Connectors for the No. 5 crossbar system

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Connectors are used for associating markers with other common control circuits and with the switching frames for brief intervals during the handling of a call. In the No. 5 crossbar system, the seven major types, indicated in Figure 1, are employed. Besides showing the circuits with which each type of connector is used, this diagram shows the number of paths closed by each connector, and also the direction of the connection, that is, whether the marker seizes the frame, or the frame seizes the marker. This difference in the direction of connection is also indicated in the name of the connector. Where the marker seizes a frame, the connector is given only the name of the frame the marker seizes. Thus there is a line link connector, a trunk link connector, an outgoing sender connector, and a number group connector. When it is the marker that is seized by the frame, on the other hand, both the word marker and the name of the frame are included in the name of the connector. Thus there is an originating register marker connector, an incoming register marker connector, and a line link marker connector. For the line link frames, both types of connectors are required, and thus there are both line link connectors and line link marker connectors; the former is used while the marker is setting up connections between line link and trunk link frames, and the latter only when a subscriber lifts his handset to place a call.

Paths through the connector are established by operating multicontact relays,* each such relay closing 60 contacts. Since each connector closes more than 60 paths in establishing a connection, there will be more than one multicontact relay per marker in each connector. These relays have two operating magnets, and by separating the operating circuits of each relay, the equivalent of two 30-contact relays is available. Advantage is taken of this for the line link marker connector and the number group connector—the former requiring one and a half relays per marker, and the latter two and a half.

Two different circuit patterns are used for associating the multicontact relays to

*RECORD, *May*, 1939, *page* 301.

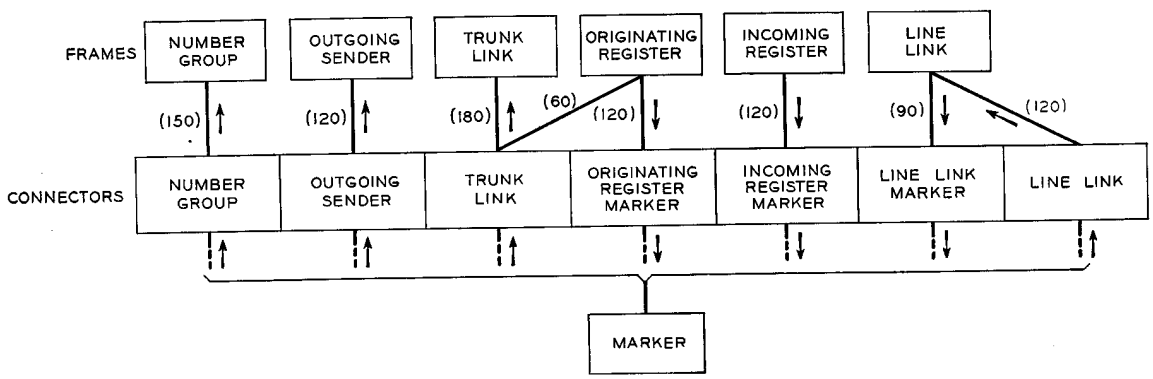


Fig. 1—The seven principal types of connectors used in the No. 5 crossbar system with the circuits with which they are associated and the number of paths they close.

form a connector, as shown in Figure 2. The arrangement shown at (a) is called a single-ended connector, while that at (b) is a double-ended connector. The latter is used only for registers and senders. Only one multicontact relay is shown connected to each marker, but as pointed out above, there will always be more than one of them depending on the number of paths that must be closed. With the single-ended connectors, which are used for line link, and number group frames, the connector multiple is connected to the armature contacts of all the multicontact relays and extended

