Register and sender frames in No. 5 crossbar

O. J. MORZENTI
Switching Equipment

Registers and senders* in the No. 5 crossbar system,† although performing the opposite functions of receiving and transmitting switching information, respectively, have many points of similarity. The time of action for each of them, unlike the marker, is largely controlled by apparatus outside the central office. With an originating register, for example, the time required is at least that necessary for a subscriber to complete dialing the desired number; with an outgoing sender, the governing factor is the speed at which the equipment in the distant office may be actuated. They both must "register" or store the dialed number. They both must count pulses, and "steer" them into the proper digital sequence. They are both required to time their various operations to assure proper functioning. They are alike also in both requiring access to markers for exchange of information for brief periods. This access is provided through connectors consisting of multicontact relays. All of these similarities have permitted the design of registers and senders to follow a uniform pattern.

Despite their common features, senders and registers of the No. 5 crossbar system are called upon to serve under such widely varying conditions that there are many points of dissimilarity also. Thus to meet immediate Bell System needs, there are five types of registers—one originating and four incoming—and four types of senders. Each

* See page 63.
† See page 5.

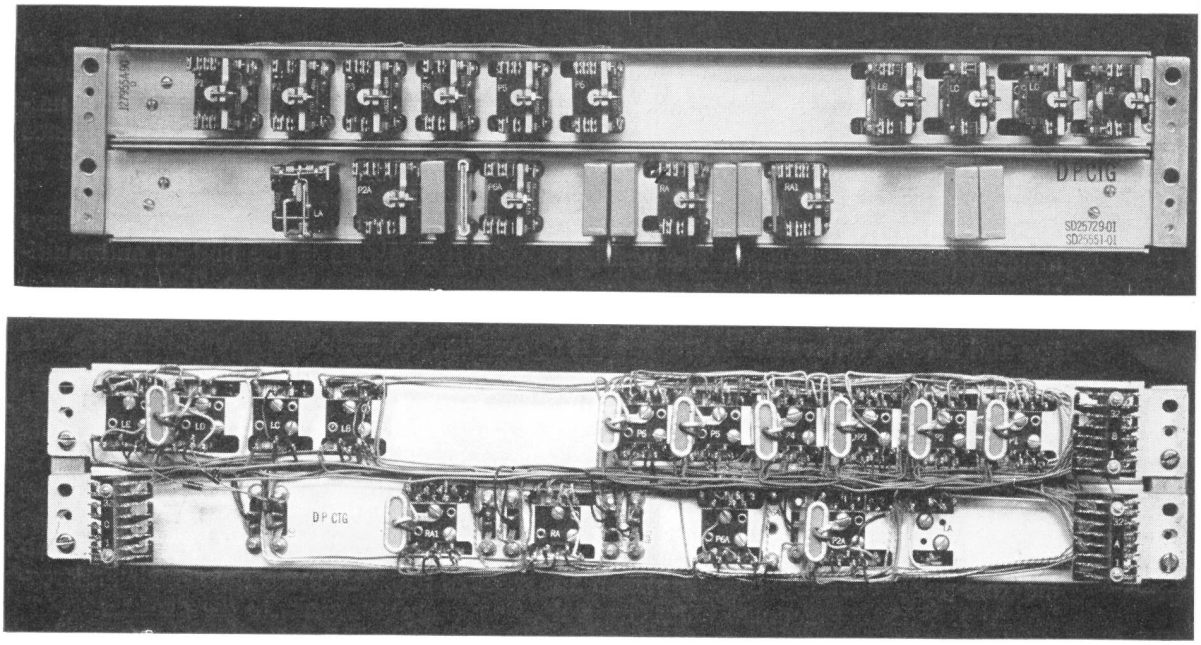

Fig. 1—A dial-pulse counting unit for the No. 5 crossbar system. Front view above and rear view below.

of these has a variety of optional features which are required in different combinations for different offices, depending upon the numbers of digits, lines, frames, classes of service, types of pulsing, the need for automatic message accounting, etc. An idea of the degree to which this differentiation is carried is shown in Table I, wherein the three categories, originating registers, incoming registers and outgoing senders, branch out into the nine types of registers and senders. These in turn are comprised of sixty-eight major features represented by functional units, of which thirty-four are always required in the system and thirty-four are optional.

