

*Restoring Worn Telephone Equipment to Further Usefulness  
Is an Important Western Electric Function Carried On  
In the Shops of Its 28 Distributing Houses*

## Giving New Life to Old Equipment

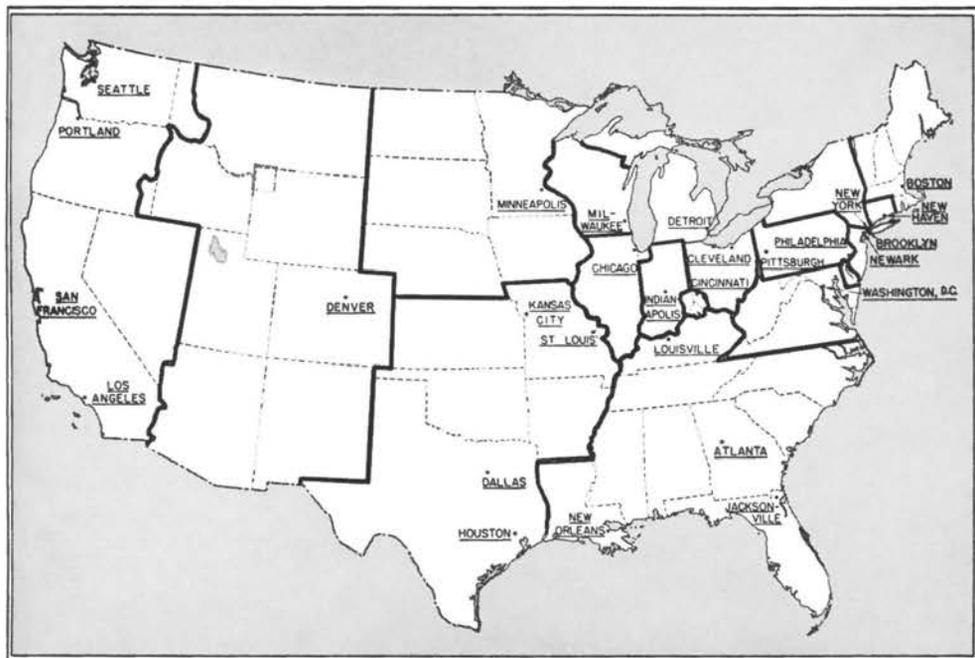
*Philip H. Miele*

THE RESPONSIBILITIES of the Western Electric Company, supply unit of the Bell System, are often cited as four: manufacturing, purchasing, distribution, and installation. That is not the whole story, however; for part of the job of keeping the telephone companies supplied with good equipment is to keep that equipment in the very best possible condition—repairing it so that, after the long years of hard service it was built to withstand, it can begin another long service life in the telephone network.

This is no small outgrowth of the Company's supply responsibilities. Repairing communications equipment is both a big and an important undertaking. Each year, for example, Western Electric's repair shops recondition and restore about 10 percent of all the Bell telephones currently in use. Then consider for a moment that the telephone is only 6 percent of the equipment in the net-

work behind it—and you'll have an even clearer picture of the scope of Western Electric's repair job.

Some of this vast quantity of material returned by the telephone companies to Western is found, after inspection, to be in as good operating condition as the day it was made, needing only a cleaning to wipe away the scars of long service, or a slight adjustment or replacement of a part to insure even longer service. All the research and engineering, the skilled manufacturing and painstaking installation, that go into putting the telephone network together would become useless for some customers if even as small a component as a telephone transmitter should break down. That's why heading off breakdowns before they occur, rehabilitating before repairs are necessary, is of vital importance to the telephone companies in their job of rendering good and dependable service.



*On this map are spotted the locations of the Western Electric Company's 28 Distributing Houses. An integral and important part of each is its Repair Shop*

As distributor for the Bell System, Western Electric operates 28 distributing houses, which are strategically located throughout the nation to serve the Bell telephone companies. These houses vary in size from the one in Cincinnati, O., employing about 60 persons, to the one in New York City which employs about 1,150. They render two principal services: one, for which they are well known, distribution; and the second, less known, repairing. Of the almost 8,000 employees who work in the distributing houses, more than 5,000 are engaged in a wide variety of repair activities—activities which in turn call for almost as wide a variety of skills as are required in the manufacturing operations of both the Com-

pany and its subsidiary, Teletype Corporation.

