Multiplying the Subscriber's Line

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Equipment Development

IN many business establishments the volume of telephone calls requires the use of more than one telephone. Incoming calls arrive over several lines, either directly from the central office or through the establishment's private branch exchange. The individual termination of these lines in separate telephone instruments might not provide the best service, for during the business day certain of these telephones would be left temporarily unattended and incoming calls would be answered, generally after some delay, by nearby employees.

To meet these service conditions when only a few lines and telephones are required, the telephone companies have made much use of circuits, known as station wiring plans, which permit access to more than one line by each employee. But a study of the problems arising when a larger number of lines and instruments are involved, indicated that it would be possible to design a more satisfactory telephone arrangement, affording more convenient and attractive station equipment, quicker answers on incoming calls, and signalling and switching means superior to those used with the wiring plans.

The development work subsequently undertaken has resulted in the "No. 100 Key Equipment—Multiple Line." This station system is designed for use where it is desired to have a number of telephone lines with suitable lamp signals accessible to one or more telephone sets. By operating a key associated with the line, any one of a number of employees can originate, answer and hold calls on any one of the lines appearing before him. Lamp signals and buzzers are provided to indicate incoming calls. The equipment is suitable for operation with both dial and manual systems.

This equipment is particularly adapted to business offices where any one of a group of employees doing work of the same character may satisfactorily dispose of a call originally directed to another who is absent. A typical example of this is an insurance office, which employees leave on business during certain portions of the day. The equipment is useful also in

Fig. 1—A six-line double-sided keybox for Multiple Line Key Equipment, showing the single assembling screw

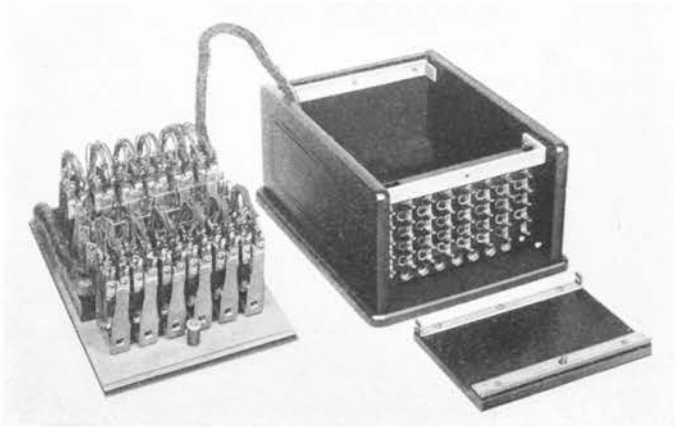

Fig. 2—When the assembling screw of the keybox is loosened, the terminal plate, and key and lamp connections, are readily available

enabling an office clerk to answer calls for employees not at their desks, by grouping before the clerk all the lines in a particular department.

Equipment for the system may be divided into two major parts: the keyboxes, in which are mounted the keys and lamps controlling the lines, and the relay equipment. Keyboxes are usually conveniently located on the user's desk; relay equipment can be concentrated in a more remote location.

Keyboxes are made in two types: the "single-sided", to be operated from one side only, and the "double-sided", with a duplicate set of keys so that it can be operated from opposite sides. Each of these types is made in two capacities — for three lines and for six. This, however, sets no limitation on the number of lines that can be made to appear before each user, for, by placing keyboxes side by side on the same desk, the user's telephone can be made common to any number of lines. These same lines can be connected in multiple to other keyboxes — to give each line an appearance on as many as six desks. By double-sided keyboxes with two users for each group, as many as twelve persons may be enabled to answer any particular one of the lines.

While only a single telephone-station circuit is common to all of the lines in one or more single-sided keyboxes on the same desk, more than one person may have access to the lines by connecting more than one telephone instrument to the same telephone circuit. Only one of these, of course, can use the system at one time. For a group of double-sided keyboxes, a separate telephone circuit is furnished on each side so that two persons may use the system indepen-

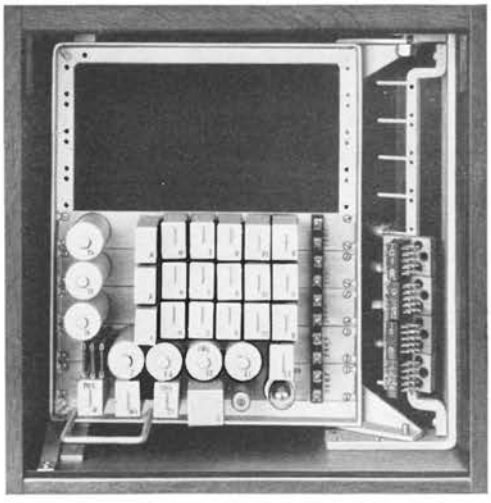

Fig. 3—Relay equipment for a three-line single-sided system. The three upper transverse mounting plates, the relays mounted on them, and their terminal strips at the right, are the three line-circuit units; below is the timing and buzzer unit

dently. As with the single-sided keybox, more than one person on each side of a double-sided keybox may have access to the system through duplicate telephone instruments on each telephone circuit.

