BELL LABORATORIES RECORD
January, 1943 Vol. XXI No. 5

To Members of Bell Telephone Laboratories:

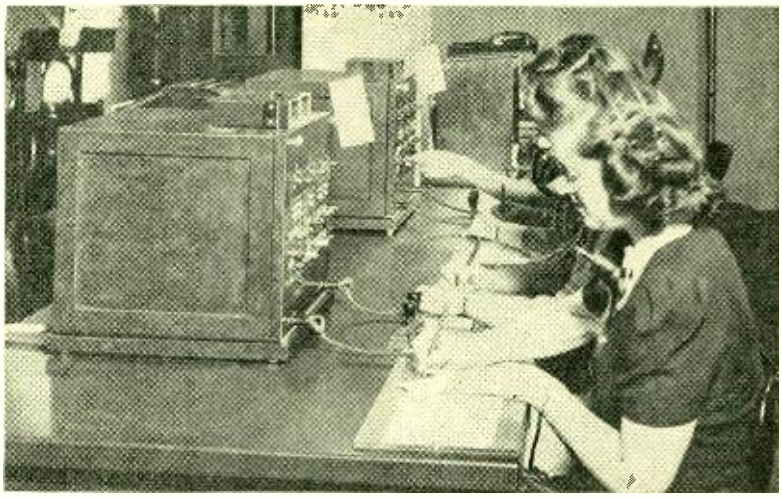
Greetings to the men and women from the Laboratories who are in our Nation's service. We are proud of you. Greetings to all the members of our organization.

The past year has been one of great achievement. We completed what we began in 1941—the transformation from peacetime activities to war work. Our effort is now directed towards winning the war; and most of it goes into devising new tools for our armed forces. Our work has already contributed effectively to military successes; and it will contribute still more. Every member of the Laboratories is helping to defeat the enemies of civilization.

In the Laboratories we have the rare privilege of being able to serve our common cause in our normal habitat and with relatively little disruption in our personal lives, except for the strain of greatly increased effort. Our effectiveness is attested by numerous letters of commendation from representatives of the armed forces, and by the Army-Navy Production Award. This confidence has been won not merely by quantity and variety of our work but more importantly by its quality.

The year 1943 will bring heavier demands upon us; and we must strive with all our might to fulfill those obligations. Foremost in our minds must be the quality and performance of the products which we design. Our armed forces rely upon this equipment: it must not fail in any emergency and must work well under the most adverse conditions for equipment which fails is worse than useless. Let us make sure that everything which goes out from our Laboratories can be counted on to do its part; and that can be assured only if each and every one of us does his part.

Oliver E. Buckley



Stretching Toll Facilities for the Emergency

By B. C. BELLOWS
Toll Facilities Director

RAPIDLY growing toll traffic during 1941 made it evident that increased facilities would be needed at toll offices, but the heavy manufacturing program of the Western Electric made it equally evident that it would be difficult if not impossible to secure a sufficient number of new switchboard positions to take care of the expected traffic. A study was therefore undertaken to discover some other way of enabling the Associated Companies to continue to give fast, non-hangup toll service with a minimum of manufacturing effort in providing new equipment.

At outward toll positions only a small part of the operator's time is occupied in actually plugging a cord into the desired jack. Most of it is employed in determining the connection wanted, waiting for other operators and the called subscriber to answer, and performing a number of operations that vary with the type of office and the traffic being handled. Each position can accommodate ten pairs of cords but is regularly equipped with either six or eight pairs. The larger number is required where the type of traffic handled is such that the time required to establish the connection is comparatively short. A survey showed, however, that where the boards were equipped with six cords, only two were in use on the average, and that where eight cords were provided, the average number in use was two and a half. The comparatively large number of cords is provided so that when an operator has successive calls on which her work time is small, or the conversation time is long, she will not have to stop work for lack of available cords.

To secure fuller use of the cords at the outward toll board, the supplementary outward toll position was designed. It consists principally of a small table-mounted cabinet, shown

in the illustration at the head of this article and in Figure 2, and provides for greater use of existing cords at each position by making them available to several operators rather than to one. Work which involves the handling of cords is kept at the regular position but, in general, the rest of the work is done at the supplementary positions. The manufacturing effort these cabinets require on the part of the Western Electric Company is much less than that required for a complete toll position. These new supplementary positions, moreover, will serve indirectly to meet some of the requirements for additional inward toll positions, since they can be used in sufficient numbers to release outward toll positions that in many offices may be employed to give inward service after relatively minor modifications.

Each cabinet—comprising two supplementary positions—has five sets of key and lamp units. These units correspond in function—with certain additions—to the keys and lamps associated with each cord pair at the toll positions, and are used in place of them. Ordinarily two of these supplementary cabinets are employed with one regular toll position, as indicated in Figure 1. They are set on tables in any convenient place, preferably in the toll operating room, and supplementary operators are assigned in sufficient number to handle the load. The appearance of the cabinet is shown in Figure 2.

Two of the lamp and key units are regularly associated with the operator's jacks at the right and two with the operator's jacks at the left. The fifth, called a floating cord pair, may be used by either operator, after first throwing toward her position the two-way grouping key mounted over the regular keys. Grouping keys are also mounted over the keys for the two pairs of cords at the ends of the cabinet. This permits them to be associated with the other operator's jacks or with the operator's jacks of an adjacent cabinet. These grouping keys allow the number of supplementary operators to be chosen with respect to the type of traffic, since they permit as many cords per operator as can be handled conveniently.

As a maximum there will be two operators for each cabinet, and when the nature of the traffic is such that an operator can readily handle more than two cords, three operators may be used for two cabinets, or even one for each cabinet. With this new sys-

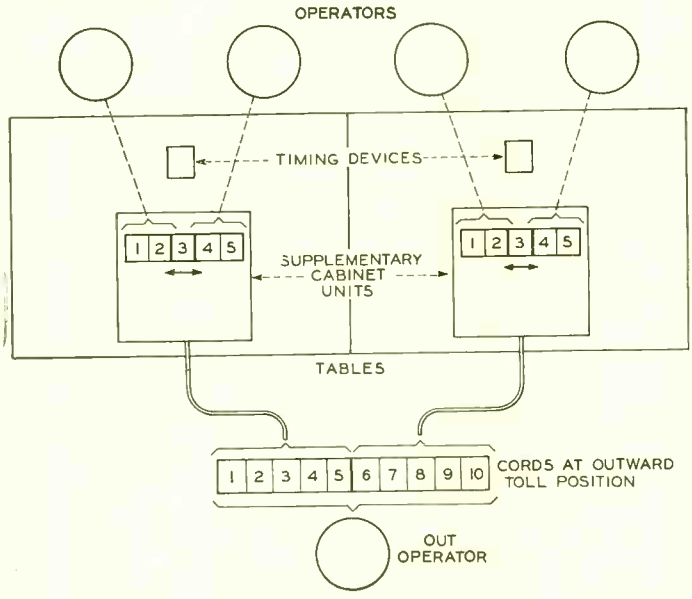


Fig. 1—Typical arrangement of supplementary toll positions

tem, therefore, there may be as many as five operators for each one that was used before. Of these five, four will record and handle calls at the supplementary positions, while the fifth—at the main toll board—assists by inserting or removing plugs as required.

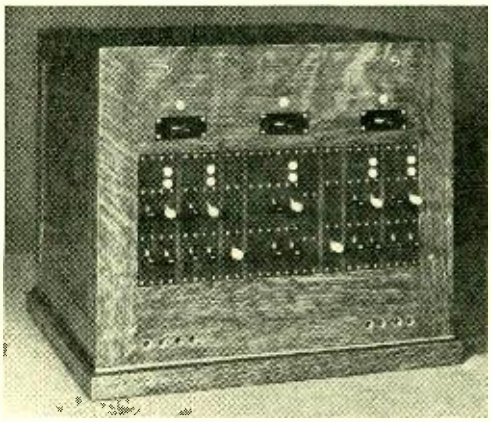


Fig. 2—Front view of new supplementary toll position

Of the four keys for each cord at the supplementary position, the one at the lower left, when in the "up" position, lights the front lamp of the cord to signal the operator at the associated toll position, who is called the "switching operator," that the supplementary operator is idle. In the "down" position, it lights the rear lamp to indicate that a call is completed and that the connection should be taken down. The other three keys perform functions normally performed by keys at the toll positions. One is for ringing; one for splitting the connection and connecting the operator's telephone set to either the front or back cord of a pair; and one for connecting the operator's telephone set either for talking or monitoring. The two white-handled keys, each in a strip by itself, are positional keys, and are used to signal the switching operator to come in on a call to receive instructions for plugging up. The two lamps for each cord correspond to the two normally associated with each cord at the toll board.

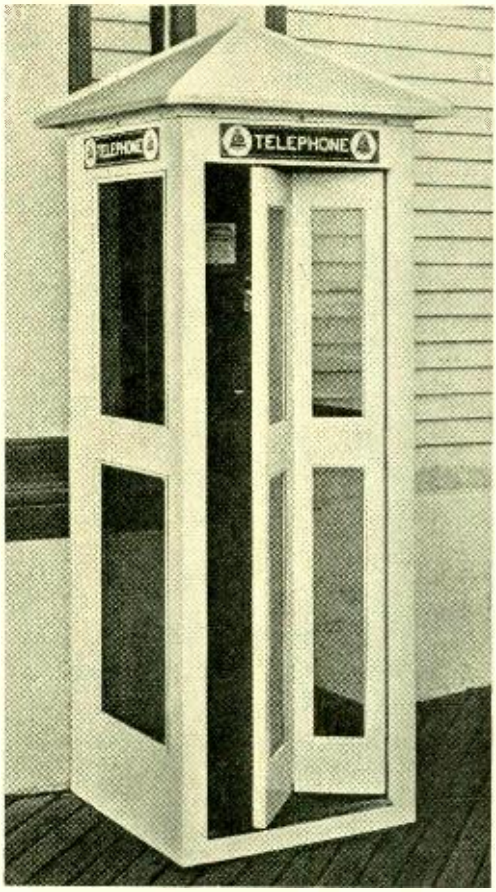
When a call comes in the switching operator selects a cord pair with a lighted front lamp, and plugs the rear cord of this pair into the calling jack. The supplementary operator answers the call, records it, and then operates her positional key to attract the attention of the switching operator. After being told the trunk wanted by the supplementary operator, the switching operator plugs up the desired connection and then disconnects. If ringing, dialing or key-pulsing is required, the switching operator will perform these operations before disconnecting. The supplementary operator will repeat the number wanted to the distant operator, and do anything else required in handling the call, including timing. When the calling subscriber hangs up at the end of the call, a cord lamp is lighted at the supplementary position. Its operator then operates her disconnect key, which signals the switching operator to take down the connection. The efficiency of the supplementary operators will be somewhat less than that of the regular operators, partly because of the added work of obtaining connections through the switching position and partly because the supplementary operators will be idle at times because of lack of idle cords. This slight decrease in efficiency, however, can be offset by applying this supplementary operation to more of the toll positions.

As already noted, two of these cabinets provide equipment for ten cords, and thus may be used with a single switchboard position equipped with ten cords. Where there are more or less than ten cords at the switch-

board positions, the flexibility secured by means of the grouping keys at the supplementary positions makes possible a wide variety of combinations.

The switching positions may be used for handling calls in the normal manner when the office load does not require the use of the supplementary positions. A key at the main toll board is provided for changing from normal operation to that using the supplementary positions. This key is operated when the toll position is to be used as a switching position and is restored to normal when normal operation is again resumed.

This new development materially increases the capacity of a toll switchboard. It thus supplies the added facilities needed to meet the increase in speech channels resulting from extensions and improvements of broad band systems, and it does so with only a relatively small increase in equipment cost and with a minimum demand on manufacturing facilities. The number of additional operators needed is somewhat greater than the increase in capacity, but with the mechanized warfare now confronting us, manufacturing capacity is the dominating need.



Outdoor Telephone Booth

Booths for public telephone service at outdoor and semi-exposed locations are now in substantial demand for army camps and also for defense housing projects and trailer camps where regular subscriber service cannot be installed during the present emergency. To meet these requirements and to conform to the limitations now placed on critical materials, booths for this service will be restricted for the present to a single type, coded No. 9.

In design and appointments this booth is essentially equivalent to the No. 3 outdoor booth. Its doors have panels of wire glass and its side panels may be either of wire glass or plywood. These panels are shipped separately and assembled locally. Linoleum covers the floor and base plates. There is a standard booth lighting fixture in the ceiling.

Cable Splices and the Hostess Problem

By JOHN RIORDAN
Technical Consulting Staff

WITH the first cable splice came the question of how the pairs of one reel were to be connected to those of the next. In subscriber cables, the pairs are usually connected by any convenient random choice. Random splicing was also used at other than test points in the earlier large-sized toll cables which were operated at voice frequencies. When small groups of quads or pairs or small cables are involved, particularly those for carrier systems, random splicing may result in undesirable crosstalk, because two circuits on different quads or pairs may remain in closely coupled relationship for long distances. To avoid this, numerous cut and try methods of splicing have been used. In 1935 H. P. Lawther, Jr., of the Southwestern Bell Telephone Company supplied the first mathematical treatment of the problem. He had voice-frequency cables in mind but his solutions are also highly satisfactory for carrier cables when a prime number of units are spliced. For non-prime numbers other than service pairs, however, greater diversity of the positions occupied successively by each spliced unit is desirable to equalize crosstalk and transmission characteristics.

The question then arises whether there are splicing procedures which fulfill all the crosstalk requirements satisfied by Lawther's splices and in which this greater diversity is attained when the number of units spliced is not a prime. This question turns out to be identical with the hostess problem of seating guests at dinner parties.

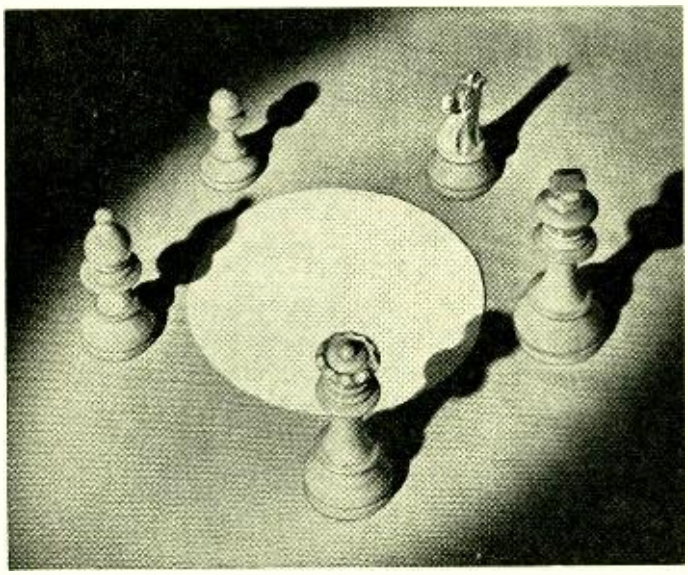


Fig. 1—Chessmen represent the guests at a dinner party with the queen as hostess, thus posing the problem of feeding the same diners differently at a succeeding dinner

Suppose a hostess has to plan a series of parties for the same group of people. Although they are all congenial it is essential, for reasons of diplomacy, that no person has the same neighbor on either side on different nights.

Naturally this cannot be done indefinitely but she must find the seatings for the largest number of parties possible.

This predicament is comparable to one encountered in splicing cable circuits because the seats around the table may be considered as circuit positions in a single layer of the cable. Simplifying the actual many-layer cable into a single layer makes the several parties represent the reels of cable spliced. Neighbors in telephone parlance tend to crosstalk and the least disturbance is carried from one circuit to another when they are neighbors infrequently. Neighbors of neighbors are also of some importance in crosstalk reduction, which mars somewhat the resemblance to the hostess problem, but this second effect is not considered in the present discussion. A further necessary property of planned splicing is that the same procedure must be used at each splice for various practical reasons.

The hostess problem is easiest when, besides herself, there is an even number of guests, say $2n$. The maximum number of dinners without repetition of neighbors is then equal to n. Take $n=2$, that is, assume that four people and the hostess are to be seated. The hostess naturally takes the same position always and the possible arrangements for the two dinners, if she takes seat 5, are as given in the table.

ALTERNATE SEATING ARRANGEMENTS FOR FIVE

		Seat Numbers				
	Dinner	*1*	*2*	*3*	*4*	*5*
	1	1	2	3	4	5
Alternate A	2	2	4	1	3	5
Alternate B	2	3	1	4	2	5

At the first dinner the arrangement is arbitrary, and for convenience we call the person in seat 1, person 1, in seat 2, person 2, and so on. Then there are only two possibilities for the second dinner, these being the permutations of the numbers 1, 2, 3, 4, 5 which contain no successions like 12, 23 and so on—indicating neighbors at the first dinner—or 21, 32 and so on. Alternates A and B show these seatings. With only two dinners this is not hard to arrange, but it gets more difficult as their number increases. For $n=3$, for example, we have to find two permutations which do not repeat the adjacencies of the first dinner nor those of each other.

