while the giant camera is limited to a length

*Record, *April*, 1934, *page* 238.

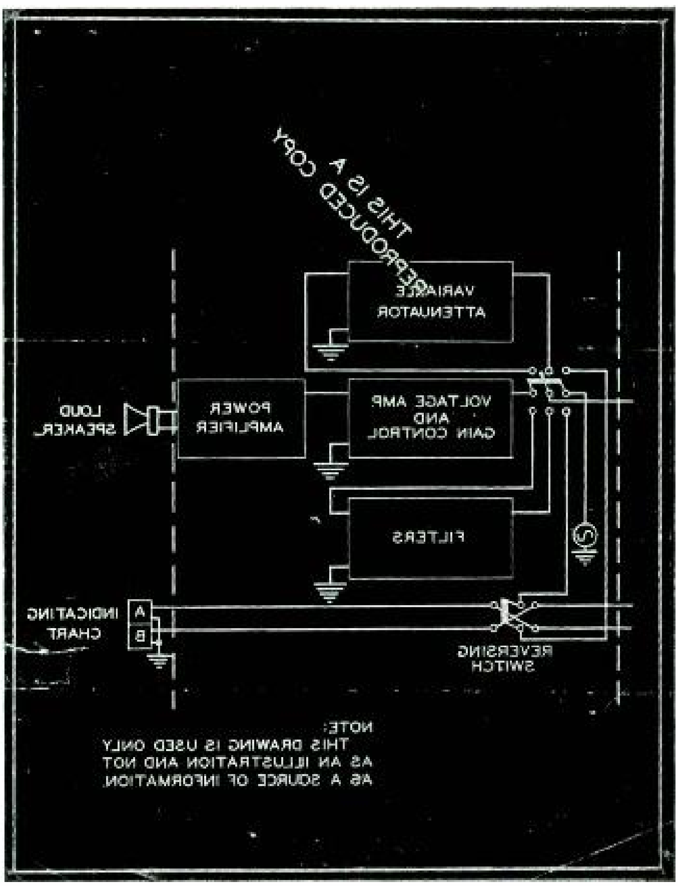


Fig. 3—A Vandyke negative showing reverse reading feature

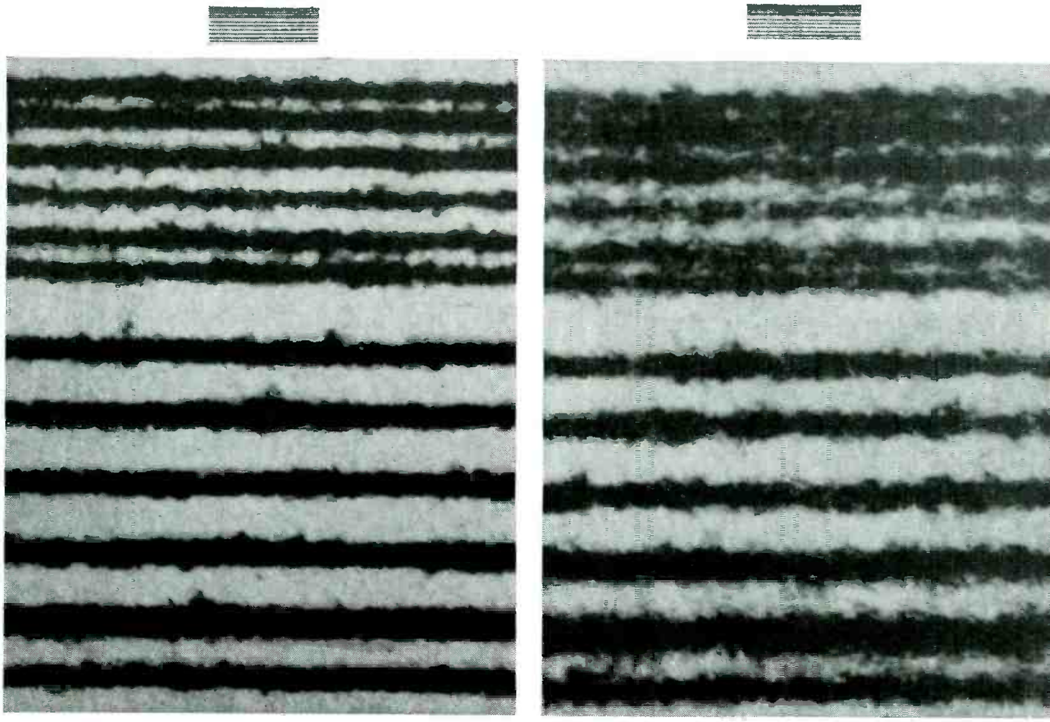
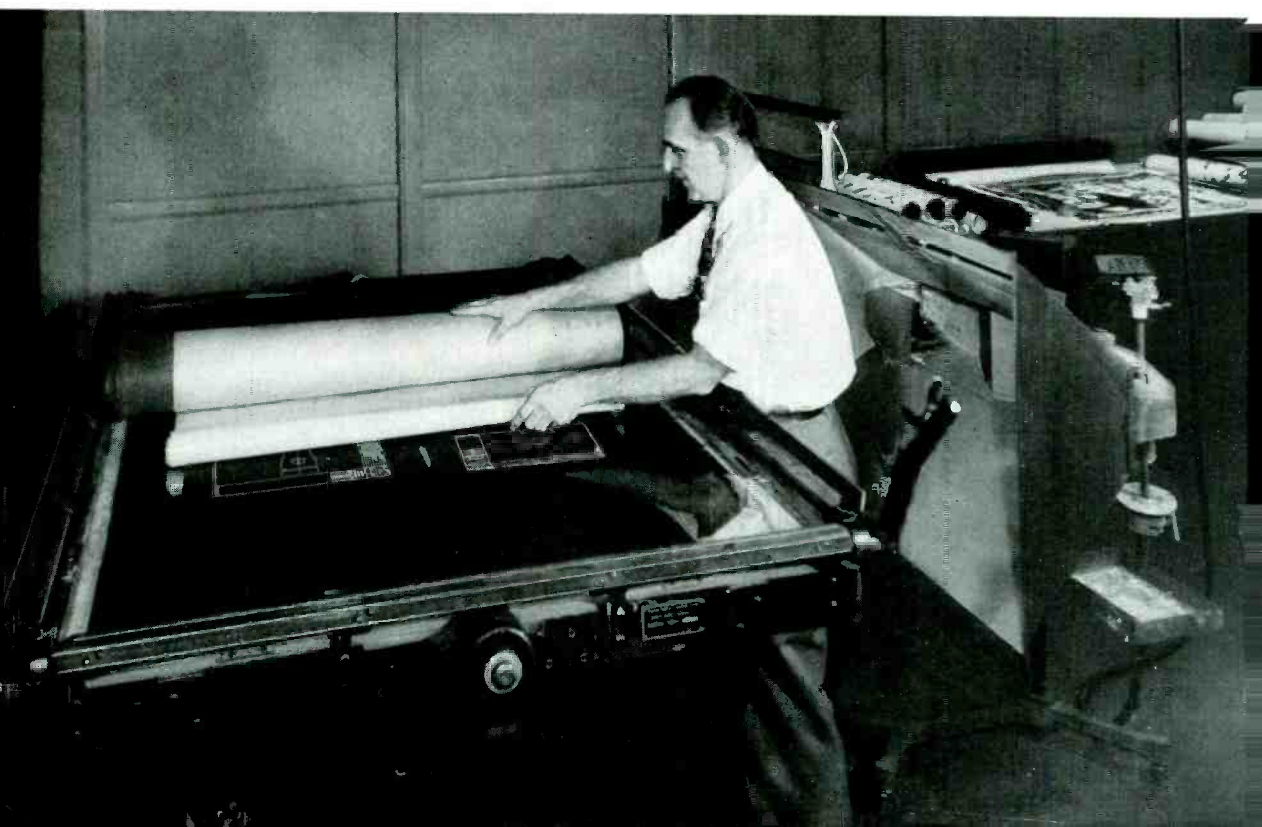


Fig. 4—Visual evidence of gain in clarity from use of reverse rather than direct-reading negative. Actual lines in small inserts above, and the same lines magnified fifteen times, below. Left—Photograph of brown-line print made from reverse negative. No light diffusion in making either negative or positive. Right—Photograph of brown-line print made from direct-reading negative. Light diffusion occurred both in making the negative and in making the positive

Fig. 5—The vacuum printing frame is loaded in a horizontal position and then tipped vertically



of six feet. With the contact printer, the copy is made by transmitted light, but the tracing is turned over so as to make a reversed negative.

This machine may also be used for "reflex" printing, which makes the negative by reflected light. For reflex printing, the photographic paper is placed between the light and the work to be copied. Light passes through the sensitized paper and is reflected from the original back to the emulsion on the paper. Since the light passes through the sensitized paper before reflection, the entire area of the emulsion is affected to some extent and thus the white areas of the negative have a grayish cast. This does not affect the printing quality of the white portions of the negative because of the high degree of contrast obtainable. This process is particularly convenient for making copies from opaque originals when the camera facilities are not available. In general, the contact printer can be used as an alternative to the giant camera except where a change of size is required, and has the added advantage of being able to copy larger drawings than can be handled with one setting of the giant camera.

Facilities for making reproductions in the Laboratories Central Service Department include a large blueprint room with eight blueprint machines, one of which is used for making Vandyke negatives; a smaller adjacent room for making reproduced tracings; and a suite including both dark and light rooms for the giant camera, the photostat machines, and the contact printer. All of this work, as well as the photographic work, is under the direction of F. Haese, with G. J. Wismar in direct charge of blueprint and Vandyke production, and R. Haard in charge of work done with the giant camera, the contact printer, the photostat machines and reproduced tracings. The blueprint machines operate under ordinary lighting conditions, but the contact printer and the printing side of the giant camera require dark rooms because of the greater sensitivity of the paper used.

The cost of various types of reproductions naturally varies because of the different paper used, the number of steps in the process, and the labor and time required to secure the finished prints. Blueprinting is the least expensive because it is all done in a single step on the same machine. When good trac-

Fig. 6—The contact printer must be operated in a dark room

THE AUTHOR: After eight years with the Central Railroad of New Jersey, where he established efficient methods in various operating departments, D. R. McCORMACK, in 1919, joined the Engineering Department of the Western Electric Company. His first assignment in the Engineering Department was with the Methods Department. He later took over the task of reorganizing the Engineering Files and subsequently the Photograph, Photostat, Blueprint and other reproduction processes. He is at present Central Service Manager of the Laboratories, and has charge of the following Departments: Central Files, Mail, Messenger, Office Machine Service, Reproduction, Telegraph, Transcription and Transportation.

ings are available, blueprinting is generally preferable, or if Vandyke negatives are available, blue-line prints may be obtained at the same cost, and brown-line prints at a somewhat higher cost. Any reproduction on blueprint paper will fade, however, and thus where long life is essential, some other form of reproduction is preferable.

Where the originals are opaque, where they are a poor grade of pencil tracings, or where a change in size is required, photocopy work is necessary. The first step results in a negative from which either blue-line or brown-line prints may be obtained. Such prints are more expensive because of their requiring two steps and a generally slower process. When no change in size is required, such reproductions may be made either on the giant camera or on the contact printer, depending on the nature of the work in process at the time.

Photostats are intermediate in cost between brown-line prints and photocopy work on the giant camera. The heavier paper employed and the limitation in size, however, restricts the use of this method. Reproduced tracings are much more expensive than any of the other methods that are used for making reproductions, but the need for them arises less often.

United Nations Conference Telephone Service

By Richard G. Smith, *Editor*
"Pacific Telephone Magazine"

San Francisco, already one of the busiest war centers, became a focal point of world attention when the announcement was made that the United Nations Conference on International Organization would be held there beginning on April 25. The announcement also concentrated the attention of the Bell System on the city by the Golden Gate, for it was evident that one of the most elaborate single communications jobs ever undertaken on the Pacific Coast would be required to serve conference delegates, their staffs, and the press and radio.

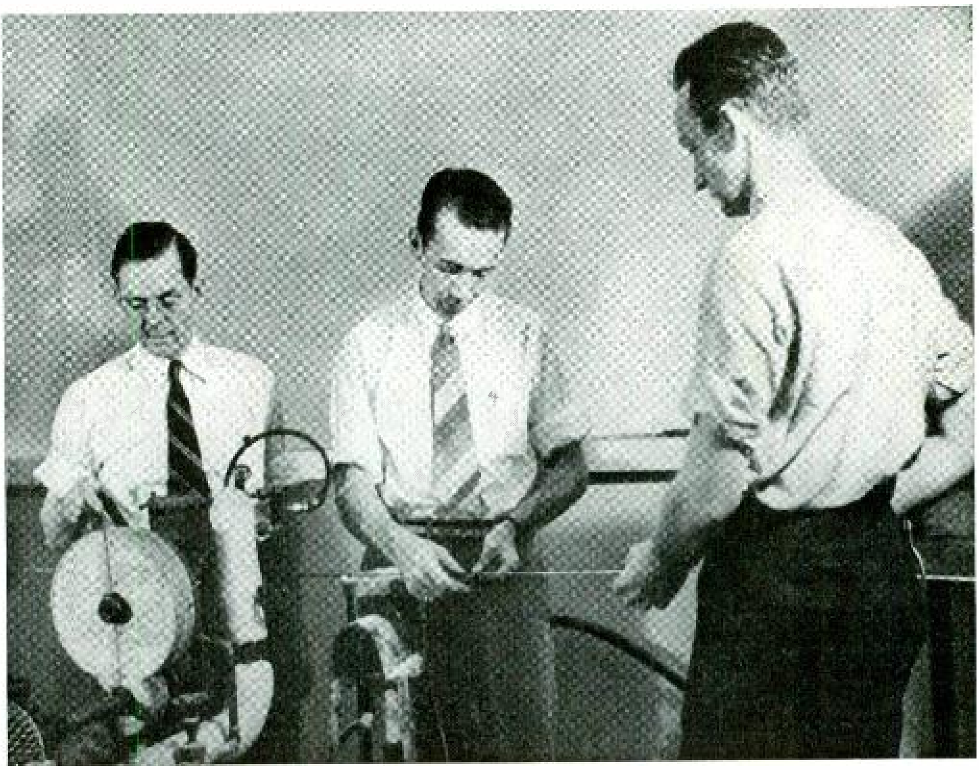
The first meetings to plan the telephone system were held by The Pacific Telephone and Telegraph Company on February 21, and by mid-March Government officials had decided on the location of the conference meetings: the Veterans' War Memorial Building and the adjacent War Memorial Opera House, located at the Civic Center. Installation of the conference switchboard in the Veterans' Building was begun on March 17, and by April 15, attendants were handling calls for "INternational 3300."

