

The Crossbar Switch For Dial Central Offices

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The problem of telephone switching, or how best to connect any one telephone line to any other, has always been of fundamental importance to telephone engineers.

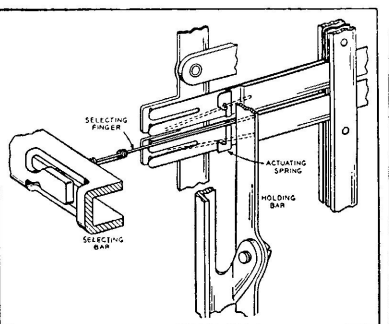
In the crossbar switch (now on field trial installation in a Brooklyn, New York, central office), there is made available a distinctly different type of switch, and one that offers very definite advantages over previous types. Its most effective utilization will require a somewhat different system of trunking and different circuits, but neither of these latter aspects needs be considered in pointing out the essential nature and advantages of the crossbar switch itself. It is necessary, however, to indicate the basic characteristics of the earlier forms of switching to illustrate the specific difference of the crossbar type.

The type of switch that is used almost exclusively in manual telephone systems (using "switch" in the broad sense as any means of connecting one wire or circuit to another) is the plug and jack. . . .

When mechanical methods of switching were developed, they followed the basic principle of plug and jack, but the jacks were replaced by small metal terminals arranged in compact banks, and the plugs were replaced by brushes. These were made to slide along the terminals of the bank until they reached the terminal of the desired line, when a connection would be made.

Two forms of machine (dial) switching have been widely used in this country; the step-by-step, and the panel system. In the step-by-step system one brush is employed for each bank, and it moves both vertically and horizontally until the desired terminal is reached. With the panel system, the brushes move only vertically, but the banks are larger, and accommodate a number of brushes operating over parallel vertical paths. . . .

Both of these systems work very satisfactorily under conditions for which they are most suitable. There are two respects, however, in which improvement seemed possible. One



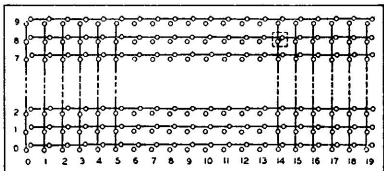
In the crossbar unit two sets of terminals are mounted in place of the one set that is used in the step-by-step and panel systems and sliding contacts are eliminated

is that with either system a comparatively complex mechanism is required to operate the brushes. The other is that a sliding contact is required, and the terminals and brushes must be of some durable metal to withstand the wear. Unfortunately, the harder metals do not have as low contact resistance as the softer precious metals such as silver, and are more subject to the formation of poorly conducting surfaces.

The crossbar switch brings improvement in both of these conditions. It avoids sliding contacts and thus facilitates the use of precious metal contacts, and it accomplishes the required connections with a much simpler mechanism. It does this by employing an entirely different and much more direct method of switching.

In the manual system, and in both the step-by-step and panel systems, which resemble it in this respect, the members of one set of terminals are banked together, and the members of the other set, which are to be connected to those of the first, are arranged to be moved up into contact with them.

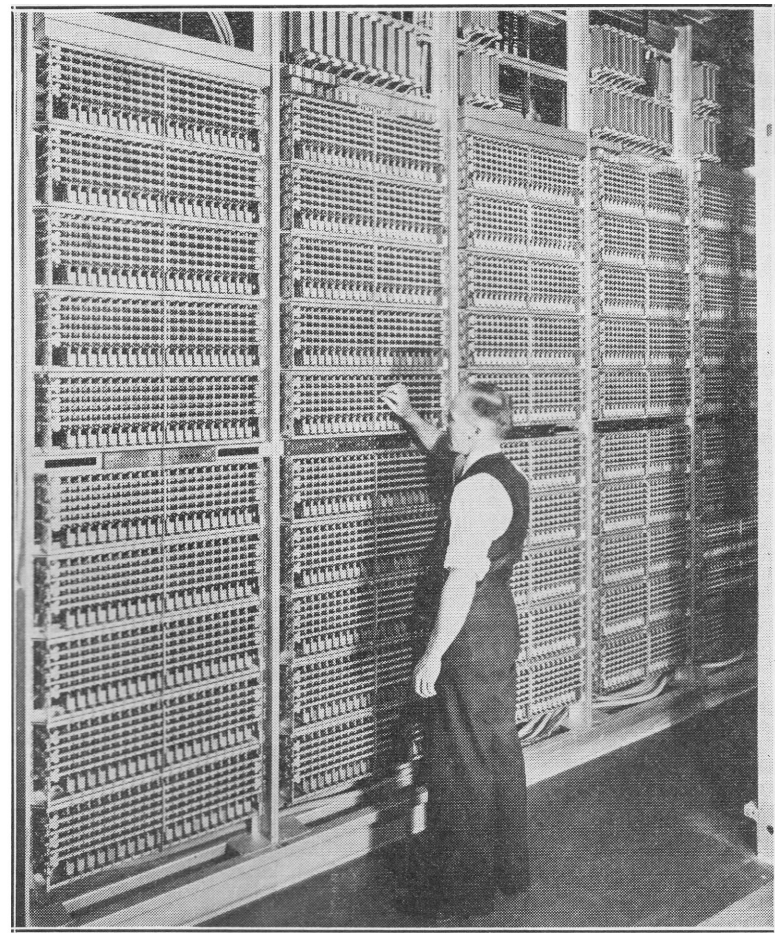
In the crossbar system all such necessity of motion is avoided by mounting a pair of contacts at each position in the bank, and by eliminating the brushes completely. One contact of each pair is multiplied with the corresponding contacts of the other pairs in the same row. The horizontal multiplying corresponds to that of the panel system, while the vertical multiplying is as