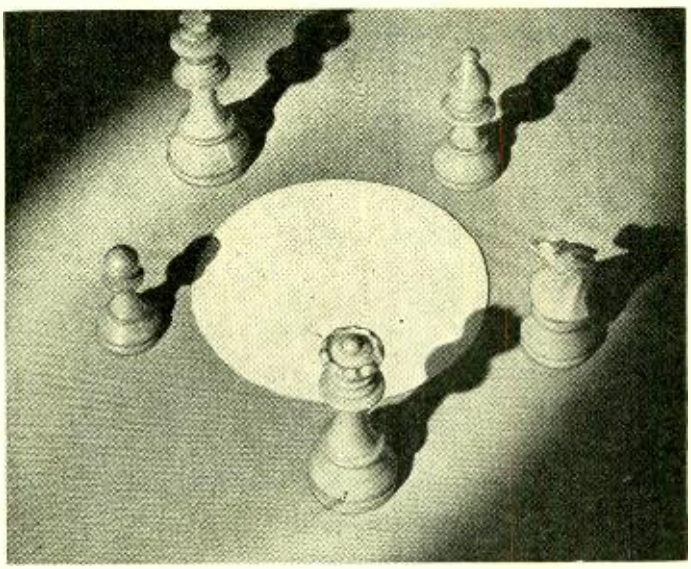


Fig. 2—The problem has been solved by seating the queen in the same place as before and the other diners so that at everyone's right and left there is a different guest than before

All solutions of the hostess problem for arbitrary n have not been found, but one particularly simple general solution has been worked out in considering the problem of cable splicing. In the above example, the second arrangement may be considered as derived from the first by substituting 2 for 1, 4 for 2, 1 for 3 and 3 for 4. This may be expressed by a circular notation in which each number is replaced by its successor, the first number being taken as the successor of the last. In this notation:

$$\begin{matrix}(1\ 2\ 3\ 4\ 5)\\(2\ 4\ 1\ 3\ 5)\end{matrix} \text{ is } (1\ 2\ 4\ 3)\ (5)$$

and $(3\ 1\ 4\ 2\ 5)$ is $(1\ 3\ 4\ 2)\ (5)$

Then a solution of the hostess problem for $2n+1$ persons is given by $n-1$ repetitions of the substitution:

$(1\ 2\ 4 \ldots 2n\ 2n-1\ 2n-3 \ldots 5\ 3)$ $(2n+1)$, or

$(1\ 3\ 5\ 2n-1\ 2n\ 2n-2 \ldots 4\ 2)\ (2n+1)$.

In both of these the last number, the hostess' number, stays with the same seat, as indicated by the isolated number $(2n+1)$.

ALTERNATE SEATING ARRANGEMENTS FOR SEVEN

	Seat Numbers						
Dinner	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1	1	2	3	4	5	6	7
2	2	4	1	6	3	5	7
3	4	6	2	5	1	3	7

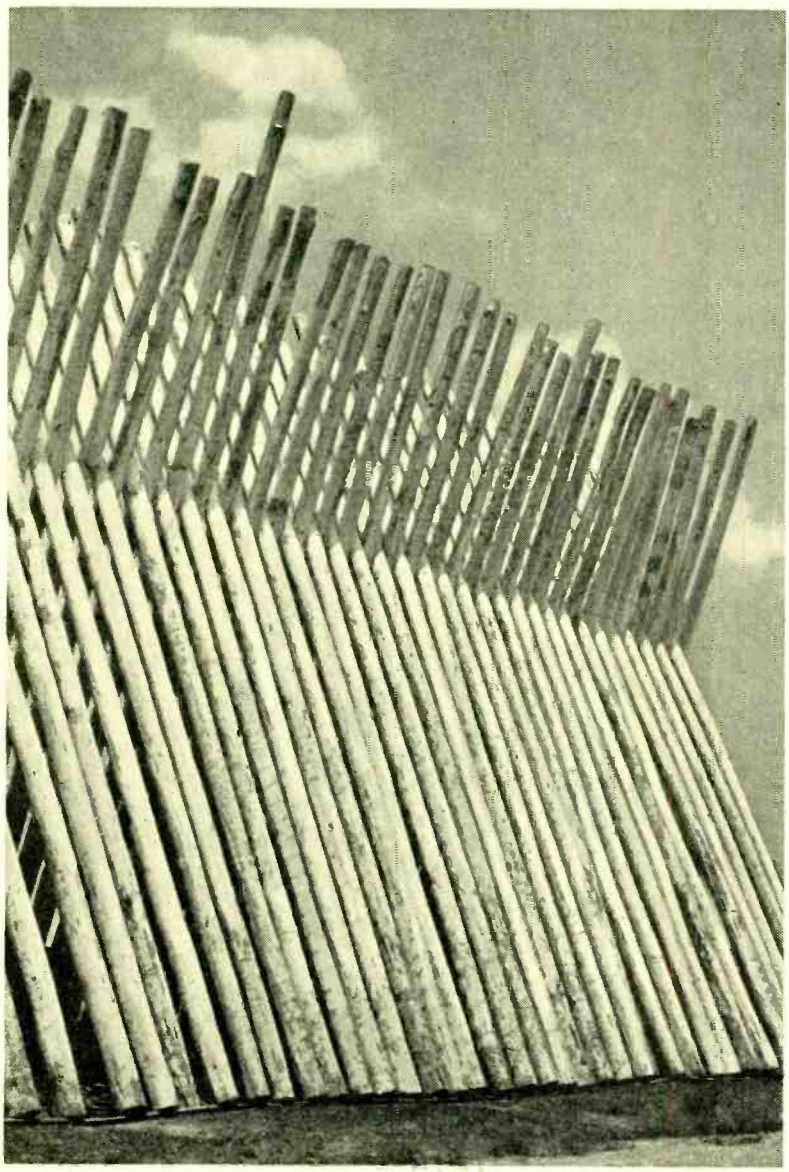
For example, for $n=3$, a set of seating arrangements is given in the table. Note that the third is obtained from the second by the same substitution used in getting the second.

While this is satisfactory as a solution of the hostess problem, it has the disadvantage as a splice specification that it leads to undue repetition of neighbors of neighbors or adjacencies of cable units separated by another unit. However, it may be made the basis of a treatment, too elaborate to be given here, for obtaining a large variety of splicing plans.

Transcontinental Telephone Cable Placed in Service

On December 21, Walter S. Gifford, President of the American Telephone and Telegraph Company, officially opened the new transcontinental cable from New York to San Francisco. During his conversation with N. R. Powley, President of The Pacific Telephone and Telegraph Company, Mr. Gifford revealed that the main reason why it was decided in 1939 to build an underground cable line across the west was the possibility of war with Japan. Two years of construction work across plains and mountains were required to build the new line, which runs for 1,600 miles from Omaha to Sacramento, connecting at these points with existing cable networks of the East and the Pacific Coast.

NEWS AND PICTURES *of the* MONTH



Vertical drying of southern pine poles for greensalt treatment
(*see page* 117)

Federal Taxes on Income

WITH THE PASSAGE of the Revenue Act of 1942, Federal taxes take on a new meaning for all of us. Not only are exemptions reduced and rates increased on 1942 incomes, but this year we will pay an additional tax called the Victory Tax of 5 per cent on 1943 "remuneration for services." This Victory Tax is not paid with the regular tax but is withheld by the employer after January 1, 1943, on all remuneration in excess of $12 a week or $52 a month. How large the total tax is (the regular tax combined with the Victory Tax) may be seen from Figure 1. An unmarried man earning $3,000 a year, for example, pays nearly one-fifth of his salary in tax, and for higher incomes the rate increases steadily.

With such large totals due as income tax, it may be very desirable to set aside the pro rata amount each month, and to deposit it in a bank to be available as the tax falls due. A convenient way of doing this is to authorize the Laboratories to deduct the needed amount each month and deposit it to your account in a bank of your own choice. Forms for authorizing such deductions may be secured from the Payroll Department at 463 West Street. The approximate weekly or monthly sum required may be determined from Figures 2 and 3. Figure 3 shows the income tax, not including the Victory Tax, plotted against monthly salary, while Figure 2 shows the equivalent figures for salaries below $3,000 a year based on an alternative form of tax calculation. This alternate method of figuring the tax, which has been slightly modified this year, makes certain overall deductions so as to simplify the calculation of the tax. Except in unusual cases, it gives a lower total than does the normal form.

Since the Victory Tax is deducted from

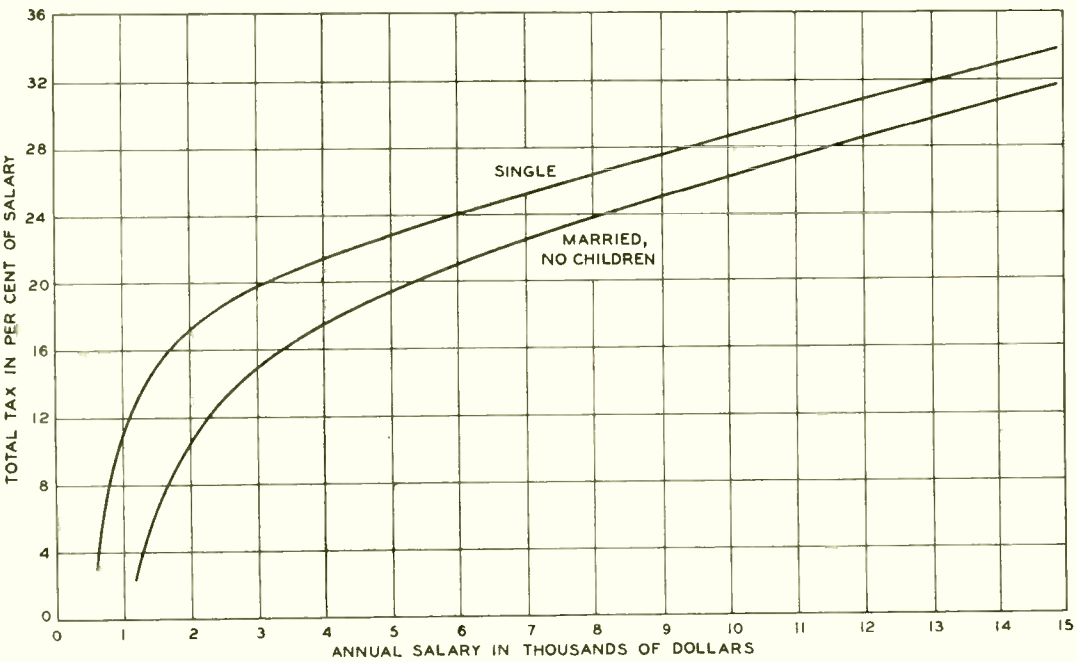


Fig. 1—The depth to which the new Federal Income Tax will dig into our pockets may readily be determined from the above curves, which plot the total tax as a per cent of annual salary against the annual salary itself. The Victory Tax is included in these curves

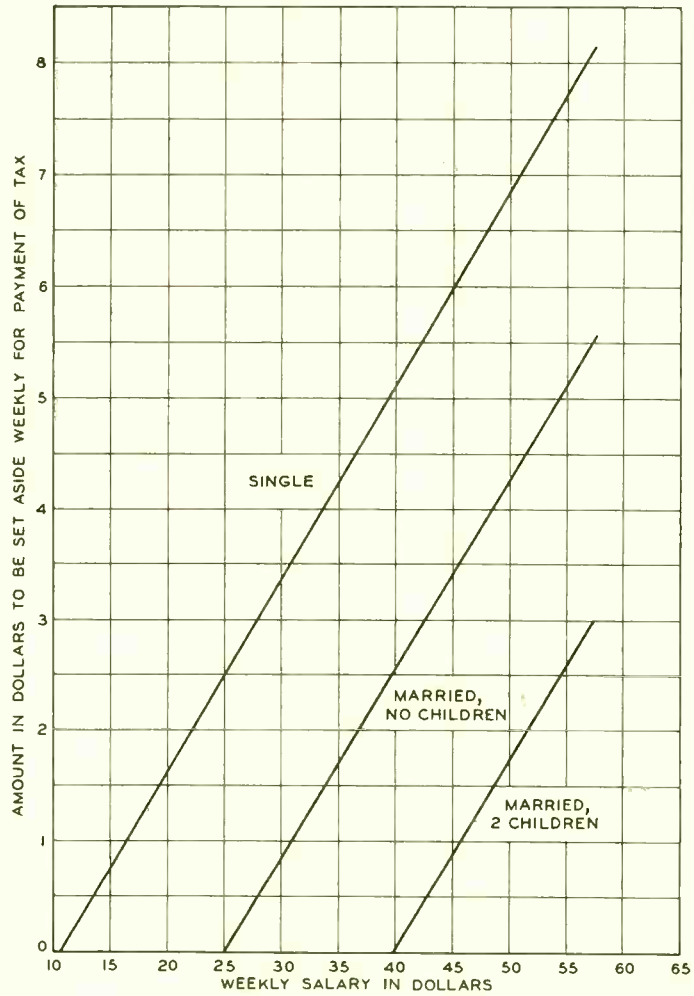


Fig. 2—When annual income is less than $3000, an optional method for calculating the tax is provided. The curves at the left show the amounts that should be set aside weekly, for single persons, for married persons, and for married persons having two dependents

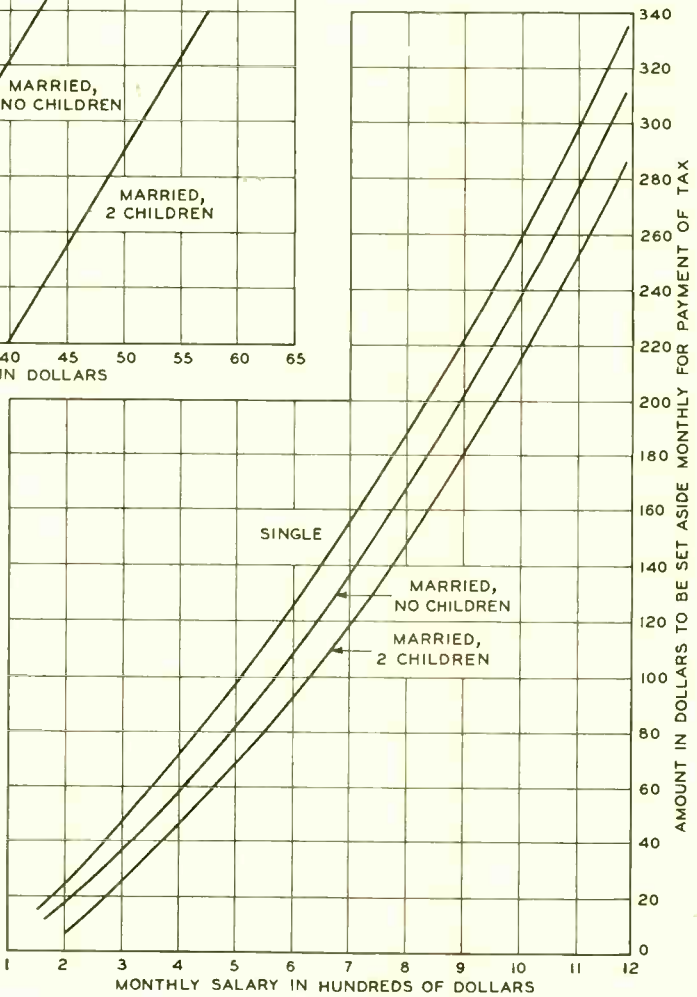


Fig. 3—The normal method of calculating tax is applicable regardless of annual salary. The amounts that should be set aside monthly to provide for payment of the tax is shown by the curves at the right

Taxes and War Savings Bonds provide the funds to win the War. Buy bonds and also save for taxes.

Arthur Florie and Patrick Sullivan collect material from one of the sixth floor laboratories during the recent Salvage Campaign

salaries without any action on the part of the individual, it is not included in the amounts plotted in Figures 2 and 3. In calculating this Victory Tax, no distinction is made between married persons and single, nor is any allowance made for dependents, but the Laboratories is required to exclude $12 of each weekly payment, or $52 of each monthly payment, before computing the amount to be withheld. As soon as practicable after the war, the new tax law provides for refunding 25 per cent of the Victory Tax paid by single persons, provided this is not greater than $500, and 40 per cent of the tax paid by heads of families, provided this is not greater than $1,000. This refund is increased by 2 per cent, but not more than $100, for each dependent. This post-war refund, however, is reduced by the amount of any credits allowed against the tax for life insurance premiums, reductions of indebtedness, or investments in war bonds.

