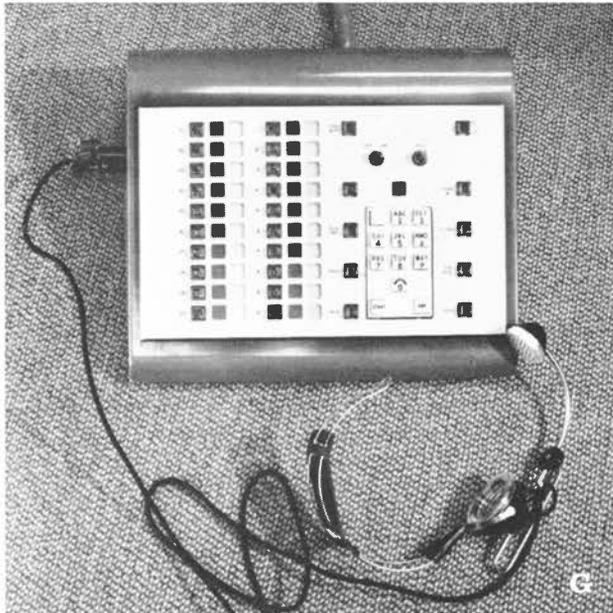


A



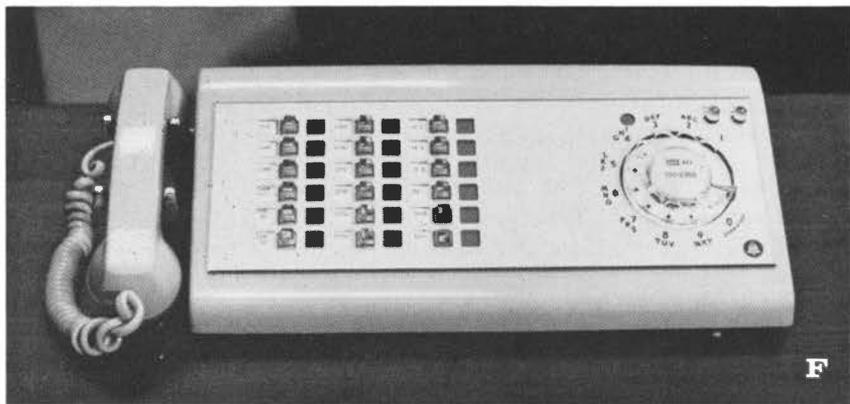
B



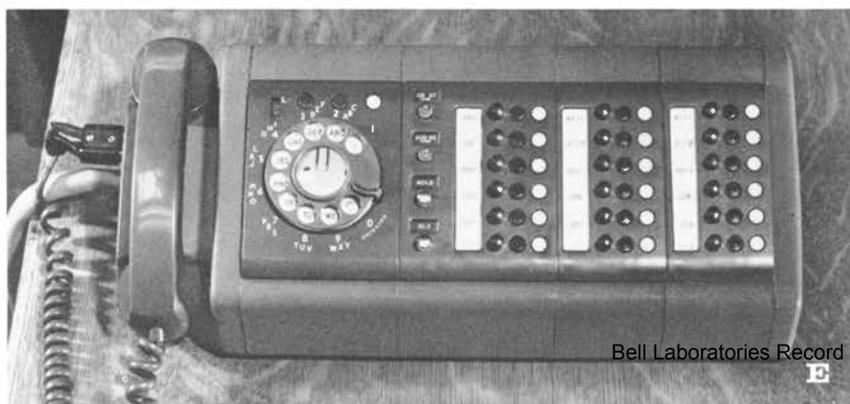
C



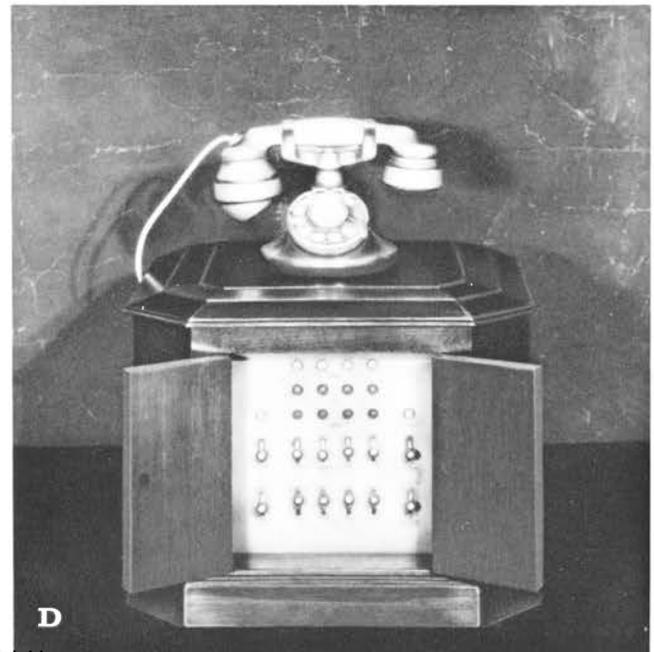
C



F



E



D

Miss J. H. Coyne



PBX Consoles

TELEPHONE SWITCHBOARDS have long been a familiar sight in business establishments. In Private Branch Exchange (PBX) service, operators initially used the cords, plugs and jacks on these switchboards to perform all switching for internal communication as well as to make connec-

PBX Consoles, old and new—The new Universal Console, available in two sizes (A), provides push-button control for attendants associated with most modern types of dial PBX systems. Typical of recent installations is that at the Advance Division of Carlisle Chemical Works in New Brunswick, N. J., where Mrs. Mary Schreiner operates the small Universal Console in connection with the 101 Electronic Switching System (B). Long before pushbutton design, however, cordless consoles with lever-type keys were associated with small step-by-step 740A (C) and 740C and (D) PBX systems. An early console (E) for the small crossbar 756A PBX was replaced by the still more modern 3A Telephone Console (F). A prototype (G) for the development of the Universal Console appeared with some of the early Direct Inward Dialing installations.

tions between the customer's stations and the exchange network. Even with dial PBX systems, cord type switchboards continued to be used for incoming and assistance calls. This tradition now has been challenged by the introduction of PBX attendant consoles which operate without cords, plugs and jacks.

The modern console is a small, attractive, key operated "switchboard" which may be placed on the surface of a desk or table. The attendant uses pushbuttons and a dial to answer and complete calls; actual switching occurs in associated dial switching equipment. Tones and illuminated panels and buttons give all the signaling and supervisory information needed to handle the calls.

Cordless consoles increase operating efficiency and speed call completion as well as improve the attendant's working environment. Operating efficiencies are achieved by saving the attendant's time and effort through such features as dial completion and automatic disconnection. The usual switchboard jack field is eliminated and all attendant operating equipment is confined to a small area. Reduced attendant work, motion, and time result in faster call completion. Operating efficiency and speed of call completion are increased still further

by the addition of auxiliary features such as automatic call distribution and call "Camp-on." Camp-on holds a call to a busy line and automatically connects to, and rings, the called line as soon as it becomes free.