### *The Scope of Shop Operations*

VISIT any one of the shops and you'll be impressed by the scope of its operations. In one shop, for instance, you'll see many of the hundreds of varieties of equipment normally repaired there pouring in from the telephone company; being classified, tested, sorted into any one of numerous categories; some of it moved on again for repair, then again for a final test and inspection; packed, and stored in the warehouse until ordered again by the telephone company.

On the ground floor, old apparatus, some of it no longer manufactured by



*This machine automatically washes telephone parts at 160 degrees and then dries them*

the Company but still in good working order, is dismantled for salvage of whatever parts can be used in the newer models that have come along. Telephone instruments that stream in by the hundreds are channeled over to another area, visually inspected, classified, and most of them sent upstairs for repair. A considerable number of them, however—about 15 percent in this shop's case—are almost as good as new. A little cleaning, perhaps a cord changed, then a complete electrical test—and they're ready for re-use.

Upstairs, more complex repair jobs are performed: extensive "con-

veyorized" operations, exacting scientific ones, washing, painting, woodworking, testing, wiring—almost everything you would find in any one of the Company's manufacturing plants. Here, much the same quality originally built into Western's products is being built back into them; they leave the shop only when they are as gleaming new as the day they were made.

One young lady seems to be administering a blood transfusion. A closer look shows that she is using a newly developed machine for putting carbon crystals into telephone transmitters. In another area, someone seems to be putting

parts of telephone instruments into a washing machine. He is. And right next to him are similar parts being rolled around in a drum full of shoemaker's pegs and a polishing compound. Along the conveyor line, men and women are cleaning, replacing, adjusting and repairing the inner components of the telephone instruments.

In other parts of the shop, men are busy wiring switching equipment—everything from small private switchboards to giant toll units. Complex Teletype sending and receiving machines are tested, dismantled, repaired, and tested again. Intricate

mobile telephone units are repaired or modified to conform to the latest developments in this new communications field. And in still other parts of the shop, careful cabinet-making work is going on. Old service-worn telephone booths are cleaned of their scars—the arrow-pierced hearts and scratched-in rhymes are scraped away, the broken doors fixed, and the posture of the entire booth made erect again.

This shop, like the other 27 throughout the nation, works closely with the telephone company which it serves. It repairs equipment belonging to the telephone company; it operates on schedules that are determined by both the short- and long-term needs of the telephone company; and, while its operations are largely standardized with those of the other 27 shops, it performs some operations that are peculiar to its territory to meet special operating requirements of its customer.

In repairing equipment belonging to the telephone company, the handling of that equipment is almost entirely determined by the needs in the field. When the equipment comes into the shop, it is classified both according to its condition (which is learned through preliminary tests) and according to what the telephone



*Not a blood transfusion, but a new device for replacing carbon crystals in telephone transmitters*

company wants done with it. If, for instance, in a particular operating area, there is a program under way of conversion from an old to a new model of apparatus, the older one is dismantled, some of its usable parts are stored for later use, and the other parts are sold to Western Electric's subsidiary, the Nassau Smelting and Refining Company, for salvage or to local junk dealers. The proceeds of the sale are credited to the telephone company. On the other hand, the telephone company determines whether repairable equipment coming into the shop is to be repaired immediately, stored for later repair, or