Scrap Salvage Campaign

The salvage drive carried on by the General Methods Committee this past autumn brought in over 100 tons of material and exceeded any previous clean-up campaigns by from thirty to forty tons. As will be noted from the accompanying table, some sixty-seven tons of materials were handled by the Salvage Department and with the exception of about two tons, this material was disposed of as of December 5. In addition to the material listed on the table there are approximately 71,000 pounds in storage in the Baker and Williams Warehouse which are being salvaged as time will permit. Quite a large part of this material is apparatus which is not needed in the Laboratories in its present state.

In handling and disposing of the material, a considerable amount of effort is expended in endeavoring to see that critical material, fabricated parts and apparatus be retained to assist in prosecuting the war program rather than actually junking the material. The Central Instrument Bureau and the

Material Collected in Scrap Drive

	Pounds
Aluminum	1,035
Brass	11,137
Cable, Lead	14,199
Cable, Special and Switchboard	724
Coils	2,250
Copper	17,774
Iron	62,047
Lead	2,564
Rubber	458
Nickel	392
Turnings	486
Wire	2,258
Zinc	112
Western Electric Equipment	20,316*
Total	135,552†

*3,777 pounds of this has been turned over to the Stores Department for Laboratories use.

†In addition there are approximately 71,000 pounds of salvage materials, mostly assembled equipment, in the Baker and Williams Warehouse, which are being reviewed for possible further use before salvaging.

Stores Department are coöperating with the Salvage Department by reviewing the salvageable equipment and parts to help ascertain the material which should be retained by the Laboratories.

Most of the usable material is removed or segregated from the junk equipment and material before it is actually put through the normal junking operations. A large part of this salvaged material is being arranged on racks in a Salvage Stockroom in Basement G where it, along with other left-over materials and items not usually stocked, is available for general use. This stockroom is now in operation and anyone desiring to secure this material may do so by visiting this stockroom location.

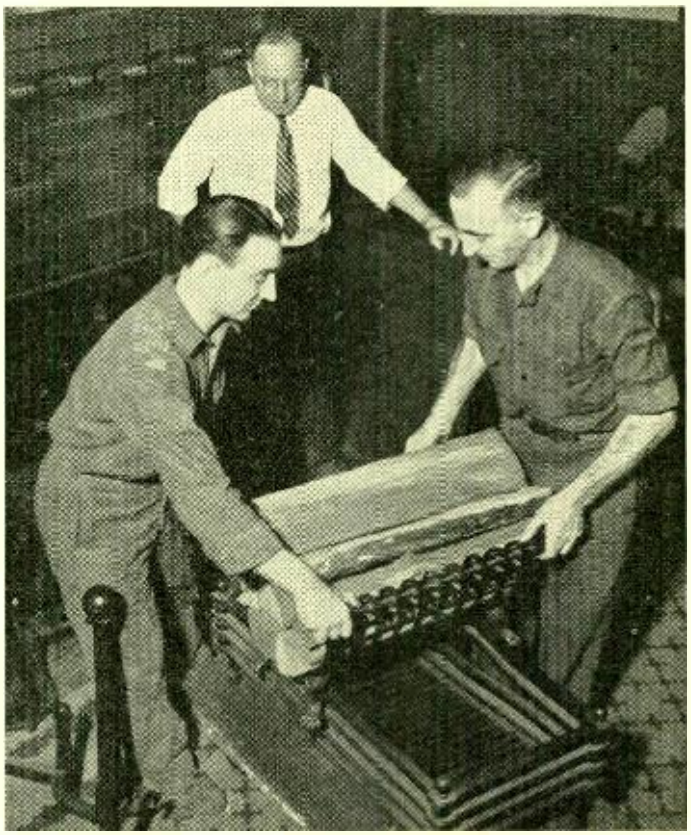
Looking Ahead in Employee Transportation

Do you remember about a year ago when news items reminded us how much our American transportation system depended upon rubber, gas, cars, and buses? Yet as individuals we continued to drive as usual, consoled perhaps by the thought that many of the things most worried about never occur. After all, what could be done to heed these warnings and to assure maximum convenience in getting to work?

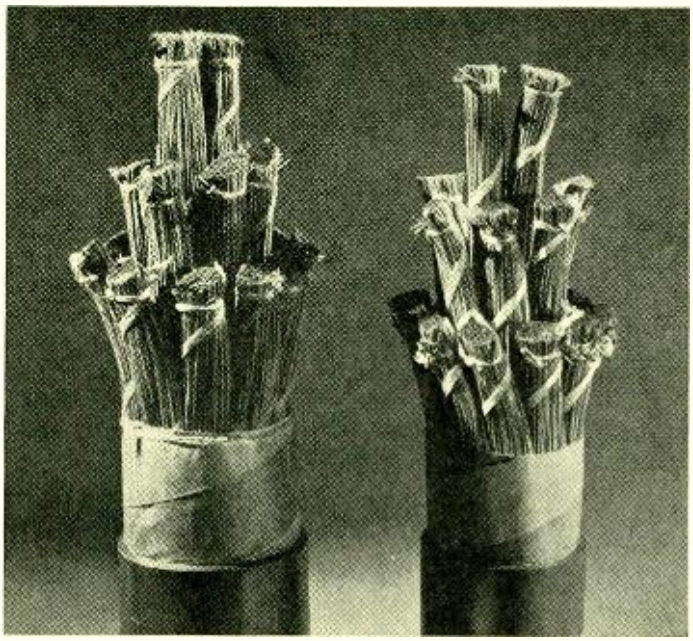
A condensation of available conflicting data convinced Mr. Whiteside in Personnel as Counselor on Transportation that conservation of available transportation items was the answer. Following this basic plan, Laboratories' personnel were encouraged through Departmental supervisory and service organizations to use public transportation while it was available; regular and overtime working hours were adjusted to existing transportation schedules; trial bus runs were instituted to give workers a chance to use public transportation; and efficient private car group commuting was encouraged when a "stick to the private car" attitude was shown. Present rationing proves the soundness of the plan to conserve transportation which was proposed by Personnel.

As employees and managements in industrial concerns have in general not cooperated voluntarily to solve commuting problems, the Office of Price Administration has found it necessary to issue regulations forcing all employees and employers of 100 or more persons engaged in war work to coöperate in an Organized Transportation Plan.

Committees have been organized for this purpose at Laboratories' work locations in New York and New Jersey. The members of these committees were appointed by Dr. Buckley from recommendations made by the Executive Committee of the Bell Lab-



The Bureau of Publication scraps its fireplace equipment, a holdover from days when Western Electric executives occupied Section 11A. Left to right—Jack Stanisci, H. W. Schaefer and John Kelly



Comparative size of 1,818*-pair cables with* 26*-gauge* (*left*) *and* 28*-gauge wire*

oratories Club, and by officers of the Bell Telephone Laboratories Employees' Association. As the representative of Management, Mr. Whiteside was designated Coördinator of Transportation and is Chairman of each of the committees given in the table below:

Transportation Committees	
New York Locations	H. K. Leicht
	W. Mehmel
Murray Hill	A. J. Akehurst
	R. Van Luipen
Whippany	R. E. Coram
	M. Haigh
Deal and Holmdel	W. B. Angerole
	Mrs. D. Hermann

It is the duty of these Transportation Committees under the law to refuse approval of applications for tires and extra gasoline when in their judgment the applicant has not done all in his power to conserve these critically scarce articles. Management and employees have each a definite responsibility; management to arrange working hours where possible to facilitate group commuting and to make readily available such data as will be necessary for employees to group commute; employees to make use of this information and efficiently commute in buses, trains, or cars with the spirit of "no vacant seats on the ride to work."

Much has already been done to promote group commuting, but members of the new committees realize that more uniform hours in overtime schedules and ride sharing group rearrangements stand out as major factors which will improve and greatly reduce the total daily miles driven by employees.

Where governmental agencies have evidence that present regulations have been complied with and that a really efficient job of group commuting is being done, there is every indication that they will coöperate with transportation committees in seeing that a minimum of time and labor will be lost from war jobs in the obtaining of rationed transportation items. It is well to remember that a transportation questionnaire quickly and correctly returned to the transportation committee when requested, and a minimum of vacant seats in your car as it rolls along to work, may save many of those irksome trips to the rationing board and may obtain for you tires and supplemental gas when needed.

28-Gauge Wire Introduced as War Conservation Measure

Improvements in telephone instruments in recent years have made possible the use of smaller conductors and thinner insulations in exchange area cable, and cable development has provided as many as 2,121 pairs of 26-gauge wire in a full-size sheath of two and five-eighths inches outside diameter. This work also demonstrated that it is possible to include as many as 3,030 pairs of 28-gauge conductors in a full-size sheath but limited demand has not justified using this gauge up to the present. As a wartime

conservation measure, however, 28-gauge cable has now been standardized in the smaller sizes up to 303 pairs. The accompanying photograph shows the relative size of the standard 1,818 pair 26-gauge cable (left) and an experimental cable (right) with 1,818 pairs of 28-gauge. A third less copper is required for the latter.

News From Men in Service

Lieut. Harry C. Hart

"I am stationed at the headquarters of the Naval Inspector of Ordnance for the New York District. Nominally inspectors, we in fact represent the Navy in all dealings with manufacturers of ordnance equipment. We find ourselves acting as engineering consultants, shippers, production planners, expeditors, coördinators, everything. The big problem is to find ten consecutive minutes for constructive work between long-distance telephone calls."

Lieut. Col. Raymond O. Ford

"I have been an instructor at the Command and General Staff School at Fort Leavenworth, Kansas. Lieut. Col. Richard A. Devereux, Major William W. Sturdy and Major Floyd A. Minks of the Laboratories were in the class that graduated in November."

Lieut. Charles A. Hebert

"I was originally assigned to duty as Communication Officer of the Ambrose Section, Inshore Patrol, and stationed at the base on Staten Island. While there I was advanced to the rank of Lieutenant. Early in October of this year I was transferred to temporary duty at the Fleet Sound School, Key West, where I am at the present time. Under present orders I will leave here in late December to proceed to duty on a destroyer tender."

Ensign Halsey A. Frederick, Jr.

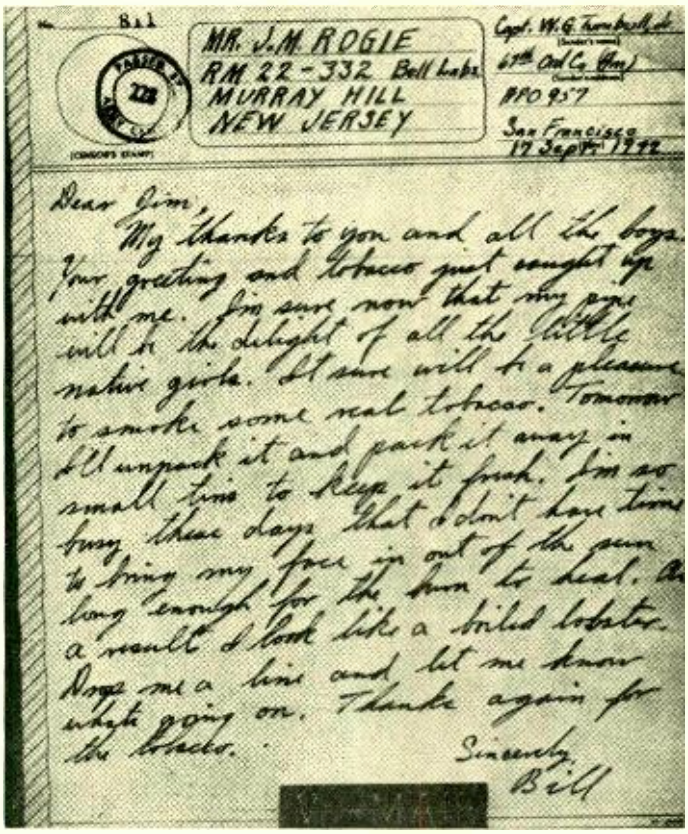
"It's nice to get the Record and see what's going on back at the Labs. I'm being sent to Florida (from the Philadelphia Navy Yard) for temporary additional duty. Congratulations on the 'Army-Navy E'."

Clement Bosch

"This military police job keeps me pretty busy—riding trains on escort duty, guarding ships, etc. Haven't had a day off in seven weeks. Even though I'm in the Metropolitan area, the Record is like a letter from home."

Charles T. Bolger

"I am a member of a Signal Unit stationed here at Drew Field, Florida. So far I have completed training in radio operation and maintenance. Work here is rather pleasant because of the excellent weather. Working hours are eight to six, seven days a week."


811

MR. J.M. ROGIE
RM 22-332 Bell Labs
MURRAY HILL
NEW JERSEY

Capt. W.G. Turnbull Jr.
698th Ord Co (Hvy)
APO 957
San Francisco
17 Sept. 1942

Dear Jim,
My thanks to you and all the boys. Your greeting and tobacco just caught up with me. Jim sure now that my ears will be the delight of all the little native girls. It sure will be a pleasure to smoke some real tobacco. Tomorrow I'll unpack it and pack it away in small tins to keep it fresh. Jim so busy these days that I don't have time to bring my face in out of the sun long enough for the sun to heal. By a month I look like a boiled lobster. Drop me a line and let me know what going on. Thanks again for the tobacco.

Sincerely
Bill

Some months ago a group of Capt. William G. Turnbull's associates sent him a package of tobacco to which he showed his appreciation by the above letter

John E. Paplin

"The Air Corps needs airplane mechanics and that is the reason for my being here at Seymour Johnson Field in North Carolina.

There is still very much to learn but some day I hope to be of real assistance in keeping our planes in the air. This life is surely very different from my work in the Laboratories."

Ernest F. Neubert

"I am at present a turret gunner in an outfit of Martin B-26's here at Barksdale Field, La. These are undoubtedly one of the best bombers in the world. I like the Air Corps very much because it offers anyone valuable experience and excellent opportunities in addition to many hours in the air, which, alone, would be enough inducement for anyone, once he's got the 'flying bug'."

* * * * *

"Christmas Greetings and Aloha from Hawaii" was the message on a card received from Capt. Howard J. Keefer, Signal Officer, just as the Record was going to press.

Captain Irving C. Osten-Sacken is now Operations Officer for a Photographic Squadron at Bolling Field and as such is in charge of all flights made by the squadron.

Major Ward K. St. Clair has been transferred from the Military Personnel Branch to the Plant Branch of the Signal Corps and has been assigned to the Project Control Agency in Philadelphia where he is in charge of the Wire and Radio Section.

John C. Roe was commissioned a Major in the Infantry on October 12.

David F. Ciccolella is now a Captain in the Coast Artillery. He is now an instructor in fighter-searchlight tactics in the Army Air Force School of Applied Tactics at Orlando, Fla.

A card from Walter B. Ellwood says that he is a civilian employee in the Research and Development Division, Bureau of Ordnance, Navy Department, Washington, where he is a research physicist.

Members of the Laboratories Granted Leaves of Absence to Enter the Armed Forces Since the Last Issue of the Record

United States Army

Fred E. Alexander
William R. Carolan
Arne Christiansen
Joseph P. Delano
Carl W. Fleischer
Leon M. Goldfeder
Robert Granger
Lieut. Daniel F. Hoth
Alexander E. Lawson
Leonard M. Nielsen
Eino A. Pasanen
William J. Perry
John C. Pfaff
Albert C. Reynell
John P. Robinson
Wilbur G. Sauer

United States Navy

Frank A. Braun
Edward M. Burke
James M. Cullen
James V. Cunningham
Charles E. Greene
Carl H. Hamann, Jr.
Florence A. Lutgen
Raymond J. Martin
Lieut. Vincent M. Meserve
Frederick W. Starzer
Robert W. Tomb
Lieut. David F. Tuttle
Henry Widmann

ROBERT J. DROUT from the Air Corps at Keesler Field, Miss., says that right at the present he is doing a combination of clerical and manual work.

JOHN NICHOL writes from Camp Livingston, La., that he is connected with the Medical Corps and that the work is quite interesting.

PERSONAL LEAVES OF ABSENCE have been granted to BOYD E. BROWN to enter the Signal Corps Training School and to RUSSELL L. VALENTINE to enter the U. S. Merchant Marine.

MAJOR EMIL ALISCH is now attending the Battalion Commander and Field Officers Course at the Infantry School located at Fort Benning, Ga.

MAJOR WILLIAM R. LYON writes that he was under the weather and had spent two weeks in the hospital at Fort Benjamin Harrison in Indiana. "I had a visit from Major K. O. Thorp. Another patient was Lieutenant Bill Knott. Knott and I took walks and played bridge. One of the nurses was an expert player."

RECENT CHANGES IN PROVISIONS FOR MILITARY LEAVE

DR. BUCKLEY in a recent letter to employees of the Laboratories outlined revisions that had been made in the plan covering payments to those on military leaves of absence. The plan was recently approved by the Board of Directors and became effective on January 1.

In the new plan provision has been made to continue the practice of giving to each employee with a year or more of service, for a three months' period following his entering military service, the difference between his Government pay and his Laboratories pay. However, the method of computing the Government pay has been modified somewhat and now takes into consideration any other allowances that are provided by the Government.