Decorative Console Design

The current trend toward more attractive offices and office equipment has created a customer demand for PBX attendant positions of modern design. This demand is particularly evident in the case of small businesses where the PBX attendant frequently serves also as the company's receptionist. When using the new compact consoles, the attendant sits at a desk as do other office personnel. Removing the old shoulder-to-shoulder assembly line type of switchboard arrangements in multiposition installations has vastly improved the attendant's working conditions.

The pushbutton operation afforded by consoles fits in well with other trends in telephone service for business customers. One such trend is the increase of dial PBX service. In 1954, dial PBX extension lines represented about 38 per cent of all PBX lines in Bell System service; by 1962 this figure had grown to 67 per cent. The proportion of dial lines is expected to continue to rise with added emphasis through the recent introduction of CENTREX service. This new business telephone offering provides dial PBX service to the customer, but permits most of the calls to and from the exchange network to bypass the attendant. However, even with Direct Inward Dialing provided by CENTREX service, the attendant plays an essential role by handling incoming calls to the customer's "listed" number and other special calls.

Certain special features to be offered to business customers in the near future will allow even more calls to bypass the attendant. With one such feature, a station user will be able to transfer his incoming calls to other stations without attendant assistance. Another feature will permit him to dial a conference connection involving as many as six parties. These features afford customers faster and more convenient service. At the same time, they relieve the PBX attendant of much routine work, freeing her to handle those calls requiring more personalized service.

Consoles are not really new to the Bell System. Table top cordless attendant positions were used with small step-by-step PBX's as early as 1928. However, these early consoles were limited to use with certain relatively small switching systems of low or medium traffic handling capacity.

During the intervening years, various attendant consoles were designed for use with specific dial

PBX switching systems. An objective of each design was to improve upon its forerunners with regard to appearance, space, capacity, ease of operation, and flexibility for performing miscellaneous functions. Some of the highlights in this succession of consoles are interesting to note.