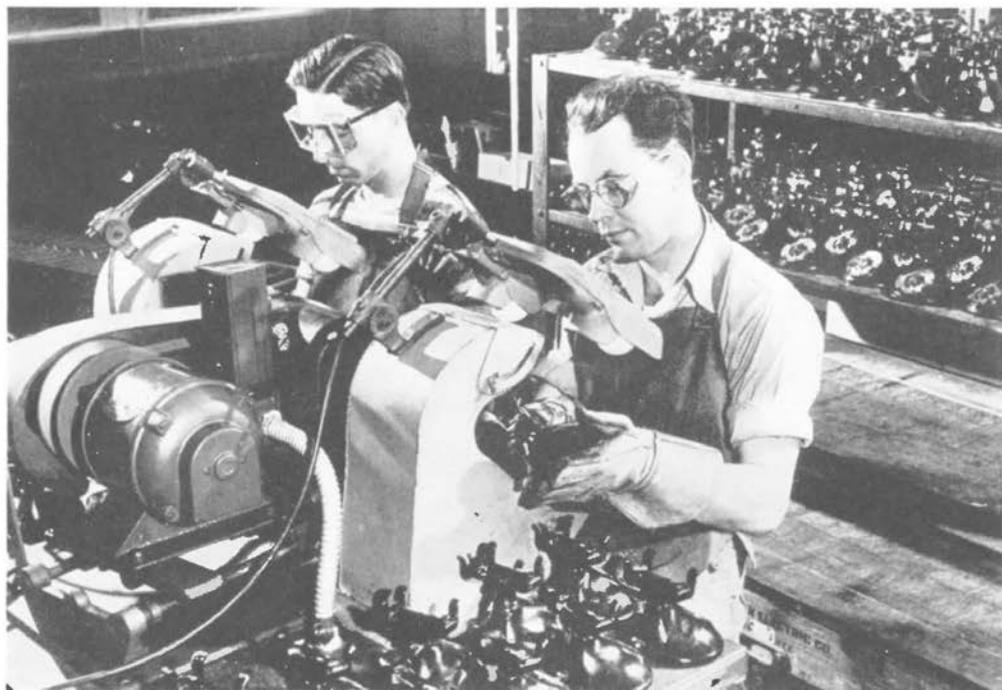
purchased by Western Electric for resale to other telephone companies.

### *Company Forecasts and Shop Schedules*

THE SCHEDULES on which the shop operates are established jointly by the shop and its customer. Every three months, the telephone company issues a forecast which predicts its needs during the period. The forecast cites specific items that will be needed in specific quantities and at specific intervals. The shop, on the basis of this forecast, works with the telephone company to prepare a schedule providing, as far as possible, a uniform level of repair activity throughout the three months. Once established, this quarterly schedule remains flexible, however. At monthly meet-

ings, sometimes weekly ones, and at times even by telephone call, the shop may modify its program to meet changed conditions in the field.

Although all 28 repair shops are geared to meet the specific requirements of the individual telephone companies which they serve, the shops are nevertheless strikingly similar to each other in their operations. Western Electric equipment is made to standard specifications, and therefore the technique of repairing it for one telephone company is the same as that of repairing it for another. This results in a similarity between the repair shops and, as we shall see later, adds up to substantial savings to the telephone companies, since repair methods and equipment may be developed for all the shops by one relatively small central staff group.

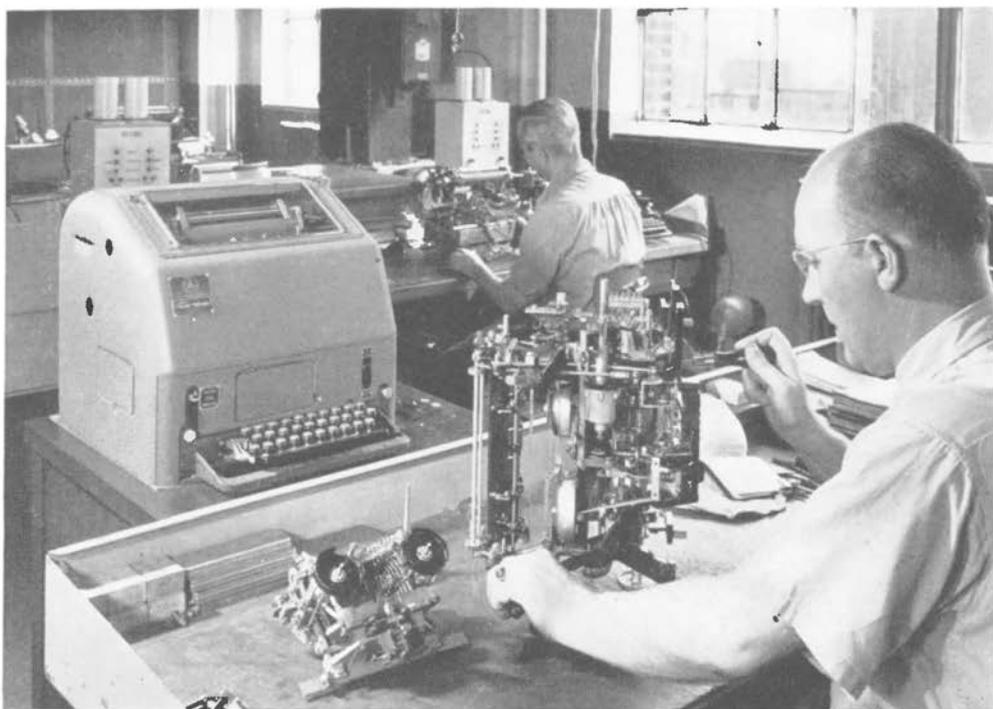


*In this buffing operation, veteran telephones are cleansed of the scars of long service*