Payments on behalf of dependents will hereafter be made on the basis of the full difference between the Laboratories and Government pay for a three months' period following the completion of payments outlined above; heretofore, these payments were based on one-half the difference between Bell Laboratories and Government pay to be continued up to the end of 1942.

When the amounts of payments to be made have been established—once at the time of entry into service and, later, at the time payments to employees with dependents commence—these payments will be maintained without change regardless of any increase in Government pay or allowances; heretofore, Laboratories payments were reduced whenever increases in Government pay occurred.

Temporary employees are now eligible under the provisions of the plan after one year, rather than six months, of net credited service.

Complete details regarding the application of the plan are being incorporated in a reissue of the General Executive Instructions covering *Absences Due to Active Duty in Military or Naval Forces of the United States* which will be distributed shortly.

In a booklet commemorating Pearl Harbor, the cover design of which is shown above, the Western Electric Company records the performance of the Company during the first year of the war. The addition of 20,000 *women workers brings the total personnel of the Company to* 75,000 *of which* 43,00 *are men and* 32,000 *women. This represents a growth from* 60,000 *of a year ago despite the fact that* 13,000 *Western men are now in service*

Chosen by Lot

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

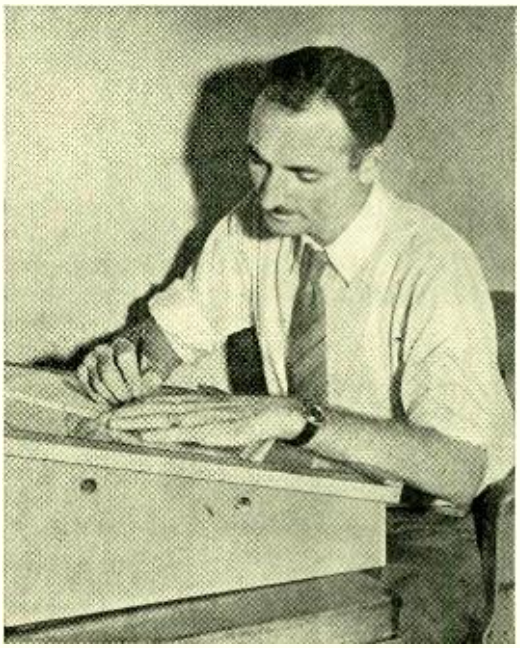
* * * * *

A REAL DIRT FARMER from the Jersey Hills is ED GALAMBOS of Apparatus Drafting. Twenty of his thirty-five acres are under cultivation raising corn for next year's hogs and cabbages for sale. From his garden, orchard and poultry-run he has enough food stored and in prospect to free him from any worries on rationing.

Graduating from Central High School, Newark, Mr. Galambos was a draftsman for a number of companies in the electrical field and entered Western Electric in 1928. Four years later he transferred to the Laboratories, where he worked mostly on drawings of transmission apparatus and radio. For some time he was stationed at Whippany and motored daily to and from his farm near Flemington. When gas and tire shortages intervened he was transferred to West Street, so that he could commute by rail.

EDWARD A. GALAMBOS

After Ed was married he and his wife began to spend summers on her mother's farm. Eventually they bought it, and decided to live there the year round. The place is ideal for their small daughter, who has learned at first hand that eggs come from hens and milk from cows.



ALBERT J. CHASE

ALBERT CHASE of Murray Hill gives voice to the thoughts of hundreds of Laboratories people when he says "My work on confidential war devices gives me an opportunity, second only to actual participation in combat, to help make a decent world for my daughter to grow up in."

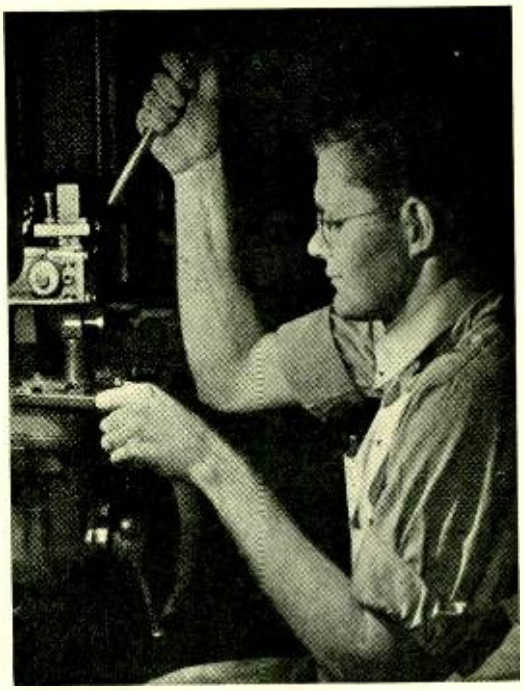
Entering the Laboratories in 1930 after high school, Mr. Chase attended N. Y. U. at night and graduated as a B.S. in E.E. in 1938, a preparation for which his present job makes him thankful. For some years he worked on phonograph recording problems, among them the call-announcer. After a year on transmitter carbon studies, he joined

his present group in Transmission Instruments. Laboratory walls and roof do not always shelter him and his associates; much of their work is done outdoors, sometimes under rather rigorous conditions. In normal times he enjoys tennis and swimming with his wife, formerly Eleanor Lott of our P.B.X. force. Their home is in Summit.

* * * * *

ERIC STRUBING would like to be a machinist's mate in the Navy but he knows that the war work he is doing in the Development Shop of the Laboratories makes him just as valuable to his country.

After graduating from Brooklyn Technical High School in 1940, Eric entered the Junior Mechanic Training Course in the Laboratories. In the Development Shop he was transferred at regular intervals to different parts of the Shop so that while working on jobs within his abilities he might observe the procedures of the experienced mechanics. Thus he received a comprehensive machine shop training while having five hours a week of classroom instruction in mathematics, materials, processes, telephone practice and drafting. He graduated from this course on December 11 last. If and as the war permits, Eric will take an evening course in electrical engineering.



ERIC G. STRUBING

TELEPHONE FACILITIES FOR MEN IN SERVICE

WHEN A MAN IN SERVICE makes a long distance call to say goodbye to someone at home, that call becomes as important to him and to his family as a war call, and like a war call it should go through. Realizing this the Operating Companies of the Bell System are trying to give our fighting men the fastest and best possible service they can under existing war conditions. This effort is not for the purpose of encouraging soldiers and sailors to make unnecessary calls but to show the men that when they need to call they will get from the Bell System organization the very best service than can be given.

Camp managers are being provided at many of the larger military and naval establishments throughout the country. In general, a full-time man is required for camps of 5,000 personnel or more. In some cases establishments smaller than 5,000 men require full-time managers and in other cases it is sometimes possible to assign two or more nearby establishments to one man. When this is not practical, supervision is being assigned on a part-time basis to a local manager or other representatives.

These managers are responsible for handling all contacts with the Officers in Charge as well as with the enlisted personnel. They go far beyond their strict responsibilities to act as friends and advisers to the thousands of men with whom they come in contact. The amount of time needed to handle properly all requirements of both official and public telephone service at the larger camps often necessitates the assignment of additional men to cover the job adequately.

A considerably enlarged program for providing attended public telephone service at Army and Navy establishments and in nearby communities is being carried out by the Operating Companies. On May 1, 1942, there were 7 attended service locations in camps with over 5,000 men. Since then 67 others have been added and 113 being installed or planned.

Attendants at these locations

are giving close, careful, and friendly personal attention to the telephone needs of the men in service. Besides making change and assisting with long-distance calls, they lend a welcome touch of femininity to a military atmosphere.

From a publicity and informational standpoint, the Operating Companies are rapidly developing a better understanding among service men of the problems in furnishing them telephone service and of the efforts to give them the best possible service. All of the companies are providing the men with "service aid" material designed to help them to use the service, including rates to frequently called points, the desirability of using station service where practicable and the location of attended stations. Folders, distributed for this purpose, in many cases include a map of the nearby city indicating points of general interest.

The Telephone Business

Before the war all telephone systems at Army establishments, including systems owned and maintained by the telephone companies as well as those owned by the Army, were operated by the Army, using soldiers and civil service employees at the switchboards. During 1942, at the Army's request, the telephone companies took over this work at a steadily increasing number of camps, supply depots, air fields, forts and hospitals. By October 1 the companies were operating 150 of these switchboards, with more to come, and all company-operated systems were also being company-maintained. More than 2,000 Bell System employees, the majority of them operators, were engaged in this work in October and the number was then increasing almost daily. An important result, of course, is to release soldiers for other duties.

"The Telephone Hour"

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

JANUARY 11, 1943

Till the Clouds Roll By from "Oh Boy" — *Kern*
Orchestra

The Blue Danube — *Strauss*
Lily Pons

Casey Jones — *Traditional*
Orchestra

I'll See You Again from "Bittersweet" — *Coward*
Lily Pons

Stenka Razin — *Glazounow*
Orchestra

Queen of the Night from "Magic Flute" — *Mozart*
Lily Pons

JANUARY 18, 1943

Waltz — *Arensky*
Orchestra

Ave Maria — *Schubert*
Marian Anderson

Thème Slave from "Coppelia" — *Delibes*
Orchestra

Summer — *Chaminade*
Ev'ry Time I Feel de Spirit — *Traditional*
Marian Anderson

Touch of Your Hand from "Roberta" — *Kern*
Orchestra

My Heart at Thy Sweet Voice from "Samson and Delilah" — *Saint-Saëns*
Marian Anderson

JANUARY 25, 1943

I Love Thee — *Grieg*
Lawrence Tibbett

Chopsticks — *Traditional*
Orchestra

Song of the Flea — *Moussorgsky*
Lord, I Want to Be — *Traditional*
Lawrence Tibbett

Bolero — *Ravel*
Orchestra

Credo from "Otello" — *Verdi*
Lawrence Tibbett

FEBRUARY 1, 1943

Great Day — *Spiritual*
Chorus

At Parting — *Rogers*
Love Went a-Riding — *Bridge*
Helen Traubel

Oh! How I Hate to Get up in the Morning — *Berlin*
Orchestra

Pleurez, Pleurez, Mes Yeux from "Le Cid" — *Massenet*
Helen Traubel

The Tsar's Bride—Overture — *Rimsky-Korsakoff*
Orchestra

Abide With Me — *Monk*
Helen Traubel and Chorus

On the Type-K carrier project, between Terre Haute and St. Louis, instead of paralleling an existing cable with a second cable, it is planned to operate the two directions of transmission over two existing cables which go over different routes. This makes it necessary to establish repeater stations on both routes, and certain other special arrangements are necessary. However, the expedient saves large quantities of copper.

Laboratory Gas Distributing System

At the Murray Hill Laboratories hydrogen, oxygen and nitrogen gas are piped to individual laboratories from a central source. The hydrogen supply is kept in one room and the oxygen and nitrogen in another to avoid the possibility of an explosion. The gas is stored in eight high-pressure cylinders of which four are connected at one time through reducing valves to the laboratories. The other four are the reserve supply.

N. S. Whitehead connects a full tank to the central gas distributing system at the Murray Hill Laboratory

In the hydrogen lines there are flow meters to limit the maximum delivery to each room, depending on its volume, to a rate which will make impossible the accumulation of an explosive mixture in any room. About four tanks of hydrogen are used per day and the same amount of oxygen and nitrogen per week.

News Notes

O. E. Buckley, Eric Weil and F. A. Korn represented the Laboratories at a luncheon held under the auspices of the National Association of Manufacturers to honor those companies who had received the Army-Navy "E" award. The luncheon was held at the Waldorf-Astoria Hotel on December 4 to focus public attention upon industries' part in the war and to honor those who have won the "E" award.

H. S. Osborne, formerly Plant Engineer of the A T & T, is now Assistant Chief Engineer.

R. H. Millinger, President of the Illinois Bell Telephone Company, has been elected President of the Telephone Pioneers of America for 1943.

G. B. Thomas and John Mills attended the Bell System Personnel and Public Relations Conference held in New York City.

H. M. Spicer, at Washington and at the General Electric Company, Schenectady, observed tests on motor generator sets and controllers for radio use.

O. H. Loynes and T. F. Gleichmann visited repeater points between New York and Pittsburgh in connection with the field investigations that are being conducted on the K2 carrier system.

GIUSEPPE BRUCCOLERI

EDWARD C. MOLINA

R. R. WILLIAMS has been appointed to serve on an advisory committee to administer two $2,000 Charles L. Mayer awards, one in 1942 and one in 1943, for outstanding contributions to the knowledge of factors affecting the growth of animal cells with particular reference to human cancer. The awards will be given to further the scientific work of the recipient.

RETIREMENTS

A LONG PERIOD of service in the Bell System was terminated on December 31 when EDWARD C. MOLINA, Switching Theory Engineer of the Systems Development Department, retired with a Class A pension in accordance with the Retirement Age Rule. Mr. Molina joined the Western Electric Company at West Street in 1898 and three years later transferred to the Engineering Department of the A T & T in Boston where he worked on transmission problems. In 1905 he transferred to the circuit design group to develop trunking plans and circuits for mechanical switching systems. Among Mr. Molina's important contributions was the development of a registration and translation system of pulses for controlling the operations of selecting switches which permitted lines designated on a decimal basis to be interconnected by switches functioning on a non-decimal basis. The panel system was an immediate outcome of this system. One of the values of a translating system was to capitalize the higher call-carrying efficiencies of large groups of trunks and this involved the mathematical theory of probability, a subject on which Mr. Molina became an outstanding expert.

When the Boston Laboratories moved to New York in 1907 Mr. Molina continued his work on both the circuit and probability aspects of dialing systems. Late that year he introduced into the solution of trunking problems the "particular subscriber's point of view" and his Poisson trunking formula. In 1910 he developed the counting relay circuit for panel system senders. After the D & R was formed in 1919 he concentrated his energies on applications of probability theory to telephone engineering problems—work which he carried on in the Laboratories as Switching Theory Engineer.

In recent years Mr. Molina has contributed many papers in his chosen field; lectured at several universities and before engineering societies; presented papers before the Toronto, Bologna and Oslo International Congresses of Mathematicians; and testified on the mathematical aspects of issues involved in rate cases and patent litigation. His *Poisson's Exponential Binomial Limit* was published in 1942, thus making the tables involved available to Government Departments and other manufacturers. These tables were originally developed for the solution of telephone trunking and switching problems and used more recently for inspection and sampling by quality control engineers. The publication, *Army Ordnance*, reviewed the book and commented quite favorably on it, particularly on its value in ordnance manufacture.

Mr. Molina is a Fellow of the Royal Economic Society, Institute of Mathematical Statistics and A.A.A.S. and a Member of the A.M.A., M.A.A., A.A.S., A.I.E.E., A.S.A. and the Econometric Society.

* * * * *

GIUSEPPE BRUCCOLERI, a cleaner in the Plant Operation Department, retired on December 15 with a Class A pension follow-

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

W. M. Beaumont
F. E. Blount
H. W. Bode
G. M. Bouton (2)
L. J. Bowne
H. B. Brown
J. T. L. Brown
E. Bruce
H. T. Budenbom
A. J. Busch
I. E. Cole
F. S. Corso
J. F. Dahl
S. Darlington
W. B. Ellwood
A. L. Fox
J. W. Gooderham
W. S. Gorton
F. A Goss, Jr.
F. Gray
E. I. Green
R. H. Griest
C. W. Halligan
H. C. Harrison
C. N. Hickman
Francis A. Hubbard
D. H. King
E. F. Kingsbury
J. P. Laico
E. Lakatos
W. Y. Lang
W. G. Laskey
M. A. Logan (3)
W. A. Malthaner
L. A. Meacham
A. E. Melhose (2)
O. S. A. Mesch
D. Mitchell (2)
G. S. Phipps (2)
E. E. Schumacher (2)
A. M. Skellett
E. M. Smith
S. J. Stockfleth
J. E. Tarr
E. R. Taylor
W. W. Tuthill
H. W. Ulrich
E. F. Watson
E. C. Wente
R. C. Winans

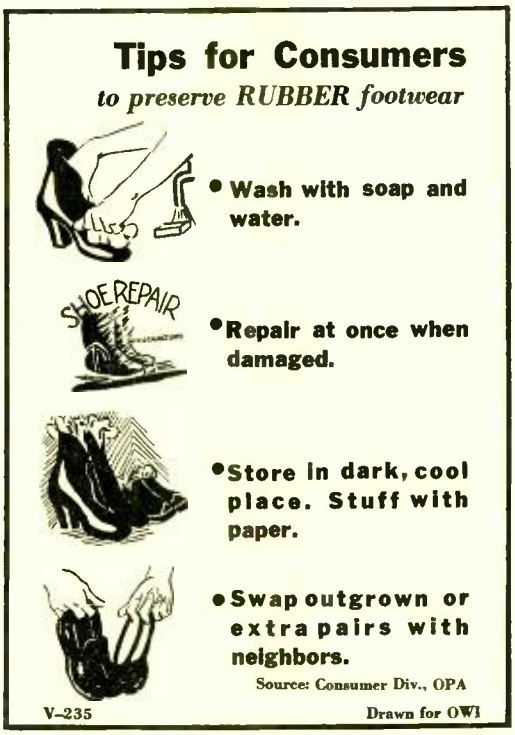
ing a year's absence because of sickness disability. At the time Mr. Bruccoleri came to West Street in 1908, the Manufacturing Department was still housed in the building and cleaning involved the removal of waste and scraps which are typical products of manufacturing operations. The gradual change in character of the work conducted in the building has brought changes in the cleaning job as well. Later Mr. Bruccoleri was assigned to cleaning service in the restaurant, and served in that capacity until his retirement.