Attendants were given special training in the handling of calls for the conference. Training classes covered four days. Standard practices were adopted to meet the special requirements. The girls who operate the switchboard were selected primarily from San Francisco central offices since they are familiar with the locality. Supplementing the existing forces in caring for additional traffic stimulated by the conference, several hundred experienced operators from other Coast cities have been called upon.

Included among the telephone attendants for the conference are girls who speak Russian, French, Spanish, Portuguese or Chinese. Delegates who do not speak English are requested to give the name of the language in which they wish to converse to the attendant answering the call; for example, "French." An attendant conversant in that language then picks up the call.

A special telephone directory was issued for the use of delegates. The book, printed in English, contains about 1,000 listings and has two principal divisions: an alphabetical section with telephone numbers, and a classified section by nations. It also features sections on telephone, telegraph and cable information, and a map of downtown San Francisco, with conference buildings and hotels "spotted."

Installation of an entirely new distributing plant was necessary for "INternational 3300," and a small army of telephone men worked on the job. Many of the plant men were brought in from cities throughout Northern California and Nevada, and Western Electric men handled the switchboard installations for the conference and hotels.



Synthetic Rubber for Wire Insulation

By V. T. WALLDER
Chemical Laboratories

ACUTE shortage of natural rubber has manifested itself to the public primarily in terms of the lack of automobile tires, but another important use, for which substitutes had also to be provided, is insulation for wire and cables. When it became apparent that the supply of natural rubber would be reduced nearly to the vanishing point, exploratory investigations were conducted which led to the selection of a synthetic rubber known as GR-S or BUNA S. This product is prepared by copolymerizing approximately three parts of butadiene and one of styrene. With the quantity production of synthetic rubber, particularly GR-S, and the necessity that it be used for wire insulation, the properties of this synthetic material had to be established.

In carrying out this program the Laboratories determined the moisture absorption, electrical characteristics, physical properties, brittleness temperature and accelerated aging of GR-S; also included were studies on vulcanization and chemical analysis to identify constituents which might contribute to the moisture absorption or affect adversely the electrical properties of the material.

Three typical samples of uncompounded GR-S were milled on cold rolls and then molded into sheets 0.075 in. thick under 800 pounds per square inch pressure at 135 degrees C. Heat was applied for five minutes and the sheets were then cooled in the mold under pressure. These specimens were conditioned for twenty-four hours at 25 degrees C. and 40 per cent relative humidity, weighed and tested for electrical characteristics. Then after immersion in distilled water for seven days at 25 degrees C., they were retested. Comparative tests were made on smoked sheet natural rubber. Alternating current tests for dielectric constant and

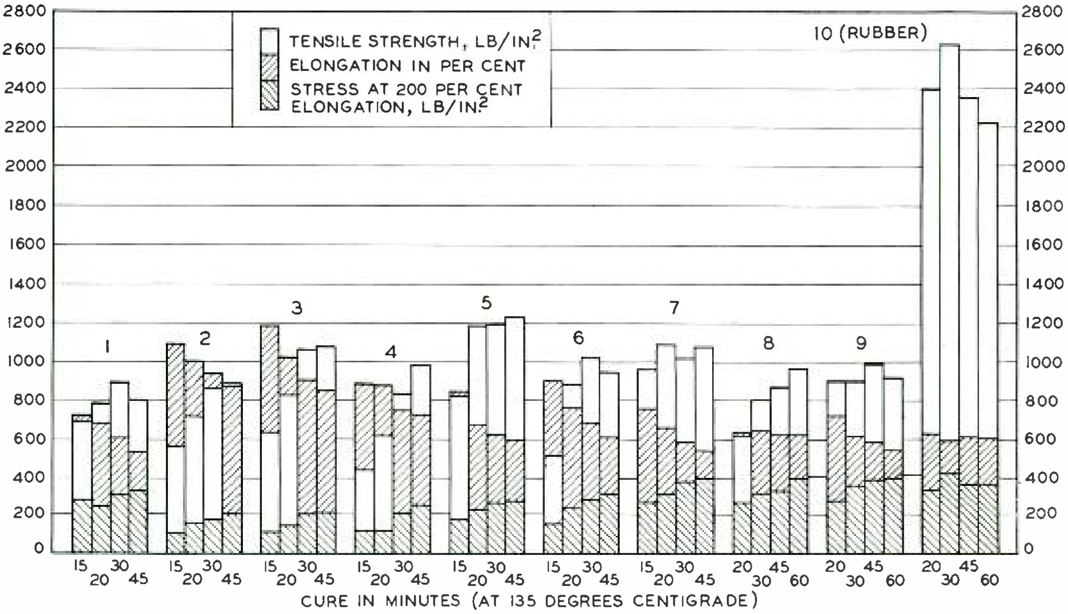


Fig. 1—Physical properties of GR-S *rubber compounds compared with those of natural rubber*

power factor were made at one kilocycle; direct current tests for resistivity at 400 volts. The results showed that raw GR-S is inferior to smoked sheet rubber in resistivity by a factor of at least ten when dry and in some samples by more than one hundred when wet. In dielectric constant and power factor the synthetic compared favorably with natural rubber.

Vulcanized pure gum compounds were prepared from GR-S and smoked sheet natural rubber and tested for electrical characteristics before and after immersion for one week in distilled water at 25 degrees C. The results of these tests indicated that vulcanization reduced the moisture absorption of the GR-S and increased its electrical stability. The average dielectric constant

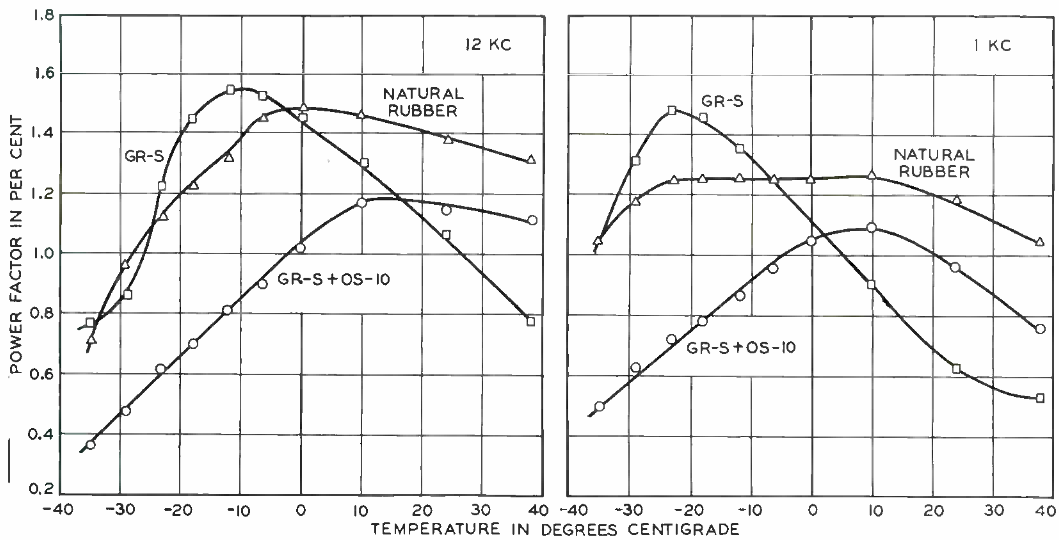


Fig. 2—The natural rubber compound used in these tests had a higher power factor than GR-S *at room temperatures*

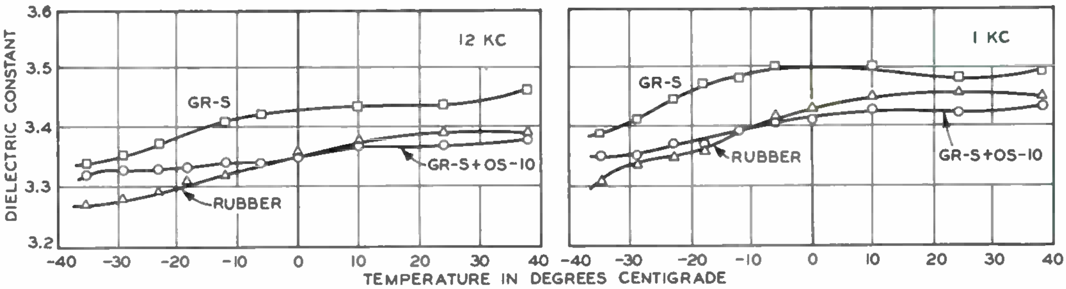


Fig. 3—The dielectric constant of the GR-S *compound used in these tests was somewhat higher than that of the same natural rubber compound*

of 2.8 did not differ appreciably from that of the vulcanized natural rubber, but the resistivity was about 10^{-14} ohm-cm. compared with 10^{-16} ohm-cm. for the natural product. In power factor the GR-S compound was somewhat lower than the natural rubber compound originally, but showed a relatively greater increase after exposure to 25 degrees C. water for a period of one week.

An important use of GR-S rubber is for low capacitance insulation on wire. Reclaimed rubber does not meet the desired requirements because the carbon black and mineral filler which it contains increases its dielectric constant. For many of these applications a compound must be chosen which will have sufficient rigidity when vulcanized to withstand deformation during subsequent cabling operations as well as under field conditions. These properties were obtained by adding a low melting point gilsonite as the principal volume filler to nine samples of GR-S gum obtained from different manufacturers. This material has little effect on the dielectric constant, moisture absorption or electrical stability under moist conditions.

Physical test results on the nine GR-S compounds together with a natural rubber control are shown in Figure 1. Maximum tensile strengths for the GR-S samples varied from 860 to 1,200 pounds per square inch. Vulcanizing times ranged from twenty to sixty minutes at 135 degrees C. By comparison the natural rubber compound had a tensile strength of 2,620 pounds per square inch after a cure of thirty minutes. Most of the GR-S compounds had elongation values at break which were comparable with those of the natural rubber compound. Their tensile stresses were generally considerably lower than that of the natural rubber compound.

Sheets vulcanized to give maximum tensile strength were prepared from each of the nine GR-S samples and from natural rubber

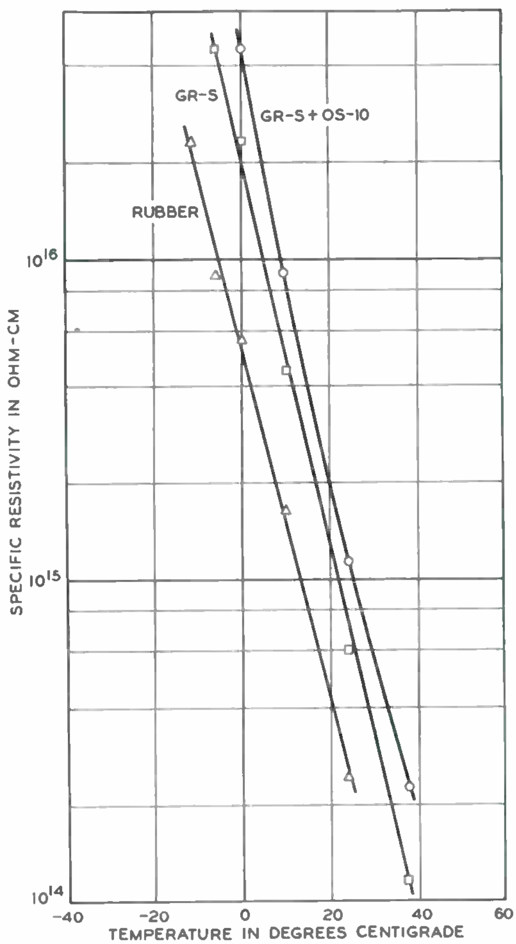


Fig. 4—In specific resistivity the GR-S *compound was almost half an order higher than the same compound made with natural rubber*

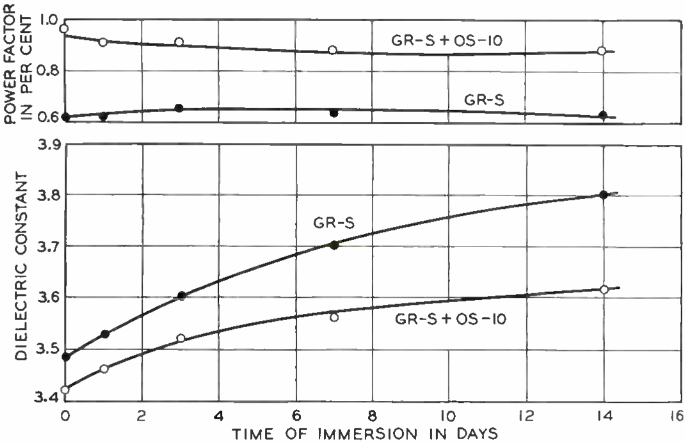


Fig. 5—After immersion in distilled water at 25 degrees C. up to two weeks there was little change in power factor of GR-S *compounds but some increase in capacitance*

(OS-10) of higher styrene content. Each compound was extruded on a stranded conductor equivalent to No. 17 American wire gauge, vulcanized in steam and conditioned at 25 degrees C. and 40 per cent relative humidity for several days. The samples were then tested over a temperature range from −35 degrees C. to +48 degrees C. for dielectric constant and power factor at one and twelve kilocycles and for insulation resistance at 400 volts. These tests were repeated after the specimens had been exposed to distilled water at 25 degrees C. for intervals up to 14 days.

for electrical tests. They were conditioned for twenty-four hours at 25 degrees C. and 40 per cent relative humidity, after which their power factor, dielectric constant and specific resistivity were determined. Following these tests the sheets were immersed in distilled water maintained at 25 degrees C. After seven, fourteen and thirty-one days' immersion, the surface of the samples was dried and the electrical tests repeated.

The average dielectric constant, power factor, and resistivity of the compounds made with GR-S were approximately the same before immersion as for the natural rubber compound. After water immersion the dielectric constant and power factor increased slightly and the resistivity decreased. These changes correlate well with the conductivity of a water extract of the raw GR-S and with a water extract of ash obtained by ignition.

Insulated wire is subjected in service to wide ranges of temperature. To compare the effects of temperature variation on the electrical properties of GR-S with those of natural rubber, three compounds were prepared from smoked sheet natural rubber, GR-S and a mixture of equal parts by weight of GR-S and a polymer

The results are plotted in Figures 2, 3 and 4, and showed that the power factor of the natural rubber compound was higher at room temperature than that of the GR-S compounds both at one and twelve kilocycles. The power factor of all three compounds was greater at the higher frequency. At one kilocycle the power factor-temperature peak was more pronounced for the GR-S compounds than for that of natural rubber where a plateau region occurred between −20 and + 20 degrees C. At the higher frequency this plateau effect of the power factor-temperature characteristic is less evident although the change with temperature is still less than observed with GR-S.

