





*"Kit" parts of a modular wall telephone set: the handset with modular cord already inserted, the connecting block with quick-connect field and modular jack, the faceplate for the block, the base itself, and the housing. A movable plug on the back of the base is easily inserted into the wall-mounted jack, and the set is slipped into position on the plate. Such interchangeable parts are also available for residential desk sets, with the same variety of colors and cord types that are offered in non-modular sets. Economies in inventory plus convenience for customers and craft personnel contribute to the success of the modular plan.*

*Modular telephone sets, assembled from "kit" parts, offer Operating Companies new ways to satisfy an expanding market and hold down operating costs. Flexible inventories of easily and quickly assembled modules can help to meet increased demands on installers and on facilities and thus can advance the cause of improved customer service with economy.*

## Telephone Sets Go Mod (Modular, That Is)

Stephen W. Walden

**T**HE JONES FAMILY moved to a new address. Their two telephone sets were left behind, to be retrieved by the telephone company. At the new home, the Joneses decided, as an afterthought, to change color selections, but the installer did not have the new colors on the truck. Result: three installation calls, customer inconvenience, six telephone sets in and out of inventory.

But consider two other situations:

The Brown family moved, too—from a house in Hallandale, Florida, to a nearby apartment. They unplugged their telephone sets at the house, took them to the apartment, and plugged them in again. Result: no installation calls, no customer inconvenience, no inventory changes.

The newlywed Smiths requested initial telephone service. When the installer arrived, they added an extension to the order and also changed the original color. The sets were assembled immediately, in the truck, and installed in minutes. Result: one short installation call, no customer inconvenience, no inventory problems, and a "sale" of additional service.

Typical cases? These customer requests and changes are certainly typical. And the "Browns" and "Smiths" are becoming typical in many parts of the country, because of the recent introduction of modular telephone sets.

### **Mushrooming Demands**

To keep pace with relocations, expansions, and the introduction of new Bell System products, and still maintain technical efficiency, telephone companies must keep available both a large inventory of telephone sets and cords and the personnel to install and maintain them. And it is predicted that, without some changes in basic operating methods, Bell System telephone companies will be faced with the need to double their plant installation forces and associated facilities within the next 15 years.

The current demand for color sets is one cause of increasing complexity of installations and changes and the consequent need for large inventories. High customer acceptance of the recently introduced "package plans," offering reduced rates

for three telephones per residence, is another. And a third comes from a product line expanded by PRINCESS®, TOUCH-TONE®, TRIMLINE®, and Design Line™ telephones. With this variety of options and the high probability of customer-requested changes at the point of installation, the amount of inventory one installer must carry on the truck is both expensive and space-consuming.

Another factor contributing to high inventories is cord change. The last several years have seen a great increase in requests for changes from standard-length to longer cords, for both new telephone-set installations and repair calls. In some companies' service areas, over 50 percent of the telephone sets are installed with long cords. Further, 20 to 25 percent of all station-set troubles can be traced to cords, adding considerably to Operating Company maintenance costs. The scale of the inventory problem is illustrated by the fact that over 230 cord "codes"—types and colors—are now needed for basic residential service.

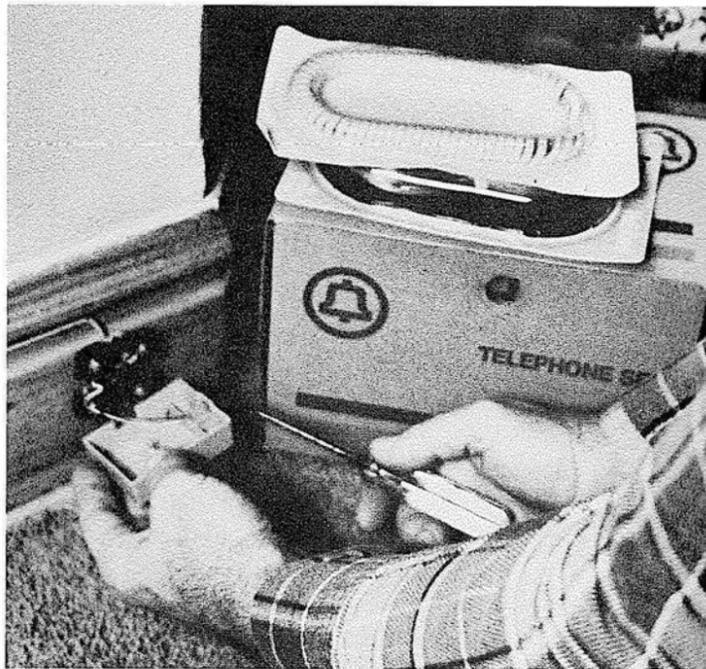
The modular telephone plan offers potential savings in both inventory and personnel growth expectations. Interchangeable, plug-in modules for residential telephone sets give an installer a more flexible inventory, a potentially greater stock of telephone sets, and the capability to make more calls in a given time. Using "kit" telephone parts minimizes the capital investment required to stock the many types and colors of both sets and cords. Carrying fewer of the bulky, more expensive telephone bases (i.e., the bare electromechanical units) leaves more space for a wide variety of colored housings and set types.

