



*Mrs. G. Dane of the Holmdel laboratory demonstrates the use of the operator's console to be installed in a Centralized Intercept Bureau. This mockup model was constructed at BTL as part of the design project for the automatic intercept service.*

*New stored-program equipment makes call interception service more fully automatic. This "Automatic Intercept System" tells the intercepted caller what number he dialed and why the call can't be completed, and gives him a new number if one is available.*

# Automatic Intercept Service

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**N**EW, stored-program equipment for handling intercepted calls to "nonworking" telephone numbers has been developed at Bell Telephone Laboratories. This equipment makes call interception faster and more fully automatic, and furnishes the customer more complete information on why his call was not completed. More satisfactory service at a lower cost is the end product.

Each customer within a numbering plan area in the Bell System is assigned a seven-digit number, used for routing calls to his telephone. The first three digits identify a central office; the other four identify his individual phone. To meet customers' requirements, the available numbers are continuously being changed, discontinued, and reassigned.

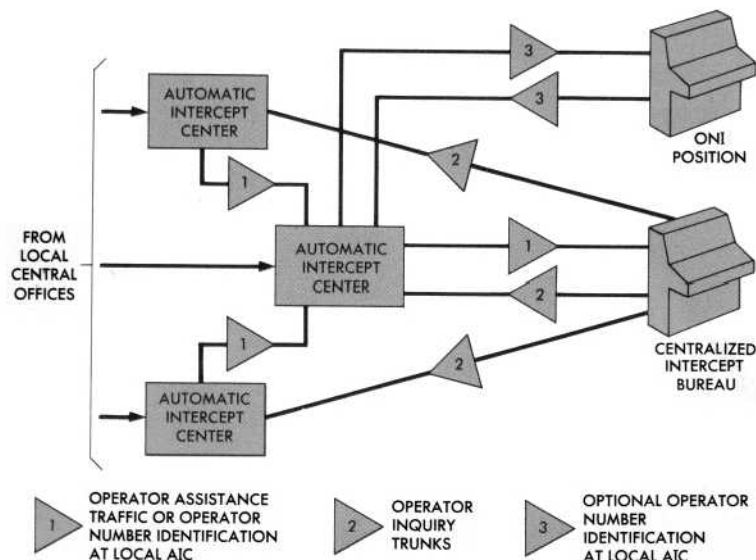
When a number is discontinued, it cannot be reassigned to another customer immediately. The new customer would get calls intended for the previous one. Incoming calls to discontinued numbers are therefore intercepted in the terminating central office. An operator tells the caller why the number is no longer assigned and, if possible, gives him the new number for the called party. Reassignment of a discontinued number is delayed long enough to ensure that very few calls intended for a previous customer will be routed to the number.

Three kinds of calls to "nonworking" numbers must be intercepted. The first, just described is a call to a recently changed or disconnected number. The second is the call to a "vacant" number - a number for which there is no terminating equipment in the central office. The

third type is a call to a number for which there is equipment, but that has not recently been assigned to any customer. The latter two kinds of calls are presently routed to a recorded announcement that tells the customer he has reached a nonworking number, inviting him to stay on the line if he needs an operator's help. Calls to changed or disconnected numbers are routed directly to an intercept operator, along with calls from customers who did not hang up after hearing the recorded announcement. The intercept operator asks the caller what number he is calling and consults a printed record of nonassigned numbers, which is updated daily, tells the customer the status of the number he is calling, and gives him a new number if one is available.

A significant number of intercepted calls are the result of customers inadvertently dialing unassigned numbers. If the number the customer intended to dial is also unassigned, he gets the proper report nonetheless. Usually the number he meant to dial is working, however, and the operator simply suggests he dial it again. The call goes through on the second try, and the customer may not understand why it didn't go through the first time.

The new Automatic Intercept System (AIS) will eliminate the confusion and irritation caused by intercepted calls, letting the customer know what number he actually reached. It will also permit rapid, continuous updating of electronically stored files of unassigned numbers. Finally, it will furnish the customer a recorded announcement containing all the information he needs in most cases, freeing intercept operators from all



*Calls requiring intercept service are routed first to an Automatic Intercept Center, where disc files and recorded announcements are located. If an operator's help is needed, the call is forwarded to an operator at a Centralized Intercept Bureau.*

but unusual situations.