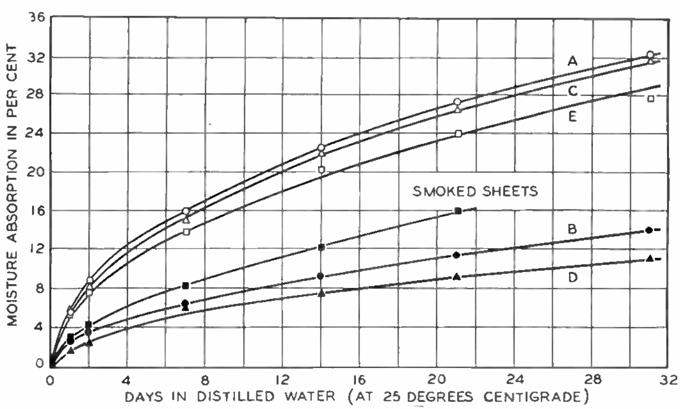


Fig. 6—Moisture absorption of different samples of GR-S *gum showed wide variations*

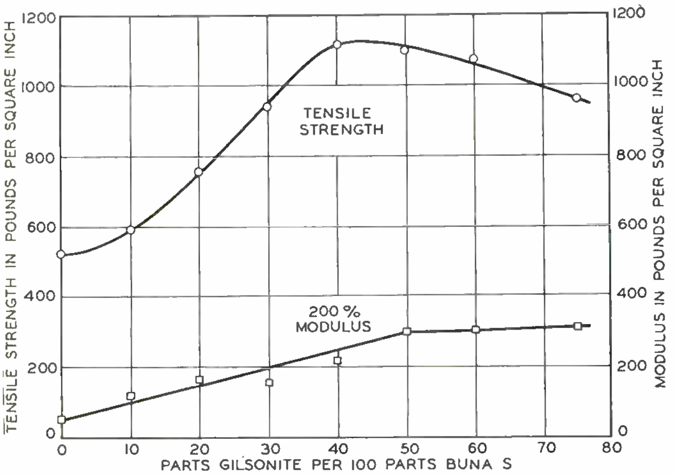


Fig. 7—Gilsonite improves the tensile strength of GR-S *compounds*

a maximum tensile strength of 520 pounds per square inch and a stress at 200 per cent elongation of 50 pounds per square inch, Figure 7. When forty parts of gilsonite were added per 100 parts of GR-S, these factors were 1,115 and 210 pounds per square inch respectively. Further additions of the extender decreased the tensile strength.

The effect of sulfur content on the time required for vulcanization was measured by preparing compounds with two, four and six parts of sulfur per 100 parts of GR-S and vulcanizing them for various times at 135 degrees C. The results are plotted in Figure 8. Examination of these data showed that sulfur combined with the gum at a constant rate until most of it had reacted. Using these results to calculate the temperature coefficient of vulcanization, a value of 2.07 per 10 degrees C. was obtained. To maintain

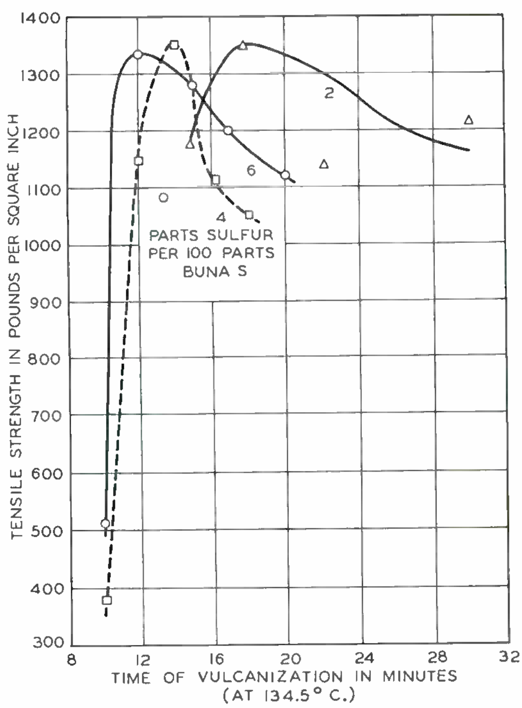


Fig. 8—Effect of sulfur content and the time of vulcanization of GR-S *on its tensile strength*

In the three compounds studied, the dielectric constant for GR-S was slightly higher than that for the rubber or the OS-10 compounds. It increased with temperature and decreased at the higher frequency.

In specific resistivity, Figure 4, the GR-S insulation was almost half an order higher than that of natural rubber and insulation made of the mixed polymers was still better. It should be emphasized, however, that these values are not representative of those obtained on high-quality insulation which consistently shows higher resistivity for compounds made of natural rubber.

After immersion in distilled water at 25 degrees C. there was little change in power factor, Figure 5. That of the GR-S insulation increased about ten per cent and the values for the natural rubber compound fell between those for GR-S and the higher styrene compound.

Comparison of the dielectric properties of GR-S compounded by the same formula with gum from different manufacturers indicates that those samples which show low moisture absorption in the raw polymer have low water-soluble ash and low conductivity of a water extract of the ash. Data on moisture absorption at 25 degrees C., Figure 6, show wide variations among five samples of GR-S.

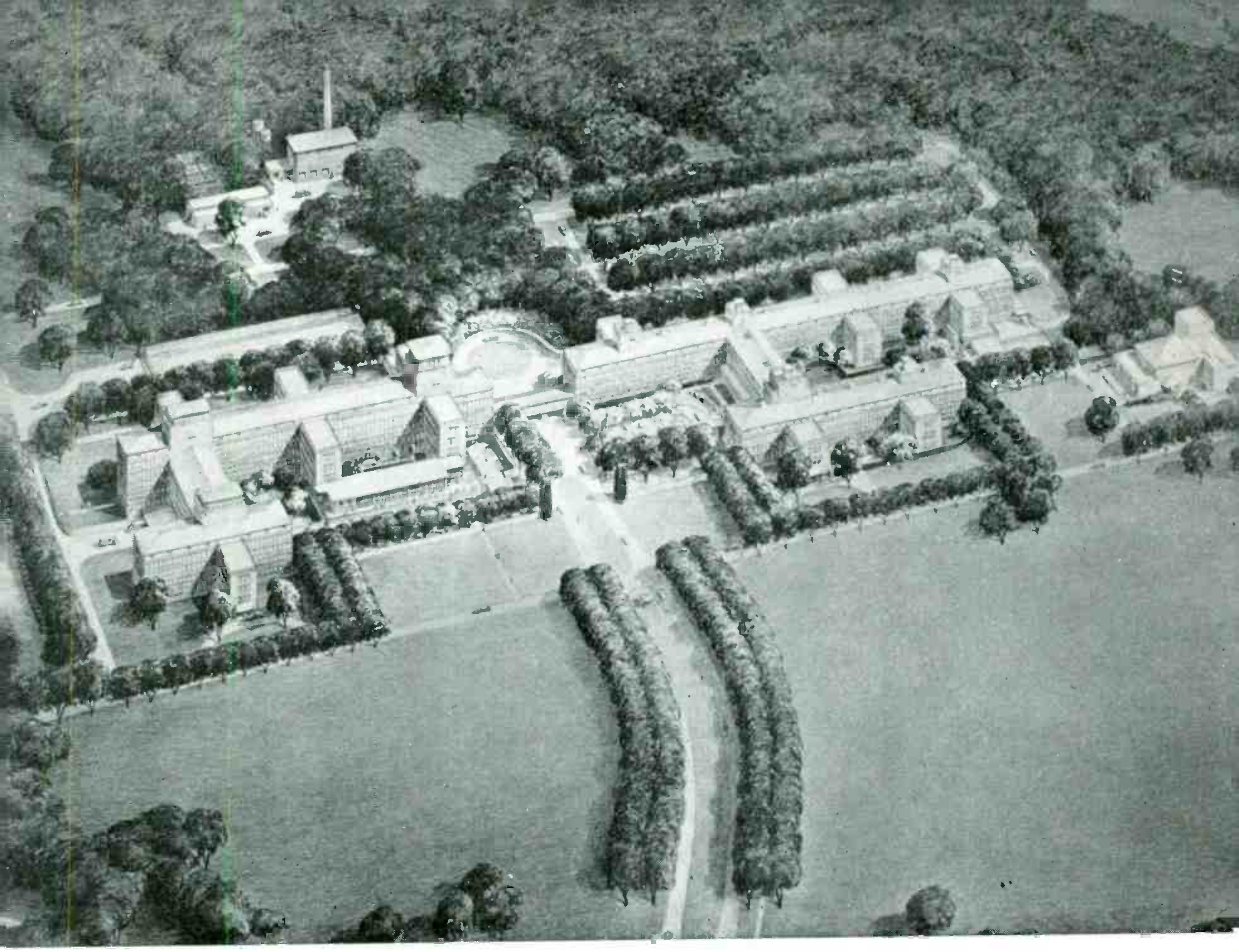
Organic extenders, such as gilsonite and blown asphalt, improve the tensile strength of GR-S rubber. The compound used in these tests that contained no extender or filler had normal production, the speed of vulcanizing synthetic rubber insulation must approximate that made of natural rubber, particularly when the continuous vulcanizing process is employed. Although GR-S has a lower temperature coefficient of vulcanization than natural rubber, it can be vulcanized at speeds that approximate those of the natural product by selecting suitable curing agents.

Some applications of rubber require service at low temperatures and tests were therefore made to determine the temperature at which GR-S compounds of different styrene content become brittle. The results showed that the brittleness temperature of those which had from 20 to 25 per cent of this constituent was from −43 degrees C. to −48 degrees C. Increasing the styrene content to 50 per cent increased the brittleness temperature to −10 degrees C. A similar natural rubber compound became brittle at −50 degrees C. under the same conditions.

GR-S compounds are more resistant to accelerated aging than those made with natural rubber. In oxidation tests, where samples were subjected, at 70 degrees C., to oxygen at 300 pounds per square inch pressure, the GR-S compound absorbed oxygen at a lower rate than did natural rubber and deteriorated less. After ten days' exposure to oxygen, the tensile strength of the GR-S compound had increased to 125 per cent of its original value, while that of natural rubber had decreased to about 75 per cent. The resistance of GR-S insulation to cutting by compression compared favorably with that of similar natural rubber compounds when tested at 25 degrees C. Under compression tests at 80 degrees C., however, GR-S compounds retained only about 35 per cent of their cutting resistance at room temperature, compared with 65 per cent retention for the natural rubber compounds.

These tests indicate that GR-S is a serviceable substitute for natural rubber for wire insulation. The most significant shortcomings of the synthetic product are its lower tensile strength and its inferior resistance to compression cutting at elevated temperatures. Millions of feet of GR-S insulated wire have been manufactured by the Western Electric Company during the past two years and it is giving satisfactory service in the present emergency both for civilian and military uses.

THE AUTHOR: V. T. WALLDER received the B.S. degree in Chemistry from the University of Pennsylvania in 1936 and immediately joined the Chemical Department of the Laboratories as a member of the Technical Staff. At first he was concerned with the development of protective braids, finishes and coverings for insulated wires and cables. From 1941 to the present Mr. Wallder has been engaged in the development of rubber and synthetic rubber compounds for wire and cable insulations.



Murray Hill Laboratories to Be Expanded

A SUBSTANTIAL increase in the Bell System's laboratories will be made as soon as war restrictions permit, according to a statement by Dr. Buckley, released on May 6. The Laboratories buildings at Murray Hill, which now house over 1,000 people, will be approximately doubled in size. The illustration above shows the architects' sketch of the complete building group; the new building, at the left, will extend the lines of the present one about five hundred feet in a northeasterly direction, and will be joined to it by a bridge with a sheltered bus terminal beneath. Voorhees, Walker, Foley & Smith are the architects, as they were for the original buildings. Mahoney-Troast Construction Company of Passaic, N. J., will be general contractors.

The first unit of the suburban laboratory cost about $2,500,000 and has been widely acclaimed as a model for other laboratory design. Since it was opened in the fall of 1941, about one hundred groups from varied industries, Government departments, and some from abroad have come to study its new features. The unique requirement of a laboratory is that it must be designed for change. Prominent among new features which visitors come to see are the quickly movable partitions and the ease with which wires, cables, and pipes may be installed or removed and yet concealed from view. At intervals, small wings jut out from the main building, providing well-lighted offices for physicists, chemists and engineers conveniently close to their laboratories. Shops, library, hospital, and restaurant all fit into the pleasing functional pattern.

Designed for peacetime use, the new laboratory opened just as war was breaking and its new and adaptable space proved to be a great aid to the Laboratories' war service. Within its walls scores of war projects have been started, some small and completed quickly, others large and expanding from a room to whole sections of the building.

Rapid Progress on Coaxial Cable Program Reported by A. T. & T. Co.

BY THE end of this year the Bell System expects to have 2,000 miles of its coaxial cable network manufactured and at least three-fourths of this mileage in the ground, the American Telephone and Telegraph Company announced recently.

One year ago the American Telephone and Telegraph Company announced a five-year coaxial cable program involving 6,000 to 7,000 route-miles of construction. The rapid pace at which the job is going forward has been dictated by the steadily increasing need for more telephone circuits between the Nation's far-flung war centers.

In addition to its use for long distance telephone service, coaxial cable is capable of transmitting the very broad bands of frequencies required for television. The coaxial system now being built is therefore suitable to form the backbone of future nation-wide television program networks.

By the end of this year the cable crews on the new all-cable route to the West Coast are scheduled to be in the vicinity of Fort Worth and Dallas, halfway across the continent. The aim is to reach Los Angeles in the spring of 1947.

The following tabulation, which includes the existing links in the coaxial network plus the sections to be installed or in process this year, shows the present status of the program announced so far:

In Service

New York-Philadelphia. A 2-coaxial cable, 90 miles long; installed in 1936 for experimental purposes; now in service for telephone purposes.

Stevens Point, Wis.-Minneapolis, Minn. A 4-coaxial cable, 200 miles; installed in 1940; now in service for telephone purposes.

In the Ground—Not Yet Equipped

Baltimore-Washington. A 4-coaxial cable, 43 miles.

Philadelphia-Baltimore. A 6-coaxial cable, 100 miles.

Terre Haute-St. Louis. A 6-coaxial cable, 175 miles.

Atlanta, Ga.-Jacksonville, Fla. A 4-coaxial cable, 295 miles.

1945 Program

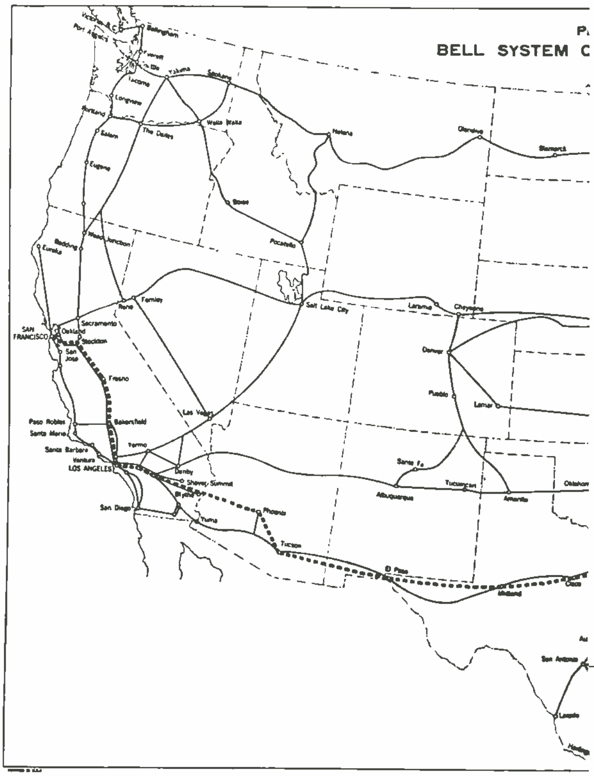
Atlanta, Ga.-Meridian, Miss. A 6-coaxial cable, 310 miles.