News Notes

An extensive program for the standardization and simplification of radio parts used in military and naval radio and electronic equipment is being undertaken by the War Committee on Radio of the American Standards Association. The Army, Navy, W.P.B., R.M.A. and I.R.E. are coöperating with the A.S.A. in this work. Members of the Laboratories who are in various sub-committees include C. J. Christensen, insulating materials; A. J. Christopher, fixed condensers; F. J. Given, fixed paper-dielectric capacitors; and D. K. Martin, with I. E. Fair as his alternate, chairman of the committee responsible for crystals and crystal holders.

Several new radio telephone communication links, all of them important to the war effort, are now in the stage of engineering tests. One such line was recently opened—a direct circuit between New York and Santiago, Chile. The previous U. S.-Chile service was handled via radio circuits between New York and Buenos Aires and then by land wires across the Andes to Santiago.

R. A. Heising, as the fifth lecturer in the *Ultra-High Frequency Symposium* held by the Communication Group of the New York Section of the A.I.E.E., spoke on *Propagation*. Mr. Heising discussed antennas, transmission lines and guided waves. Mr. Heising, in the November issue of the *Proceedings of the I.R.E.*, reviewed the seventh edition of the *Standard Handbook for Electrical Engineers*.



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

NEW YORK TELEPHONE COMPANY

H. O. Abrahamson.....7100
T. J. Arkinson.....3200
D. C. Ballan.....7400
G. E. Banks.....7500
W. B. Bigger, Jr.....7400

A. J. Borer.....2200

Arkinson

Banks

C. E. Brooks.....3300
J. F. Busch.....3200
E. W. Byrne.....3200
J. L. Carter.....3200
Michael Conzani.....3200

G. H. Corrigan.....7400
Matthew Corry.....7400
W. E. Dabb.....7400
V. J. DeGhett.....7400
Lee DePace, Miss.....3200

F. K. DeVoe.....7400
J. M. Dietz.....2100
W. M. Dietz.....3200
W. E. Dunham.....7500
W. H. Dunham.....7400

Miss DePace

J. M. Dietz

C. N. Durand.....7100
E. H. Eveland.....2100
H. M. Fee.....3500
M. O. Fichter.....3200
C. F. Flint.....7400

R. W. Folsom.....1700
C. E. Fordham.....2200
J. G. Fosdick.....1700
A. C. Foth, Jr.....3200
M. J. Frank.....7400

R. W. Gast.....2600
E. H. Goldsmith.....2200
Walter Hilchen.....3200
A. H. Hilternen.....2100
L. C. Hosek.....6000

Gilbert Howard.....7400
C. H. Kauke.....3200
B. J. Keating.....2100
L. J. Kelly.....2200
R. H. Klie.....7400

Howard

Kuczma

A. J. Kuczma.....1900
A. N. Luce.....1400
L. M. Ludlam.....1900
R. A. Martiny.....3200
L. J. Mase.....3200

J. K. McDuffee.....1400
J. M. McNamara.....7400

C. T. Miller.....3200
J. G. Mohl.....1900
T. J. Montigel.....7100
L. H. Moore, Jr.....7400
George Morfopoulos.....3200

B. I. Mott.....1900
E. M. Mowton.....2100
E. C. Muller.....3200
A. E. Nelson.....3200
James Nemes.....7100

J. A. Normann.....2100
C. W. Norwood.....3200
W. E. Reinhardt.....7400
W. T. Richards.....2200
F. J. Rinciari.....3200

Siemers

Williams

H. P. Scheffer.....3200
J. J. Seiler.....1900
H. K. Siemers.....7400
T. E. Sippel.....1700
H. P. Smith.....7400

S. C. Smithers.....3200
T. M. Torrens.....3100
C. A. Walters.....3200
W. K. Webster.....3200
D. H. Williams.....3200

K. M. Winkworth.....1600
H. R. Yoeckel.....3200
H. H. Young.....1500

WESTERN ELECTRIC COMPANY

J. M. Acker.....7500
W. J. Albersheim.....1600
W. F. Armson.....7500
H. S. Arnold.....2100
G. B. Ashe.....1700

W. L. Bell.....1700
R. W. Benfer.....1700
P. H. Betts.....1700
N. J. Brendel.....7500

Brown

Butler

M. R. Brown.....1700
W. J. Brown.....1700
M. J. Burger*.....1700
J. J. Butler.....1700
J. C. Bylander.....1700

J. J. Callanan.....7500
F. C. Cathers.....1700
L. A. Ciha.....1700
T. S. Diab.....7500
H. W. Dohlmar.....7500

Rudolph Droppa.....1700
R. L. Eilenberger.....7500
S. O. Ekstrand.....1400
A. R. Ell.....7500
A. E. Emerson.....7500

H. O. Emmons.....1700
H. A. Fagan.....7500
Lester Feinstein.....1700
J. F. Florio.....7500

Callanan

Droppa

H. R. Foster.....1700
H. L. Harper.....2100
B. B. Hayworth.....1700
G. E. Heiland.....1700
J. F. Hipple.....1700

L. E. Hodges.....1700
C. R. Hoffman.....3500
A. F. Hofmann.....3600
Henry Hurray.....1700
A. F. Jacobsen.....1700

H. L. Johnson.....7500
Ralph Jongedyk.....1700
N. D. Kanely.....1700
W. F. Kannenberg.....3500
J. T. Keough.....7400

R. W. Kosley.....1700
O'Ray Liechti.....1700
K. H. Lloyd.....1700
W. J. Locke.....7400
R. P. Luttkus.....1400

John Maas.....1700
F. G. Marble.....1700
J. J. Martiner.....1700
J. G. Matthews.....1700
O. H. Maurer.....2200

Hofmann

Johnson

J. P. Maxfield*.....1100
G. P. McGraw, Jr.....1700

R. H. McMahon.....7500
W. E. McMahon.....2200
C. C. Meyer.....7500
B. K. Miller.....7500

Kanely

Locke

J. H. Miller†.....1700
W. D. Moeder.....1700
K. W. Muhling.....7500
Clara E. Muller.....3400
W. F. Orth.....1700

A. J. Osinski.....7500
M. A. Pallesen.....7500
H. L. Pappler.....7500
Bernice J. Potwin.....2600
G. L. Pross.....1700

V. C. Rankin.....1700
J. K. Schoolcraft.....1700

K. H. Schreyer.....7500
Harold Scott.....7500
R. R. Scoville.....1700
A. L. Sinclair.....1700
E. W. Templin.....1700

J. E. Tweeddale.....1700
N. G. Wade, III.....1100
A. A. Waraske†.....7500
Gustave Wegman.....7500
F. C. Willis.....1700

Miss Miller

Wohlgemuth

T. W. Winternitz.....1700
A. C. Wohlgemuth.....1700
E. T. Wojciechowski.....7500

*Now with N.D.R.C.
†On Military Leave of Absence.

* * * * *

1100 Physical Research (H. Fletcher)
1400 Electronics Research (J. R. Wilson)
1500 Television Research (R. Bown)
1600 Radio Research (R. Bown)
1700 Commercial Products Development (O. M. Glunt)
1900 Research Staff (H. R. Jeffcoatt)
2100 Transmission Apparatus (W. Fondiller)
2200 Switching Apparatus (H. A. Frederick)
2600 Apparatus Staff (H. S. Sheppard)
3100 Switching Engineering (H. M. Bascom)
3200 Equipment Development (H. H. Lowry)
3300 Switching Development (W. H. Matthies)
3400 Transmission Engineering (R. G. McCurdy)
3500 Transmission Development (D. A. Quarles)
3600 Systems Administration (M. Sultzer†)
6000 Personnel (G. B. Thomas)
7100 General Accounting (A. O. Jehle)
7400 Commercial Relations (B. B. Webb)
7500 Plant (S. H. Willard)

THE TRANSFER of 240 members from Associated Bell System Companies to the Laboratories to aid in carrying on the extra load of war work is an example of the general interchangeability in the Bell System of individuals with the same basic training and background and of the willingness of the Associated Companies to coöperate with the Laboratories. Those coming from the New York Telephone Company and from the Western Electric Company are tabulated on these pages and the rest will be listed in the next issue of the RECORD.

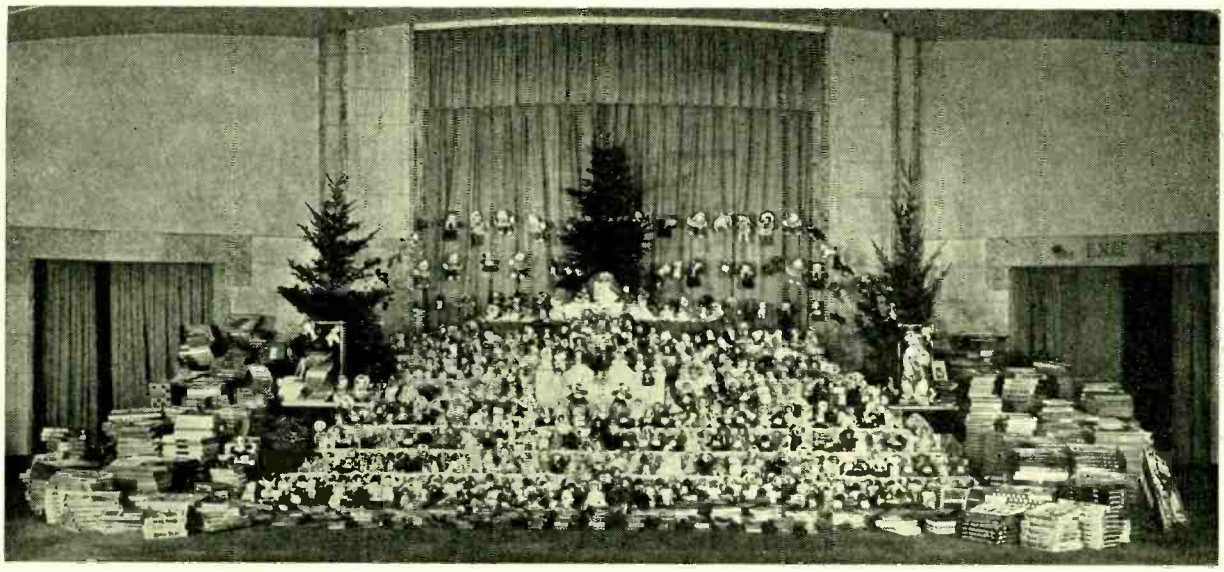
An analysis of this transfer of personnel shows that 122 are Members of the Technical Staff; 24 are Members of the Laboratories Staff; 57 are Draftsmen; 19 are Laboratory Mechanics; and the balance, 18, is made up of technical and staff assistants and service and accounting clerks. In the period covered, December 1, 1941, to November 30, 1942, personnel at the Laboratories increased by 1,203 to a total of 6,102. Those coming from the Associated Companies thus represent about 20 per cent of this increase.

In addition, the Western Electric Company, Hawthorne, has assigned 125 draftsmen and the Installation Department of the Western Company in New York has assigned 189 installers to the Laboratories organization on a loan basis for which they bill us. These men have also been of great assistance in carrying on war programs.

* * * * *

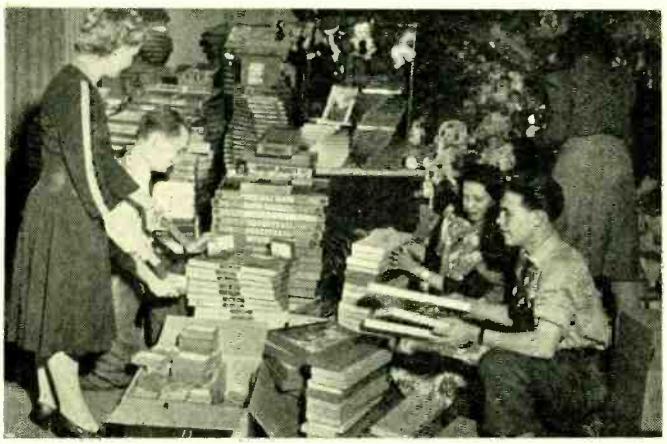
THE NOVEMBER issue of the *Proceedings of the I.R.E.* contains an article entitled *Radiation from Antennas* by S. A. SCHELKUNOFF and C. B. FELDMAN.

J. H. SHEPARD visited the John Oster Company at Genoa, Ill., and Racine, Wis., the Dumore Company and The Electric Motor Corporation at Racine and the Barber-Colman Company, Rockford, Ill., in connection with electric motors.



This year over 3,000 dolls and toys were distributed to fifty-three institutions and welfare agencies in the metropolitan district by the Christmas Committee

Left—Alice Sorensen, Elizabeth McKewen, Margaret Ferrie (standing), Ada Van Riper and Doris Walz. Right—S. A. Milne, Joan Connolly and H. F. Beck



In these photographs, taken during the time the display was being set up, names are given from left to right. Left—Anne Povey, Edward Buck, Mildred Swanson and Charles Klein. Right—Regina McCormack, Marjorie Hayes, Mary Reddington, Charlotte Bortzfield and Nellie Schofield

Women Members of the Laboratories

Christmas Committee

The dolls and toys obtained by the Laboratories Christmas Committee were exhibited in the auditorium at West Street from December 9 to 11. This year a total of $1,250 was gathered with which the committee bought over 3,000 pieces. 350 dolls were dressed by Laboratories' people and the exhibit included 500 stuffed animals, over a hundred dozen games and toys, and a hundred manicure sets for adolescent girls. In addition, the girls dipped into their capital and filled a hundred bags for the Red Cross which were sent overseas to soldiers and sailors of our Armed Forces.

Photographs of the dolls and toys collected and exhibited at the Murray Hill Laboratory will appear in the February issue of the Record as the exhibit there was held a week later than the one in New York.

Magazine Cover Girl

November's cover for *Industrial Standardization* featured Dorothea Holshuh of Systems Drafting. The pose is a serious one, as befits a publication which contains "Standard Symbols for Communication Drawings" by W. L. Heard.

Miss Dorothea Holshuh

Miss Holshuh received her training in Systems Drafting some time ago, but in recent years had been working elsewhere. Last spring she was asked to return and help out during the shortage of draftsmen. A graduate of Plainfield High School, Miss Holshuh now lives with her father on Eleventh Street.

Miss Alice R. Williams

* * * * *

Alice Williams is a Technical Assistant in the Metallurgical Laboratory at Murray Hill where she prepares metallic specimens, photographs them through a microscope, and finishes the prints. After three years at Bryn Mawr, Alice took a defense training course in metallurgy at Stevens and joined us in August of last year. Much of her work

is on permanent-magnet alloys, an important field since those materials enter into many communication jobs.

* * * * *

"Pat" Beattie was a receptionist in a business office, but she wanted to get into war work, so she got a job in our Electronics Research Laboratory. Here she is shown straightening the lead-in wires for vacuum

Miss Patricia Beattie

tube parts so tiny you can hardly see them. Pat's boy friend will soon be in the Army, so she's glad to be helping on the production front.

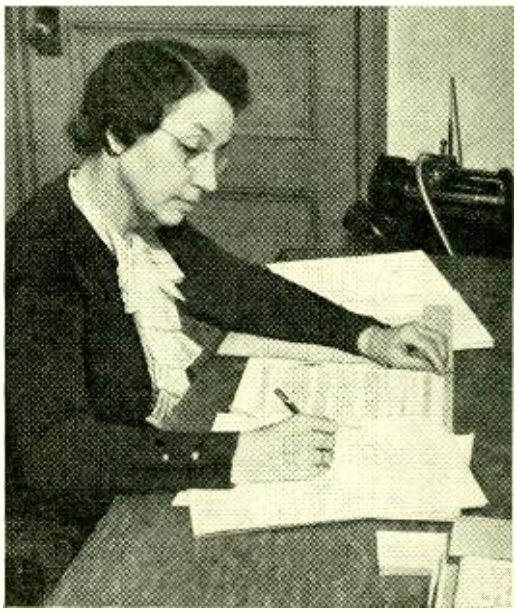
* * * * *

In World War I there were women laboratory workers, and Cordelia Mattice was one of them. She had majored in physics at Cornell and had taught it at Wellesley for a couple of years, so she got a job in a gas company's chemical control laboratory. When the war ended she came to the Laboratories as a stenographer and worked for E. W. Adams, who was at that time Assistant General Patent Attorney. During a rush period, Mr. Adams suggested that Miss Mattice try her skill at writing descriptions of circuits for which patent applications were being prepared. She did well at it, and gradually acquired the technique and background to handle all phases of patent work. Her specialty is dial circuits; her grasp of that trickiest part of the telephone art is a continual surprise to the engineers. In order to obtain registration with the Patent Office as a patent attorney, she took a correspondence course in law and was admitted to the New York Bar.