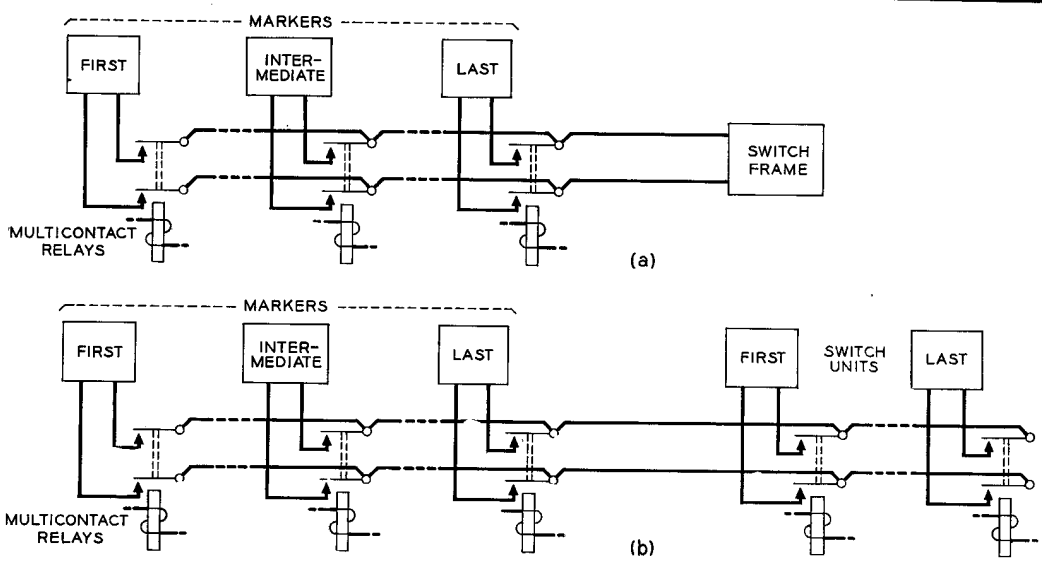


Fig. 2—Two types of connectors are employed: single-ended connectors arranged as indicated at (a), and double-ended connectors as arranged at (b).

to the switch frame the connector serves. There is thus one connector for each frame. With the double-ended connectors, on the other hand, used only for senders and registers, the connector multiple is connected to the armature contacts of both a group of multicontact relays for the markers and another group for the circuits to be connected to them. With this type of connector, therefore, a single connector will serve a group of similar circuits.

The trunk link connector, in conjunction with the originating register circuit, is both a single-ended and double-ended connector. There are multicontact relays for connection of 240 leads to each marker. The single-ended connector multiple for 180 leads is extended directly to the associated trunk link frame. The double-ended connector multiple for the remaining 60 leads is extended to the multiple side of the multicontact relays on the originating register frames which represent originating registers associated with that trunk link frame.

The reason for the provision of two types of connectors is that as soon as a line link, trunk link, or number group frame has been released by one marker, it is free for seizure by another. After a register or sender has been disconnected from a marker, however, it will not, in general, be free for connection to another, since it will be busy recording the digits dialed by a subscriber or transmitting pulses over an outgoing trunk. Double-ended connectors are thus used for registers and senders to permit the connector, after it has been released by one register or sender and a marker, to be at once reused for another connection. If single-ended connectors were used for these equipments, there would be relatively long intervals while the sender or register was performing its other functions when the connector was not in use.

The two sets of multicontact relays used with double-ended connectors are mounted in different locations. Those that connect the marker to the connector multiple are on the connector frames, as are those of the single-ended connectors, while those that connect the registers or senders to the connector multiple are on the register or sender frames, described later.*

Because of the similarity of the connector circuits and the large number of them required, the connector frames were designed to be built up of functional units in accordance with one of the basic features of the No. 5 crossbar system. The principal unit includes six multicontact relays

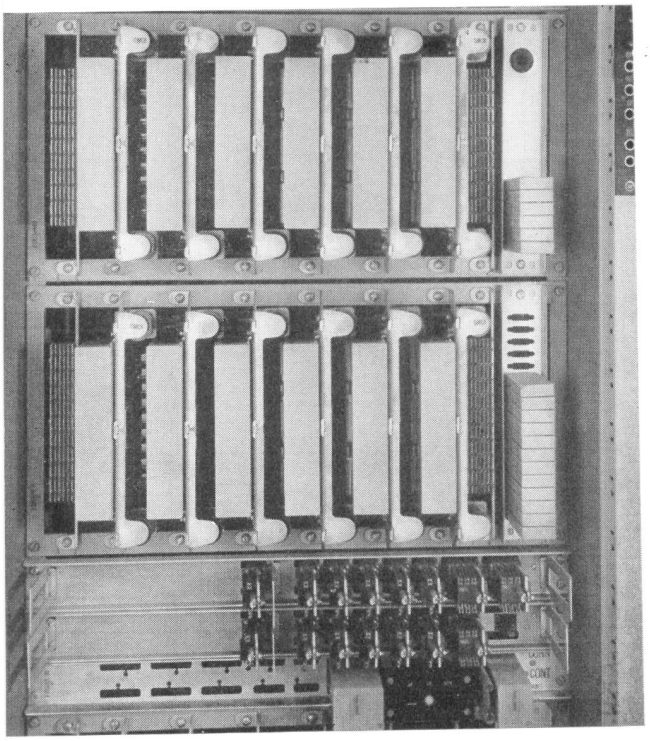


Fig. 3—Front view of a line link connector which employs two multicontact relay units.