In keeping with the standardization and simplification of manufacture that has been stressed in the design of the No. 5 system, it was desirable to reduce the wide variety of functional units and to arrange for their combinations in the fewest and simplest standardized patterns. The numbers of functional units have been reduced wherever practicable by making one unit serve in two or more places. Fourteen of the units are common to several types of registers or senders. For example, of the twelve possible types of units entering into the make-up of an originating dial-pulse register, six are also used in the incoming dial-pulse register.

With all optional features included, the maximum number of mounting plates required is twenty-two (for the originating register) and the minimum is fifteen (for the incoming revertive-pulse register). To secure greater standardization, it was felt desirable to fix on a space of twenty-two mounting plates for all cases. The positions of the functional units within any sender or register are also fixed to permit standard jigs and fixtures to be used in the shop for over-all operating tests. Each of the functional units has terminal strips at one end for loose-wired cross-connections between functional units. This loose wiring is readily run from standard drawings to interconnect whatever assembly of units is required for each office. A typical functional unit—the dial-pulse counting unit—is shown in Figure 1. Various functional units grouped to form a complete register for a particular office are shown in Figure 2. Figure 3 shows the register arrangement for a hypothetical central office requiring all of the functional units.

Since no register or sender requires more than twenty-two mounting plates, five of them may be arranged on a two-bay frame, with eleven mounting plate spaces in each of the bays. For the smaller registers or senders, or those equipped with only a few options, this arrangement results in vacant spaces. This loss of space, however, is more than offset by the resulting uniformity in manufacture and maintenance and in the ease with which additions or changes may be made.

TABLE I—NUMBERS OF FUNCTIONAL UNITS AND OPTIONS FOR REGISTERS AND SENDERS

	Total Number of Functional Units	*Basic Units (Always Required)*	*Optional Functional Units*
Originating Register			
Dial Pulse	12	4	8
Incoming Registers			
Dial Pulse	13	6	7
Multi-Frequency .	8	4	4
Revertive Pulse...	5	4	1
Central "B".....	5	4	1
Outgoing Senders			
Dial Pulse.....	6	4	2
Multi-Frequency .	5	3	2
Revertive Pulse...	7	3	4
Panel Call Indicator	7	2	5
Total	68*	34	34

*Of these 68, there are fourteen functional units used in several applications; thus there are only 54 discrete and different units.

The frame consists of two 23-inch bays with fuse panels at the bottom and multicontact relays at the top. The fuse panel arrangement is universal for all registers or senders, consisting of two panels, the one on the left bay caring for the even registers or senders and the one on the right bay, for the odd ones. Each panel is fused from a different frame feeder, so that if power should fail on one, only half the registers or senders will be put out of service. The multicontact relays at the top serve as connectors to concentrate the sender and register connector paths to the markers.

