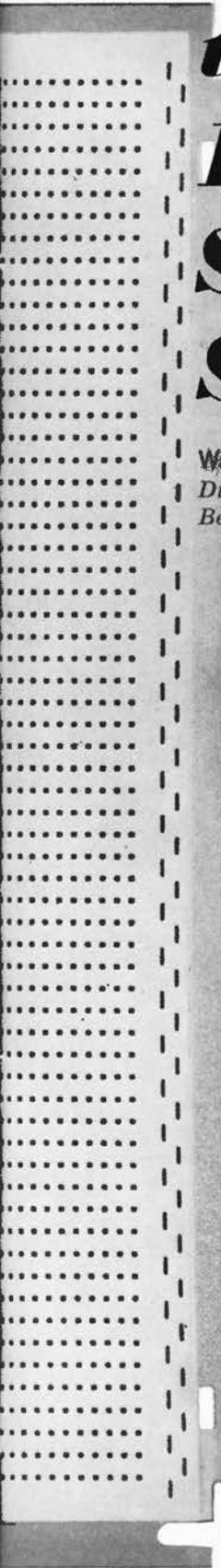


*Card above with its 2000 tiny magnets is part of twistor memory (see page 17).*



# *the 101 Electronic Switching System*

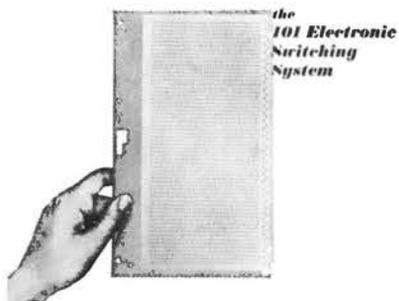
Wallace A. Depp  
*Director, Electronic PBX Laboratory  
Bell Telephone Laboratories*

**This remarkable new system, made possible by recent advances in electronics, is the beginning of a new era in telephone service for business**

■ Soon a dramatic new telephone system for business customers will become available. It will be known as No. 101 ESS (Electronic Switching System). As the name implies, this new system uses modern electronic techniques to bring improved services to small businesses.

Suppose that you, the reader, are a member of a small business, what can this new system do for you? Let us assume that your firm is located at the edge of a large city and that there are less than 200 telephones on the local premises.

Looking into the future a bit, let's say the system has just been installed and you note as you come to your desk early one morning that the telephone set is not the same. It is one of the new sets with Touch-Tone calling service in which ten neatly arranged pushbuttons replace the conventional rotary dial. Actually, the new system will accommodate either Touch-Tone calling or rotary dial instruments in any combination without need for changing other associated equipment. However, Touch-Tone calling, which will be available beginning late this year, allows you to "dial" your number in about one-half the usual time.



Beside the phone is a neatly printed set of instructions, but before reading them you lift the handset and tentatively dial the number of your associate down the hall. You are pleasantly surprised with the immediate "hello" from the receiver. You are surprised that Joe was in so early in the morning, but more surprised that his response was so immediate. Your surprise was evident to Joe. Fortunately, he had begun to read the small booklet which had accompanied his new telephone. He explained to you that a PBX telephone is normally rung for one second, followed by three seconds of silence. If, by chance, you connect to the other telephone during a silent interval, you may have to wait for as much as three seconds before it rings. This new system is designed to ring the other telephone im-

mediately and then after this initial alerting, to revert to the cycle of one second on, three seconds off.

### The 'Add-on' Feature

Since Joe is now an "expert" on the new system, you decide that the two of you should put it through its paces. Joe suggests that you try the add-on conference feature. While he is still on the line, you merely depress the switch hook for a fraction of a second, get dial tone and dial the number of a mutual friend. He responds immediately and after his initial surprise at hearing two voices, you invite him to add on a fourth friend. You soon realize that any one of the conferees can add on the fourth party. After the fourth is added, any one of them can drop out without disturbing the connection for the remaining three.

In fact, after one of the conferees hangs up, you suggest that you add on someone from outside the office. You are brave



*The attendant has a simple console from which calls can be completed with minimum attention from her. Cabinet in background holds switching unit, the only other equipment on customer's premises.*



*The 101 ESS control unit is located in the central office. It can serve as many as 32 businesses located within a radius of a few miles.*

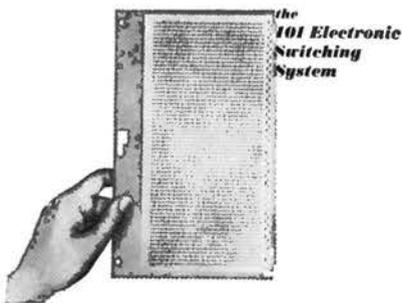
*Testing the switching unit which is located on the customer's premises. This view shows one of the plug-in apparatus packages which simplify maintenance of customer equipment.*



enough to suggest that you add your wife, who, after hearing not one but three male voices greet her at this early hour, graciously agrees that this new telephone system is indeed "really something." Of course, with the previous PBX a conference connection could be arranged by calling in the attendant and after a series of "Are you there?" questions, a conference could be established.