Ever since college days Miss Mattice had made her home with her mother. In 1939 those close ties were broken by death, but fortunately Miss Mattice has many friends, with whose interests she has gradually refilled her life. One happy event of each week is a dinner-and-movie party on Friday with a group of women from the Laboratories.

* * * * *

When Marion Shaw's payroll number was drawn, it was a question whether to picture her at the West Street P.B.X. or at the cashier's desk in the cafeteria, where she works at lunch time. At the switchboard, she is usually the girl who answers when you

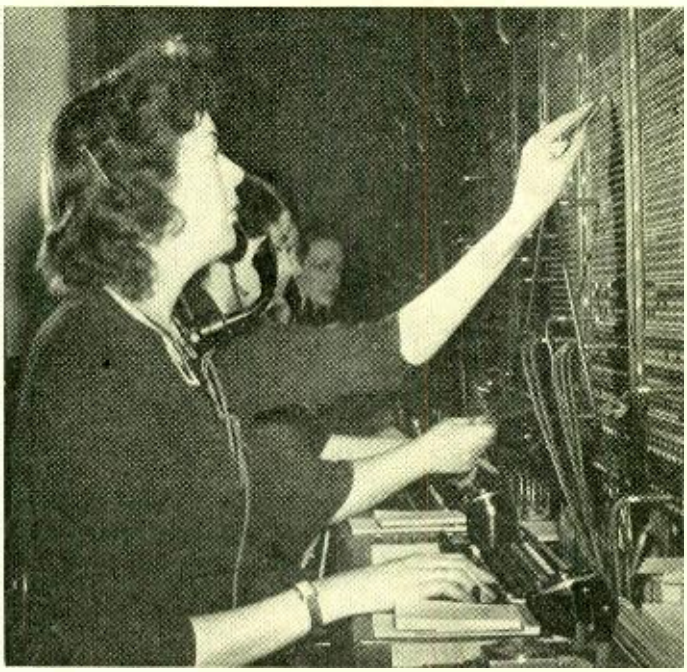


Miss Cordelia Mattice

ask for Long Distance or the tie lines to Hawthorne or Point Breeze. With the aid of her "Memory Book" she has become quite skillful in locating Army and Navy people in the maze of posts and Washington offices.

In speeding up our war calls, she is glad to feel that she is backing up her particular soldier, who is in the permanent staff at Camp Upton.

A resident of our own Greenwich Village, Miss Shaw went from Public School 3 to the New York Telephone Company in 1927; from there she entered the Laboratories in 1929.



Miss Marion Shaw

News Notes

C. S. Knowlton was at Wright Field, Dayton, on motor generator problems.

E. C. Hagemann and C. D. Owens were at Kearny in connection with the approval of finishes on cores used in broadband carrier systems.

D. D. Miller made several trips to Leeds and Northrup Company in Philadelphia on special projects relating to the war effort.

During the week of November 7, R. J. Nossaman interviewed members of graduating classes at Iowa State College, Iowa University and Missouri University.

R. H. Colley was in Washington recently where he discussed various activities of the American Wood Preservers' Association and timber products specifications for Government use.

At the Hawthorne plant of the Western Electric Company A. W. Ziegler and J. F. Barry discussed the development and manufacture of quartz crystals; A. J. Grossman, the manufacture of special networks; J. A. Kater, problems relating to the production of condensers for government projects; C. D. Owens, cores of compressed magnetic powders; H. T. Wilhelm, precision resistance measurement problems; and G. W. Meszaros, power-equipment.

G. E. Bailey and H. E. Marting were in Washington and Philadelphia on switchboard multiple-cable and other problems.

On October 30, C. D. Hocker and C. H. Amadon visited Sandy Hook and on November 14 to 16, State College, Pa., for the purpose of reconditioning racks on which are mounted hardware samples for outdoor exposure tests for the A.S.T.M.

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

Research Department

G. M. Eberhardt — Vivian Kilpatrick
D. R. McLennan

Systems Development Department

A. S. Dubuar — H. K. Warnke

Apparatus Development — *Library*

O. H. Danielson — Dorothy Mahon

General Service — *Plant Department*

M. L. Clarke — Tim Sullivan

A. S. King was in Trenton on step-by-step shelves and machine-wired banks.

R. H. Miller and J. W. Woodard visited the Northern Electric Company at Montreal to discuss telephone system problems.

G. F. Sohnle made a trip to Winnipeg, Regina and Edmonton, Canada, to discuss the installation of telephone equipment.

C. W. Van Duyne and R. R. Gay discussed synchro-motors and generators at the General Electric Company at Schenectady and at Fort Edwards.

Twenty-Five-Year Service Anniversaries

During H. M. Trueblood's quarter century of service with the Bell System he has been intimately associated with the development of methods and procedures for the protection of telephone plant and personnel from the effects of induction from power and electrified railway circuits. In this connection he has been a member and secretary of the Joint Subcommittee on Development and Research of the Edison Electric Institute (formerly the National Electric Light Association) and the Bell System. This committee has published several volumes of reports that have been of fundamental importance in the coördination of paralleling telephone and power circuits for the avoidance of interference. In the railway electrification field, Dr. Trueblood has been concerned with the Pennsylvania, New Haven, Norfolk and Western, Virginian, Lackawanna and other electrifications from the standpoint of preventing inductive interference with communication circuits. Recently work on electrolysis prevention and protection has been under his direction. A feature of the latter subject has been the protection of buried cables from lightning.

Dr. Trueblood received B.S. degrees from Earlham College and Haverford College; spent five years as field officer with the U. S. Coast and Geodetic Survey; attended M.I.T. and then Harvard from which he received his Ph.D.; and was instructor and then assistant professor in the Electrical Engineering Department of the University of Pennsylvania. He joined the Engineering Department of the A T & T in 1917 and a few months later went to the U. S. Naval Experimental Station at New London in research work in connection with submarine detection. He returned to the A T & T in 1919, becoming a member of the D & R and came to the Laboratories during the 1934 consolidation. He is now Protection Development Director in the Transmission Engineering Department.

Mr. and Mrs. Trueblood live in Dobbs Ferry. Their three sons are now far from home—the eldest is with the Army Air Force in the Panama Canal Zone, the second, Harvard, 1938, is in South America, where he has been Director of Courses in the Chilean-North American Institute at Santiago, and the third, Harvard, 1941, is at the California Institute of Technology on N.D.R.C. work as a chemist. Mr. Trueblood is fond of tennis, swimming and fishing and is a Telephone Pioneer.

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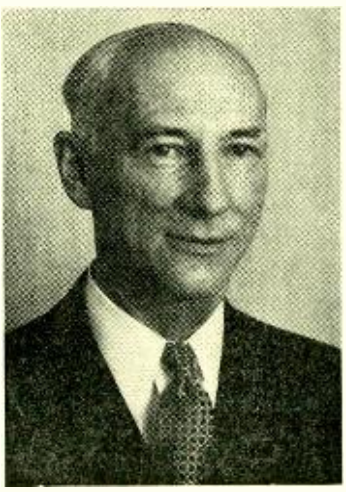
C. H. Amadon graduated from the Biltmore Forest School in 1908 and then continued in the practice of forest engineering until he joined the Engineering Department of the Western Electric Company in 1917. Since then he has been engaged in establishing standard inspection procedures and supervising inspectors of the timber prod-

Howard M. Trueblood



Clarence H. Amadon

George R. Lum

HORACE W. ULRICH
of the Switching Development Department completed forty years of service in the Bell System on December 22

ALBERT F. GILSON
of the Plant Department completed thirty-five years of service in the Bell System on December 13

HARRY C. DIEFFENBACH
of the Equipment Development Department completed thirty-five years of Bell System service on December 27

ucts used in outside telephone plant. This work was carried on in the Inspection Engineering Department until 1927 when it was transferred to the newly organized Outside Plant Development Department. Since that time, as a member of the timber products group, Mr. Amadon has had a responsible part in setting standards for timber products and in the development of improved processes for the preservation of wood.

Mr. and Mrs. Amadon, who live in Mountain Lakes, have two girls, one a freshman at Iowa State and the other a junior in High School. Mr. Amadon is particularly interested in Irish setter dogs and enjoys hunting and fishing. He is a member of the Telephone Pioneers of America.

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MUCH OF G. R. LUM'S twenty-five years of service with the Laboratories has been concerned with the appearance and mechanical design of many products of the Laboratories, particularly those of the Commercial Products Development Department. His early work can be seen in both the carbon and condenser type microphones and mounting for early broadcasting purposes, loudspeakers, particularly the 540 type, audiphones, artificial larynx, public-address systems for schools, the telephone handset and the combined set and many other products.

ARTHUR G. CHAPMAN
of the Transmission Engineering Department completed thirty years of Bell System service on December 12

HOWARD WEINHART
of the Physical Research Department completed thirty years of service in the Bell System on December 17

WALTER R. STUART

LLOYD D. HABERMEHL

WILLIAM F. MALONE

Forty-two patents have been credited to him covering Laboratories' products with which he has been associated.

Before joining the Bell System Mr. Lum spent six years with Yale and Towne Manufacturing Company on mechanical and ornamental iron and bronze design; a year and a half with Duffner and Kimberly Company on leaded glass windows and lighting fixtures; and then spent six years in business for himself in similar work. His first work at West Street was on the design and development of naval equipment and in this connection spent some time on U. S. Navy destroyers. During his early years with the Laboratories he took courses at C.C.N.Y. in design of electrical equipment, two years at the Art Students League, another two years of study with Mahonri Young on sculpture and drawing and several years with Michael Jacobs, drawing and painting. For the past ten years Mr. Lum has been concerned with appearance design in the Laboratories. He is now working on the mechanical design and general appearance of equipment being developed for the armed forces.

Mr. and Mrs. Lum live in Manhattan during the winter and on their boat at Bayside on Long Island Sound in summer. He now has a new boat, a 41-foot ketch, which he had built, but he himself was responsible for most of the metal and cabinet work involved. Yachting and the arts are his particular hobbies.

W. R. STUART joined the Stores Division of the Commercial Department at the Western Electric Company in 1917 at the time that this department was formed and has been associated with this type of work during his twenty-five years of service. In 1940, when all stockrooms and storage facilities were centralized in the General Service Department, Mr. Stuart was placed in charge of the Central Stockrooms, the Local Stockrooms located at West Street and the New York storage facilities, including the storage of Models and Samples, as well as the Baker-Williams Storage Warehouse. Recently the West Street Procurement Stockroom, at which location material is assembled and forwarded to the proper Shop location in the New York area, has been made a part of his organization. Also, the Salvage Stockroom in Basement G at West Street which has recently begun operations has been planned and organized under his responsibility.

Mr. Stuart has contributed in the design and installation of many of the self-service stockrooms not only at West Street, but at our outlying locations, including the general stockroom and the first self-service chemical stockroom at Murray Hill. He also assisted in the design of the central chemical glassware washroom at Murray Hill.

Before Mr. Stuart joined the Bell System he had been associated with the E. W. Bliss Company. He attended Pratt Institute and the First Municipal Training School in New York State for planning officials.

In his home community of the Village of Lynbrook, Mr. Stuart has been active in civic affairs. He is a member of the statistical committee of the Defense Council, a member of the Planning Board (an official body) for the past nine years, and is president of the Village Party. Mr. and Mrs. Stuart have three children, one boy who is attending Fordham University and who is also in the United States Marine Reserve, one daughter who is married and another who will graduate from High School this June. Mr. Stuart assisted in the formation of the Laboratories Horseshoe Pitching Club and has been its chairman for the past two years.

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L. D. HABERMEHL joined the Engineering Department of the Western Electric Company in 1917 and his first work was with the Auditor of Disbursements in the Accounting Department. Later he worked with the group responsible for the classification of all expense. For the past ten years he has been concerned with the preparation of expense reports for executive control.

Mr. Habermehl lives in Dover. He enjoys hiking, particularly around the old iron mines in that section of New Jersey. Skating is another of his recreations. He is a member of the Telephone Pioneers of America.

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THE PREPARATION OF DRAWINGS and specifications for the new panel offices was W. F. MALONE's first work with the Engineering Department of the Western Electric Company. In 1923 he transferred to the Equipment Development Department and the next eight years prepared manufacturing information covering trial installations of new equipments. During this time he was responsible for supervising the installation of the terminal equipment for the Key West-Havana submarine cable and the radio control equipment in the Long Lines building in New York. Since then Mr. Malone has been engaged in developing equipment for carrier telephone circuits over cable pairs and in the design of key equipments. More recently he has been concerned with the development of fixed information centers for plane spotting.

The Malones, who have one son in High School, live in Totowa Borough in New Jersey. Mr. Malone is active in civic affairs. He has been on the Board of Education for the past five years and is associate member of the Registrants' Advisory Board of the Selective Service System for Passaic County. For many years Mr. Malone has been chairman of the Laboratories Golf Club and was responsible for organizing the Bell System championship matches arranged for those companies in the metropolitan area.

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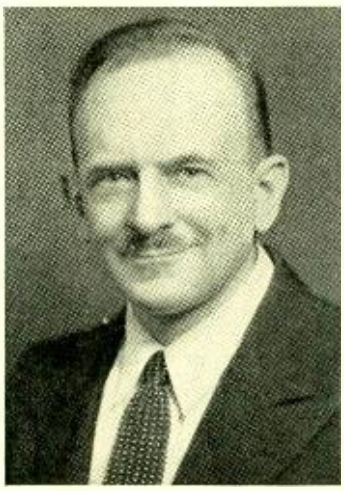
WHILE STUDYING electrical engineering at Cooper Union Evening School, G. J. MAGGI worked for the Children's Aid Society of New York but in order that his work would be more applicable to his studies he joined the Plant Department of the New York

GUY J. MAGGI



HOWARD HALL

EDWIN C. HAGEMANN

Telephone Company in 1917. He soon joined the Signal Corps of the Army and was in training at New Hampshire State College when the Armistice was signed. He then returned to the New York Telephone Company but soon transferred to 463 West Street to engage in the group responsible for the standardization of dial PBX equipment. When orders for this type of equipment increased he was transferred to the equipment analyzation group where these PBX's were analyzed on a job basis for special requirements. He has been associated with this group since then, analyzing special requirements on various types of dial systems, especially the step-by-step dial office.

For many years Mr. and Mrs. Maggi lived in the Bay Ridge section of Brooklyn but moved to Malverne, L. I., about three years ago. They have two daughters, ages 9 and 6, in elementary school. Mr. Maggi is on the Board of Governors of the Malverne Park Civic Association and is a member of the Edward J. Hall Chapter of the Telephone Pioneers of America.

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AFTER WORKING for the Martin Aircraft Corporation for several years HOWARD HALL joined the Engineering Department of the Western Electric Company in 1917. During the war period he was associated with the design and construction of detectors and gun-fire ranging apparatus for the Army. After the war he was with the printing telegraph group and then transferred to the group handling the conversion of manual offices to panel offices and in this connection designed many of the tools required and instructed installers in their use. Later he joined the research design group and for several years was occupied with the development of the apparatus that was used in connection with the New York-Azores cable.

In 1926 Mr. Hall handled the mechanical design of the apparatus used in the first demonstration of television and in the later two-way television between 195 Broadway and West Street. He holds several patents on pictures in review, color and microscopic photography, X-ray and music reproduction. He is now concerned with projects connected with the war effort.

In his home community Mr. Hall is a deputy sheriff and a member of the C. D. First Aid Committee. His hobbies are fishing and operating his large fruit and poultry farm in South Jersey.

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ON RECEIVING the degree of B.S. in Electrical Engineering in 1916 from Bucknell University, E. C. HAGEMANN joined the Crocker-Wheeler Company where he was engaged in advertising and sales engineering work. The next year he joined the A T & T where he engaged in transmission testing in the toll cable plant, working at various repeater stations between New Haven and Washington. Early in 1918 he enlisted in the U. S. Naval Reserve, taking a course in the Navy's steam engineering school which led to his commission as ensign after a preliminary training on New York harbor craft and on a transport ship.