Under Automatic Intercept Service, calls in local offices are routed to a central Automatic Intercept Center (AIC). The files are searched for the called number, and a recorded announcement is connected to the customer's phone. The announcement contains all the information available, including the number the customer dialed, and a new number if one is available. If the customer still needs help, his call is transferred to a Centralized Intercept Bureau (CIB), where specially trained operators handle the call.

When a call to a nonworking number is intercepted in a common-control type office, the called number is already recorded in four-digit or five-digit form in the common-control equipment. For the interception equipment, the number is reconstructed as the seven digits dialed by the customer and placed in an outpulser. The outpulser is connected to a trunk to the intercept center and sends the number to the center. In noncommon-control offices equipped for Automatic Number Identification: (ANI), the intercept circuits are modified to use the ANI equipment for identifying the number.

In both types of offices, the called number and a one-digit prefix are placed in the outpulser; the prefix identifies the kind of intercept call. A "0" prefix means the number is blank, or unequipped; a "1" means the called number has been connected for trouble intercept; "2" means the local office has failed to identify the number; "3" identifies a call to an equipped but unassigned number.

The Automatic Intercept Center contains a

time-division switching network and a stored-program processor, similar to those used in the No. 101 ESS (see *Expanding the No. 101 ESS, RECORD, May 1966*). The network connects to a maximum of 512 trunk or equipment terminations and can accommodate as many as 64 connections simultaneously.

When a call comes into the AIC from a local office, it is connected to a multifrequency receiver, which receives the digits and passes them to the processor. The processor decides, from the prefix, whether to (1) connect a blank number announcement immediately, (2) connect the call to a CIB operator, or (3) look up the called number in the files.

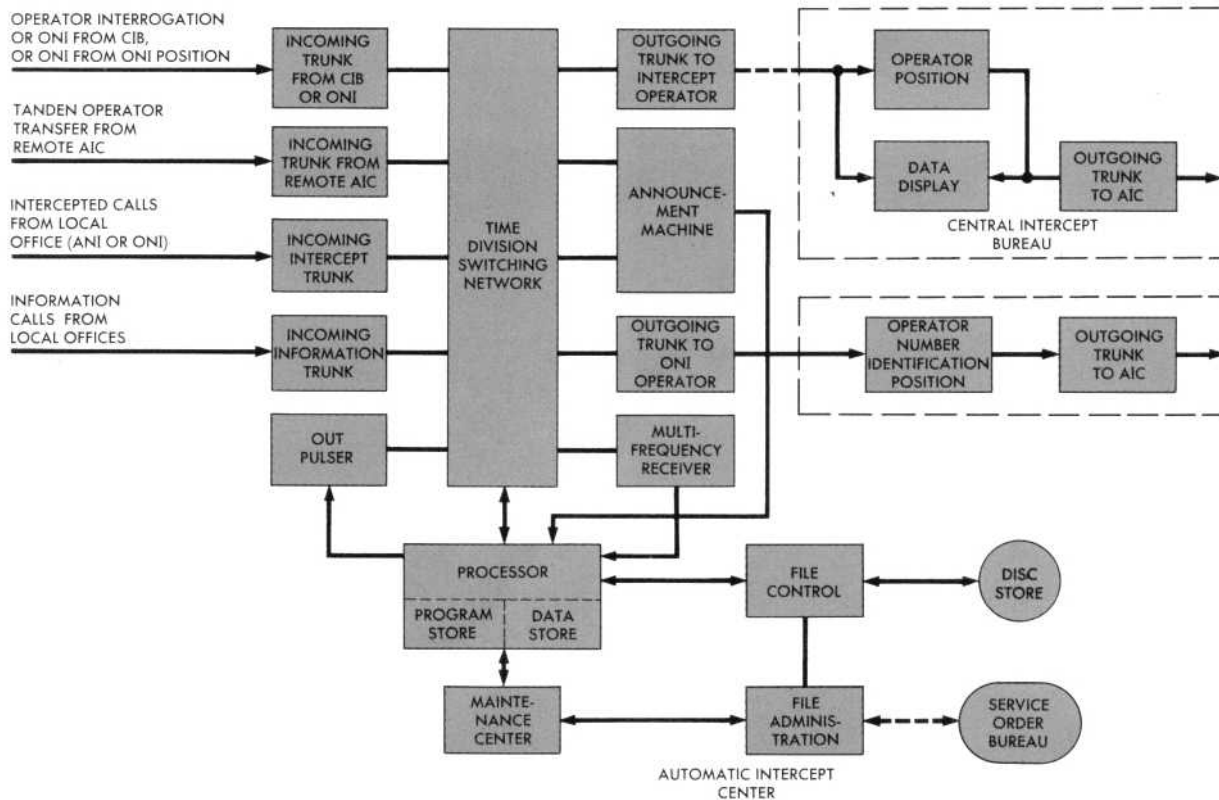
For situations where local offices are not equipped to identify the called number on intercepted calls, Operator Number Identification (ONI) is provided at the AIC. Intercepted calls in these offices are routed to the AIC via existing intercept equipment in the local office, which may handle all intercept traffic on a single trunk group without indication of the type of intercept, or which may send signals to the AIC to indicate operator class, blank number, or trouble intercept.