spaced on 2¾ inch centers to provide ample space for soldering the leads from the markers. Two of these units are shown in Figure 3. Terminal strips are mounted at each end of the unit, and the bare copper wires that connect the armature contacts of all the relays are connected to the terminal strips at each end as shown in Figure 4. The small cans to the right of the right-hand terminal strip in Figure 3 enclose contact protection networks.*

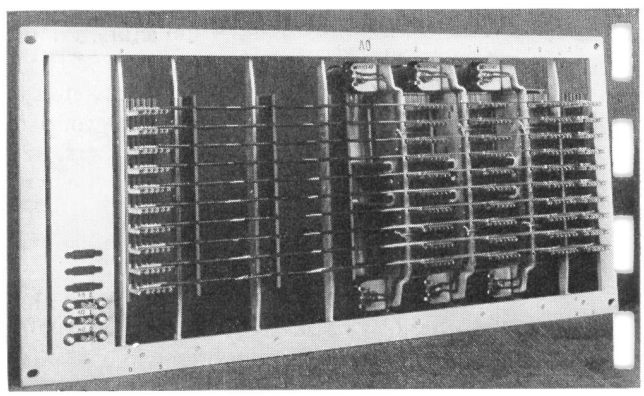
From one and a half to four such units—depending on the number of paths to be closed—will serve six markers, which is all that many of the No. 5 offices will require. For offices that require less than six markers, some of the positions for the multicontact relays will be left vacant, as shown in Figure 4. For offices requiring more than six markers, supplementary connector frames are provided, which may be furnished to serve either three or six additional markers. When such frames are used, the terminal strip at one end of the unit on the basic connector frame is wired to the terminal strip at one end of the unit on the supplementary frame to form a single connector.

Besides the multicontact relays, each connector requires a set of preference relays and a set of control relays. A preference relay unit requires one, two, or three mounting plates depending on the type of connector. Connectors through which markers seize the frames have two sets of preference relays, a regular set and an emergency set. The latter is brought into service automatically in the event of failure in the former. Control units consist of one or two mounting plates, and one unit is provided for each connector.

Six sets of terminal strips are located at

*Record, *February*, 1949, *page* 50.

Fig. 4 — Rear view of a multicontact relay unit partially equipped.



* See page 79.

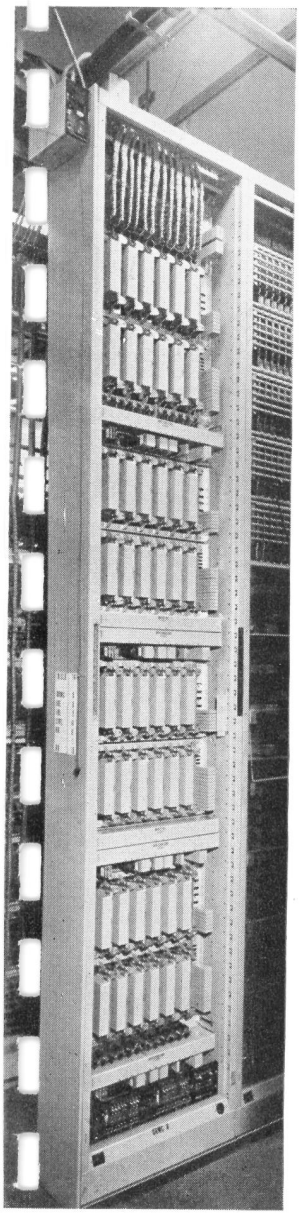


Fig. 5—An originating register marker connector frame.