Later in the day you have a good chance to capitalize on the early morning trial of the new system. A call comes in from a favorite customer directly to your desk. He had dialed in via DID (Direct Inward Dialing). He had received a card about your new number listing and was glad to be able to get to you directly rather than wait for your (previously) busy attendant to serve him. Today, in connection with a military contract, he is urgently in need of a piece of your equipment. It must be slightly modified and it must be ready for shipment by truck at 5:30 p.m. You, as a member of the Sales Department, add on a member of the Engineering Department to confirm the feasibility of the change. A supervisor of the shop organization is added on to check the time required for the change.

As these people drop off the line, there is a question of a confirming order and the price. Since this order involves a modification on an expedited schedule, you wish



*Control unit is unpacked in New Jersey Bell's New Brunswick central office.*

to consult your supervisor privately for guidance. You inform your customer that you will put him on "hold" for a minute to check the pricing information. You call by depressing the switch hook for a fraction of a second, receive dial tone, dial a two-digit code, and then the number of your supervisor. You obtain the desired information, depress the switch hook momentarily, dial the same two-digit code and you are reconnected to your customer. Needless to say, he is impressed with the expeditious manner in which you have handled his request and he is quick to tell you so.

### **Rerouting Future Calls**

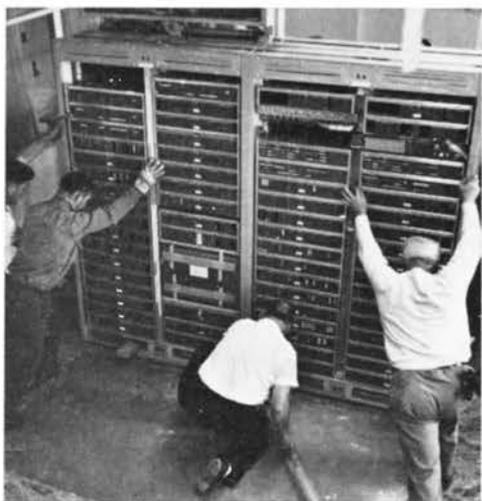
Later, as you reflect on this conversation, you have a glimmer of a doubt. "What if I had not been at my desk when the call came in?" "Could the new telephone system have helped me in that case?" A second look at the instructions is rewarding and you prepare yourself for that circumstance. You plan to be in a conference with your associate down the hall for the next hour, but you are expect-

ing an important call. You may reroute your future calls by dialing another two digit code, followed by the telephone number of your associate. The system responds with a distinctive tone indicating that it has taken action on your request. In this way, the calls "follow" you to your associate's office. Later this rerouting may be cancelled by dialing the same code from your telephone.

But suppose you are going to be out of the building for a few hours? Then you reroute your calls to another member of the Sales Department. "What happens when all of the members of the Sales Department are out to lunch?" They simply reroute their calls to the attendant or a clerk. "What if you are busy on your line when another call comes in for you?" All the members of the sales organization may be in a "hunting" sequence so that an incoming call is routed to another member of the group. As you learn to use these features, the doubt in your mind fades away. The new telephone system is indeed ready to "work" for you, even in the cases when you are not sitting by, ready for the incoming calls.