On his return to the Bell System Mr. Hagemann joined the Physical Laboratories at West Street and was concerned with testing and development of condensers, capacitance standards and bridges and with studies of materials and apparatus for use at radio frequencies. During the past fifteen years, in Transmission Apparatus Development, he has been chiefly engaged in loading coil and retardation coil development work. For the past year his efforts have been on apparatus for war projects.

The Hagemanns live in Short Hills and have one son who is just completing his freshman year in the accelerated program at Yale. Mr. Hagemann is fond of skating, fishing and boating and vacations are usually spent at Lavallette on the Jersey shore.

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M. V. HUNTER visited Air Associates at Bendix, N. J., on motor problems.

W. S. Ross conferred on machine design problems at the General Electric Company in Fort Wayne.

W. W. Brown, in New England, investigated bearings for all-wood operators' chairs.

F. F. SIEBERT was at the Bodine Electric Company, the Janette Manufacturing Company and Western Electric Company at Chicago on machine-design problems.

O. C. HALL spent a few days in Lowell, Mass., in connection with the initial installation of overtime charging for coin and message rate lines in step-by-step areas.

E. W. Hancock and C. H. McCandless went to Philadelphia to discuss the test-out and cutover procedures of the No. 4 toll-crossbar installation.

* * *

John J. Moloney of the Plant Operation Department died on November 12. Mr. Moloney joined the Laboratories in 1928 as a cleaner. Since 1936 he had been assigned to the Graybar-Varick building, first as a night watchman and more recently as a uniformed watchman.

J. J. Moloney, 1904-1942

Andrew D. Dowd, a former member of Technical Staff in the Systems Development Department who was retired with a disability pension in 1937 after twenty-eight years of service, died on December 10.

J. N. Reynolds, who retired from the Laboratories in 1939 after thirty-four years of service, died on December 6. Previous to his death he had been working for the Naval Ordnance Laboratory in Washington. A biography and photograph of Mr. Reynolds appeared in the May, 1939, issue of the Record.

Charles C. Carr, formerly a member of Technical Staff in the Systems Development Department who was retired with a disability pension in 1931, after twenty-four years of service, died on December 15.

Miss Gratia L. Prouty, formerly a member of the Laboratories Staff in the Personnel Department who was retired with a disability pension last June after twenty-one years of service in the Bell System, died on December 20.

"We See by the Papers"

Miss Virginia Peker . . . was married yesterday to Richard Ivor Forrest. . . . He is employed by the Bell Telephone Laboratories.—*Yonkers Herald Statesman, November* 9, 1942.

Bell Laboratories are equipped as never before for the ordinary and government demands which are being placed upon them. They are staffed by experts in electronic physics, chemistry, magnetics, optics, applied mathematics, wire and radio telepathy, broadcasting, sound, motion pictures and recording.

When the war broke out this laboratory had the background of newly developed and broadly based techniques that could be utilized in the war effort. Highly specialized assignments are undertaken. Many of the new and improved weapons and methods are designed and developed by this and other private enterprise laboratories.

Research is a part of the foundation of America's genius. It is operating now not only to push the war offensive but to prepare for the era of peace ahead.—*New Castle, Pa., News, November* 10 (and elsewhere).

Mr. and Mrs. Henry Wiegers of North Haledon announced the engagement of their daughter Blanche to David Van Slooten . . . employed as an engineer in the laboratories of the Bell Telephone at New York.—*Paterson News, November* 12, 1942.

Frank D. Leamer resigned as a member of the Borough Council as he has moved to Summit to be nearer his place of business, he being connected with the Bell Laboratories at Murray Hill. Mayor William Dixon and Attorney David Young, III, paid high tribute to his services.—*Morristown Daily Record, November* 13, 1942.

Question—(asked of 18-19 year olds): What are you doing to get in the fight?

Leon Goldfeder, 18, is a mail clerk at the Bell Telephone Laboratories.

"I have just sent in my application for the Merchant Marine Cadet Corps. I acted so quickly because I am interested in it and besides I prefer the sea to army life."—*New York Daily Worker, November* 15.

Technical Sergeant Francis Reed has returned to his post at the 152nd Armored Signal Company, 12th Armored Division, from a course of instruction at the Bell Telephone Laboratories in New York City.—*Du Bois, Pa., Express, November* 18, 1942.

Five Bell Laboratory men—Messrs. Petrie, Boman, Wright, Benson and

CAMPBELL—who have been lunching daily at this restaurant (Emily Burmeister's) are extending their sessions to a daily dinner.—*New York City Villager, November* 19, 1942.

. . . A new air raid warning system, by remote control, the first of its kind to be used, as being as near foolproof as expert skill can make it. The system, which uses sirens, but perhaps could be made to sound klaxons, was designed by the Bell Laboratories. It is in operation in Yonkers and New Rochelle.—*Freeport, L. I., Review Star, November* 19.

IN A SETTING of fall flowers, the marriage of MISS AUDREY HANNAH ANDERSON and ENSIGN JOSEPH A. LEHANS was solemnized at a 7:30 o'clock ceremony.

The new Mrs. Lehans, a graduate of Camden schools and Woodrow Wilson High School, is with the Bell Telephone Laboratories in New York City in a secretarial capacity.

Ensign Lehans attended Clifton schools, and is a graduate of Clifton High School. He received his Engineer's degree from the New York University and also completed a course in engineering at the City College of New York. Prior to his being commissioned on August 4, Ensign Lehans was a radio and electrical engineer with the Bell Telephone Laboratories in New York. He was assigned to Dartmouth College in September and was graduated last week. He will enter Harvard University to further his studies.—*Paterson, N. J., News, November* 25, 1942.

MISS GERYL AURICK is being married at 8 tonight to Aviation Cadet Herbert Levelle, U. S. Army Air Forces. The bride will reside with his mother during the first period of his training, and will be associated with the Bell Telephone Laboratories in New York.—*New Rochelle Standard Star, November* 28, 1942.

C. JUNE HANOLD OF ARLINGTON ENGAGED TO WED ROBERT WILLIAM EDMONDS

MR. EDMONDS, a graduate of the Kearny High School, Newark Technical School and Newark College of Engineering, is a member of Newark Technical School fraternity. He is with the Bell Telephone Laboratories.—*Newark Call, November* 29, 1942.

MR. AND MRS. HENRY A. HUBSCHMITT of North Mountain Avenue, Montclair, have announced the engagement of their daughter, Katheryn, to Henry M. Winter.

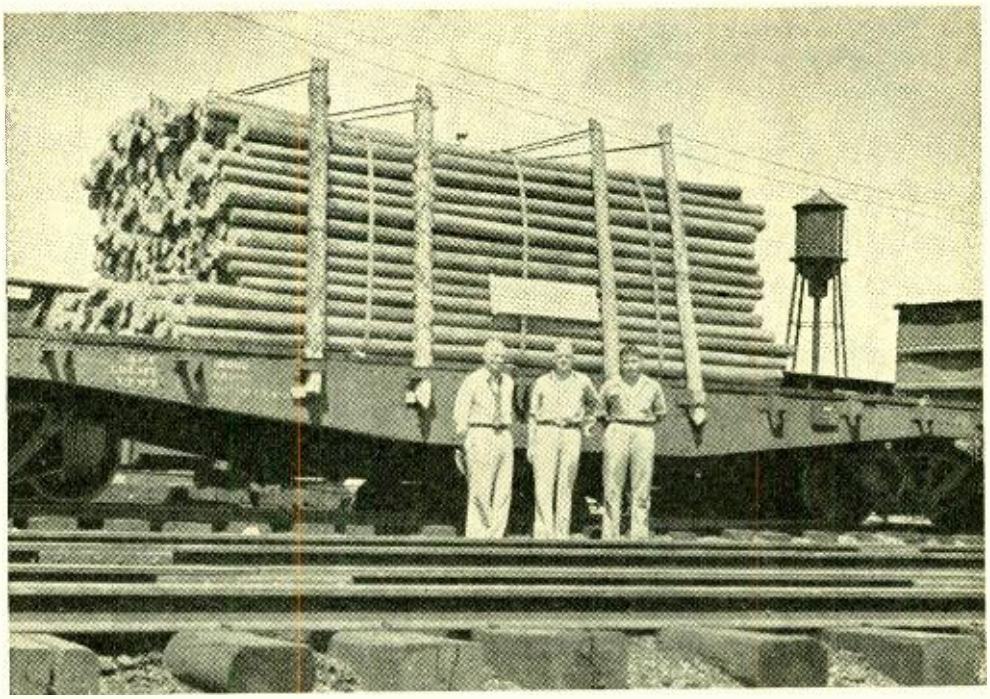
Miss Hubschmitt is a graduate of Montclair High School and attended Montclair Secretarial School. She is with the Bell Telephone Laboratories, New York.—*Newark News, November* 30, 1942.

WASHINGTON—A general review of the outstanding part radio has played and will play in the winning of the war for the United Nations, and the outstanding rôle it is expected to play in the post-war society, was presented before the Detroit Athletic Club late last week by FCC Chairman James L. Fly. . . . The Chairman stated that Commission engineers, with the coöperation of the Bell Laboratories, have developed a means of purposely distorting sound-waves before they leave the transmitter which has doubled the effectiveness of our short-wave broadcasts.—*Radio Daily, New York, November* 30, 1942.

AT THE MEETING of the Eleventh Ward Democratic Club, 29 Ravine Avenue, Jersey City, tomorrow night, a special representative of the New Jersey Bell Telephone Company will give a lecture-demonstration entitled "Up-to-the-Minute," in which he will describe some of the research work done in the Bell Telephone Laboratories and show how these experiments have been put to practical use in developing today's methods of communication in peace and in war.—*Hoboken Jersey Observer, November* 30, 1942.

N.J.C.W. GIRLS PLAY PART IN WAR EFFORT

. . . All the girls who did this engineering drawing work in their final semester before graduation last June were placed in war industries at once. Their class president, GRACE BOLTON of Teaneck, a mathematics major, showed so much promise that she was released in March for special research work in industry, receiving her degree with partial credit for war work. She is now a mathematical assistant in the Bell Telephone Laboratories, Inc., New York. . . . Another at Bell Labs is GRACE LAKIN of Plainfield. —*Newark News, November* 30, 1942.



Greensalt Treatment of Poles

By G. Q. LUMSDEN
Outside Plant Development

EIGHT million creosote-treated southern pine poles have been installed by the Bell System in its exchange and toll lines since 1897. Creosote is a very effective fungicide and these poles have had a satisfactory life record. Rival preservatives are beginning to challenge creosote's top position, however, and many of these have been investigated by the Laboratories in the past fifteen years. A cleaner pole completely free from creosote exudation has a distinct advantage for some locations in the telephone plant and clean poles can be assured by the use of salt treatments. The most promising of these is greensalt, a solution of chromium, copper and arsenic compounds in water. The compounds in this solution have the unique quality of remaining soluble until the preservative has been injected into the wood; then they become fixed so that the toxic elements are retained practically permanently.

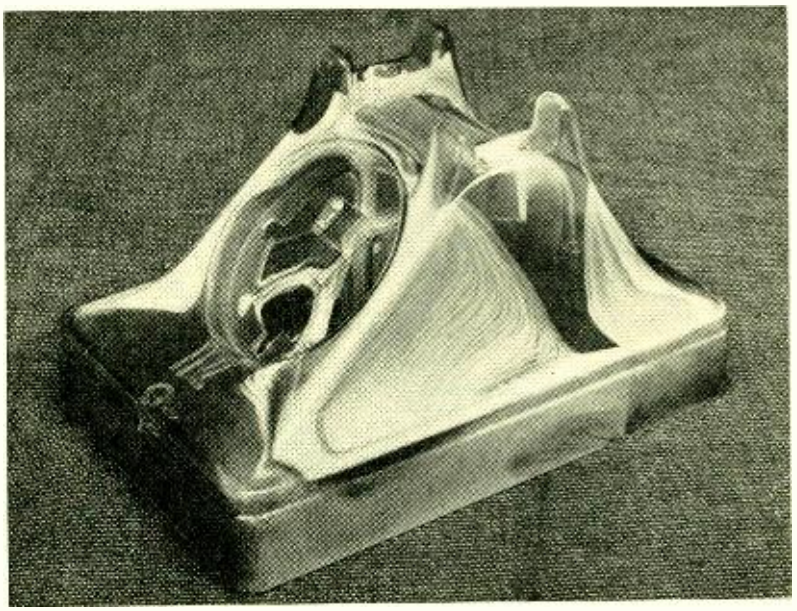
Following preliminary laboratory studies started in 1933, the first outdoor exposure specimens, small sticks of wood treated with greensalt, were set in the Gulfport test plot early the following year. The tests compared very favorably with similar ones on creosoted wood. Indeed, the results were so good that full-size southern pine poles were treated in 1938 and were placed in the test plots. Present indications are that greensalt poles will have a service life at least equal

Western red cedar poles treated with greensalt have been tested as part of a study to find out how to eliminate the shell-rot hazard in this species. Lodgepole pine poles similarly treated have been set in the Rocky Mountain Area and in test plots and red pine poles likewise treated have been set in New England.

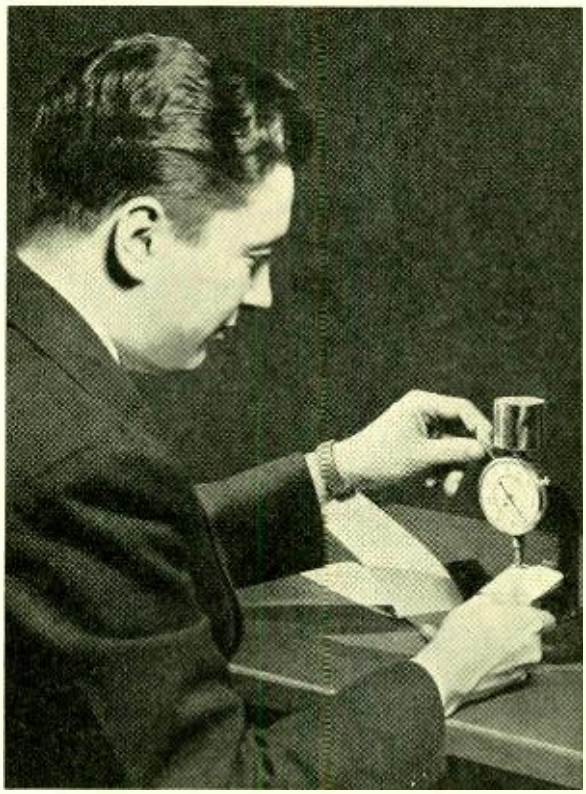
It is too early for extended comments on the behavior of greensalt treated poles in the field but the impressions of engineers and linemen who install them are that they are highly satisfactory in appearance. Reports indicate that attachments can be readily made to them and that they take paint easily.

Under normal conditions a further expansion in the use of a fire-resistant type of greensalt as a pole preservative would already have taken place; but in view of emergency restrictions on the chemicals used in greensalt it is problematical whether any further commercial treatments will be made until after the war.

The photograph at the head of this article shows the first carload of southern pine poles treated with greensalt being shipped to the Philadelphia area. Left to right: F. I. Brownley, Plant Superintendent, Taylor-Colquitt Company, Spartanburg, S. C., and R. H. Colley and A. H. Hearn of the Laboratories.



This curiously striped subset housing was made to study the lines of flow of the plastic material in the molding die. A few white-pigmented granules of molding compound were mixed with a charge of clear granules. Under heat and pressure the charge became plastic as it flowed into the die. Each pigmented particle left behind it a trail of color much as a drop of ink makes a trace in running water



Proving-in a Paper Micrometer

By J. M. FINCH
Chemical Laboratories

THICKNESS of paper and other sheet insulating materials has been measured for years with the pressure-adjusted machinists' micrometer. Recently it has been proposed that a dial micrometer would be a satisfactory alternative instrument and more easily manipulated. To determine the comparative merits of these two devices a test program was therefore undertaken by the Laboratories in coöperation with engineers of the Hawthorne Works, Western Electric Company and of the John A. Manning Paper Company.

The project involved selecting a dial micrometer of suitable design; also design of paper test specimens, determination of the manner and sequence of making the measurements, choosing the method of recording the data, and its statistical analysis. The three organizations concerned measured ten identical spots on each of ten specimens which permitted a much more definite comparison of observations than is possible by taking the same number of observations at spots selected at random.

The thickness of paper products such as teletypewriter tape, condenser paper and cable insulation has to be measured within 0.0001 to 0.0003 inch. To meet this severe requirement and apply the same pressure to the specimen as the machinists' gage, 25 pounds per square inch, the dial micrometer, shown in the headpiece, operates by a weight instead of a spring. Its dial is graduated in divisions of 0.0001 inch and the micrometer surfaces, which match those of the pressure-adjusted machinists' micrometer, are plane circles 0.250 inch in diameter.