But simplified installation, reinstallation, and repair procedures, plus reduced cord inventory, set recovery, and field turnaround are just a few of the modular plan's advantages.

First costs involved in converting a service area to the modular plan must, of course, be considered. However, an economic forecast, developed to study the modular plan's impact on telephone-company profits, predicts early recovery of initial conversion costs, followed by substantial long-term savings. And the options the modular plan offers for future operation have even greater potential. For example, since the interface between the telephone line and telephone is a simple plug-and-jack arrangement, telephone-company craft personnel can devote more time to the increasingly complex—and more challenging—tasks involved in customer service. And other recently introduced programs such as PhoneCenter and mail-out, which use modular telephones, represent innovative approaches to improved operating methods.

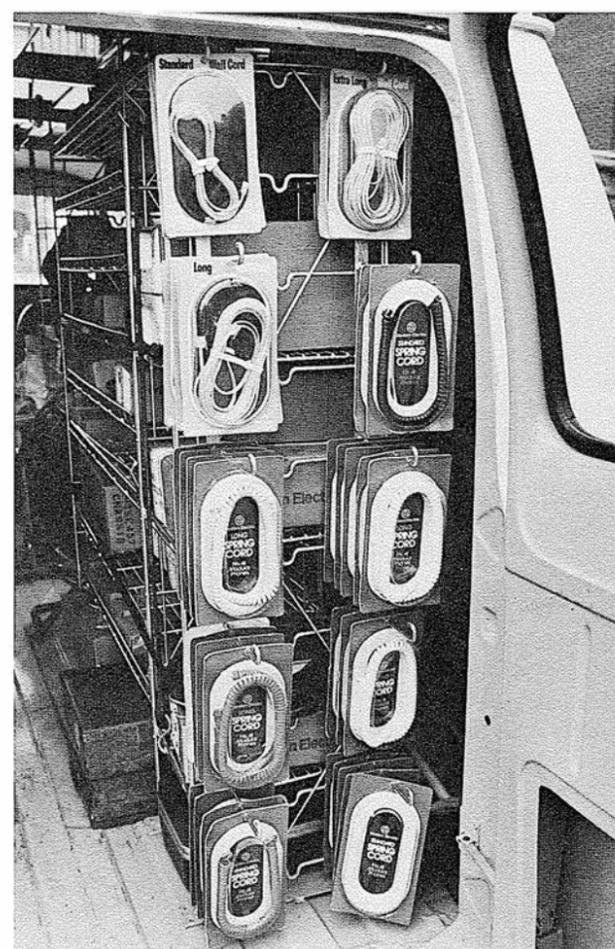


*Service orders are a lot easier to fill with modular telephone sets. Robert Greenlee, installer-repairman for Illinois Bell's South Chicago district, selects parts from his truck inventory to assemble a modular set "to order" at the customer's home.*