Shreveport, La.-Dallas, Tex. An 8-coaxial cable, 200 miles.

Washington-Charlotte, N. C. An 8-coaxial cable, 400 miles.

Meridian-Shreveport. 315 miles with 6-coaxial cable from Meridian to Jackson, Miss., and an 8-coaxial cable from Jackson to Shreveport.

Construction of the remainder of the coaxial program thus far announced is expected in the next four years. The order in which the remaining sections will be installed is yet to be determined. In general, there will be four interconnected backbone routes: (1) The Atlantic Seaboard route, from New York to Miami via Atlanta; (2) the Southern Transcontinental, from



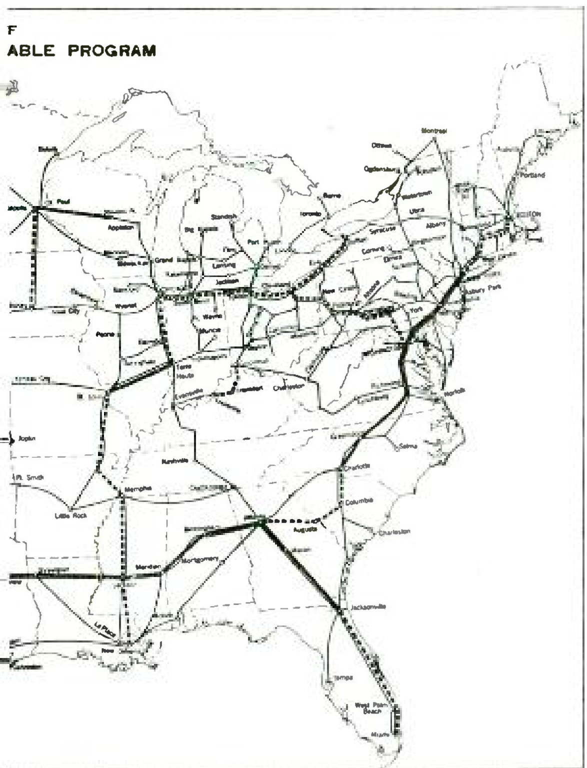
Coaxial cable installed or in process (end of 1945)

Atlanta to Los Angeles; (3) the Mid-Western route, from the East Coast to Chicago via Pittsburgh and Cleveland; and (4) the North-South route, from Chicago to New Orleans via St. Louis and Memphis.

On those segments of the network where additional long distance telephone circuits are most urgently needed, the Bell System has been proceeding with installation of the coaxial systems as rapidly as the cable and equipment can be manufactured.

In order to provide more telephone circuits to the West Coast with all possible speed, Bell engineers plan a temporary postponement of coaxial construction between Charlotte and Atlanta. In this section, existing cable facilities can be adapted to function with the New York-Los Angeles coaxial cable in the provision of telephone circuits. This would leave installation of the Charlotte-Atlanta coaxial cable until later.

Experiments with coaxial systems as a means of transmitting many telephone conversations simultaneously over one pair of conductors began more than a decade ago.



lance of 5-year Program —— *Existing major toll routes*

Use of the New York-Philadelphia cable for transmitting television images was first demonstrated in 1937.

The "coaxial" itself consists of a copper tube with a single wire in its center. With the present terminal and repeater equipment, a pair of coaxials can provide 480 telephone circuits. Or, the coaxial can be arranged to transmit both the visual images and the sound for television programs.

Radio Relay Sites Announced

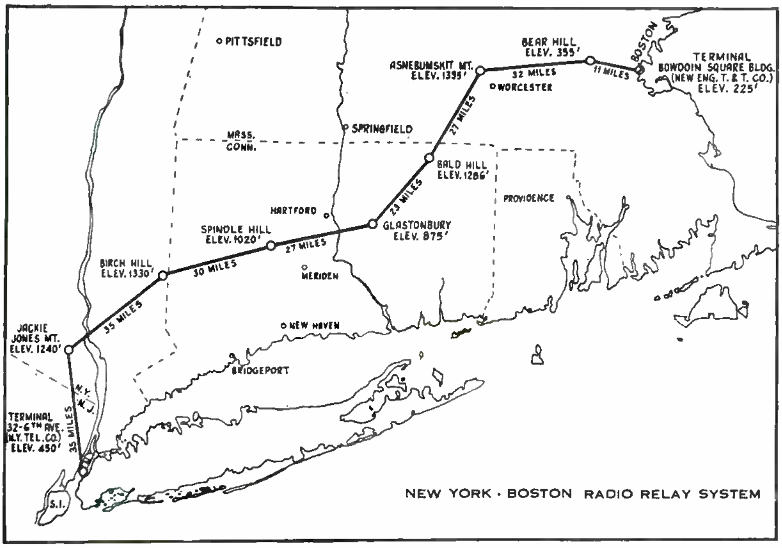
A. T. & T. moved ahead on its trial of microwave radio transmission last month by filing application with the Federal Communications Commission for authority to construct seven relay stations between the terminals of the New York-Boston radio relay project. FCC approval on the two terminals was granted last year.

This trial of microwave transmission is intended to determine its efficiency, dependability and economy for multiplex telephony and for interconnecting sound broadcast and television stations. It will help to determine how large a rôle this type of system will play in the provision of additional links in the Bell System's network of communications routes.

Bell System scientists view radio relay as a promising means of attaining very broad bands of transmission which can be carved up into different channels for telephone and telegraph messages and for sound broadcast and television programs. A technique by which this can be done on the new coaxial cable systems has already been developed by the Laboratories.

Sites for the relay stations, about 30 miles apart, were chosen for their elevation. This not only takes into account the fact that microwaves do not travel much farther than the horizon, but it also puts the transmitting and receiving antennas well above intervening obstructions so that the waves can be beamed from hill to hill. The New York terminal will be atop the Long Lines Building at 32 Sixth Avenue, while the Boston station will be on the Bowdoin Square Building of the New England Telephone and Telegraph Company.

To house transmitting and receiving apparatus, buildings will be erected at the



NEW YORK · BOSTON RADIO RELAY SYSTEM

seven relay points. At each station, highly directive antenna systems will pick up and amplify the radio waves and beam them on a direct line-of-sight path to the next station.

The New York-Boston experiments are planned in three parts of the radio frequency spectrum—near 2,000, 4,000 and 12,000 megacycles. Eight channel assignments, each 20 megacycles wide, are being requested from the FCC in each of these parts of the spectrum. It is planned to use the eight channels to provide two simultaneous transmissions in each direction, with different frequencies in adjacent relay sections.

If the experimental facilities prove as satisfactory as the radio engineers expect, and if this method of transmission is found to be economically feasible, apparatus will be standardized in order that the Bell System may be prepared to install similar systems on other routes throughout the country as needed. The same frequencies can be used over and over at alternate relay stations on these systems. In cases where two or more systems radiate from one terminal or where branch circuits connect with the backbone network, additional frequency assignments may be necessary. The probable later addition of spur connections to nearby cities and towns points to a spreading out of radio relay channels in all directions from a backbone network. It is entirely possible that the radio relay systems eventually will be connected with the Bell System's coaxial cable network for nation-wide telephone service and for sound and television programs.

The New York-Boston route was selected for the experimental trial of micro-wave radio relay because of its nearness to the Laboratories and because of the continuing need for additional facilities between these two cities. Also, with coaxial cable already in place between New York and Washington, completion of the radio relay system would provide very broad band transmission facilities all the way from Boston to Washington.

The radio research and development personnel of the Laboratories is now engaged almost entirely on war work. The New York-Boston project will be carried forward as rapidly as personnel may be released from this work.

Long Lines Rushes Five K-Carriers for United Nations Parley

Five new K-carrier systems were rushed to completion by the Long Lines Department of the A T & T for the United Nations Conference at San Francisco. These increase the number of long distance talking circuits to San Francisco from 140 to 190.

Twenty-one private line teletypewriter circuits in addition to sixteen already in use to San Francisco also have been provided. Of these, ten are from New York, seven from Washington, three from Chicago and one from Dallas. Those from New York, Chicago and Dallas are nearly all special newspaper circuits. In addition, the Associated Press, International News Service and United Press continue to use their regular teletype services.

The A T & T also handles the regular and special broadcasting hook-ups for the conference. The total of eleven includes the American and Canadian networks and two special services for Government use. CBS and NBC also are using their regular teletypewriter services.

"The Plane With a Thousand Eyes"

[EDITOR'S NOTE: *In the December issue of the* RECORD, *E. H. Sharkey of High-Frequency Development told of his assignment as a Technical Observer to the 13th Air Force, to introduce newly developed equipment to the men who were to use it. An account of its success is excerpted, by permission of* Air Force, *the official journal of the Army Air Forces. Illustration—U. S. Navy Photo.*]

"CONSIDERABLE research and practice went into the development of the Snooper—which has been referred to by the Japs as 'the plane with a thousand eyes.' Credit for much of the pioneering must go to Col. Stuart O. Wright, who in 1942 rounded up some veterans from the old First Sea Search Attack group and formed the first Snooper squadron.

"First they tried out the new equipment while hunting enemy subs. Then came months of additional testing at Eglin Field. Finally in the summer of 1943 they decided they were ready. In August of that year, the first squadron arrived in the Pacific and joined the 13th Bomber Command.

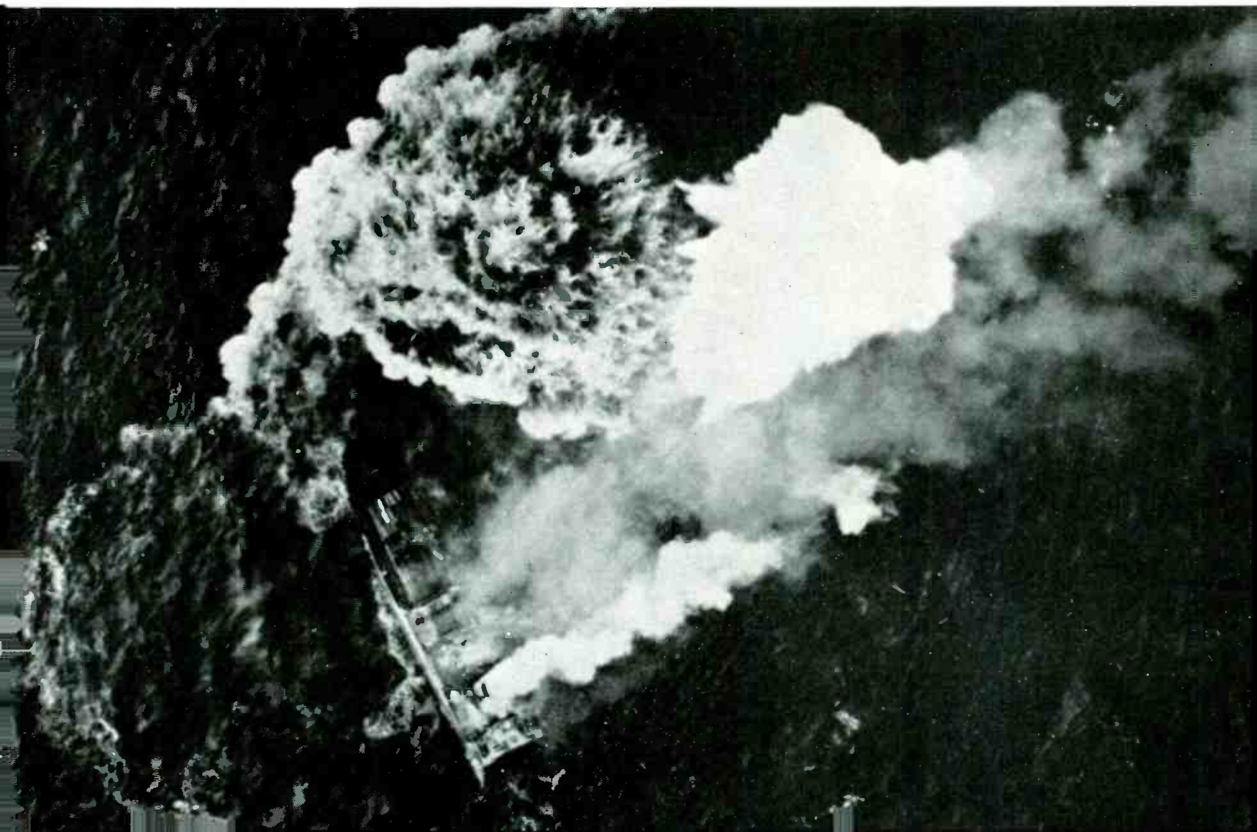
"In those days the Japs were convinced they could hold the Solomons for a long time. We had fairly good control of the sky in daylight but at night Jap surface vessels could shift men and supplies from one island to another with little chance of detection.

"But on the night of August 23, 1943, we gave the enemy one more indication that this war was going to be fought according to our time table and under our conditions.

"Two Jap destroyers slipped out of their hidden harbors and moved into the slot that runs all the way up the Solomons between Santa Isabel and New Georgia. They were going to evacuate some troops from Kolombangara and Vella Lavella.

"We knew they were coming. They had been doing this regularly for it had been almost impossible to intercept them due to treacherous waters and darkness of night.

"Suddenly several bombs rocketed down as if they were released along an invisible line connecting the plane with the ships. As they hit squarely on the destroyers they tore the night apart. The airplane made two bomb runs and each time scored direct hits.



"This was the first Snooper mission and a highly successful one. But the Japs evidently thought that precision bombing after sundown was purely a matter of luck. They continued to send shipping down the slot.

"This refusal to face realities proved costly for the Japs on the night of September 29, 1943. In Snooper annals, this date is known as 'the night of the Tokyo Express.' On that night eleven enemy ships steamed down the slot to evacuate their men from Kolombangara.

"The Snoopers were expecting them. They had six planes up, and every entrance and exit in the slot was covered.

"There is little twilight in the tropics and the darkness closes in quickly. It was just a few minutes before the last faint rays of the setting sun had vanished from the western horizon that the Snoopers caught the Jap convoy in Bougainville Strait.

"By the time the battle was joined, it was completely dark but the Snooper crews could see their hits. Five distinct fires flared up from five of their targets. One ship blazed like a candle in a closet before capsizing.