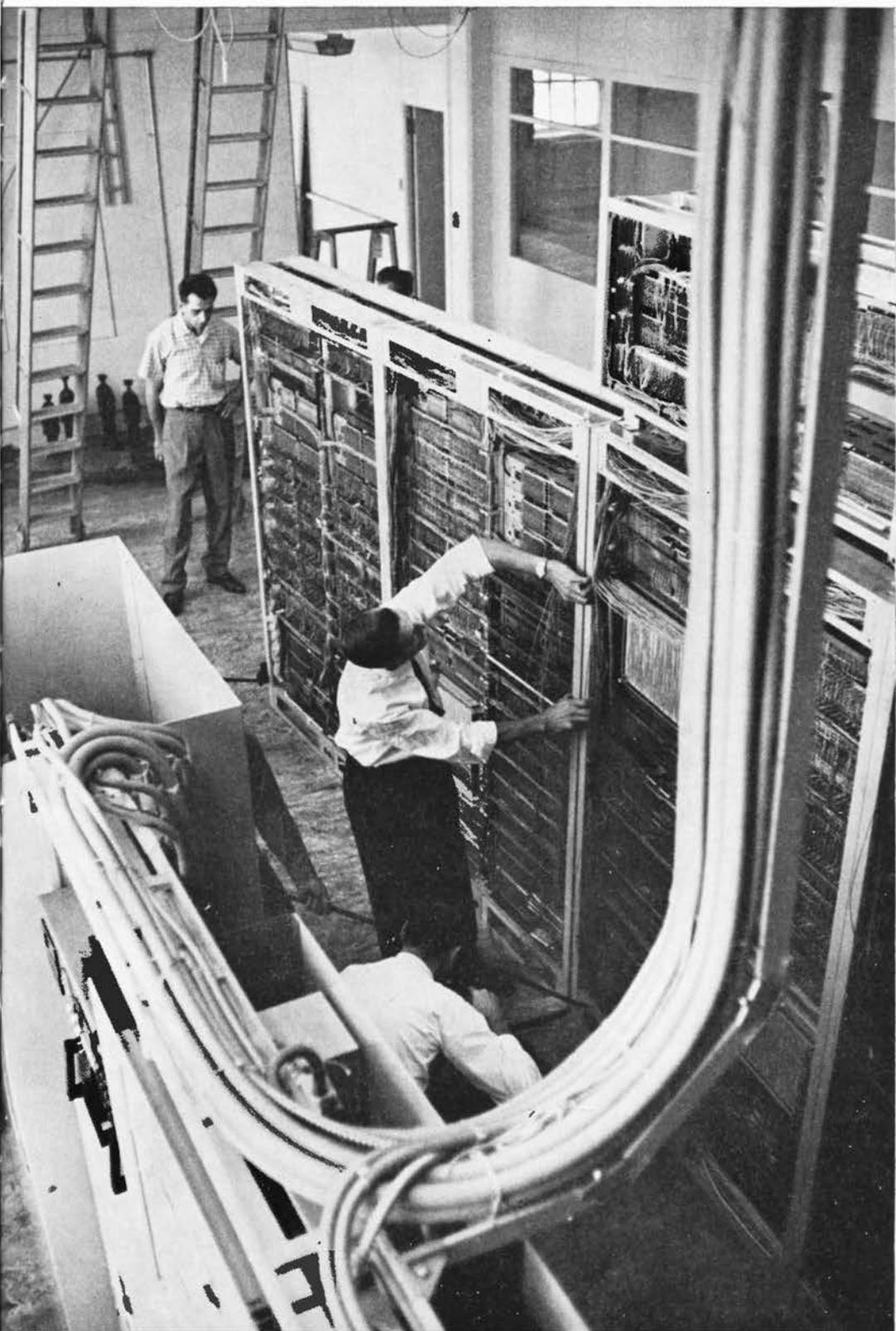
### **Faster Long Distance Calling**

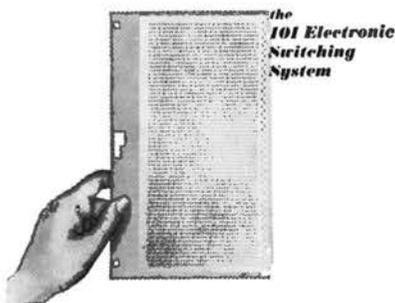
The new system is also ready to save you time in placing your long distance



*After it is unpacked, equipment for the technical test is moved into position.*

*Installation of the control unit of the 101 ESS equipment in the New Brunswick central office of New Jersey Bell. It is now under technical trial by Bell Laboratories.*





calls. There is no longer need to go through the attendant who used to keep a record of your calls. You dial your calls directly and you receive a bill each month for those which originated from your extension. This is made possible by the AIOD (Automatic Identified Outward Dialing) portion of Centrex Service which works in conjunction with central office billing equipment. In order to further expedite your long distance calls, you may dial an abbreviated group of three digits instead of the usual ten or eleven for those numbers most frequently called.

The features that have been described are typical of those which might be provided broadly throughout a small organization. Several others are also available. In addition, the executive group and their secretaries may have more elaborate arrangements in conjunction with existing key telephone systems and Call Director telephones.

The photograph on page 12 illustrates the console from which calls may be completed with a minimum of attention from the attendant. A part of her time is now released to serve, for instance, as a receptionist or as a part-time clerk. In the background is the remainder of the equipment which is located at the customer location. These compact cabinets have a capacity for up to 200 lines with high calling rates. It makes no noise and is designed to blend in with the other office furniture.