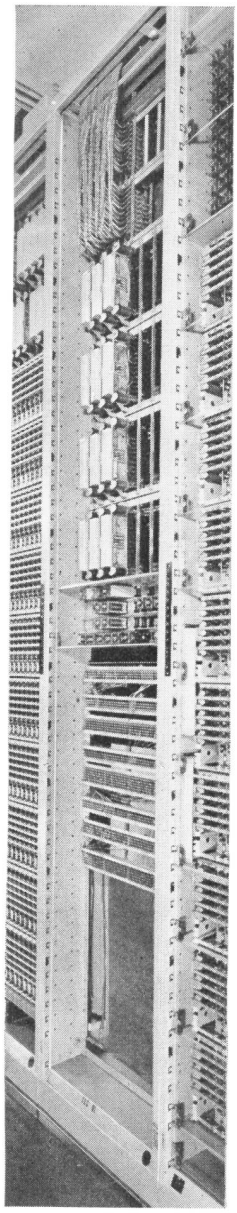


Fig. 6—A trunk link connector frame at the Media office.

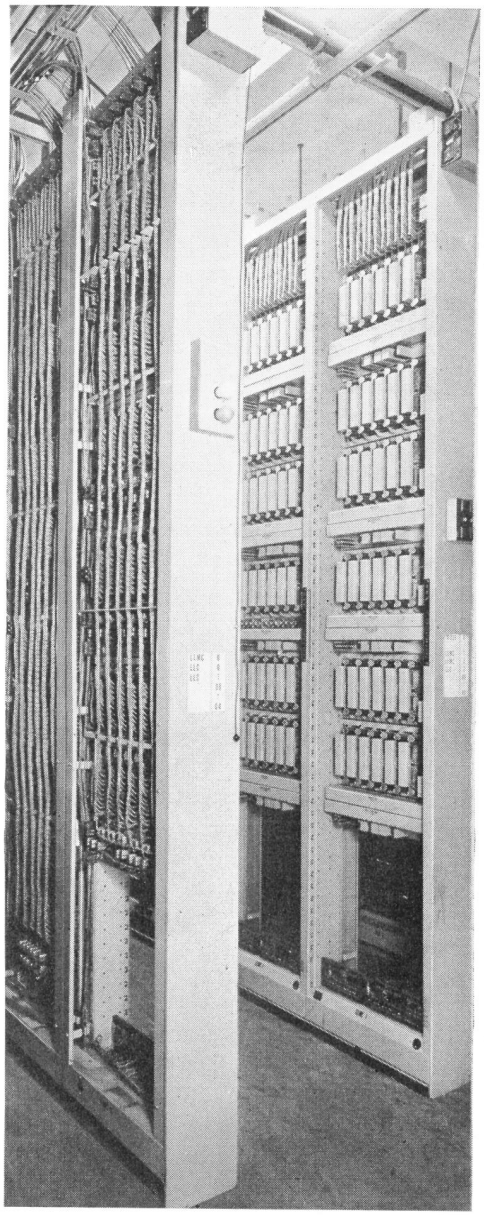


Fig. 7—Front and rear views of a line link marker connector in the Towson office near Baltimore.

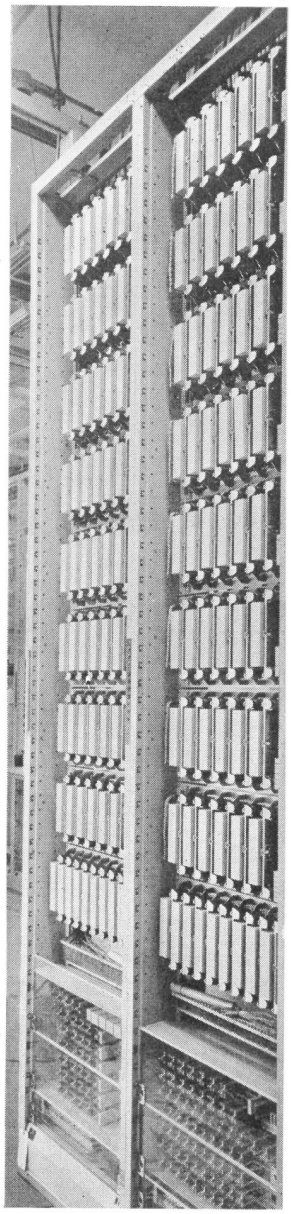


Fig. 8—A master test connector frame at the Towson office.

the top of each connector frame. The marker leads are cabled to the front of these strips, as may be seen in Figures 5 and 6. On the rear of the frame, vertical local cables extend the marker leads to the multicontact relays for all connectors on the frame, as evident at the left of Figure 7. One set of terminal strips, together with a vertical local cable, is furnished as a unit at the time that each marker is equipped.