"In the early morning the action finally was broken off. The Jap formation turned—what was left of it—and retreated back to its base. The enemy had used every means available to break through the aerial blockade. Their anti-aircraft fire was heavy and one of the Snoopers went down. But the Snoopers again had proved themselves."

V-E Day at the Laboratories

V-E Day at the Laboratories was not a scene of wild jubilation. Too many among us had lost someone to gain that victory, too many had someone still fighting in the Pacific, and there were too many gold stars on our service flag for that. True, there was relief and joy that part of the job was done—but only part.

Fleet Admiral Ernest J. King's letter to the Laboratories reminds us to finish the job:

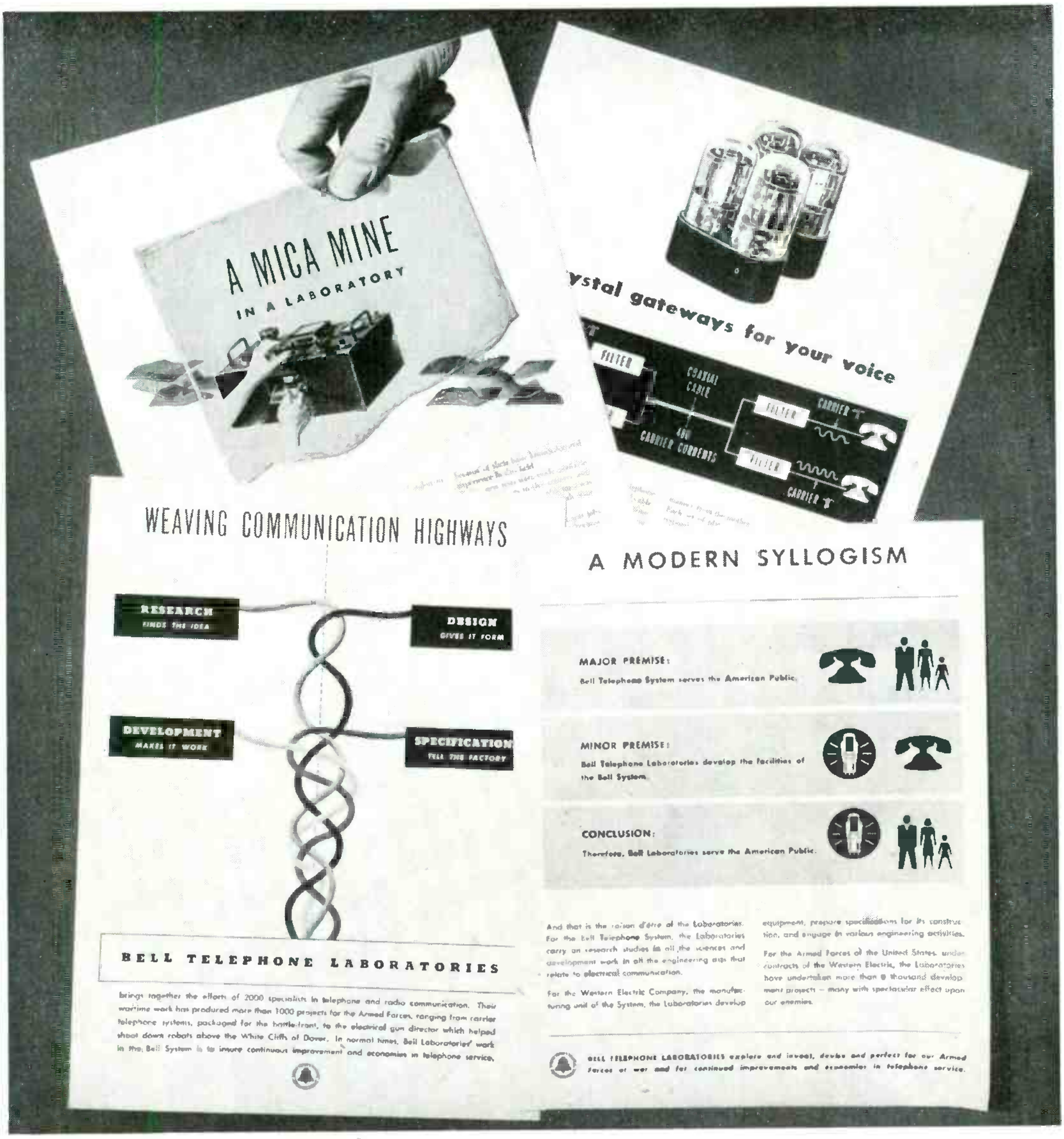
"General Eisenhower has announced the cessation of organized resistance in Europe. A thrilled and grateful Nation is justifiably proud of all who made this accomplishment possible.

"But this is total war—a global war. We are but halfway to complete victory. There remains to be conquered the entire Japanese nation. Men are still fighting, and still dying, and will continue to fight and die in the hard push to Tokyo.

"The casualty lists tell the story, tragic yet glorious, of the fighting men's will to win unconditional victory, no matter what the cost. We have a solemn compact with these men. The road that lies ahead demands

Dr. Buckley acted as toastmaster at the dinner in honor of John Mills tendered by his associates in the Bell System. The high esteem in which Mr. Mills is held was reflected in the tenor of the talks by Dr. Buckley, F. B. Blackwell, G. B. Thomas, F. B. Jewett and L. S. O'Roark, all made in such a manner that an unusually pleasant evening was enjoyed by the 240 attending from each of us a matching determination and unity of effort that will shorten the time during which such sacrifices must continue.

"Today every worker should rededicate himself and herself to the task of providing these men with the weapons and equipment they need to smash the remaining enemy. To delay now in celebration of past success would be fatal to carefully laid plans. We cannot—and must not—pause in discharge of our duty so long as a Jap remains a threat to the life of a single soldier or sailor."



Did You See These Bell Laboratories Advertisements?

A series of advertisements intended to inform a wide audience of the work done by the Laboratories for the Bell System in peace, and the Armed Services in war, is appearing this year in technical and scientific magazines. They are prepared by N. W. Ayer & Son in coöperation with P. B. Findley and M. Brotherton of the Laboratories. The Ayer agency is also responsible for general Bell System advertising. Next time you open a technical magazine, look for the Laboratories advertisement

William P. Trottere, 1901-1945

William P. Trottere, a member of the Technical Staff with nearly twenty-five years of service, died on April 18. Mr. Trottere joined the Engineering Department of the Western Electric Company in 1920 as a technical assistant. After taking the drafting training course he entered the drafting group of what is now the equipment development section of the Systems Development Department. Later he transferred to the equipment engineering methods group of the same department. For the past twenty years Mr. Trottere has been concerned with the standardization of electrical design and maintenance information supplied to the Western Electric and associated companies in the form of equipment and circuit specifications and drawings. In this he has worked closely with the Engineer of Manufacture of the Western. He was also responsible for the proper distribution of all drawings and specifications prepared by the Systems Department. For the past few years he has been doing similar work in connection with Army and Navy projects.

Delroy C. Betts, 1893-1945

Delroy C. Betts, an instrument and tool maker in the Development Shops Department at Murray Hill, who joined the Laboratories last July, died on April 10.

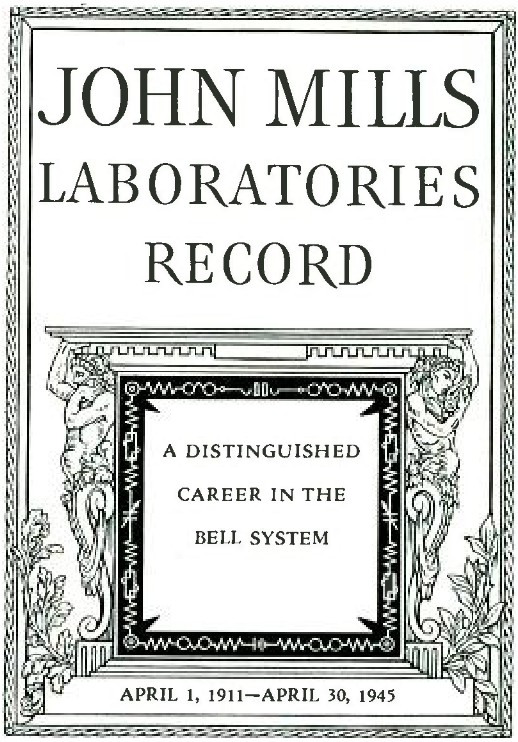
Charles Fey, 1892-1945

Charles Fey, an accounting clerk in the General Accounting Department, who joined the Laboratories in 1934, died on April 16.

Western Electric Produces Gilding Metal for Bullet Jackets

When General Eisenhower's plea for more ammunition shocked the United States out of its state of complacency in late November, 1944, the War Production Board promptly called on the Western Electric Company to help in an all-out effort to rush those sorely needed bullets to our fighting men. True, a great many people may wonder how the country's largest manufacturer of electronic and communications equipment would fit into an accelerated bullet production program, but the answer is quite simple.

At the Hawthorne plant, Western Electric maintains one of the Nation's most modern metals fabricating mills. Although not large when compared with some of the country's huge ordnance plants, having a limited capacity of approximately a million and a quarter pounds of metal a month, its special output of gilding metal for use in 0.30 and 0.50 caliber bullet jackets certainly proved significant in helping to meet the Western Front emergency. The gilding metal consists of an alloy of 90 per cent copper and 10 per cent zinc with an impurity content of less than one-tenth of one per cent so as not to impair forming characteristics necessary in the fabrication of bullet jackets. At



Reminiscent of the early issues of the RECORD *is this cover design for a souvenir book of photographs and letters assembled by his associates in the Bureau of Publication and presented to John Mills at his retirement dinner* the ordnance plant the metal is "blanked" and "cupped" in preparation for further processing at other plants which draw, shape, and fit the gilding metal cups with steel inserts. Finally the bullet is inserted into the shell case complete with powder.

The production of gilding metal at the mills runs approximately 700,000 pounds a month, which is sufficient for about 40,600,000 bullet jackets. Under this schedule, 400,000 pounds goes into 0.30 caliber bullets while the other 300,000 pounds is used for 0.50 caliber bullets.

"Twang!" Went the Telegraph Seventy Years Ago

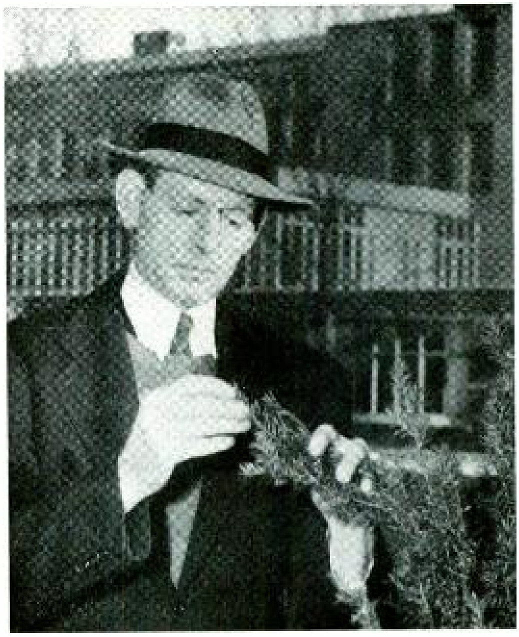
One of the rare days of June happens to be a telephone anniversary. For it was the second of the month, seventy years ago, when the principle of the electrical transmission of speech was verified.

Alexander Graham Bell, in the course of his teaching and experimental work, had conceived the idea that he would be able to pass speech over a telegraph wire if he could find a mechanism that would "make an electric current vary in its intensity as the air varies in density when a sound is passing through it."

Bell described his proposed apparatus to his father and others during the summer of 1874. On June 2, 1875, he was working in Boston on another invention. With Thomas A. Watson to help him, he was trying to send several messages simultaneously over a telegraph wire. Using tuned metal reeds as senders and receivers, he hoped that each pair of reeds at the same pitch could be made to transmit a telegraph message without interfering with signals from reeds at other pitches operating over the same wire.

A reed stuck, which was a common occurrence. Watson plucked at it to free it, also a common occurrence. But Bell, in another room of the building, was tuning the corresponding reed. He had it near his ear when over the wire he heard the twanging reed. Years of experimenting told him that what he had heard was a transmitted sound, tone and overtones complete. In a flash he comprehended that the distant reed, vibrating above an electro-magnet, had set up an undulatory current such as he was seeking.

After Bell and Watson had spent the afternoon plucking reeds, duplicating the phenomenon time and again, Bell gave Watson instruction to make an instrument that turned out to be the first Bell telephone. Watson put it together overnight, and next day, June 3, it transmitted recognizable voice sounds. But it was almost a year before hard work brought forth the telephone that carried the first complete sentence, "Mr. Watson, come here, I want you!"



If you see a tall slim man examining the shrubbery at Murray Hill with a critical eye or superintending the planting of a new tree, it is probably R. C. Keyser, who is in charge of the outdoor grounds there. A horticulturalist and landscape adviser of wide experience, one of Mr. Keyser's most interesting assignments before coming to the Laboratories was the designing and planting of the wild Flower Trail and the Wick Herb Garden for the Morristown National Historical Park. Prior to this he had worked with the Westchester Park Commission and as landscape adviser for the city of Pensacola, Florida. Mr. Keyser's constant care has contributed much toward getting the more than one hundred large trees and many shrubs, which were transplanted to the Laboratories' grounds, accustomed to their new environment.

ICTORY in Europe

On to the PACIFIC

Colonel M. A. Specht

"I left Texas in November and proceeded by rail to an Atlantic port of embarkation. We landed in the United Kingdom in the characteristic fog and unpleasant wet weather of the winter months there. Our billets were in an old manor house. It had been previously occupied by Patton's men before D-day. The place was barren and somewhat dilapidated, but not too bad. Our stay in England was more or less enjoyable. The people are very friendly to us Yanks.

"We proceeded to France then, by a motor march, thence via LST and another motor march to a camp area. Our billets here were in a hotel of rather ancient vintage previously occupied by British and before that by German troops. It only lasted a week. Then, off again. This time a long motor march through France and Luxembourg to Germany.

"We're now operating in one of those headline-making armies you read about in the daily papers. There are big things in the making right now. This time there's no doubt about it—the Krauts are taking a drubbing and one from which they will not soon recover, especially if they continue to defend their towns. Here it is all different, it is all work and no play. The non-fraternization order sees to that even if it weren't otherwise taken care of by the job in hand. I'd like to tell you more about non-fraternization, the civilian attitude, our mail which doesn't arrive for a spell of three weeks and then suddenly comes all at once, what we get to eat, PX rations, laundry, baths (wish I could take one right now!), and those homely little things which I always took for granted but which you realize are so important only when you don't have them, like electric lights, running water, central heating."