Incoming calls from offices without intercept type indication and calls identified as operator class are routed either to a special ONI position at the AIC or to a regular intercept operator position with an "ONI" indication, depending upon traffic requirements. In either case the operator asks the calling customer what number he is calling and keys the number into the AIC. From this point the call is handled as if the local office had outpulsed the seven-digit number with a "3" prefix, except that if a subsequent transfer to an intercept operator takes place, an indication shows that the number was operator-keyed.

Calls identified by the local office as being directed to blank numbers (which at present usually are connected to a 6A announcement machine) receive a recorded announcement at the AIC, stating that the number is not working without announcing the called number, and are subsequently transferred to an intercept operator if the calling customer does not disconnect. Calls to numbers on trouble intercept are routed by the AIC to the intercept operator with a trouble intercept indication.

Files of unassigned numbers are stored in magnetic disc memories. Two are furnished, for reliability, and each contains a complete list of the unassigned numbers in all central offices served by the AIC. Each record consists of a 46-bit word, containing the seven-digit number,





*An electronic processor controls the handling of calls in the Automatic Intercept Center. All switching is through an electronic time-division*

*switching network, which connects incoming calls to the processor, the announcement machine, or other equipment, as necessary to handle the call.*

its status (changed, disconnected, etc.), and a count of calls to the number. The count is used for determining when a number may be re-assigned. If a new number is available, another 46-bit word is used to store the number, the area code or geographic area in which it is located, and an indication whether the geographic location is available as a recorded announcement. The processor uses this information in composing an announcement or in transferring the call to an intercept operator at the CIB.

The disc files may be updated immediately via teletypewriter or data link channels. Under the existing system, files are updated daily and printed for the intercept operators. Most orders to disconnect a telephone are placed before the day the phone is to be disconnected, so the printed records are reasonably accurate. Immediate updating will make them completely accurate.

When information is stored in the files, the updating channel immediately gets a verification readout from the disc file. Each updating channel can also be used to get a printout of the information stored in the disc file, including the count of calls, for individual numbers or for an entire exchange.

Recorded words and phrases, including numbers, are supplied by a 96-track announcement

