Pulse conversion in No. 5 crossbar

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Most DSA[1] and toll switchboards are equipped with pulse-sending apparatus to permit them to complete calls directly to dial offices. Depending on the types of offices in the direct switching area, this pulse-sending apparatus may be a dial or one of several types of key sets. When some of the offices to which the operator may have to complete calls require one type of pulsing, and others another type, a group of senders is commonly associated with the switchboard that will accept the pulses sent out by the operator's dial or key set and then send out to the distant office the type of pulsing it requires. Such an arrangement is generally more satisfactory than to provide two or more pulse-sending devices at each position of the switchboard and require the operator to determine the type of pulsing needed for each call she completes. These senders form a separate group for use exclusively by the switchboard.

With the introduction of the No. 5 crossbar office with its inherently great flexibility, however, it has been possible to provide arrangements that permit the No. 5 crossbar equipment, where it is in the same building as the switchboard, to be used for calls of this type, and thus the provision of a separate group of switchboard senders becomes unnecessary. Since the function of the crossbar circuits in such applications is primarily to accept one type of pulsing from the switchboard and convert it to another type for transmission over a trunk, the process is called pulse conversion. Ordinarily the amount of this type of traffic is comparatively small, and it may thus be handled by the No. 5 office with little if any increase in the size of the register and sender groups.

When an operator plugs into one of the trunks requiring pulse conversion, the procedure so far as she is concerned is the same as though she had plugged into a trunk not requiring pulse conversion. No special traffic instructions are required. The trunk circuit itself, however, is arranged to seize automatically an idle incoming register,[2] which will record the pulses from the operator's key set and certain other information. The register then seizes a marker and transfers the information to it. The marker, in turn, causes an idle sender[3] of the proper type to be connected to the trunk

[1] RECORD, *December*, 1945, *page* 466. [2] See page 5. *March*, 1950, *page* 104. [3] See page 63.

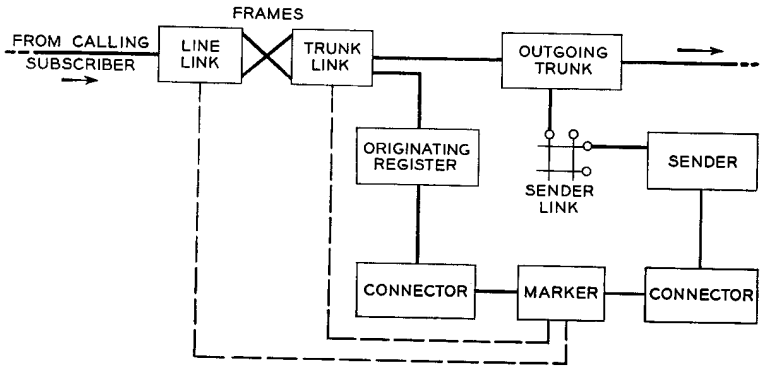

Fig. 1 — Block diagram of major circuits involved in handling an outgoing dial call.

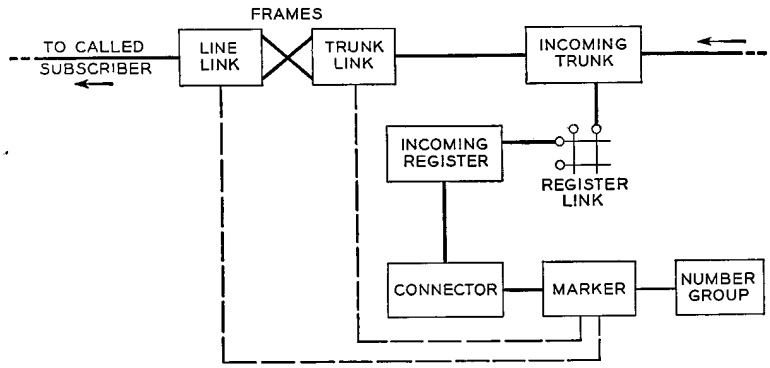

Fig. 2 – Block diagram of major circuits involved in handling an incoming dial call.

into which the operator has plugged, and transfers the required information to it. The sender transmits pulses of the proper type over the trunk, connects the trunk through to the switchboard, and then disconnects itself. The register and marker will have disconnected themselves shortly after the association of the sender. The marker is held for only about a quarter of a second, and the sender only long enough to transmit the necessary pulses over the trunk.