There are, however, some local requirements which call for shop operations that are unique and that cannot be standardized. Here too is an example of the shoulder-to-shoulder teamwork between the shop and its customer. The telephone company may require that a switchboard recently purchased from Western Electric be modified to meet some unusual condition encountered in the field. Or it may need a piece of equipment not manufactured by Western Electric and not obtainable from other manufacturers:—a special test set for instance, or a custom-made telephone booth to match others installed years ago. These are small orders, not likely to be repeated soon, and are handled by the repair shops in cooperation with the telephone company.

An exhaustive description of the many facets of the cooperation between the shop and its telephone company customer would, in fact, be an exhaustive description of Western Electric's repair operations. So close is this cooperation that it is almost impossible to find an exact point of separation between the responsibilities of the two organizations.

Add the broad scope of activities that we have seen in this one repair shop to that of the other 27 and you will readily see that Western Electric's job of building back into its products the quality originally built into them is a big undertaking—far bigger, in fact, than it ever was. Since the war, the shops have been repairing 65 percent more telephones than ever before.



*Repairing teletype apparatus is an intricate job, and a most useful one to the telephone company*

### *The Post-war Challenge*

SINCE THE WAR, the chief concern of the repair shops, like the Company of which they are a part, has been to keep pace with the nation's growing need for telephone service, with the problems presented by changing conditions in the post-war economy, and with the latest developments in the telephone industry itself.

The nation's demand for more telephone service has resulted in an unprecedented expansion of the telephone industry. In the few years since the war's end, Western Electric has manufactured millions more telephones than were added during the previous fifteen years, bringing the total number of Bell telephones in service in this country from some nineteen million to more than thirty-

three million. Labor and equipment, the basic costs of doing business, have just about doubled over pre-war levels. Meanwhile, post-war developments in the telephone industry have introduced totally new equipment in addition to basic changes in the design of much of the existing equipment in the great communications network.

If the volume of business has doubled over pre-war levels and the costs of doing business have almost doubled also, while the very nature of the business has been greatly changed by new developments, how are the repair shops meeting the responsibility of doing a bigger-than-ever job at these higher costs?

Here are two seemingly unrelated facts which illustrate the answer: first, the shops have only 33 percent more personnel than they had back in 1939; and, second, the post-war construction program calls for less than 50 percent more shop space than there was in 1939.

Double the number of telephones in service since 1939; only 33 percent more people to repair them in only 50 percent more shop space. How is this possible? The answer is that in keeping pace with the fast changing conditions that affect the shops, more than 3600 new and better methods for repairing and testing telephone



*Mobile telephone service presented the Shops organization with a big new post-war task: gearing up for complex repair jobs. This receiving set is being fixed in a copper shielded booth in one of the shops*

equipment, more than 725 new pieces of test and repair equipment, have been developed since the war's end: developments that cost less, require less plant, and produce better results.

Most of these developments have come from a small corps of engineers known as the Engineer of Shops organization. This central engineering group develops and makes available to the shops standardized methods and facilities that add up to better and more economical repair service for the telephone companies and insure uniformly high standards of repair work in all 28 shops. At almost any given time these engineers are busy on some 235 development projects. Savings in repair costs, where they can be measured, will be about half a million dollars this year as a result of these developments. Other savings, mostly intangible, would also be indicated by substantial figures if they could be measured.

### *Recent Development of the Engineer of Shops*

LET'S TAKE a closer look at one of the shops and examine some of the new methods and developments that have been introduced since the war. If you'll think back to where tele-



*Telephone booths which bear the marks of hard use are scraped clean of their scars and made fit for more years of service*

phone instruments were being tested and classified, you will remember that a number of them were found to need hardly any repair at all. The classification they went into is known as "rapid recovery," a post-war innovation, which calls for a complete electrical test, whatever minor repairs are necessary, and a thorough cleaning. This saves both the time and expense of the more extensive operations. Generally, telephones treated under rapid recovery are ready for the telephone company the day after their arrival.