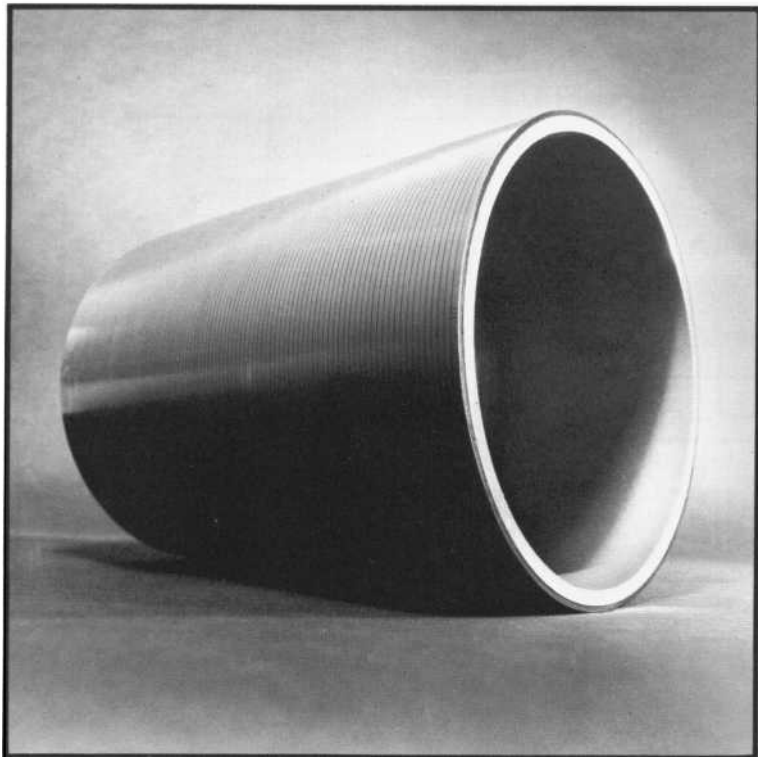
machine. Again, there are two, for reliability. The output of each track can be connected to customer lines through the switching network.

Tracks 1 through 48 are recorded with a standard set of words or phrases and digits 0 through 9. Each word or phrase lasts one and one-half seconds; each digit lasts one-half a second and is recorded with both neutral and descending inflections. These recordings are designed to cover all announcement sequences that do not require announcing a new geographic location.

Tracks 49 through 96 are custom recorded for each installation with the names of localities. They are used to give a caller the name of a new locality where he can reach the person he wants to call.

The locations of the recorded numbers, words, and phrases are stored in the Central Processor, which selects what is required for an announcement in the proper sequence for the particular intercept situation. Timing pulses from the announcement machines are synchronized with the start of each recording, and the processor uses these to change connections from one word to the next in handling a call.

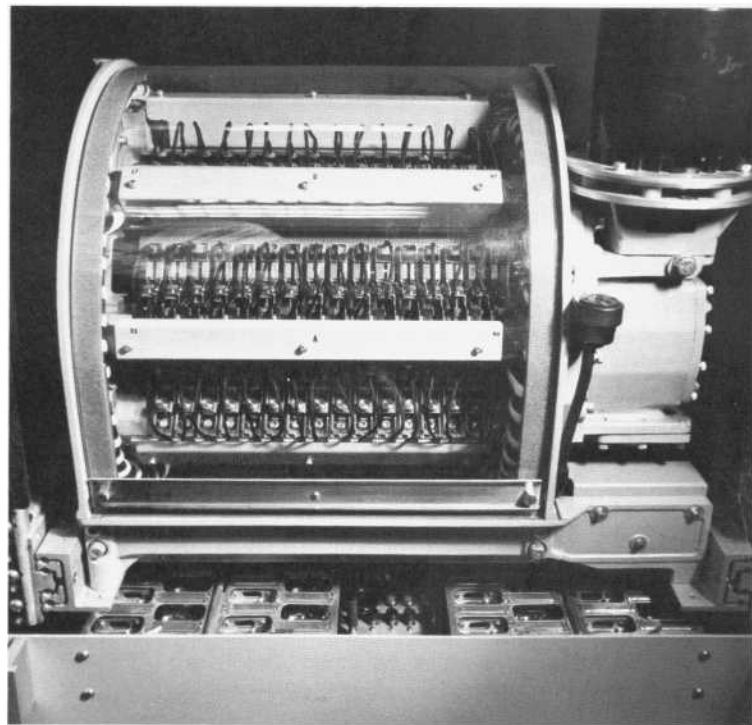
If an incoming call must be connected to an intercept operator immediately or transferred to an operator after the announcement, the proces-



*This 96-track magnetic drum, used in the announcement machine, holds phrases and digits used in forming announcements. The first 48 tracks contain words, phrases, and numbers, while the remaining ones are custom recorded with names of localities.*