Captain Bertram M. Froehly

Captain Bertram M. Froehly, B-25 pilot of the First Air Force, visited West Street recently for the first time in three years. Captain Froehly returned from overseas duty a year ago. He went overseas with the 15th Bomb Squadron—the first American outfit to be stationed in England. He has received battle stars for the invasion of Africa in 1942, the battle of Tunisia, and for the Sicilian Invasion. He has also been awarded the Air Medal and four oak leaf clusters for completing forty missions.

Lieutenant Alfred Bertin

"I'll tell you about one of the missions to the Manila area now that the censorship regulations for that sector have been lifted. Incidentally, this happens to be the one in which I crashed. In the briefing the night before we learned what our target was and all the information about flak and intercep-

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tion and the route to be followed. The target happened to be Grace Park Airdrome that hadn't been hit before.

"The crews were awakened at 0100 and we ate and then went to the line. We took off at 0300 and flew to a point about 200 miles from our target where we got into formation for protection against fighters and continued on. When we were about five minutes from the target, the sky began to fill with black puffs of flak. There was quite a bit of it but these gunners weren't very good and didn't knock anyone down. Quite a few planes had holes in them, including ours.

"During the bomb run I usually stand in the bomb bay to watch the bomb hits and also to kick any out if they happen to get caught in there. After the bombs are away, we get out of there in a hurry. On our way back our gas began to get a lot lower than it should, so we figured that the flak burst under our wing must have put a hole in the tank. As our tanks read empty when we were over Mindanao, we crash-landed there. Everything was O.K. except that when we hit the ground the interior became a sheet of flame. Everyone got out except one, but the rest of us were pretty well burned. How we got out of Mindanao is still a secret because of security reasons.

"The mission was an exception insofar as we usually get back to our base. Quite a few of our missions average around 2,000 miles round trip and last twelve or thirteen hours. This was one of them. The whole crew received a Purple Heart but so far we haven't any other medals. I might say that we don't care if it is the only one that we ever get."

Roll of Honor

Killed in Action

Lieutenant Ernest G. Graf
Ensign David F. Greenhagen
Private Sarkis Karibian
Private Edward A. Fern
Lieutenant Stanley W. Erickson
Captain Orrin F. Crankshaw
Private Harry A. Malone, Jr.
Private Eugene H. Sheehan
Lieutenant Thomas M. Pepe

Missing in Action

Lieutenant Robert F. Healy
Private Joseph T. Murphy
Lieutenant Everett T. Urbanski
Lieutenant John K. Gardner

Prisoner of War

Lieutenant Ralph D. Horne

Leaves of Absence

As of April 30, there had been 979 military leaves of absence granted to members of the Laboratories. Of these, 59 have been completed. The 920 active leaves were divided as follows:

Army 513 **Navy 301** **Marines 30**

Women's Service 76

There were also 18 members on merchant marine leaves and 23 members on personal leaves for war work.

Recent Leaves

United States Army

Florence Gordon
Lyla Mann
Robert W. Molloy

United States Navy

Franklin J. Dempsey
Anthony L. Ferrara
Carl W. Fink
Herbert J. Fischer
Robert J. Hausler
Arthur Leonhardt
John F. Leyden
Thomas J. O'Connor
George E. Schoener
Marjorie C. Urban

United States Marines

Mildred Beckner

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Lieut. Thomas M. Pepe Killed in Action

Previously reported missing in action, word has now been received that Lieut. Thomas M. Pepe was killed in action in the South Pacific on March 9. A photograph and biographical sketch of him appeared in last month's RECORD.

Lieut. John K. Gardner Missing in Action

Lieut. John K. Gardner of the U. S. Army Air Forces has been missing in action since February 17, 1945. Lieut. Gardner was the navigator of a B-17 Flying Fortress whose mission was to bomb Frankfurt, Germany. The target was successfully bombed and on their return to the base in England, it was noticed that the craft had lowered its landing gear and dropped out of formation. The plane was under control, and was last seen disappearing in a cloud.

LIEUT. JOHN K. GARDNER

On a previous mission he had guided their blazing B-17 until it could bomb enemy troop positions and then charted it safely back through flak corridors to an emergency landing in France.

Lieut. Gardner was a member of the 388th Bomber Group, a unit of the Third Air Division, the division cited by the President for its shuttle mission to Africa when Messerschmitt plants at Regensburg were bombed.

Joining the Laboratories in September, 1941, he was a technical assistant at the Laboratories at Deal, New Jersey, before he entered the Air Forces in November, 1942. His only brother, Lieut. George T. Gardner, was killed in action on Easter Sunday.

Howard S. Hopkins

"Having traveled through Italy, France, Belgium, Holland and now Germany has kept me on the go. I have been in Germany for some time. I am still an Infantryman and so far there is never a dull moment. From what I've seen, and it's been first hand, I'd say it was an excellent job so far as regards destruction of German property. I have seen the handiwork of Nazi looting in Allied countries. Here the civilian population is kept indoors cooped up just as Allied civilians once were and permitted out one hour per day. Non-fraternization on our part is strictly enforced, so it's quite a change from other countries we've liberated."

A. B. Watrous

"I am now overseas stationed somewhere in Italy and assigned to the Signal Corps. There is a Frank Lukacs attached to the outfit I'm with. He is the brother of J. J. LUKACS of the Systems Department whom I knew and worked with at West Street."

Leon P. Newby

"I have been overseas for fifteen months and have seen most of our bases in the Pacific area. We are now in the western Carolines. Came here with the Marines and had a rough time for the first month or so. The price of victory comes high as most of us have learned in the past few months. Japs have tried to raid us with landing parties several times but have been beaten off and killed or captured. The Marine Air Wing is

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doing a splendid job here and the Japs don't venture out very often. They estimate there are 40,000 Japs immobilized by them in this area.

"If you folks are wondering how we are living these days, all I can say is 'It couldn't be better.' We are in Quonset huts as this is a hurricane zone. We lived in tents a year and the huts are quite a change. All the cigarettes we need. Fresh meat and vegetables about every day. Have had our first oranges and fresh eggs in over a year. So you can rest assured the fighting men are getting the food you folks are doing without."

Captain Nils H. Anderson Receives Bronze Star

Presentation of the Bronze Star Medal for meritorious service in combat from March 8, 1943, to May 15, 1943, to Captain Nils H. Anderson, now in charge of combat firing problems at Camp Croft, South Carolina, took place on April 12. Captain Anderson, then a Second Lieutenant, was Communications Officer of the First Battalion Headquarters, 135th Infantry Regiment.

Captain Anderson was in two major engagements. The first engagement was at Fondouk Gap, where our troops were assigned to open the gap for the British First Army's 6th Armored Division, and in the face of heavy artillery fire which lasted for six days Captain Anderson's outfit kept open communications lines, contributing to the breakthrough of the British armored division.

The second engagement was on the now famous Hill 609, on the other side of which was Mateur and final victory in Africa. Captain Anderson's outfit again kept communications open for a period of seven days, resulting in the key junction breakthrough and final victory. He later left for Italy with his division, where he was wounded and awarded the Purple Heart.

R. E. Strebel

"Since I last wrote I've completed a gruelling phase of the course including all kinds of transmitters and receivers. Under transmitters we studied and worked with all types; portable, semi-portable, non-portable; all channels, high and low frequency, various power capabilities. Theory tests are given every week and a tough lab test at the end.

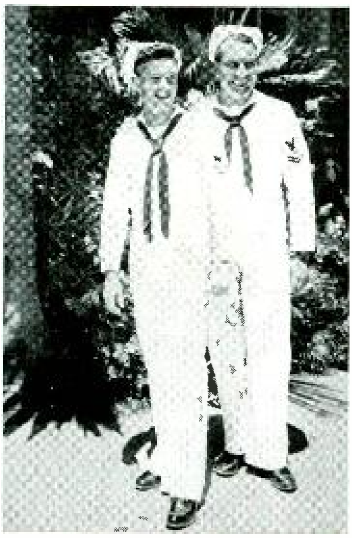
Major General Hestes (left) presenting Bronze Star to Captain Nils H. Anderson

A few of the well-known manufacturers are Westinghouse, RCA, Collins, but Western Electric builds the finest. My experience with schematics as a draftsman certainly helped me a lot. One of my instructors was unlucky to catch hold of 2,000 volts but fortunate enough to survive.

"This phase of training included frequency modulation antennas, radio direction finders and a course in navigation. Navigation is required to understand and operate all RDF equipment. Antennas and antenna theory I find to be one of the easiest subjects of the course."

Monroe W. Dring

"I managed to get through the Primary training program and was fortunate to be sent to Washington, D. C., for my secondary training. This is where we get our practical training—working with gear that is used aboard ship and on shore stations. We worked almost exclusively with receivers in primary—mostly in theory. Actually when we finished we were nothing more than radio servicemen. However, here we start working with, first, Navy type receivers, then Navy type transmitters of various kinds. Then comes 'Sonar'—underwater sound equipment. I was working on the board for two weeks here before I started school, drawing



Col. R. O. Ford (left) is in Europe. In the other photo, J. C. Stuhlman meets B. P. Ransom in the Pacific

up circuits for this equipment. They were circuits used for adapting the shipboard gear to laboratory use. Actually, the operation of the equipment is changed little. Ran across some BTL designed, Western Electric built 'Sonar' equipment. Out of curiosity I asked some of the instructors (who, incidentally, are, for the most part, men who have been at sea, working with the gear under combat conditions) how they rated Western Electric equipment with some of the others. Most of them say it's definitely the best. I'll form my own opinions in a few months, although I suppose I'll be prejudiced at the start."

Emmett F. Noe

"I have moved about quite a bit. From Washington, D. C., I went to school at Sperry Gyroscope in Brooklyn. There I specialized in gyro repair for gun sights. After two months at the Sperry School I was given some practical experience in the Brooklyn Navy Yard. For three months I installed, overhauled, and checked gun sights. Then I was sent to the Canal Zone to start a shop for the maintenance of the same sights. Two other men arrived with me and we started our shop. The building was waiting, but the equipment hadn't arrived, so we were put to work repairing all types of fire control equipment, from sound-powered phones to computers and hydraulic and amplidyne systems. After three months of this our equipment arrived and we set out to finish our shop. We set up most of our own test equipment, wired it and standardized it in hopes of perfection. With completion of the shop I went back to gyro repair and continued in it until I took an examination for the Navy V-12.

"In June I arrived in Asbury Park, New Jersey, for a month of pre-midshipman school. In July I started my first term at Yale University. At the end of February I'll have completed two terms of college. It seems that my enlistment in the Navy was an invitation to school. Except for the few months in Panama, my enlistment has been spent in Naval schools."

Raymond Yerden

"I'm in a maintenance outfit just as I was in New Caledonia, and I am in charge of the refrigeration section on repair work, so you see there is never a dull moment. Time has never passed so quickly."

William Dimella (left) is at Camp Edwards, Mass., and B. A. Stiratelli is at Camp Lejeune, N. C.

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Lieutenant Paul Mallery

"I am now somewhere in the Philippine Islands. I am rather hoping that the Army will see fit to send me home soon, as I am on my 31st month overseas now."

David W. Jones

"No doubt you know that I'm back and down at Staunton, Virginia. Traveled in style, came over on the *Queen Elizabeth*, stayed at Halloran Hospital in Staten Island for two days and then came down here on a de luxe hospital train. The trip over was swell although I didn't get around too much because there was a shortage of crutches and until the others got tired or a little sick, I had to take my turn, but after that I used them quite a bit. Meals in bed and the best of service was also provided. I don't know who was in charge but the ship had near all English help on it. The medics were American though. What a ship! It's hard to conceive the size of it, just a few feet smaller than the Empire State Building is tall. There was a rumor that subs were near by and the next morning they said we were fourteen hours behind time; but the officers didn't give a reason, so it was possible."

Edwin J. Schnabel

"I've been in Germany for the last two months and am quite anxious to get out of it—rest assured that this Rhineland is not all the guide books say it is. The BELL LABORATORIES RECORD is more welcome by me than pay day—a nostalgic reminder that all the world is not E.T.O."

Colonel Raymond O. Ford

"There are two other Laboratories' men in this headquarters with me who were promoted not long ago. FRANK PARSONS, who is in the Ordnance, was promoted to Lieutenant Colonel, and FRED MONELL, who is in the Signal Corps, was promoted to Major.

"As you can see from the papers, things are going pretty well and we keep fairly busy here on General Bradley's staff directing the American side of the show."

Robert Dryden

"I am stationed in a town instead of the apple orchard which was my home for seven months. Instead of mud, we now have dust to worry about since spring weather is arriving here. I am now working in our repair shop in the instrument section. Aside from repairing instruments which are used for test purposes in radio sets, we have those which are used in equipment made by Western Electric and developed in our own Labs. I am very proud to work with such fine equipment. Keep up the good work and we will continue to lead the world in electronics.

"At present I am working on a meter test set to locate trouble easily and more quickly. It will save much time and work on our part. The original idea is from the RECORD in which there was an article on a meter test set. I have managed to obtain through salvaged equipment the main parts and have resources to others I will need."

Peter A. Byrnes (left) is in Fire Control School at Bainbridge, Maryland, and Peder M. Ness is on an LST in the Pacific

* * * * *

RECENT PROMOTIONS of members of the Laboratories: William A. Beatty, Jr., PhM 3/c; George Behringer, S 2/c; Clayton B. Brown, RT 3/c; T/4 Lawson F. Cooper; Cpl. Philip P. Crowe; Pl. Sgt. William R. Davis; Louis A. Del Fabro, A/S; T/Sgt. Herbert C.

←
H. E. Schollmeyer recently visited Murray Hill. He is a Radio Technician 3rd Class, U. S. Navy, and has been on the aircraft carrier "Wasp" since its commission. Among the engagements in which he has seen action are several which have recently made headlines in the papers

→
Leon P. Newby has been in the Pacific for fifteen months. A letter from him will be found on page 226

De Valve, Jr.; T/5 Robert A. Dryden; Pfc. Joseph J. Emmons; Cpl. Richard I. Forrest; Robert A. Hawley, S 2/c; T/4 Robert E. Henneberg; Paul A. Hopf, S 2/c; T/5 Arthur Jackson, Jr.; Jesse M. Jackson, QM 1/c; Pfc. Henry A. Lamperty, Jr.; Joseph C. Lang, S 2/c; 2nd Lt. Alexander E. Lawson; Carmen C. Marsicovete, RM 3/c.

T/Sgt. John F. McCarthy; Cpl. Elizabeth McIlravey; Kenneth F. McKenna, S 1/c; T/Sgt. Francis R. Merritt; Pfc. Frank Navratil; Pfc. Victor B. Obermiller; Pfc. Thomas J. O'Neill; Joseph D. Ontka, Coxswain; Lt. Col. Frank A. Parsons; Harold W. Raimert, A/S; Howard Rohr, EM 3/c; William L. Rohr, F 1/c; Richard C. Ryan, RT 3/c; 2nd Lt. Warren B. Sage; T/Sgt. George A. Schiehser; Pfc. Robert Schuster; Cpl. Peter H. Shearer; F/O John P. Slickers; Carl E. Smedberg, CMM; Pfc. Alfred T. Stiller; Michael V. Sullivan, RT 2/c; 2nd Lt. George E. Tirone, Jr.; John A. Whitaker, AMM 3/c.