All this sounds very straightforward and regular, but as a matter of fact, the marker in handling a pulse conversion call must follow a different procedure from many of those it carries out in completing an ordinary No. 5 crossbar call. The difference lies in the fact that the marker must first treat the pulse conversion call as though it were an incoming call, and then as if it were an outgoing call. This is possible largely because in the No. 5 crossbar system a single type of marker is capable of handling both incoming and outgoing calls.

The steps taken by a No. 5 crossbar marker in handling an ordinary outgoing call are indicated in Figure 1. The marker is seized by an originating register, which has previously been connected to the calling line by this or another marker. It then connects to an idle trunk-link frame that has an idle trunk of the desired route, and seizes one of them. Having selected and seized a suitable sender for completing the call, the marker connects it to the selected trunk. After transferring the needed information to the sender, it then disconnects. Before disconnecting, however, it had also found an idle path from the calling line on the line-link frame to the selected trunk on the trunk-link frame, which is always one of its major functions in handling a call through the No. 5 crossbar office.

Its procedure in handling an incoming call is indicated in Figure 2. In this case, the calling incoming trunk seizes an idle incoming register, and the register, after it has recorded the information regarding the connection desired, seizes an idle marker. The marker then connects to the trunk-link frame to which the calling trunk is connected, and to a number group circuit to determine the location of the line called. It then connects to the line-link frame indicated and finds an idle path from it to the trunk-link frame. It is then free to disconnect.

In handling a pulse conversion call, the marker, as previously mentioned, goes through some of the steps it follows for incoming calls, and some it follows for out-

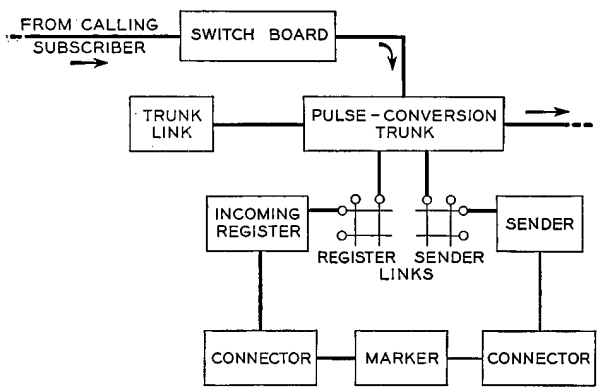

Fig. 3—In handling a pulse conversion call, the circuits used for incoming and those used for outgoing calls are both employed.

going calls, but it never has to connect to line-link frames or find idle paths between a line-link and a trunk-link frame. Its procedure is indicated in Figure 3.

The pulse conversion trunk partakes of the characteristics of both an out trunk and an incoming trunk: it is connected to a register link as is the incoming trunk and to a sender link as is the out trunk. An incoming register is seized when the operator plugs into a trunk, and after the pulses have been recorded, the incoming register selects an idle marker and transfers the information to it. The marker selects and seizes a suitable sender, and then—by way of the register link, the conversion trunk and the trunk-link frame—it operates the proper hold magnet in the sender link to connect that trunk to the sender already selected. It then transfers its information to the sender, and disconnects.

On all these drawings the paths over which the marker is seized and those that are pre-established without selective action on the part of the marker are shown by heavy solid lines. Those paths that the marker selects are indicated by light solid lines, while the auxiliary paths over which the marker gains access to the various circuits are indicated by dashed lines.

For an ordinary outgoing No. 5 crossbar call, the marker selects the trunk and the sender to be used with it. For an ordinary incoming call it selects only the path between the line-link and trunk-link frames. With a pulse conversion call, on the other hand, it selects only the sender, since the trunk has been selected by the operator, and the trunk in turn selects the incoming register. The marker is seized by the incoming register and gets the information from it as with an incoming call, and then selects a sender as in handling an outgoing call. It does not have to make a trunk selection nor find idle paths between a line-link and a trunk-link frame, however, and thus the work it does is not as extensive as with an ordinary crossbar call. Furthermore, the main switch frames of the No. 5 office are not held busy after the call has been established. The demands placed on the No. 5 office by this service are thus not great, and yet considerable economy is secured by eliminating the necessity for a special group of senders for the manual board.