To call attention to an awaiting incoming call, and to mark a busy line, small amber and green lights respectively are used at each appearance of the line. On an incoming call the "line" lamp lights and a buzzer sounds. The call is answered by moving the associated key to its "talk" position, an operation which extinguishes all line lamps, connects the telephone at the operated appearance to the line and lights all associated "busy" lamps to indicate at other appearances that the line is in use. An outgoing call similarly lights all "busy" lamps associated with the line in use. At the completion of the conversation, the key may be pushed back, restoring the circuit to normal, or advanced to the "hold" position, where it releases the telephone connection, but holds the line connection with the exchange and leaves the "busy" lamps lighted.

Although the keyboxes are made in two styles and two sizes, the design features are the same for all. The keys and lamps are assembled as a unit on a sheet steel plate which is mounted at the top of a wooden casing (Figure 1). To hide all mounting-screw heads, a top faceplate is attached to the key and lamp mounting plate by two screws from the underside. All local and incoming leads are connected to a terminal plate at one end of the box, which can be exposed by detaching a removable panel. So that the key and lamp assembly may be stocked and wired as a unit separate from the wooden casing, the terminal plate is also made removable, and is fastened

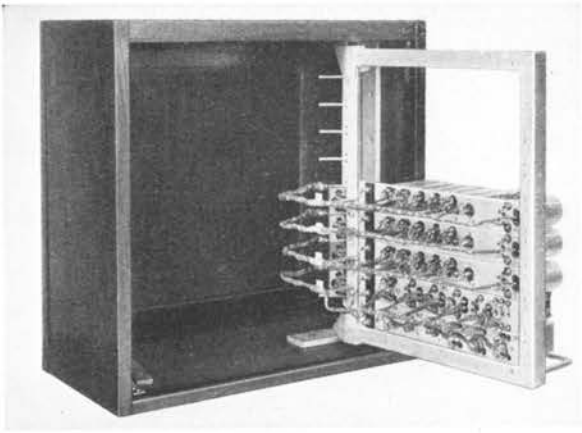

Fig. 4—Opening the relay gate makes the wiring available

in the casing before the incoming wiring is connected on the subscriber's premises. The box is regularly made of mahogany with a dull rubbed walnut finish, and the top faceplate is given a harmonizing old brass finish.

One of the most important design features of the keybox is that whereby loosening a single screw in the wooden end panel enables removing both the panel and the key and lamp assembly from the casing. The wiring from the keys and lamps to the terminal plate, which remains in the casing when the box is in service, is long enough to allow the key and lamp assembly to be laid outside the box with all connections at the keys and lamps fully exposed for testing and maintenance attention (Figure 2).

The relay equipment for the Multiple Line Key Equipment has been designed on the unit basis, in accordance with the recent tendency in equipment development. Each unit, com-

plete in itself, is wired to a terminal strip in the factory so that it can be installed with a minimum of soldering. For small installations of, for example, six to twelve lines, the units are of a single-circuit type: one unit is required for each circuit to be equipped. These units are designed to be mounted on a hinged relay gate in their containing cabinet (Figure 3), so that both the wiring and the apparatus sides are readily accessible. Each terminal strip is mounted opposite its associated mounting plate and the handmade cable connecting them is made sufficiently long to flex as the gate is swung (Figure 4). After the units are mounted in the cabinet, the incoming wiring is connected to the terminal strip. Like the keyboxes, the apparatus cabinet is made with a dull rubbed mahogany-walnut finish.

A maximum of six line circuit units, and one timing and buzzer unit common to the six lines, can be placed in the cabinet. When the operator rings the line, the buzzer furnishes an audible signal. The timing circuit, use of which is optional, controls the line lamp, extinguishing it at a definite time after ringing has ceased and preventing the line lamp from remaining lighted for long periods of time when the keyboxes are unattended. The lighted period is made long enough, however, to permit finding the lighted lamp without looking up immediately on hearing the buzzer. To reduce the size of the equipment to a minimum, the chain of slow-operate relays in the timing circuit is made to operate four times instead of but once to secure the desired time interval, and is thus reduced to a quarter the size otherwise required. Where this optional automatic timing feature is not furnished, a manually operated switch cuts off the battery supply from all the line lamps when the keyboxes are unattended. When the switch is "ON" the line lamps remain lighted until the call is answered by operating the associated line key.

For larger installations than that described, equipment units are designed to be mounted on a small relay rack. Here the line unit is arranged for ten circuits instead of for only one, and a single timing circuit is made common to all ten lines instead of to six.

Development of the No. 100 Key Equipment, in the convenience it affords and the attractive appearance it presents, marks another step in the Bell System's efforts to give "service from the subscriber's viewpoint."