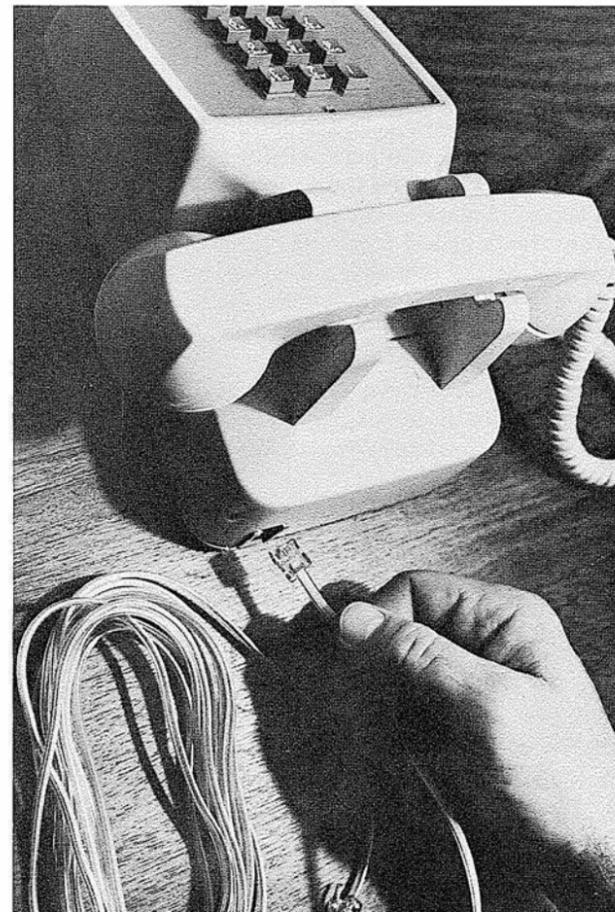


*Converting an existing installation is simple. A new cover containing an integral modular jack fits over the standard terminal block. Here the spade-tipped jack leads are attached to the customer's wall terminal block before the new cover is put in place.*

*With handset and cord, base, and cover assembled, the wall-cord plug is inserted into the jack on the base pan. A customer who is moving can "take and save" the set simply by removing the plug at the other end of the wall cord from the terminal-block jack.*



*The modular concept gives Greenlee an expanded—and more flexible—inventory. With fewer cord types and electromechanical bases to carry, he has much more space on the truck for other "kit" colors and models.*



### Compatible Kit Parts

The desk telephone set used with the modular plan is similar to other sets, except that the base and handset are equipped with jacks that accept plug-ended cords. The modular wall set also has an arrangement for attachment to a new connecting block. All sets are available both assembled, without cords, and as "kit" telephone parts. With the kit concept, discrete modules—base, housing, handset, faceplate, and cords—can be stocked in separate containers, thus facilitating service-order changes and additions.

With the modular plan, cords are literally a "snap" to install. Since changeouts require only a plug-in operation, the set needs no internal wiring changes and there are fewer wiring troubles caused by human error. When cord repairs are needed, ease of replacement can reduce repair time substantially.

To reduce inventory even further, a universal, transparent-jacketed wall cord replaces the color-matching cord. The new cord received a favorable reaction in customer-acceptance trials in Elgin, Illinois (these trials also included new length options for both handset and wall cords). The same wall-cord design fits all basic residential sets; this cuts the number of cord codes required from about 230 to 25. The reduction in inventory carrying charges is expected to be impressive.

Many Operating Companies have had a modified kit plan, using existing telephone sets without plug-in features, for about six years. The desirability and economic advantages of a modular plan had been determined, and during the design and development period these modified programs were begun as an interim measure. They proved to be worthwhile. However, since the kit parts used were not modular, the time required by an installer to assemble a set—connect cords and so forth—reduced the cost-saving feature. Now, with the new kits, plug-ins reduce assembly time to seconds and make the plan economically more attractive.

The modular program is compatible with other recently introduced plans. One is the set-recovery scheme: A customer who is moving is asked to disconnect the desk-set wall cord, take the set to the new location, and turn it in to an installer for credit. With the modular features, the customer can simply unplug—"take and save"—both desk and wall telephone sets—and the Operating Company can benefit by reducing its investment in left-in equipment.

Another plan that can benefit from the use of modular sets is field turnaround, which is designed to save telephone companies some of the cost of

refurbishing used telephones. Usually these sets are in good working condition. After only minor cleaning or cord changes, many can be returned to service. With the modular plan, even defective sets can be useful—they can be disassembled and any parts in good working condition can be used economically as kit components.