Cable forms are run up the outer edges of each frame at the rear to interconnect

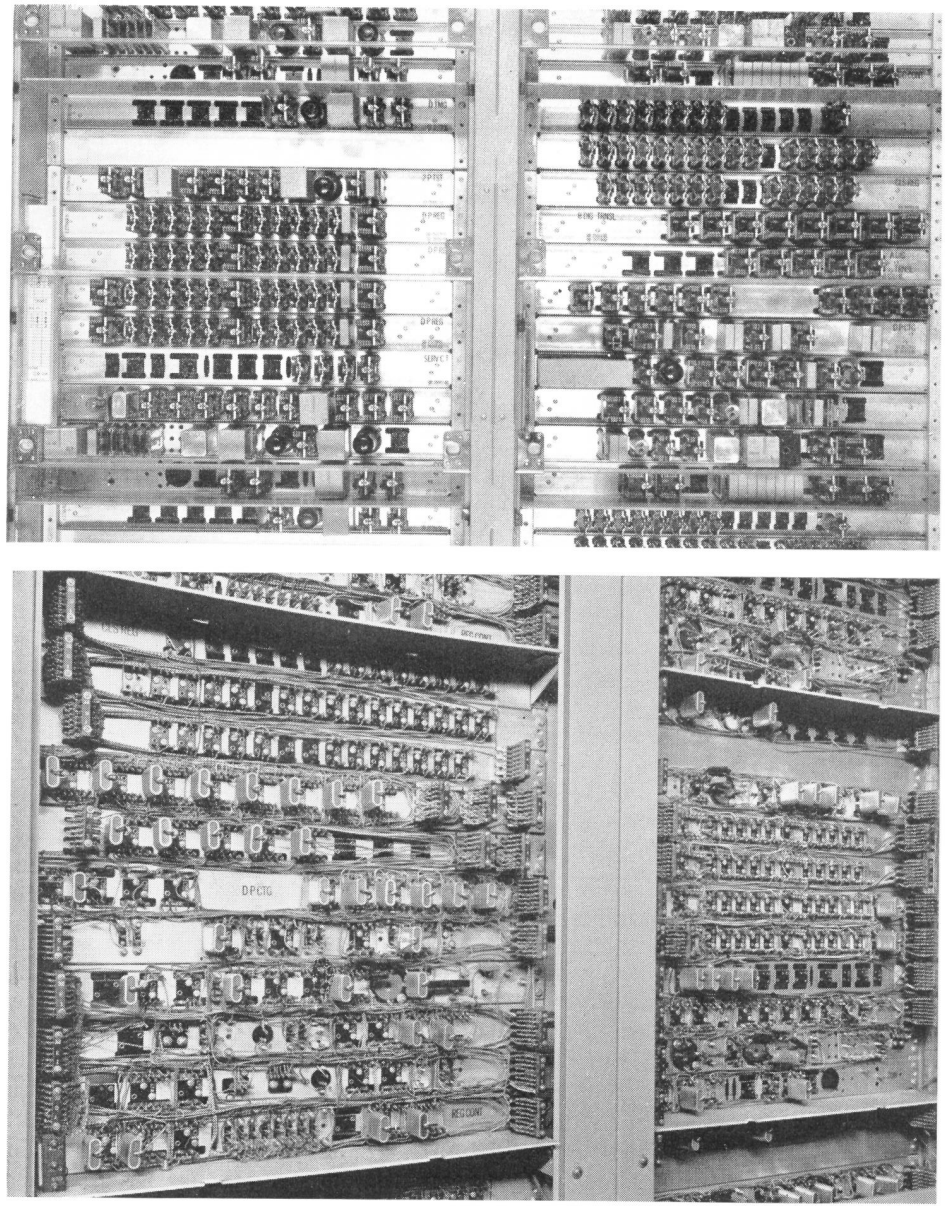

Fig. 2—An originating register for the No. 5 crossbar system. Front view above and rear view below. The counting unit of Fig. 2 occupies the fifth and sixth mounting plates from the bottom on the bay at the right.

the fuses at the bottom, the connectors at the top, the testing facilities in the frame upright, and the frame terminal strips to the sender or register equipments. They have leads brought out at the various mounting plate levels to connect to any combination of functional units which might be furnished. If one cable form included all the wiring needed for all types of registers and senders, it would, in any specific case, provide many leads not required, and add unjustifiable cost. After considerable study, ways were found, however, to standardize three frame cables to care for all conditions. One accommodates five originating registers; one accommodates any of the four types of incoming registers in any combination; and one accommodates any of the four types of senders in any combination. The single type of frame structure with standardized fuse panels, connectors, and other equipment common to a frame, thus becomes one of three possible types when the local cable is installed: an originating register frame, an incoming register frame, or a sender frame.