Test specimens, about 3 x 6 inches, were cut from ten locations equally spaced across a roll of paper seven feet wide. On each test specimen ten circular areas 3/8 in. in diameter were marked for measurement by circles which were lightly printed with a rubber stamp. Ten specimens of each kind of paper were stapled together between heavy paper covers in the order in which they were cut from the roll, thus making a book with each sheet easily available for measurement and at the same time protected

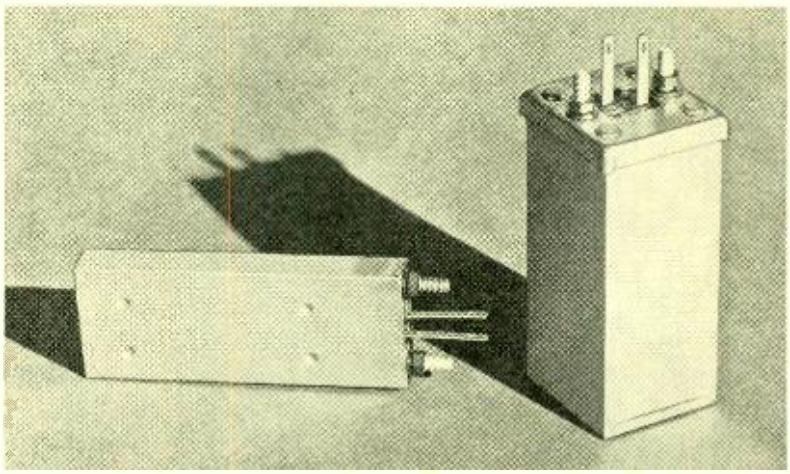
from tearing and creasing during the time the tests were being made.

The specimens were made from cable insulating paper and were measured by the three parties concerned under essentially the same conditions of humidity and temperature, 65 per cent relative humidity and 70 degrees F. A measurement was made in the center of each of the ten locations on the ten specimens and these one hundred measurements were distributed uniformly across the rolls of each kind of paper. To facilitate recording the data and analyzing the results the thickness measurements were entered on previously prepared mimeographed forms. It was important to separate the variations of paper thickness from the variations due to instrumental errors. A method of analysis was suggested by W. A. Shewhart and the actual work on many hundred observations was carried out by Miss Annette Brangaccio.

Remarkably close agreement was achieved, considering that the papers measured are compressible and that the thickness of paper is appreciably affected by its moisture content and consequently by the relative humidity of the atmosphere in which it is conditioned and measured. The thicknesses obtained with the dial instrument agree very closely with those of the machinists' micrometer; and the latter confirm results of similar tests made with the machinists' instrument some years ago. The greatest observed error of a single measurement is 0.00024 inch for the dial micrometer and 0.00027 inch for the controlled-pressure machinists' micrometer.

These tests, developed by the Laboratories, have led to the adoption by the American Society for Testing Materials of a particular form of the "dead weight" dial micrometer as described in specifications drawn up by E. C. Erickson of the Laboratories as an alternate to the machinists' micrometer for measuring the thickness of various types of paper and other sheet insulating materials.

New supplementary toll positions in the Vincennes, Ind., operating room that went into service about October 1. Toll board at left and supplementary positions at right. These positions are described by B. C. Bellows on page 110 of this issue



Paper Condensers of the Bell System

By M. BROTHERTON
Transmission Apparatus Engineering

PROBABLY no element is more familiar in telephone and radio apparatus than the electric condenser. It serves a variety of purposes: providing negative reactance, storing electric charge, or detouring alternating currents while blocking direct currents. Technically it provides capacitance—one of the three basic parameters of an electric circuit. In the Bell System the bulk of this capacitance is provided in the form of impregnated paper condensers, of which a number of types have been developed and are manufactured by the Western Electric Company to meet the conditions of different varieties of service.

The most widely used paper condenser is the central-office type, shown above, which houses the capacitance unit in a metal can sealed with asphaltic compound. The one on the left has a capacity of one microfarad and the one at the right, four microfarads. Simplicity of design coupled with large production makes these condensers small in size as well as low in cost. So many of them are now in use in the Bell System that the strips of paper in them, if fastened end to end, would extend to the moon and back with enough left over to go five times around the world.

The capacitance is provided by a unit consisting of two strips of tin or aluminum foil separated by at least two thicknesses of paper, as shown in Figure 1. The interleaved paper and foil are rolled together, dried, and impregnated under compression to form a compact unit. It is not generally realized how thin the paper insulation between foils must be made to secure the small size desirable. A 1-mf unit capable of withstanding d-c potentials up to 200 volts is smaller than a five-cent bar of chocolate. To accomplish this, the paper between foils must be somewhat less than a thousandth of an inch thick, and must be worked at approximately ninety times

the voltage gradient on lamp cord in everyday household use. A 1-mf paper condenser unit designed to operate under the low voltage gradient used in lamp cord would be as large as a suitcase.

The ability of the impregnated paper to withstand these severe voltage gradients has been made possible by minimizing the amount of chemically active materials such as acids, alkalis, and water in the paper and impregnant. These agents react in an electric field, and if present in excessive amounts will result in rapid degeneration of the impregnated paper until dielectric failure occurs. Because of this high voltage gradient, traces of impurities that are of little

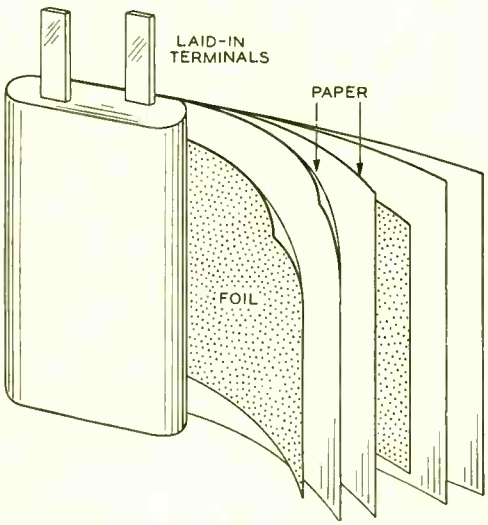


Fig. 1—Typical rolled paper condenser unit with "laid in" terminals

consequence in lamp cord insulation would lead to rapid failure in paper condensers.

Condensers for use under central office conditions are designed for ambient temperature ranges from 60 degrees F. to 120 degrees F.; and under these conditions they perform satisfactorily for an indefinitely long period at rated voltage. They are, however, limited in the range over which they may be reliably operated. This is because, at the higher temperatures, some of the asphaltic sealing compound may drain from the container and expose the unit to the infiltration of moisture, and also some of the compound may migrate into the unit, causing destructive chemical action. Nor are they suited to extreme cold, which may crack the protective jacket of the compound and expose the unit to moisture.

Figure 2 shows types of condensers housed in containers with hermetic seals. This seal remains air tight over an extremely wide range of temperature, and under severe mechanical shock. A single compound is used to impregnate the units and fill the container so that undesirable interaction between sealing and impregnating compounds is avoided. Furthermore, after the paper units are assembled in the container, they are vacuum dried and impregnated through a hole which is afterwards sealed with solder. This eliminates any possibility of water or any other contamination entering the units after impregnation as a result of handling or exposure to the atmosphere. To insure satisfactorily long life at high temperatures, it is even more important in this condenser than in the central-office type, operated at room temperatures, to minimize the presence of chemically active impurities and water because destructive chemical action is greatly accelerated at high temperatures. These condensers are inherently more costly than the central-office type because of their more complicated construction and the additional testing required to insure satisfactory performance in the more

exacting service for which this type of condenser is designed.

The condenser shown at the left in Figure 2 is filled and impregnated with a hydrocarbon wax; the terminals are brought out through neoprene-treated rubber-insulated leads; and the hermetic seal is secured by a metal sleeve which is constricted on the rubber insulation and soldered to the container. They are widely used for by-pass and filtering purposes in carrier telephone, public address, and radio equipments for temperatures extending from above freezing to 150 degrees F. Below freezing point, their effectiveness is limited because they must be worked considerably below rated voltage to secure satisfactory life due, it is believed, to void formation as the wax shrinks.

The condenser shown at the right has its leads brought out through molded phenol plastic; and it is impregnated and filled with a heavy liquid, known as Aroclor or Pyranol. In general, liquids such as Aroclor, or certain oils which remain liquid or semi-liquid throughout, are found to be superior to waxes for operation over wide temperature ranges, since waxes are subject to shrinking and cracking at low temperatures and to melting at high temperatures. For the same capacitance and voltage rating, the type of condenser shown at the right in Figure 2 is considerably smaller than that shown at the left, because of the high dielectric constant of Aroclor as compared with wax. Furthermore, they may be operated at sub-zero temperatures without damage, and they are much superior to wax-type condensers for operation at high a-c 60-cycle voltages. The Aroclor type has the disadvantage, however, that its capacitance decreases 25 or 30 per cent at sub-zero

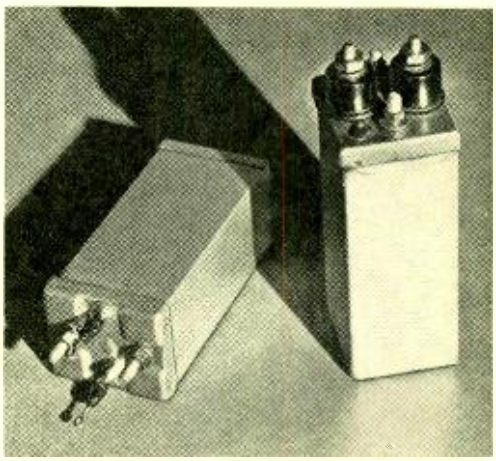


Fig. 2—One form of hermetically sealed paper condenser with neoprene-treated rubber-insulated terminals, at the left, and another form with molded phenol plastic terminals, at the right

temperatures, which is intolerable where high stability of capacitance is an essential requirement. Its small size is advantageous where it is necessary to accommodate large lumps of capacitance for blocking, filtering, and by-pass purposes where large variations in capacitance can be tolerated.

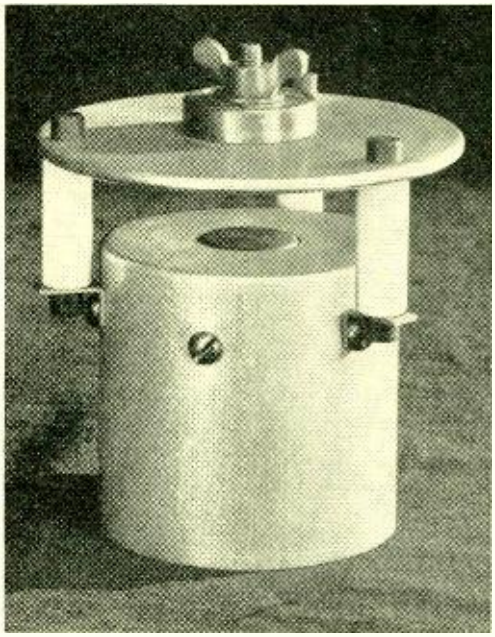
For reasons of inability to withstand high and low temperatures or because of a too great variation of capacitance with temperature, none of the three types of condensers discussed above is suitable where it is essential to secure a small capacitance change in apparatus operated over a temperature range extending above 120 degrees F. or much below freezing. To meet this requirement, a fourth type is available which is impregnated and filled with a mineral oil. With this type the total capacitance variation is only 5 per cent in a temperature range from −40 degrees F. to 200 degrees F. at a frequency of 1000 cycles. This condenser is housed in sealed containers similar in construc-

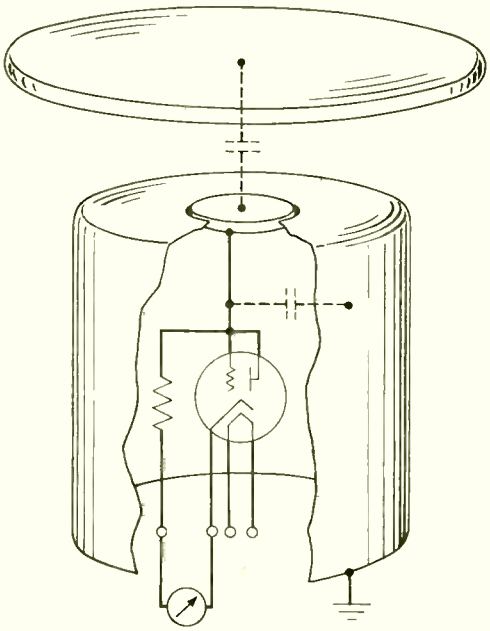
tion to those of Figure 3. As regards size, mineral oil condensers are about the same as the hydrocarbon wax condensers and are, therefore, larger than the Aroclor type for a specified capacitance and voltage rating.

Today Western Electric hermetically sealed paper condensers are playing an important part in equipment for all branches of the armed forces. The ability of these condensers to resist moisture and their rugged construction enables them to withstand the extremes of temperature and climate as well as mechanical shock to which such equipment is subjected.

Radio-Frequency Voltmeter

MEASUREMENT of the high voltages encountered in radio circuits requires a potential divider because measuring instruments cannot take the full differences of potential. One method is to connect a large and a small capacitance in series across the voltage and measure the drop across the larger capacitance. This drop can be made small by using a large ratio of capacitances, since the voltages of two condensers in series divide inversely as their capacitances.





In the radio-frequency voltmeter shown here the top plate, which is about 3 inches in diameter, and the small metal disc concentric below it, form one capacitance. Distributed capacitance between this disc and the ground provide a much larger series capacitance whose potential can be conveniently measured. A vacuum tube rectifies the potential and a milliammeter in the tube circuit indicates the full voltage.

With this arrangement voltages up to 10,000 volts with frequencies up to 50 megacycles can be measured.

Contributors to this Issue

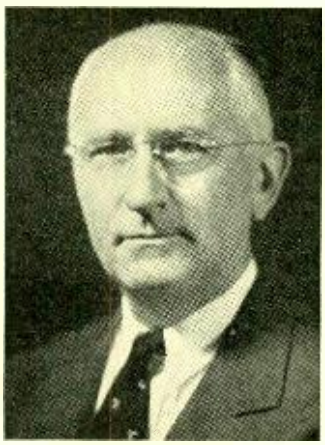
JOHN RIORDAN received a B.S. degree in Electrical Engineering from the Sheffield Scientific School of Yale University in 1923. From that year until 1926 he worked for the United Electric Light and Power Company, now the Consolidated Edison Companies. Mr. Riordan then joined the Department of Development and Research of the American Telephone and Telegraph Company where his work was largely on circuit and transmission theory, particularly in relation to inductive interference from electrified railways. This work was continued in the Laboratories after the D & R was consolidated with them in 1934. Since 1940 Mr. Riordan has been a member of the Technical Consulting Staff, where he is now employed chiefly on war work.

B. C. BELLOWS graduated from Cornell University in 1906 with the M.E. degree. He then joined the Long Lines Traffic Department of the American Telephone and Telegraph Company, where he first took a six months' student course, and then joined a group dealing with service and force requirements. In 1908 he went to St. Louis as division supervisor for the Long Lines, but in six months returned to his former duties in New York. In 1909 he became Toll Line Engineer. Three years later he joined the Western Union Telegraph Company as Toll Line Engineer, and later became Traffic Engineer. Late in 1914 he returned to the Long Lines as Service Engineer. In 1920 he became Division Traffic Supervisor for the Long Lines in Chicago, and three years later transferred to the Illinois Bell Telephone Company as General Supervisor of Toll Traffic. In 1926 he joined the Department of Development and Research of the American Telephone and Telegraph Company as Toll Systems Facilities Engineer. He came to the Laboratories with the transfer of the D & R in 1934 and in 1935 became Director of Toll Facilities.

J. M. FINCH joined the Installation Department of the Western Electric Company in 1910. The following year he transferred to the chemical group to work on insulating materials including cable and condenser papers. He was also associated with the early development of methods for testing enamel wire and the investigation of varnish enamels. Mr. Finch has

John Riordan

B. C. Bellows



J. M. Finch

made important contributions to the methods of testing insulating paper and these have been incorporated in the Laboratories' Specification. Part of his attention is now directed to investigating substitutes for sheet insulating materials.

GEORGE Q. LUMSDEN was graduated from Cornell University in 1922 with the B.S. degree. He was appointed an assistant there and in 1923 received the degree of Master in Forestry. That year he entered the Engineering Inspection Department of the Western Electric Company, where he engaged in inspection studies of timber products. Upon its establishment in 1927, he became a member of the Outside Plant Development Department of the Laboratories. His work since then has been general development studies of timber products and their preservation, and especially that phase involving new preservatives and their trial in the field.

FOLLOWING SERVICE with the British Army during the World War, MANFRED BROTHERTON attended the University of London, King's College, and was graduated in 1921. Subsequently, he worked with Professor O. W. Richardson in thermionic research and was awarded the doctorate of philosophy in 1924. After joining the Apparatus Development Department in 1927, he spent several years in the development of filters and equalizers and is now engaged in the development of paper condensers.

G. Q. Lumsden

Manfred Brotherton