Fast-growing PhoneCenters are already using modular telephone sets. Residences in an area served by a PhoneCenter are prewired with modular connecting blocks. Customers can go to a PhoneCenter, see the actual colors, styles, and types of phones available, and have their selected sets assembled “to order” and installed without waiting for special equipment or wiring changes.

A program just starting, concurrent with the advent of the Design Line telephones, is mail-out. When a Design Line set is ordered, it is mailed directly from the Western Electric factory in Indianapolis, Indiana, to the customer. When more residences are prewired with modular jacks, other programs such as cord mail-out will be possible. To test customer reaction, in one part of the first modular trial in Illinois in 1972, customers were sent new handset cords by mail and were asked to replace the old cords themselves. Acceptance was very good, with convenience cited as one important reason. The mail-out concept may also apply to special components—handsets for the hard-of-hearing, for example.

### New Look at Hardware

Bell Laboratories and Western Electric engineers developed new hardware designs to implement the modular concept. The nucleus of the plan is a plug-ended cord and associated jack, shown on page 243. These devices permit relatively simple mechanized assembly, conversion of existing residence sets, and installation at the lowest possible cost.

Designing the modular handset and mounting cords began with a redesign of the cord itself. Older cords consist of four concentric conductors enclosed in a round polyvinyl chloride (PVC) jacket. The new cord is oval, with all conductors side by side to facilitate their identification by automated machines. To keep the cord width within the proportions of existing cords, small-diameter conductors were also developed. The older conductor had a multifilament-nylon center core surrounded by four 0.0008-inch by 0.020-inch phosphor-bronze ribbons and then the conductor insulation—a layer of nylon yarn covered with extruded PVC. The change was made in the insulation: Tube-extruded nylon replaced the yarn and

PVC, thus reducing conductor diameter by 25 percent. Because nylon has a higher elastic modulus than PVC, the new cord also has improved shape retention.

With the cord geometry fixed, connector design began. The result is a small plastic plug with four internal blades making contact with the cord. The top and bottom of the plug are ultrasonically welded around the cord to form a casing that locates the conductors and contacts and also provides dielectric insulation between the contact blades.

The mating telephone-set jack is a molded plastic casing containing four lead-and-contact spring assemblies. Each assembly comprises a 27-gauge stranded wire with a spade tip on one end and a gold-plated phosphor-bronze spring on the other. The spring is crimped to the wire with a brass splice and is pliant enough to allow for slight manufacturing variations in the plug and jack. The spring supplies the force to assure a reliable contact with the plug.

In commercial connectors the leads are normally soldered in place—an expensive manufacturing process. So the development of a reliable, completely mechanized process, the lead-to-spring connection, was a breakthrough. The contact spring is made of relatively inexpensive wire that requires no subsequent manufacturing operations and is easily handled in reel form.