Front and rear views of a typical register frame are shown in Figure 4. The permanent cable may be seen at each side in the rear view. The flexible wiring between the two bays is that connecting the various functional units, previously discussed, that comprise a complete register.

Besides securing a flexible frame arrangement that requires only three types of frames for mounting any type of sender or register, on the other hand, receives its digits very quickly, and thus will be ready for connection to a marker much oftener. Therefore, a single connector cannot serve as many multi-frequency registers as it can dial-pulse registers.

At the top of each frame are five groups of sometimes two and sometimes three multicontact relays, one group for each possible register or sender on the frame. The arma-

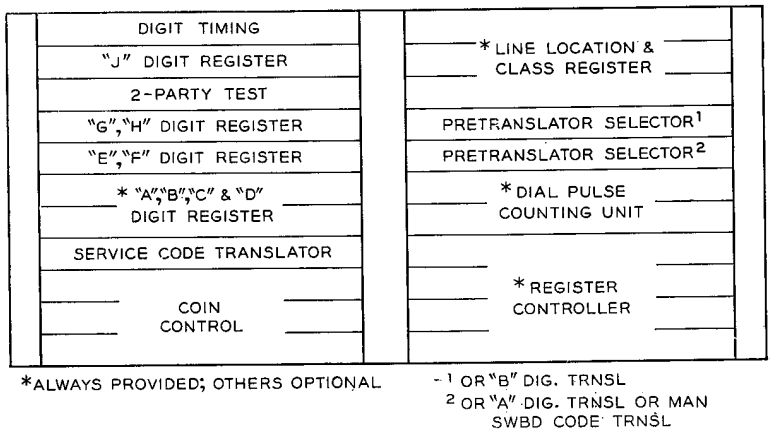

Fig. 3—A chart showing a fully equipped originating register (all units named and optional units and apparatus so indicated).

register, it has been necessary also to provide flexibility in grouping the registers and the senders for connection to the markers. Senders and registers are connected to markers to transfer information to them or to receive it from them. As stated previously, only a very short time interval is required for each transfer of information. The sender or register may be busy with a call for a much longer time than this, however, and thus a single connector can serve a number of registers or senders. Just how many will depend to a large extent on the type of register or sender. A dial-pulse register, for example, requires considerable time to receive a long train of digits from an outlying office in comparison with the time it requires to pass this information on to the marker through the connector. Thus, while the register is occupied in receiving the digits, other registers could be using the connector, and in the example chosen, this connector might serve as many as a dozen such registers. A multi-frequency

ture contacts of all five groups are multipled together for connection to the marker. If used in this manner, all five groups of multicontact relays would be part of a single connector. By mounting terminal strips at each end of the row and at two or three points within the row, however, it is possible to cut the multiple of the armature contacts at some point and thus split the connector. The terminal strips are so placed that the multiple may be cut to assign one register to one connector and four to the other, or two to one and three to the other. Of the registers or senders on a single frame, therefore, all five may be on one connector, one may be on one and four on the other, or two may be on one and three on the other, and thus essentially complete flexibility is secured. Further flexibility is obtained by multipling connectors on different frames. Thus a single connector is able to take care of registers or senders on several frames. The same connector, however, cannot serve both registers and senders.