John J. Barrett, RT 3/c; William F. Blazure, F 2/c; 2nd Lt. Raymond P. Chapman; James M. Cullen, CEM; T/3 Robert W. Dawson; Vincent Decker, S 1/c; Col. Raymond O. Ford; Sgt. George E. Fuchs; 2nd Lt. Frank R. Hanlon; John J. Nichik, RM 3/c; Capt. Jacob W. Schaefer; 2nd Lt. Arthur F. Schweizer; George A. Sharpe, S 2/c; Ensign John J. Sweeney; Cpl. Raymond S. Yerden.

Lieut. Alexander E. Gerbore is stationed at the Army Air Field in Salina, Kansas; James M. Sullivan is with the Signal Corps in Luxembourg; Lieut. Oscar Y. Otero is stationed at the Romulus Army Air Field in Michigan.

J. M. Cullen writes: "I didn't see R. F. Flinn but I'm close to where he was wounded. It sure is going to be good to get some leave, one of these days. My last leave was December, 1942."

William Dimella is at Camp Edwards, Mass., doing M.P. guard duty; John J. Barrett is "in the Sonar phase of training here at the Navy training station in Chicago"; W. H. Bauer has "been assigned for training on the A.R.L. 31 U.S.S. *Belleophon*—the name being very familiar after working for BTL."

Major Fred Monell, Jr., writes: "Had a quick look at the Rhine recently and found our old friend Lt. Col. W. H. Edwards right in the foreground. We had not met in over a year, so chorused in unison, 'Fancy seeing you here.' Also see Colonel Ford quite often."

Charles T. Bolger is on detached service taking a course in photography at Fort Belvoir, Virginia.

Patrick Smith writes: "I have been in combat and the mail service is not so good. I have been in the hospital for three months and have had several different addresses."

Howard Rohr writes: "Through the Record I located a friend who used to work in 4C and is now working in the same unit with me."

"I'm doing the same work I was doing at the Labs," writes Joseph Mazzi. "Only in a big way. It isn't too bad out here. I'm getting used to the idea of living in a warm climate. But, give me the winter anytime."

Richard A. Shine writes: "I am now stationed in Boston, after spending two years aboard an amphibious transport. I partici-

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pated in the invasions of Sicily, Salerno, Normandy and Southern France, and am now 'drinking' in all the luxuries of the good old U.S.A."

Manfred Krischik is stationed at Sampson, New York.

Richard F. Heinrich finished the course at primary optical school in Washington, D. C. and is now taking an advanced optical course at Portsmouth, Va.

Donald Schafer writes: "Right now, I'm in Aviation Radio School at Memphis, Tenn., and will be for twenty more weeks. Then I'll have four months of gunnery and operations before I get my wings."

Donald Viemeister, back in the Pacific after his leave last summer, has added another invasion to his list—Iwo Jima.

Capt. B. M. Froehly   Lt. A. F. Schweizer

Louis J. Antonucci visited West Street recently for the first time in 18 months. He is doing machine tool operating as Machinist's Mate 1/c at Norfolk, Virginia.

Frank R. Hanlon writes: "Have been in combat a few months now, flying heavy bombers over what is left of Germany. I have an Air Medal and cluster. If all goes well I should be home in late spring or early summer. If the war here ends before I finish my tour, I'll probably be slated for the South Pacific."

Mary Elizabeth McIlravey of the WAC is stationed at the President Hotel in Atlantic City.

Lieut. William H. Burgess, P-38 Lightning pilot, has returned home on leave from Italy after a year's service overseas.

Lieut. Clifford N. Greene, formerly a draftsman at Murray Hill, has just been graduated from the Army Air Forces Pilot School at Turner Field, Georgia. He visited friends recently at Murray Hill.

Robert E. Henneberg and Francis R. Merritt have recently been sent overseas; Victor B. Obermiller is stationed at Camp Upton, New York; John J. Carroll is "at the Philadelphia home terminal of the Navy's aviation supply line."

B. A. Stiratelli, a member of the Technical Staff at Murray Hill, has finished boot training at Parris Island, South Carolina, and has been assigned to the school for Marine Combat Intelligence at Camp Lejeune, North Carolina. He visited former associates at Murray Hill recently.

Lieutenant Alexander E. Lawson, Jr., was commissioned in the Corps of Engineers at Fort Belvoir, Virginia.

Eugene Francois visited the Laboratories recently. He is an air crew trainee at the Lockborne Army Air Base, Columbus.

Charles A. Haas is stationed in Berkeley, California; Edward Karpen is with the Signal Corps stationed in Seattle.

Edward J. Dixon has been sent overseas.

When A. L. Stillwell of the Laboratories was at Eglin Field, Florida, he met Eunice Storey, member of the Laboratories in the WAC, who is stationed there doing maintenance work on radar.

Philip A. Walz, after completing a six-week course of Infantry weapons and maneuvers, has gone overseas.

E. J. Moskal is at Mt. Home, Idaho, taking a three-month period of staging and training. He is doing extensive navigation on a B-24, having accumulated a full crew of officers and enlisted men. My congratulations to Flight Officer John P. Slickers upon his graduation in Texas."

L. J. Antonucci   J. V. Moynihan

A. J. McNaughton has been in "England and France so far. Future destination unknown."

Lawrence A. Vabulas "saw Charlie Dalm here in San Diego last week, and it sure was good to see one of the old gang."

James J. Viggers is "now in Germany. I told you when I was in France that there were plenty of convoys to check, but that was nothing compared to what is going past our post here in Germany."

Thomas A. Pariseau is overseas with the 54th Troop Carrier Squadron and "flying enough to make up for all I've missed in the past six months."

Robert C. Lockwood writes: "It sure was swell to get back to the Labs and see some of my old friends. I had 21 months in the South Pacific and now I am supposed to stay in the States for 18 months. Virginia is not exactly the best place in the States to be stationed, but anything in the States is a lot better than those little islands out there."

When Eugene A. Kleiner visited Murray Hill recently, while on leave from his assignment at the U. S. Naval Mine Warfare Test Station at Solomons, Maryland, he brought with him his small daughter Mary. Eugene was an instrument maker at Murray Hill before he joined the Navy last year

We have had several requests to publish addresses of our men on Military Leave of Absence. We regret that under censorship regulations this is not permitted.

Eugene Pontecorvo is with the Medical Corps somewhere in France.

"Right now I am busy teaching navigation to a hundred officers at Annapolis, Maryland, P.G. school. It's a pleasant assignment and I enjoy it. Saw Major L. W. Stammerjohn recently. We were roommates when we were working at the Labs," writes Lieut. L. G. Fitzsimmons, Jr.

F. R. Misiewicz is somewhere in the Marianas. "I have finally been situated at a permanent base. Am assigned to a radio repair group, and I'm in contact with a lot of Western Electric and Bell Lab equipment."

Joe Ontka writes: "I have hit Iwo Jima with the 5th Amphibious Force. It sure was everything that the papers said about it."

George N. Eltz is stationed in Belgium now, flying P-47's with the 29th Tactical Air Command of the 9th Air Force.

Walter E. Lichte is now somewhere in France. He would like to be remembered to all in Department 7521.

Ensign Harold C. Bell writes: "I certainly enjoyed that February article on the PBM trainer. We used it and it was 100 per cent as good as an actual instrument flight could have been and no danger involved. You are doing great work there."

James Campbell is somewhere in France with an engineer battalion.

"I am now seeing a little action in western Pacific and have a few Japs to my credit. We go out on patrols hunting them out of caves. It's just like hunting rabbits only they shoot back," writes Charles Hempel.

Commander Nels C. Youngstrom is "still on the same island in the Pacific."

H. C. De Valve, Jr., writes: "I was hospitalized because of a recurrence of an old trouble. I have not been in combat and my injury was in no way due to enemy action. The Army has done a magnificent piece of surgery so that I shouldn't cause any future trouble."

News Notes

Timothy E. Shea, formerly a member of the Laboratories and later chief engineer of the Electrical Research Products Division of Western Electric Company, has returned to the Western following four years' service as director of research for Columbia University Division of War Research, which operates under the National Defense Research Committee. Mr. Shea has been appointed superintendent in charge of manufacturing engineering at the Company's Vacuum Tube Shop in New York City, and took over his new assignment last month.

During the past year and a half, Mr. Shea has been working chiefly with the submarine forces, a job that has required extensive travel to many points throughout the world. Most important of the activities which he has directed has been the New London N.D.R.C. Laboratory which was specially organized for submarine and anti-submarine work in close coöperation with the Navy. Most of the projects Mr. Shea has supervised are still guarded by secrecy, but they have had a decided influence in the successful prosecution of the war.

* * * * *

A complete catalog of Bell System motion picture films has been prepared by the Motion Picture Division of A T & T and is now on file in our Library. Included in the list are many pictures which are suitable for showing, by members of the Laboratories, before civic groups with which they may be identified. Films for this purpose can usually be borrowed without charge on a few days' notice from the source that is indicated in catalog.

When Dr. I. I. Rabi was carrying on the investigations which recently won for him the Nobel Prize in Physics, A. L. Samuel was a part-time student of his at Columbia and was working at the Laboratories on the problem of extending the range of ultra-high-frequency vacuum tubes. Several of these experimental tubes were sent to Dr. Rabi at that time. He generously acknowledged this coöperation of the Laboratories when he received the Nobel award from Dr. Nicholas Murray Butler at presentation ceremonies held at Columbia on April 11.

* * * * *

Lieut. Col. Benjamin F. Kaiser, of the Quartermaster's Department of the U. S. Marine Corps, in a recent letter to K. G. Compton said, in part: "I take this occasion to thank you and Bell Telephone Laboratories for the excellent interim report on *The Effects of Moisture on the Electrical Operation of Communication Equipment Used in the Tropics and Possible Control.* This pamphlet contains a great deal of helpful information, and obviously much study and research have gone into this problem."

* * * * *

About 26,000 calls a week are being recorded by automatic toll ticket recording devices which had their first installation in the country at Culver City, Calif., over a year ago (see Record, July, 1944, page 445). Public acceptance of the new method is shown by the fact that within two weeks after the new equipment was placed in service, subscribers were dialing about 70 per cent of the calls they could complete by this method; after three months this increased to 95 per cent, and it is now over 98 per cent.

May Service Anniversaries of Members of the Laboratories

10 years

Margaret Higgins
R. F. Huebner
E. G. Morton
W. G. Pfann
E. G. Walsh
Joseph Weltert
W. L. Whinn

15 years

W. B. Angerole
N. J. Brendel
W. J. Carey
Patrick Clifford
Georgine Fredericks
M. W. Frick
C. R. Geith
K. P. Hansen
W. S. Henneberger
T. C. Kraft
O. E. Larsen
S. A. Levin
W. J. Reber
D. H. Ring
J. C. Schoenenberger
L. W. Stengel
A. B. Thomas

20 years

R. P. Booth
A. C. Foth, Jr.
Wilhelm Gnorich
Alfred Herckmans
Walter Kalin
Mary Kirby
John Lightbown
T. L. Oliver
Frank Rehak
Max Schrauth
George Scott
Fred Sindlinger
M. B. Umnitz

25 years

T. E. Battaglia
G. H. Bogart
S. J. Brymer
W. K. Burke
Emil Dickten
R. C. Eggleston
B. L. Leger
Frank Lohmeyer
A. E. MacMahon
E. G. D. Paterson
Isabel Polantino
Rudolph Slovenz
G. R. Stilwell

30 years

A. S. Fritz
J. P. Schafer
F. A. Wolfe

35 years

W. L. Deisel
A. O. Jehle

40 years

Abraham Chaiclin
O. H. Kopp
V. W. Langborgh

Distaff

"Symbolically, the work or activities of women, or woman's authority or domain"—Webster

AGNES GLAAB is the girl to see when you have a transportation problem at Whippany. Agnes arranges car pools for the people who drive-share or who are riders. She also takes care of gasoline and tire rationing that is handled through the Laboratories, she checks and files applications for regular occupational tire and gasoline rations, and checks with ration boards in case of any irregularity in allotments. Before coming to the Laboratories, Agnes first worked as an accountant in the U. S. Treasury at Newark, and then in the Office of Defense Transportation as an executive clerk.

Agnes has a hand in many of the civic affairs of her community—Whippany. She is Treasurer of Hanover Township, devotes approximately twenty hours a month to duty in the Motor Corps, she is Secretary of the Auxiliary of the Cedar Knolls Fire Department, is on the Post-War Advisory Committee of Hanover Township. Agnes is also Vice-President of the Women's Guild in her church and is active in the First Aid and Home Nursing divisions of the Red Cross.

AGNES GLAAB

CATHERINE DALY

A MEMBER of the Commercial Relations Department in the Chambers Street building, CATHERINE DALY assists in expediting orders for materials used for pre-production models in connection with war projects and maintains records of all phases of the progress of the jobs involved.

With a two-year-old daughter to take care of in her free time, she also manages to write regularly to her husband, two brothers and two brothers-in-law who are all in the service. Her husband is with an Armored

Doris Leach

Division in Germany. One brother is in the Navy in the Pacific, another is in Florida after serving in the African campaign. One brother-in-law is stationed in England after seeing action in Germany and another is fighting somewhere in the Pacific on a destroyer.

In view of the foregoing, it is understandable that she finds her present work at the Laboratories inspiring as well as interesting.

* * * * *

Doris Leach learned drafting in the Laboratories drafting school at Whippany two years ago. She now specializes in schematics and wiring diagrams for use in instruction manuals. Before joining the Laboratories she did clerical work in an insurance company in Newark.

Artistically inclined, Doris has taken courses in art and dramatics. Now she is taking violin lessons; and she is also inter-

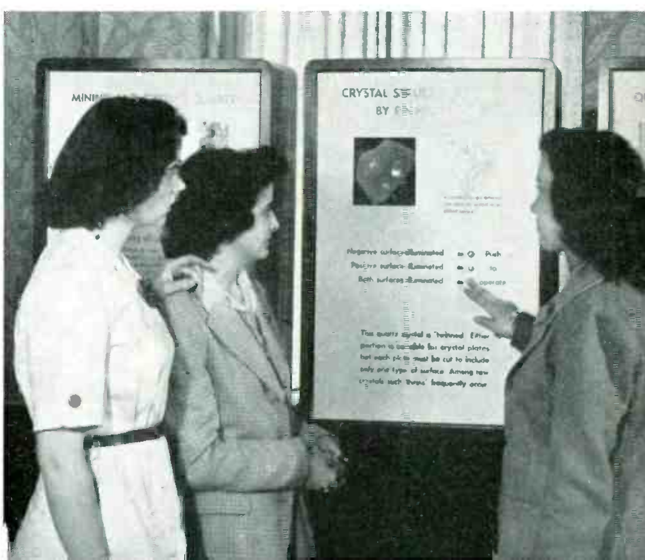
Lilas Stewart

ested in writing. Doris' father came from England and her mother from the British West Indies. Her brother is in the Navy and is now stationed at the Chelsea Naval Hospital, Boston, Massachusetts.