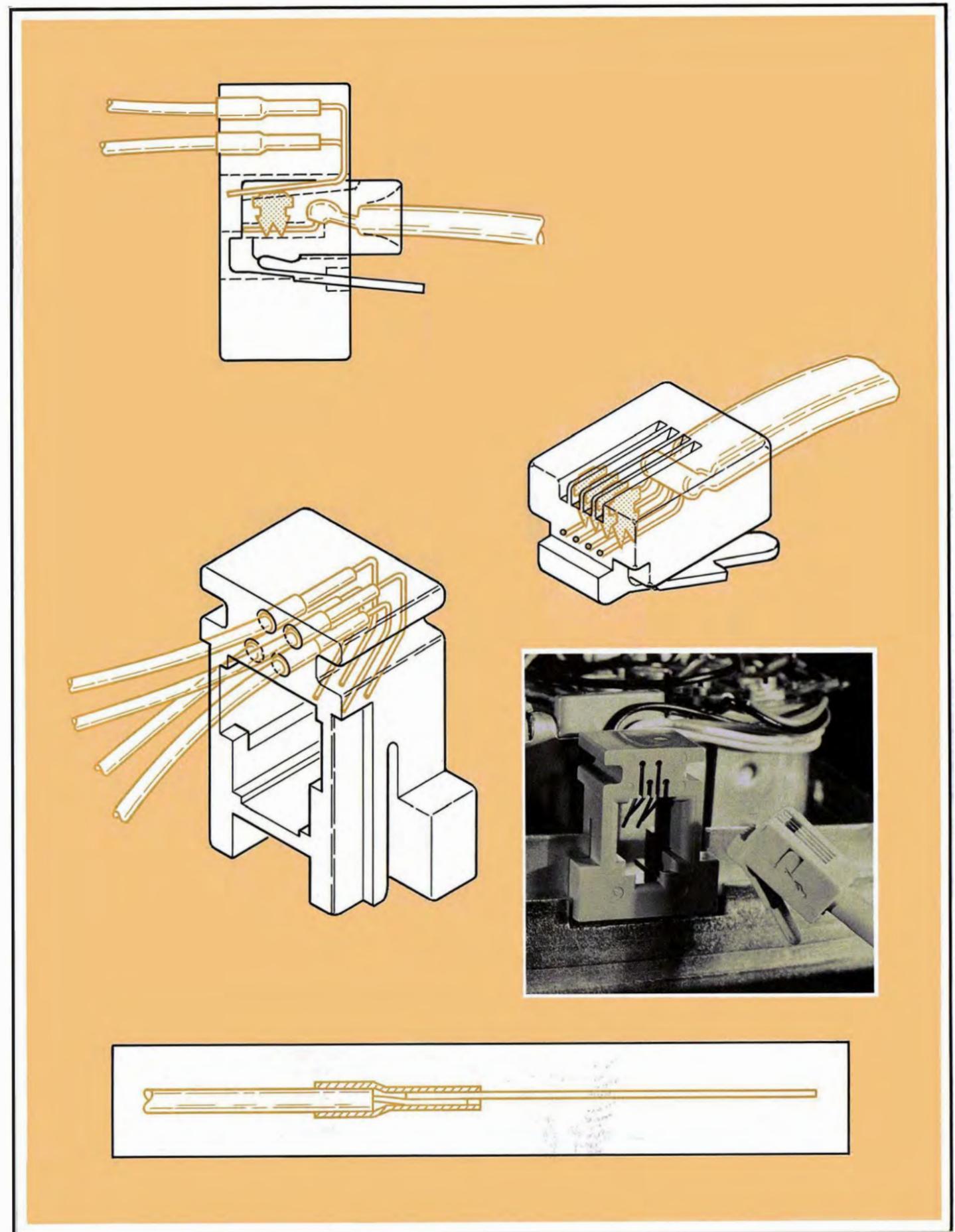
Since the jack portion of the wall-set connecting block can be assembled by the same machine that makes the jacks for desk sets, again assembly labor is minimized.