Simplified schematic drawing of the selection element of a cross-bar switch

though the brushes of the panel bank had been provided in multiple with as many brushes in each column as there were rows. Instead of moving up a brush, therefore, it is necessary only to close the contact at the proper position in the bank to make the desired connection. The motion of the brush is avoided. The only movement required is that of a mechanical link to close the required set of contacts.

Between each pair of horizontal rows is a bar running completely across the bank, which may be rotated a small amount in either direction around its axis by the action of two magnets and armatures at one end. Wires projecting inward toward the contacts are attached to these bars at each intersection with the vertical columns. With the horizontal, or selecting, bars in their mid-positions these wires, or select-



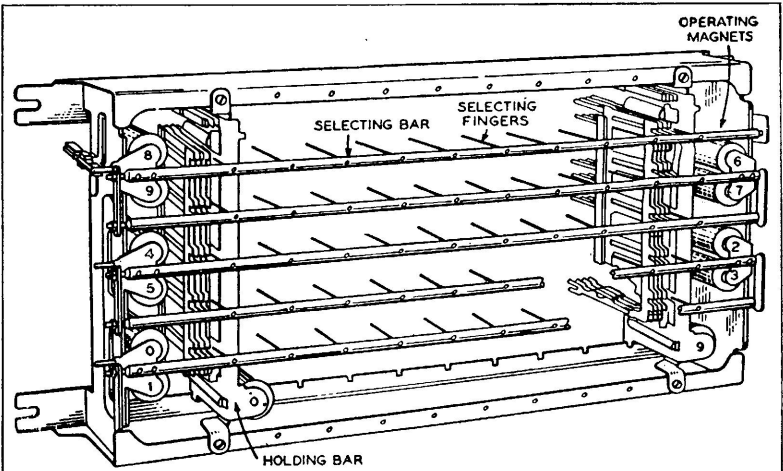
A bank of crossbar switches in the Troy Avenue Office, Brooklyn, N. Y., where the first trial installation has been made. A Western Electric installer is checking the end play of selecting bars on office link frames by feel

ing fingers as they are called, lie between the two rows of contacts, but when the bar is rotated in one direction the fingers move up to lie across the backs of the contacts in the row above it, and when it is rotated in the other direction, the fingers are moved to lie across the backs of the contacts in the row below.

Along each column of contacts is a vertical, or holding, bar which—when rotated by a magnet and armature at one end—moves a vertical bar inward to press against all the selecting fingers in that column. If none of the selecting bars are operated when the holding bar moves in, the fingers will merely be pushed between the rows of contacts and no connection is made. If one of the selecting bars is operated, the fingers of that bar will lie across the backs of one row of contacts, and when the holding bar operates, the contact at the intersection of the selecting and holding bars that are operated will be moved into contact by the action of the holding bar against the finger which, in turn, lies across the back of the contact spring. The holding bar remains operated during the period of the call, but the selecting bar returns to

normal immediately after the holding bar has operated. When the selecting bar returns to the central position, all the fingers return with it except the one held by the holding bar, thus leaving the selecting bar free for another selection with a different holding bar. The fingers are small and readily flex over the small arc of rotation of the selecting bars.

In a crossbar unit there are five



Partial perspective of the crossbar switch. The mechanism to accomplish the required connections is much simpler than that of either the step-by-step or panel systems

selecting bars, and thus 10 horizontal rows of contacts; and there are 20 holding bars, and thus 20 vertical rows of contacts, although other numbers of holding bars may be used. The contacts themselves are similar to those of an ordinary relay. In the crossbar system, moreover, twin contacts of precious metal are provided, thus giving greatly increased assurance that a good connection will be made.