Upstairs in the shop, the men re-



*A miniature laboratory on wheels, for use in testing test sets, gets a final check in the Engineer of Shops laboratory*

pairing mobile telephone equipment are working on the very frontiers of a new field. The recent addition of mobile telephony to Bell System's already long list of communications services to the public confronted the shops with the rush job of gearing to undertake this new and highly complex repair function. Even after equipment and tools were designed and personnel trained, development work on new ways of repairing mobile telephone equipment did not stop. Repair engineers found ways for calibrating monitors of high frequency transmitters which even go beyond F.C.C. requirements for transmitter

accuracy. Testing receiver sets now takes less than five instead of 35 minutes because of an entirely new testing technique permitted by a recently developed signal generator.

The washing machine and the drum full of shoemaker's pegs that we saw earlier are other post-war improvements in repair techniques. They replaced eight other machines, saving both space and money. The washing machine washes a basket full of telephone parts in a special detergent, spray-rinses, then dries them with blasts of hot air—all automatically. After the washing, the dried parts are transferred to the barrel containing wooden pegs

and a special dye and wax compound. Following a few minutes of tumbling, the parts are removed, nearly as gleaming bright as the day they were made.

Remember the girl who seemed to be administering a blood transfusion? She was using a machine developed since the war for replacing carbon crystals in telephone transmitters. The machine costs about one-eighth as much as the one it replaced and requires one-half the time to perform the same operation.

Here are other post-war developments that add up to better repair service for the telephone companies.

A miniature laboratory on wheels, that can be rolled like a tea-cart to any bench position in the shop, was introduced recently to check test sets. It comes fully equipped with compartments for storage of test leads, dial pulsing standards, tools, handbooks, and record-binders, and has a distribution switching panel, ten or twelve meters of various types, air oscillator and oscillograph and, in fact, all the equipment necessary for complete test set maintenance.

Elimination of several operations resulted from the development of a bench brush lathe which cleans telephone sets. The new lathe, installed as part of a conveyORIZED operation, eliminates cleaning by hand and makes dismounting of the telephone set before cleaning unnecessary.

A new lacquering process was adopted which permits the application of the equivalent of several coats of lacquer in one operation. The lacquer is in a more concentrated mixture than is normally used. The thinning operation can be eliminated because the lacquer and the air with which it is sprayed are heated in the new process. Along with information on this development, the central engineering group is sending the shops a special tool for measuring the thickness of the applied lacquer to .004 of an inch.

A new process of washing teletype equipment was developed, resulting in a better job and savings of both time and plant space. After washing, the teletype is rinsed and baked dry in a newly adapted infra-red oven.

Four-way savings will result from a recently designed test set for telephone dials. It will test four times as many dials in the same period of

time as the old set it replaces, will permit a reduction in the number of sets required, will cost less to manufacture, and will result in lower maintenance costs.

A new method of splicing synthetic (neoprene) covered wire in the shops will save millions of feet a year. Formerly it was not economical to use short lengths left over from new coils. The new splice is small, neat, waterproof, and just as strong as the rest of the wire on which it is vulcanized.

THESE are just a few—selected almost at random—of the developments made available to the repair shops by their corps of central engineers. Each development is part of the shops' answer to higher costs, increased volume of business, and new advances in the telephone industry. But they are not the total answer; the rest, the biggest part, is that people who work in the shops and in the Engineer of Shops organization are the kind of people who can invent new and better ways of doing their jobs, who can use these advantages, and who *want to*.

The repair activities that Western Electric undertakes in fulfilling its responsibilities as supply unit of the Bell System go a long way toward justifying the confidence which the Associated Companies have in Western Electric equipment, and, in turn, the confidence which the public has in the telephone service rendered by these companies.

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*This is the sixth of a series of articles describing Western Electric's operations and its place in the Bell System organization. For previous articles, see this Magazine for Winter 1946-47, Autumn 1947, Autumn 1948, Winter 1948-49, and Spring 1949.*