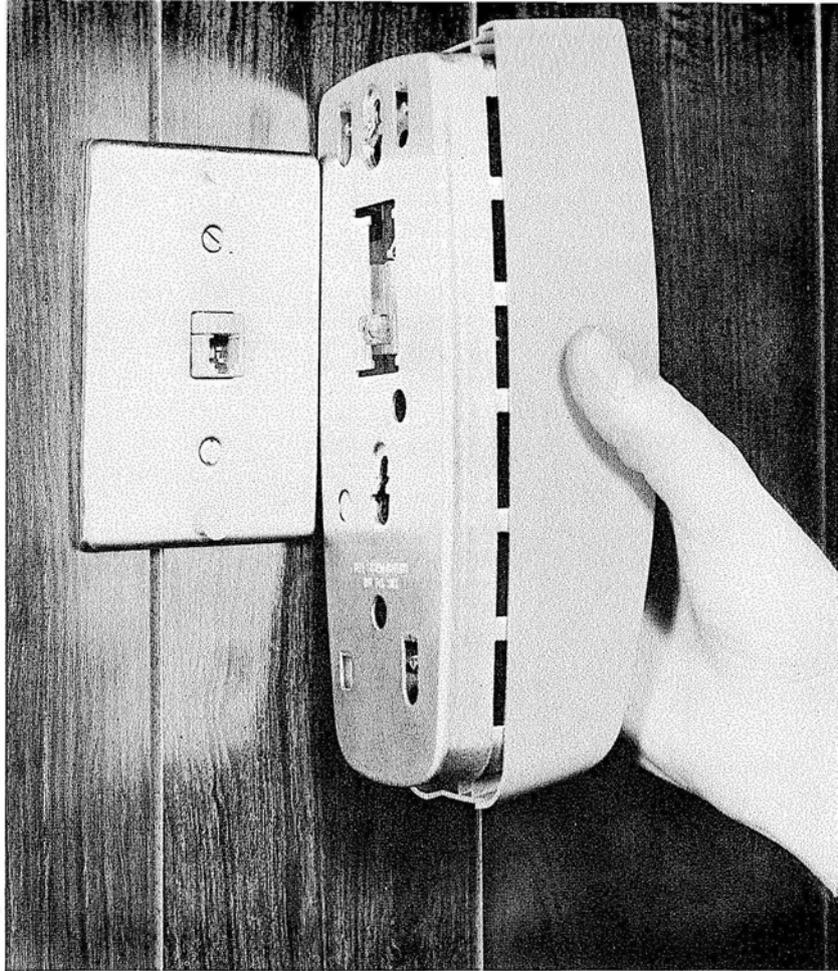
### Conversion Is Simple

The telephone-set jacks are designed to fit each type of set with minimum modifications to the base. The jack slips on the edge of the base pan and is held in place by the set's housing. This ease of conversion makes it possible to modify a telephone set at the customer's location, rather than remove and replace it with another set, thus affording the Operating Company savings in time and equipment.

Most desk sets today are installed with the mounting cord terminated on a 42A connecting block, which consists of the terminal block itself

*The heart of the modular plan is the unique plug-and-jack design. At upper left, a modular plug is shown in position in the jack. Barbed blades in the plug, shown at the right, pierce the insulation on the cord conductors to make contact. At lower left, the jack is shown in detail. The contact springs, crimped to the leads, are routed in grooves around the inner body of the jack. The photograph shows a fully assembled jack, mounted on the base pan of a wall set, and its associated plug. Below, a detail of the lead-and-spring assembly shows the brass splice crimped over the lead and spring, forming a firm, solderless connection.*





*The modular wall set contains a plug that can slide up or down in the base pan. The installer positions the plug over the wall-mounted jack, as shown here, moves the set against the wall to mate the plug and jack, then slides the set down about a half inch so that the studs on the wall plate lock into "keyholes" in the base pan. This Trimline set is equipped with an adapter base pan, which is available for converting existing wall telephones. The adapter pan contains the modular plug and keyhole slots.*

and a cover. To convert this to a modular installation, the old cover is simply replaced with a new cover that contains an integral modular jack. The spade ends of the jack leads are attached to the terminal block.

For existing installations using flush-mounted jacks or connecting blocks, a special modular jack serves as a direct replacement and is installed using existing hardware. Where it is not practical to replace wall jacks, an adapter is available that plugs into the existing fixture and contains a modular jack.

For wall telephone sets, the modular design is such that even an untrained person can easily mount and remove a telephone. A newly designed, wall-mounted connecting block can be installed by the Operating Company in either new or existing residences. The block can be mounted on hardware (such as an electrical-outlet box) or on a flat surface. The only holes required are for the mounting-bracket fasteners.

The wall-set connecting block contains a jack similar to the desk-set jack, and also includes a quick-connect field for both the jack leads and other inside residential wiring. A brushed stain-

less-steel plate covers the entire wall-mounting bracket and quick-connects. Two mushroom-shaped studs on this plate are positioned to correspond to keyhole-shaped openings on the set's base pan. For easy installation and removal, the base-pan plug is designed to move up and down on a small track. The person mounting the set holds the base over the wall plate, engages the plug in the jack—and the studs in the "keyholes"—and then slides the set down to lock it in place. (See the illustration above.)

The Bell System's introduction of the modular telephone set began on a limited scale in Illinois Bell in June of 1972. Soon after, modular desk sets were introduced at several PhoneCenters in Southern Bell. Trouble rates of associated components were traced and manufacturing improvements were made where needed. In August of 1973 the entire Illinois company was converted to the modular plan. The system-wide introduction program calls for company-by-company conversion to modular telephones as Western Electric increases manufacturing capacity. Production schedules indicate that within just a few years all new and repaired telephone sets will be modular. □