The gain in simplicity of operation is very obvious. In the step-by-step system, for example, the upward motion of the brush is caused by one magnet operation for each row the brush passes over, and similarly for the horizontal motion. In the panel system upward motion is caused by operating a clutch at the bottom of the frame, and then the brush is driven upward at a uniform speed by a power drive. The upward motion is actually accomplished in two steps, separated by a slight pause. In the crossbar switch, however, only two magnet operations, one immediately following the other, are required.

The avoidance of sliding contacts in the crossbar system is equally obvious. The contacts are merely pressed together as in a relay when a connection is made, and no sliding in the ordinary sense occurs.

By this adoption of a new basic scheme of switching, and by the provision of a suitable mechanical method of operation, it has been possible to provide a distinctly new type of dial switching. It is much too early to make predictions as to the extent of its ultimate use or the net improvements that will accrue from its employment, but it offers opportunity for shortening the switching time and for decreasing the maintenance. Apparatus has been manufactured, and the first trial installation is now going forward in the Troy Avenue office at Brooklyn, N. Y.

Construction Men Escape from Hotel Fire in Early Morning

Nine members of the Construction Department and the wife of a line foreman, lodged in the Myers Hotel at Lebanon, were fortunate enough to escape unharmed but few were able to salvage any of their personal belongings when that hostelry burned to the ground early Thursday morning, December 23.

Those who were staying at the hotel were J. B. Underhill, line foreman, and Mrs. Underhill; M. Dobson, Ray Army, P. A. Hurley, E. E. Castor, and J. L. Betzner, linemen; Guy Cantwell, splicer; L. L. Schludecker, splicer's helper; J. A. Gillespie, construction clerk.

The fire, it is thought, was started by an overheated furnace. The Indiana Bell men were awakened by smoke at about 4:30 a. m. Mr. and Mrs. Underhill were trapped in their room, and escaped through a window and down a ladder. The rest managed to grope their way out through the burning building even though the smoke was too thick to see through.

Only Mr. Schludecker managed to salvage all of his personal belongings. He gathered them up in a bundle and tossed them out a window. The others pulled a few clothes over their pajamas and dashed out. Dobson, Gillespie, and Castor lost valuable wrist watches.

Mr. and Mrs. Underhill suffered the greatest loss. They rent their home near Mentone, Ind., to another family and travel together. With them they take a wardrobe trunk full of clothes, a portable sewing machine, an electric iron, electric clock, and other valuable personal items.

"Darn It!"

Subscribers on a rural line near North Bay, Ontario, complained that one telephone was in use all the time. An inspector visited each home on the line and finally found an elderly lady using the telephone receiver as a "darning egg."

Appreciates Telephone, So She Sends Flowers



Mattie Cole at her Telephone

Manager R. D. Shaw got a real thrill out of a bouquet of flowers received at the recent Open House held at the Michigan City office. On it was a card extending con-

Indiana Bell Host to 2,700 At Michigan City Open House

(Continued from Page 1)

ranged in the Business Office, including cable, old and new telephones, and the materials of which a telephone is made.

The 1938 Almanacs were distributed to everyone attending the Open House and a more limited number of other pamphlets were given out.

The public was invited to visit the Telephone Building in various ways. Two articles, which included photographs, were carried by each

gratulations from Mattie Cole, a telephone subscriber for 27 years.

Mr. Shaw called on that thoughtful lady to thank her for the flowers. On his visit he found that she could not come to the Open House, as she had been confined to her home for two years as the result of injuries received in a fall.

"I appreciate the telephone more than ever," she said. "I can't get out, so my telephone takes me on visits to old friends."

of the two daily newspapers and two advertisements also were run in the local papers the week preceding the Open House.

About 600 letters of invitation were mailed to business subscribers and special letters were sent to various clubs and civic organizations by Manager Shaw. One thousand Invitation Cards were passed out by employees. A sign placed in the Business Office also informed the public of the coming event.

The general committee for the Open House included the three South Bend District superintendents: H. E. Bolt, Commercial; Vaun Flora, Traffic, and J. W. Quinlan, Plant, and E. C. Belzer, display manager, Information Department.

The local committee consisted of R. D. Shaw, manager; J. P. Montbrun, wire chief, and Jessie Routh, chief operator.

Plans will be made for about ten Open Houses during 1938 including the new Broadway Office in Indianapolis and a public inspection of the new dial central office equipment at Mishawaka.