* * * * *

Lilas Stewart, at Murray Hill, does a variety of things in her work in the girls' model shop. In addition to her regular duties, which include operation of lathes and milling machines in the shop, she is occasionally assigned to fabrication testing or assembly work in various laboratories at Murray Hill.

Betty Guinter, Evelyn Vitelli and Muriel Brown of Murray Hill, shown in the photograph below, examine a display that portrays the processing of quartz crystals used in electonic equipments developed by the Laboratories. The display was designed recently by the Bureau of Publication and exhibited at various locations of the Laboratories



Elaine Arlotta

Lilas comes from Portland, Oregon, and now lives in Gillette, New Jersey. She is an enthusiastic roller skater, and she takes piano lessons in New York from the well-known band leader, Johnnie Johnston.

* * * * *

Elaine Arlotta's work in the Commercial Relations Department at West Street is the recording of all cost and delivery requests placed on the Laboratories by the Radio Division and Telephone Sales Division of the Western Electric Company. Before coming to the Laboratories she was with Black, Starr and Gorham, 5th Avenue.

Like most girls doing war work today, Elaine finds plenty to do to keep her busy while she waits for the war to end. She lives in Manhattan with her family. There are letters to write to her fiance, her sister's baby to help care for, club meetings to attend, and shopping to be done. Bowling is her best loved all-around sport—dancing her favorite pastime. One of her outside activities is the "Anton Club," whose purpose it is to make special paddings for incurable cancer patients.

* * * * *

Besides her full-time war job doing stenographic and clerical work at Whippany, Elizabeth Jentzen helps her mother run the only Persian lamb and karakul sheep ranch in the East. Her mother, with Elizabeth's help, has taken over complete management of this ranch near Hackettstown, New Jersey, where they keep a herd of up to 300 sheep. Elizabeth's own Persian lamb coat is made from the pelts of lambs they raised. The lambs must be killed within three days of birth if they are to be used as Persian lamb fur. Karakul, astrakan, and krimmer fur also come from the karakul sheep at various stages of its growth, and its shorn wool is used in making Persian rugs.

Besides taking care of the sheep, Elizabeth and her mother plow their own fields and harvest their own crops of corn, soy beans, alfalfa, fruits, and vegetables—Mrs. Jentzen even shears the sheep herself.

Elizabeth attended Centenary Collegiate

Elizabeth Jentzen

Institute, where she took a secretarial course. In addition to her other activities, she is chairman of the membership committee of the Morristown Little Theater group which is planning summer theater programs. She also plays the piano and sings, and enjoys all sports. Her one complaint is that her 6 a.m. to 10:30 p.m. day is much too short.

How Dry Are We?

Drink from four to six glasses of water a day—this advice is often repeated, and the reason is given us in an article, *Reason Why*, by Dr. M. H. Manson, Medical Director of the A T & T. "In a sense you are constantly blowing off steam. And I don't mean you are bad-tempered. Nearly a pint of water a day is exhaled from the lungs. That water must be replaced.

"Also everyone knows that perspiration covers the skin and evaporates to help keep the body temperature even. This is a form of water-cooling which Nature provides for hot days or hot spots. But few of us are aware that the skin throws off from a pint to a quart a day of what is called insensible perspiration—even on winter days or in air-conditioned theaters. *More* water to be replaced.

"In most body processes water is necessary both to build up tissue and to carry off waste. Many organs manufacture fluid secretions. The liver, to name just one, uses a quart or more water a day to make bile. Nearly all glands emit secretions, and special fluids are constantly compounded to protect the brain, spinal cord, even our knee and elbow joints, from injury.

"Altogether about three quarts of fluid must be supplied every day to replace what has gone into body cooling or maintenance. From food we get about two quarts—bread, for instance, is 35 per cent water; tomatoes 95 per cent. We need about a quart more in the form of beverages—water, milk, fruit juice, tea or coffee."

Louise Baker's "Party Line"

Louise Baker's book, "Party Line,"* is a collection of intimate and humorous snatches of life in a typical American small town as seen, or rather as heard, through the ear of the local telephone operator—Miss Elmira Jordan. Miss Elmira was the "power behind the communications system" in Mayfair. In the days before listening-in on the party line was supplanted by radio's soap operas, her switchboard was the source of the chief amusement and even the chief occupation of most of Mayfair's ladies.

The stories woven with telephone lines by Miss Baker would seem "utter fantasy and unbelievable except to those who know from intimate experience the destructive power of the party line." Miss Elmira commanded the undying respect of the town if for no other reason than that she for forty-three years had her ear on the town's heart, and

*Published by Whittlesey House, McGraw-Hill Book Company, 1945, 273 pp., $2.50.

Engagements

Vincent J. Santalucia—*Mary Castiglia
Edward A. Jantzen—*Gladys Grimm
S/Sgt. Robert J. Fulton, U. S. Army—*Jean Rae Kronenberg
*Leonard M. Nielsen, U. S. Army—Alma Dorothy Weber

Weddings

*Gustav A. Backman, U. S. Army—Maude Darcy

*Members of the Laboratories. Notices of engagements and weddings should be given to Miss Mary Ellen Wertz, Room 803C, 14th Street, Extension 296.

Ann Connell throws out the first ball as the noon-hour recreational softball play gets under way at Whippany. E. I. Bulman, recreational czar at Whippany, observes

would never forget what she had heard. A community dial office has no memory, which is perhaps just as well, but neither is it guest of honor at a retirement dinner.

The characters, though highly entertaining, are not exactly original. Anyone ever having lived in a small town will recognize them immediately.

News Notes

JOHN MILLS, on April 27, spoke on *The Art of Technical Exposition* before the Practicing Law Institute of New York. His talk was one of a series in a course given by the Institute on *Current Problems in Patent Law.*

C. J. DAVISSON, K. H. STORKS and B. L. CLARKE inspected installations of electron microscopes and other instruments at the University of Michigan; Dow Chemical Company, Midland, Mich.; University of Illinois; and Carnegie Institute of Technology at Pittsburgh. Mr. Storks and Dr. Clarke also discussed chemical analysis procedures with engineers at Hawthorne.

R. M. BURNS, Chemical Director of the Laboratories, has been appointed a member of the Advisory Committee for the newly instituted Department of Plastics of the Princeton University School of Engineering.

B. L. CLARKE attended an N. D. R. C. committee meeting in Washington.

M. D. RIGTERINK, A. W. TREPTOW and G. T. KOHMAN visited the ceramic plant of the Westinghouse Electric Company at Latrobe, Pa., where they observed the process of manufacturing metal to ceramic seals.

W. J. CLARKE and G. T. KOHMAN visited the Mellon Institute to discuss new developments in the field of silicone chemistry.

A. R. KEMP and F. S. MALM conferred with Western Electric engineers at Point Breeze on present and future projects relating to insulating materials for wire and cable. Mr. Malm has been appointed a member of A. S. T. M. committee on Specifications and Methods of Testing Rubber.

A. C. Walker spoke on *Abrasion Testing of Textiles* at regional meetings of the Textile Research Institute held at the Georgia Institute of Technology, Atlanta; North Carolina State College, Raleigh; and at the Philadelphia Textile Institute.

C. J. Frosch has been appointed Program Chairman for the Newark Section of the Society of Plastics Engineers.

G. C. Southworth was the author of an article entitled *Microwave Radiation From the Sun* published in the April issue of the *Journal of The Franklin Institute.*

H. H. Glenn and C. A. Webber discussed cord problems at the Baltimore plant of the Western Electric Company.

R. A. Sykes, G. M. Thurston and J. F. Barry were at the Bureau of Ships in connection with crystal work.

E. H. Gilson and C. R. Steiner, at Point Breeze, investigated common coupling impedances in electrolytic capacitors used in an oscilloscope.

The Roster of officers and committee of the Institute of Radio Engineers includes the following members of the Laboratories: *Treasurer*, R. A. Heising; *Executive Committee*, R. A. Heising, Vice-Chairman; Board of Directors, F. B. Llewellyn, 1943-1945; *Admissions*, F. A. Polkinghorn, Vice-Chairman, Lloyd Espenschied; *Board of Editors*, G. W. Gilman, F. B. Llewellyn, E. L. Nelson, E. C. Wente, William Wilson; *Constitution and Laws*, R. A. Heising; *Education*, F. R. Stansel; *Investments*, R. A. Heising, Chairman; *Membership*, W. H. Doherty, R. B. Shanck; *Papers*, F. B. Llewellyn, Chairman, H. A. Affel, F. W. Cunningham, E. B. Ferrell, J. G. Kreer, Jr., G. G. Muller, A. F. Pomeroy, S. A. Schelkunoff, E. K. Van Tassel; and *Sections*, R. A. Heising, Chairman, R. V. L. Hartley, F. A. Polkinghorn.

Members of Technical Committees are: *Annual Review*, C. R. Burrows, G. G. Muller; *Antennas*, J. F. Morrison, J. C. Schelleng; *Circuits*, H. W. Bode, A. F. Pomeroy; *Electroacoustics*, G. G. Muller, Chairman, L. J. Sivian; *Electronics*, S. B. Ingram, J. A. Morton, A. L. Samuel, J. R.

"The Telephone Hour"

(NBC, Monday Nights, 9:00 p.m., Eastern War Time)

JUNE 11, 1945

Ah! Sweet Mystery of Life from "Naughty Marietta" — *Herbert*
Charles Kullman

Rákóczy March — *Berlioz*
Orchestra

The Crying of Water — *Campbell-Tipton*
La Danza — *Rossini*
Charles Kullman

Gaudeamus Igitur — *Liszt*
Male Chorus and Orchestra

Medley of College Songs
Charles Kullman and Male Chorus

JUNE 18, 1945

June Is Bustin' Out All Over from "Carrousel" — *Rodgers*
Orchestra

Over the Steppe — *Gretchaninoff*
Jennie Tourel

Valse from "Serenade for String Orchestra" — *Tschaikowsky*
Orchestra

Si mes vers avaient des ailes — *Hahn*
My Hero from "The Chocolate Soldier" — *Strauss*
Jennie Tourel

Cakewalk from "Symphony No. 4" — *McDonald*
Orchestra

Rondo from "La Cenerentola" — *Rossini*
Jennie Tourel

JUNE 25, 1945

Medley — *All-Gershwin Program*
Swanee
Somebody Loves Me
Embraceable You
Strike Up the Band
Chorus and Orchestra

Prelude No. 2
Prelude No. 3
Oscar Levant

Medley
Someone to Watch Over Me
Fascinating Rhythm
Orchestra

Concerto in F—2nd Movement
Oscar Levant

Medley
Lady Be Good
Do It Again
Liza
Wintergreen for President
Oscar Levant, Chorus and Orchestra

Bell Laboratories' Club has no more tickets for these programs because its limited supply has already been distributed to applicants.

Wilson; *Facsimile*, Pierre Mertz, E. F. Watson; *Radio Receivers*, H. B. Fischer; *Radio Wave Propagation*, C. R. Burrows, Chairman; *Standards*, C. R. Burrows, G. G. Muller; *Symbols*, C. R. Burrows, A. F. Pomeroy; *Television*, A. G. Jensen; and *Radio Transmitters*, J. F. Morrison, J. C. Shelleng.

W. L. Casper and J. P. Griffin, at the Long Branch (N. J.) Signal Laboratory, conferred on crystal matters.

G. M. Thurston discussed crystal test sets at the Philadelphia Distributing House and crystals at Long Branch.

H. T. Wilhelm was at Hawthorne to observe the testing of carbon resistors.

J. E. Ranges was in Atlanta in connection with a loading-coil case problem on the Atlanta-Meridian coaxial cable.

P. S. Darnell and M. D. Rigterink attended a meeting in Washington devoted to the design and construction of power-type resistors.

P. P. Cioffi, at Hawthorne, discussed permanent magnets.

F. J. Given and P. S. Darnell visited Haverhill to discuss manufacturing questions on retardation coils.

K. G. Compton, F. J. Given, R. G. Koontz, R. G. McCurdy, C. H. Sample, W. J. Shackelton and J. R. Townsend visited the Army and Navy Electronics Standards Agency to discuss various problems encountered by the Laboratories and Western Electric Company in the use of components procured under JAN specifications.

J. A. Ashworth and B. C. Meyer visited the Magnetic Metals Company in connection with magnetic lamination matters.

A page and a half review of the book *Sampling Inspection Tables*, by H. F. Dodge and H. G. Romig, appeared in April issue *The Review of Scientific Instruments*.

A. L. Samuel's paper, *Some Notes on the Design of Electron Guns*, presented before the National Electronics Conference in Chicago, was published in the April issue of the *Proceedings of the I. R. E.*

C. E. Whitney observed inverter tests at Wright Field, Dayton.

H. J. Theiling is spending several weeks in Woonsocket, R. I., in connection with preproduction work.

O. J. Morzenti was in Whippany in connection with a new unit which will go into production soon.

Please put your RECORD in the "Correspondence-Out" box when you are through with it so that it can be sent to a Serviceman's family.

R. G. Koontz, C. R. McIver and T. T. Robertson reviewed drawing standards with the Bureau of Ships in Washington.

F. T. Forster visited Buffalo, where he investigated storage batteries.

J. H. Shepard and T. Y. Shen discussed small motor problems in Rochester.

R. H. Ross visited Chicago and Cleveland relative to tests on small motors.

H. A. Richardson visited Cincinnati and Philadelphia in connection with base-metal contact maintenance.

R. H. Colley visited the Forest Products Laboratory at Madison, Wis., on soil contact technique for testing wood preservatives and other matters pertaining to timber preservation.

R. C. Eggleston, with representatives of the Bell Telephone Company of Canada and the Northern Electric Company, conducted strength tests on northern pine crossarms at Montreal.

G. Q. Lumsden was at Charlottesville, Va., recently in connection with the production of oak insulator pins which are being substituted for locust.

R. H. Colley and G. Q. Lumsden visited New Haven where tests on salt treated poles are being carried out in coöperation with the Southern New England Company.

C. D. Hocker and A. P. Jahn, on April 25, joined a group of American Society for Testing Materials members inspecting metallic coated samples undergoing atmospheric corrosion tests at Sandy Hook. Mr. Jahn was also with the Committee at Bridgeport, Pittsburgh and Altoona, where other test racks are located.

J. A. Carr and B. R. Eyth visited the Owens-Illinois Glass Company in Muncie, Ind., to discuss CSC glass insulators.

The Laboratories were represented in interference proceedings at the Patent Office in Richmond by E. B. Cave before the Primary Examiner.