### Centralized 'Brain Work'

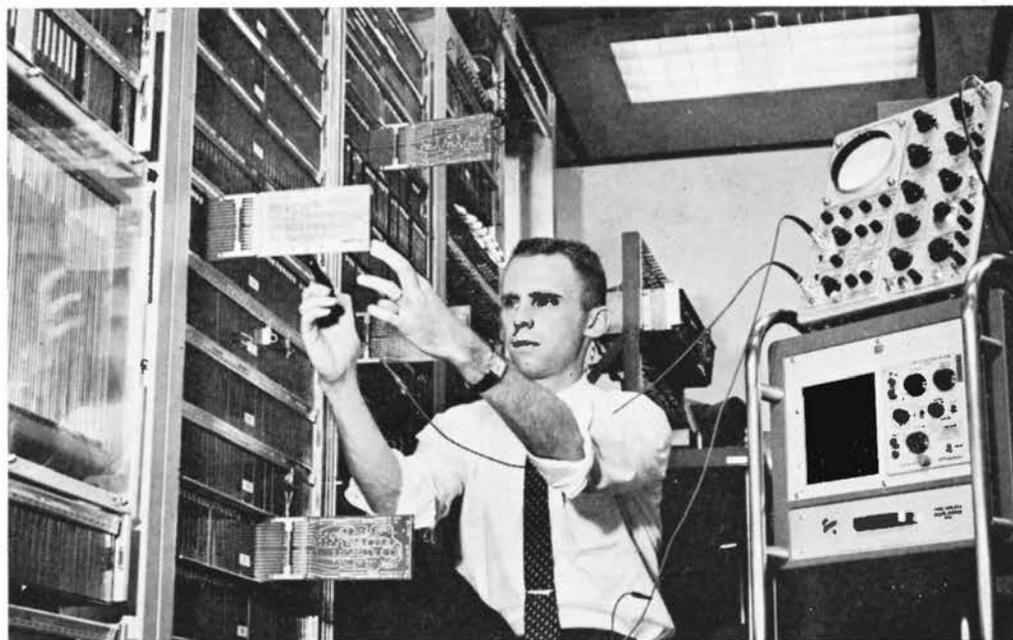
This new system has been made possible by recent advances in electronics, including new types of semiconductors and solid state memory devices. Contributing to the small size of the customer's switching equipment cabinet is the organization of the system, which is that most of the "brain work" is done by a centrally located call processing unit. This unit,



*Final wiring checks are made on experimental switching unit.*

which is located at a neighboring central office, is shown on page 13. It may serve as many as 32 businesses which are located within a radius of a few miles of the central office. Communication from individual business units to the central unit is by way of data transmission links.

The central processor is notified when you pick up the handset, and it interprets the numbers and special codes which you dial. It quickly conveys to your local equipment the information needed to make the proper connections. By the central organization of the system, the advantages of a modern, highly flexible switching system are made available to the small business. Because of the high speed operation of the system, there is no disadvantage at all to the individual business customer in sharing the time of the central processor with other customers.



*Tests are made on the control unit at Bell Telephone Laboratories' Holmdel Laboratory during the development stage of the 101 ESS project.*

A further advantage of the central organization is that the various special services which are tailored to the individual business, such as abbreviated dialing, may be initiated or changed at the central point. This eliminates the need for visits to the individual locations to change this information. It is done merely by removing from the equipment a metallic card, shown on page 10. This card is part of the new twistor memory. On it are "printed" over 2,000 tiny magnets. By placing this card in a special machine and energizing the magnets in a particular manner, we can effectively "write" onto the card, for instance, the information needed for abbreviated dialing. When this card is replaced in the central processing equipment, this information might permit you to dial a three-digit code and cause the machine to dial a number such as 9-311-555-2368.

Not all the features which have been described are unique to this new No. 101 ESS. Some are available now in more conventional PBX's. Others will become

available by modifications of existing equipment, but this system embodies a much greater number and variety of service features than has been previously available in a single system. In addition, it furnishes the flexibility of "writing" into the machine the information necessary to provide new services, some of which have not yet been considered. The ability to make a complex machine respond to your present and future wishes and needs, merely by "telling it" what to do rather than by rewiring or rebuilding it, is the beginning of a new era in providing additional telephone services promptly to our business customers.

This system is now under technical trial in the New Jersey Bell area in New Brunswick by members of Bell Laboratories who have participated in its design. Later, it will provide service to two commercial customers in the New Brunswick area. Other systems are scheduled for production by Western Electric and will be installed in other areas for service in 1964.