Each of the connector frames is a standard 23-inch single bay sheet metal frame, but because of the different number of paths closed by the various connectors, and of differences in the amount of auxiliary equipment required for certain frames, the number of connectors per frame is not the same for all types. The originating register

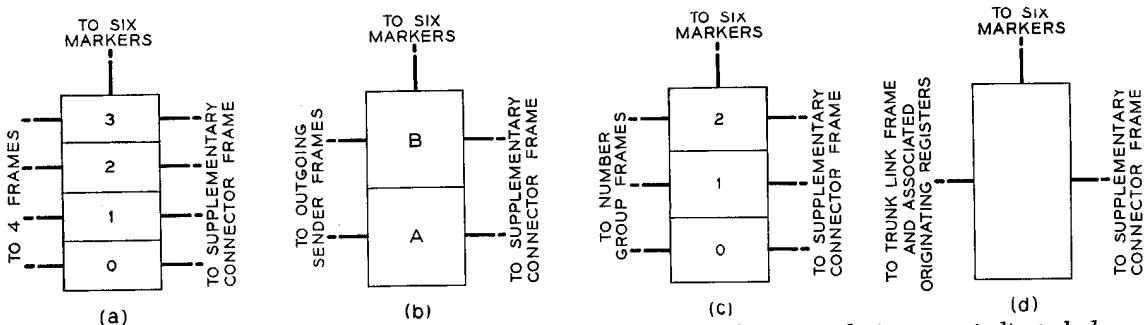


Fig. 9—Either one, two, three, or four connectors may be mounted on a single frame as indicated above.

marker connector, the incoming register marker connector, and the line link connector all have four connectors per frame, each consisting of two multicontact relay units. The arrangement of these frames is indicated diagrammatically at (a) of Figure 9. Figure 5 shows an originating register marker connector frame, which in its general arrangement is similar to the other two of this group. A closeup of part of a line link connector frame is shown in Figure 3. The preference and control relays are on the three mounting plates immediately below each pair of multicontact relay units.

Four connectors per frame are also used for the line link marker connectors, but since these connectors require only one and a half multicontact relays per marker, there are only six multicontact relay units per frame as shown in Figure 7.

The outgoing sender connector also closes 120 paths, and thus requires two multicontact relay units to serve six markers. Since a group of cross-connecting fields and a number of auxiliary relays are required in association with the outgoing sender connector, only two connectors are mounted on a frame as indicated in (b) of Figure 9.

Number group connectors close 150 paths and thus require two and a half multicontact relay units per connector. Four connectors would thus require ten multicontact relay units, but since with terminal strip and control equipment a bay will not accommodate more than eight, only three connectors are mounted on each number group connector frame, (c) in Figure 9.

The trunk line connectors close 240 paths and thus require four multicontact relay units for each connector. Since several sets of cross-connecting terminals are associated with these connectors, only one connector is mounted per frame as indicated at (d) of Figure 9. A trunk link connector bay in the Media office is shown in Figure 6. Since this office has only three markers, the multicontact relay units are each equipped with only three relays.

Besides the seven connectors used in setting up service calls, a master test connector is required in each marker group of the No. 5 system. This connector circuit is arranged to connect markers, pretranslators, and the automatic monitor circuit to the trouble recorder. Test calls may be made from the master test control circuit through the master test connectors to markers and pretranslators.

The master test connector frame consists of two bays to accommodate the connector equipment for the first six markers, and is shown in Figure 8. For marker groups exceeding this, one or two supplementary master test connector frames are required; the first serves markers 7 to 9, and the second serves markers 10 to 12. The supplementary frames are single bays of equipment.

For offices arranged for AMA, an auxiliary master test connector frame is required in addition to the master test connector frame. This is a single-bay frame that accommodates the multicontact and U relay equipment used for connecting transverters, AMA recorders, and the master timing frame to the trouble recorder.