Small cordless positions featuring locking type pushbuttons were made available for use with the small crossbar 756A PBX. Bell Laboratories also designed an attendant telephone console for use with 701B PBX's which were specially modified to provide direct inward dialing. This console featured nonlocking pushbutton pickup keys and a pushbutton dial for call completion and served as a prototype for the development of a universal console.

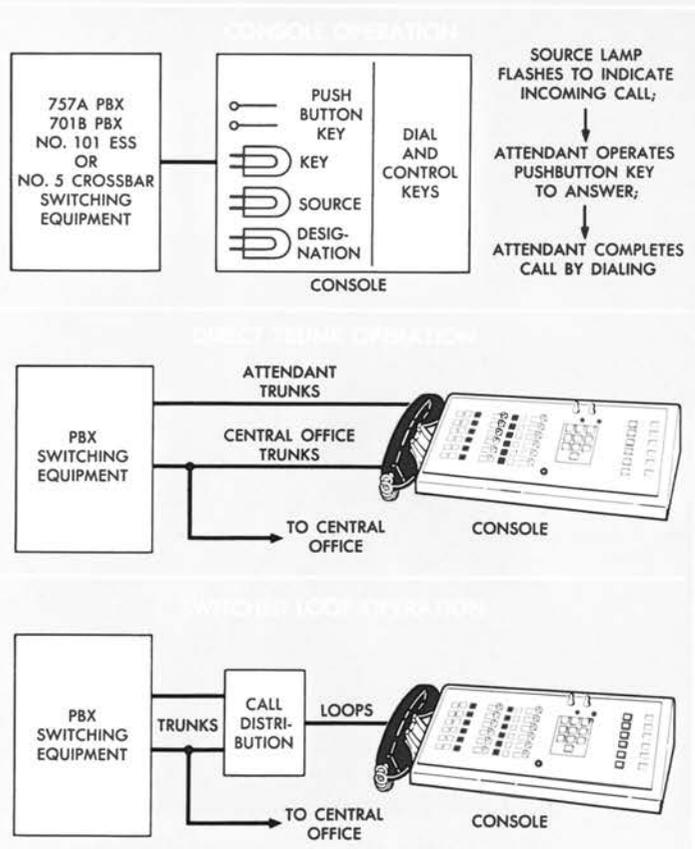
Of course, a single standard operating method as well as a universal apparatus design is highly desirable in place of individual development of consoles for each system. Recognizing this, as a first step, Bell Laboratories systems engineers studied the basic service objectives of PBX attendant facilities. These studies showed that good PBX service means that the attendant should answer calls promptly and informatively with different responses on different types of calls. Each call should be dispatched promptly, but when delays do occur, the calling party should be kept informed with progress reports at regular intervals. The attendant is expected to complete outward calls for restricted stations, assign priority for use of certain tie lines and conference circuits, and handle certain toll calls. The attendant should also be able to transfer calls when requested. She may also be expected to perform miscellaneous functions such as giving out number information and taking messages as well as other part time duties.

Improved Operating Procedure

The Laboratories next undertook studies of PBX attendant operating procedures which would meet these service objectives and be compatible with general design objectives of small size, attractive appearance, ease of operation, reasonable cost, and universality for application to various systems. Several alternative schemes were conceived and evaluated in cooperation with AT&T engineers. The operating procedure finally standardized contained elements from each of several of these alternative plans.

The studies leading up to this standardization brought out some very interesting problems. One such problem was the determination of the relative merits of automatically switching the call to and from the console versus having the call always associated with the console. Another was the use

INCOMING SIGNALS	KEY	LAMPS	
		SOURCE	DESTINATION
LISTED NUMBER CALL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DIAL "O" CALL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
RECALL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
SUPERVISORY SIGNALS			
ATTENDANT ANSWER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CALLED STATION BUSY	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
CALLED STATION BEING RUNG	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ATTENDANT RELEASE DURING RINGING	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ATTENDANT RELEASE DURING CAMP-ON	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
STATION ANSWER WITH ATTENDANT CONNECTED	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
STATION ANSWER WITH ATTENDANT RELEASED (DIRECT TRUNK)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
STATION ANSWER WITH ATTENDANT RELEASED (SWITCHED LOOP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
STATION ANSWER WITH LOOP HELD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEGEND			
<input type="checkbox"/> LAMP LIGHTED STEADILY	<input checked="" type="checkbox"/> LAMP FLASHES ONCE PER SECOND	<input checked="" type="checkbox"/> LAMP WINKS ONCE PER 2 SECONDS	
<input type="checkbox"/> LAMP DARK	<input checked="" type="checkbox"/> LAMP FLASHES TWICE PER SECOND		



This table summarizes the lamp signals for the new Universal Console. At right, general call

handling procedures and a comparison of the two basic means of connecting calls to the consoles.

of various apparatus elements, such as locking versus nonlocking keys. A third involved the choice of a signaling medium for displaying supervisory information to the attendant.