*The author adjusts the pressure of the hydrogen atmosphere in which the disc files are kept. These files, which were purchased from an outside supplier, are part of the prototype Automatic Intercept System that was installed at the Holmdel laboratory.*



*The announcement machine consists of reading heads positioned over the tracks of a magnetic drum. Phrases and digits recorded on the drum are used in composing an announcement providing the caller all the information he needs on his intercepted call.*

sor connects a data outpulser through the switching network to an outgoing trunk to the CIB. The processor places all the information on the call in the outpulser; this information is passed to the selected operator's position in the CIB and displayed on a lamp panel. The outpulser connection is then removed, and the incoming trunk connected to the operator trunk, again through the switching network. The operator trunk is then connected to the position telephone circuit, so that the operator can talk to the caller.

The time-division switching network in an AIC connected to a CIB can also be used as a tandem switching point, connecting calls transferred to CIB operators from AIC's not arranged for direct connection to a CIB. ONI calls must be routed directly to an AIC equipped with ONI or CIB positions and are not handled on a tandem basis. The outpulsed information on all calls to the CIB includes identification of the AIC from which the call is transferred. Each CIB operator position has access to each AIC served. By key pulsing a seven-digit telephone number, the operator can receive either the programmed announcement or a display of the information stored for that number.

The CIB operators can signal the local AIC to connect a call to a supervisory console through the switching network. They also have access to outgoing trunks connecting to central office line circuits, tie lines to DSA boards, repair service desks, etc. Through these facilities, the CIB operators can obtain any additional information they need in handling a call, or connect calls to outgoing trunks in emergencies.

The CIB positions can also handle information calls transferred from regular information facilities. Such calls are switched directly to a CIB position through the time-division network, after an outpulsed and displayed indication to the operator that the call is for information. Each CIB position includes shelf space for information records.

Keys are provided at each CIB position for access to central office line circuits with a position dial or with optional conditioning of the multi-frequency key set for TOUCH-TONE® calling.

Manual and automatic test and maintenance facilities are provided, and all control, memory, announcement, and disc file equipment is duplicated for service protection. Maintenance programs are provided to perform automatic testing, trouble detection, and system reconfiguration. A local and a remote maintenance teletypewriter are equipped for trouble print-outs, test requests, and other communication with the processor.

The Number You Have Reached, 36811  
Hundred, Is Not in Service in The 201 Area.  
Please Check The Number And Dial Again.  
If You Need Assistance, Please Stay On  
The line And An Operator Will Answer.

#### ANNOUNCEMENT MACHINE TRACKS

Track No.	Phase or Digit
1	The Number You Have Reached
2	Has Been Changed
3	The New Number is
4	The Customer
5	Not To Give Out
6	In The
7	Has Been Disconnected
8	Has Instructed Us
9	Is Temporarily Disconnected
10	At The Customers Request
11	Is Being Changed
12	The New Number
13	Is Not Yet Connected
14	Please Call Information For
15	Calls Are Being Taken By
16	Is Not in Service
17	Is a Working Number
18	Please Check The Number
19	And Dial Again
20	If You Need Assistance
21	Repeat
22	Please Stay On The Line
23	And An Operator Will Answer
24	Thousand
25	Hundred
26 to 35	Digit 0 to 9 With Neutral Inflection
36 to 45	Digit 0 to 9 With Falling Inflection
46	(Recorder Tone)
47	Area
48	Will You Dial it Again, Please
49 to 96	(New Location Name As Required)

*The electronic processor selects recorded phrases and digits from the 96-track magnetic drum in the announcement machine. These are connected in the proper sequence to form an announcement.*

Force adjustment data is provided at the CIB at 15 or 30 minute intervals on a teletypewriter. Traffic counts and usage measurements for traffic engineering are provided on another remotely located teletypewriter, which is equipped to provide an input tape for the traffic data recording system.

The new Automatic Intercept System, making interception service both more automatic and more complete, should be a valuable addition to the service the Bell System provides. Customers will get more information more quickly, and telephone companies can provide more complete service at lower cost.