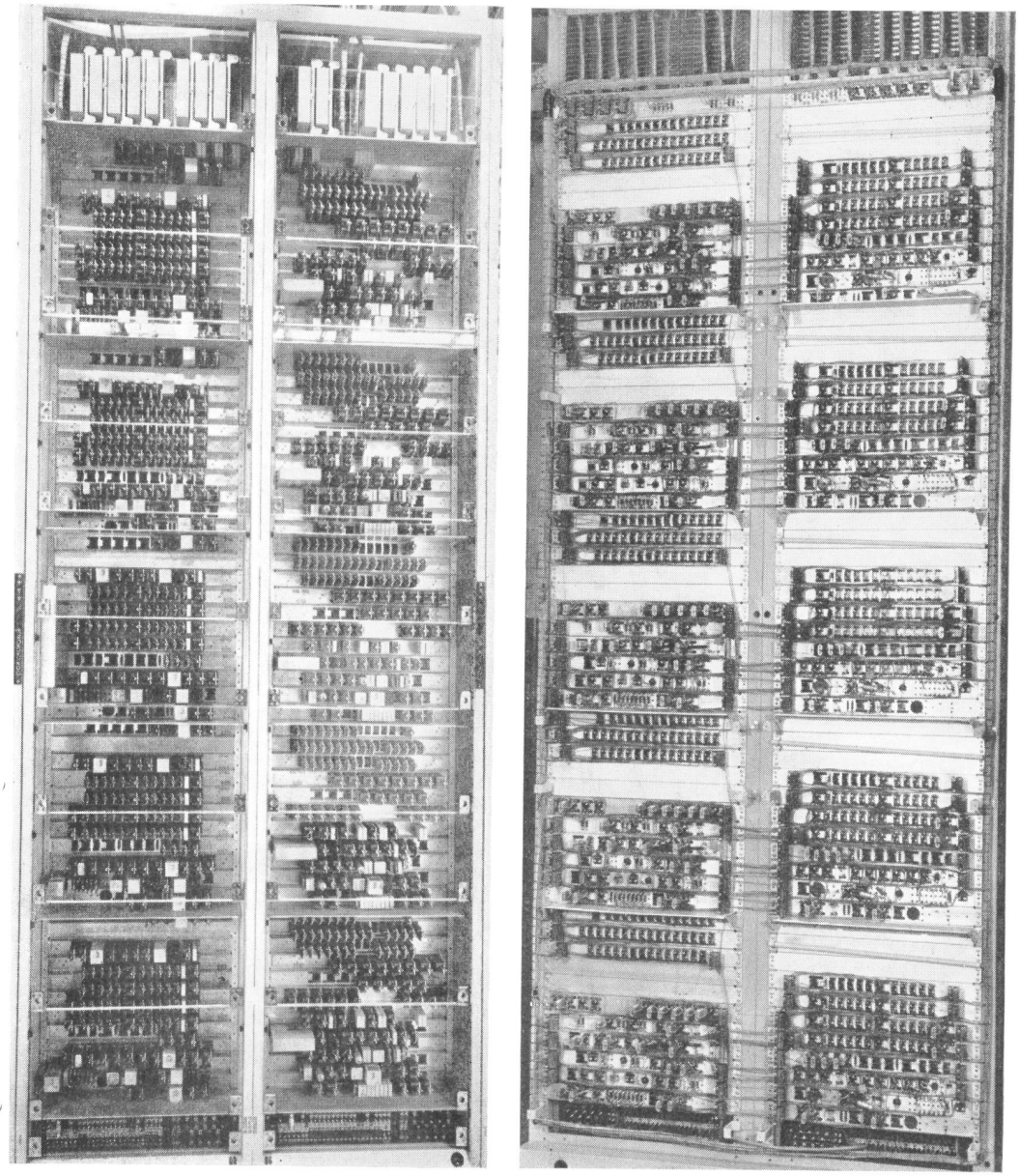

Fig. 4—Front view of an originating register frame in the Towson Office at the left, and rear view of a similar frame at the Hawthorne plant of the Western Electric Company at the right. The permanent cable may be seen at each side of the rear view. The flexible wiring between the two bays is that connecting the various functional units comprising a complete register.

Because of the provisions made in the design of the No. 5 system, there is flexibility at every stage of the assembly. Functional units may be selected as desired to build any type of register or sender. The three types of frames with their common equipment are manufactured as separate entities. Frames and their registers or senders are then brought together in any combination. Finally, both senders and registers are grouped as required by traffic to supply suitable loads for the connectors. It is features of this type that make No. 5 adaptable to many types and sizes of office.