Solving Standardization Problems

The basic operating features as devised appeared to be reasonable and achievable for PBX attendant consoles associated with the various systems under consideration. However, before proceeding with actual development, Bell Laboratories engineers devised a means of simulating various operations. Consequently, a model console was constructed and connected to a device designed to simulate the PBX switching system. This equipment enabled systems engineers to show the operating characteristics of a working console for study and demonstration purposes.

Two new switching systems (the 757 PBX and the 101 Electronic Switching System) have been designed and the Bell System's old faithful 701 PBX and No. 5 crossbar central office (RECORD, October, 1962) have been modified to provide CENTREX and other new service features. The attendant facilities of each of these systems op-

erate according to the standard PBX attendant operating procedures. Minor deviations from the standards have occurred in a few cases where complete uniformity would have placed an undue economic burden on a particular system. For the most part, however, the objective has been achieved of keeping the attendant operation the same, regardless of which dial PBX is used.

The actual operation of the console is of interest. When a call requires attendant assistance, a lamp flashes on the console and the attendant answers by operating the associated nonlocking pickup key (pushbutton). To complete the call the attendant dials or keys the number of the desired called party. Tones and lamp signals keep the attendant informed of the progress of the call so that she can judge when further assistance is needed.

Each pickup key is illuminated and has two additional supervisory lamp panels—a green source lamp and a white destination lamp. The key lamp provides supervisory information relating to the attendant's association with the particular call; the source and destination lamps provide supervisory signals relating to the calling and called parties, respectively. Three different



Miss Coyne and R. J. Braund discuss key arrangements for an experimental PBX console.

flashing rates are used to indicate the type of call involved and the status of each of the connected parties. (See chart on page 239.)

For example, if someone were to call the listed telephone number of a business firm served by the universal console, a green source lamp would flash once per second. When the attendant has depressed the associated pickup key, the key lamp and source lamp would both light steadily and the attendant could talk to the calling party. If the caller desires to speak to one of the PBX extension telephones, the attendant would operate a common start key and dial or key the desired extension number. When the called station is being rung, the attendant would receive the usual audible ringing tone as well as a distinctive ringing signal on the destination lamp.

By using various common control pushbuttons on the console, the attendant may perform such functions as releasing a connection to a busy or "don't answer" station, flashing a toll operator, or splitting the transmission connection to announce calls privately. With some dial switching systems, a TOUCH-TONE dial or other pushbutton type dial may be used in place of the familiar rotary dial.

The universal console is arranged for either of two basic methods of operation called "direct trunk" and "switched loop." With direct trunk

operation (see diagram on page 239.), each trunk coming in from the exchange network is terminated in an illuminated pushbutton and associated source and destination lamps on an attendant console. A number of attendant trunks, also individually terminated in pushbuttons and associated supervisory lamps, are provided for dial "O" and other assistance calls.

In the case of switched-loop operation fewer attendant's pushbuttons are required. These pushbuttons are associated with common control circuits called loops instead of with individual trunks. These loops are brought into the connection somewhat like senders or other common control dial switching equipment in that they are associated with each call only long enough to do their job; then they become available for another call. Calls are switched to pushbutton-terminated attendant loop circuits only when attendant handling is needed and can be automatically released when the called party answers. Calls stay on loop circuits only so long as the attendant's help is needed, while directly-terminated trunk calls remain associated with the console for the entire conversation time.

Economical Production Features

In the design of the universal console, a number of factors led us to follow the general styling of the CALL DIRECTOR set. For one thing, this design has been found to be an attractive complement to modern business office decor. Its unitized construction with plug-in components facilitate variations in capacities and operating features. Its molded plastic cover could readily be made available in a variety of colors to suit the particular customer's tastes. Furthermore, by using this basic design for the universal console, some of the CALL DIRECTOR set's component parts could also be employed. Since these components are manufactured in large quantities, this tended to reduce the cost of the console.

The universal console has been made available in two sizes and four colors (grey, green, white and beige). The capacity of the smaller 1-type telephone console is 12 pickup buttons, while the larger 2-type can accommodate up to 30. The keys, lamps, dials and other components are arranged in uniform size plug-in units so that each of the two basic console models can accommodate some variation in capacity and features. Either a matching plug-in handset or standard operator's head telephone set may be used.

It is expected that within a few years the universal console will be as familiar a sight in business establishments as the cord switchboard is today.