



***Fast and direct.** The TRANSACTION™ telephone is compact and modern. Card storage slots at the back of the set hold the various dialing cards. Just in front of the storage slots is a slot containing the magnetic-stripe card reader. The user communicates with a central computer via the buttons on the set, and listens for the computer's response on a TRIMLINE® hand set.*

Merchandising, banking, and many other enterprises stand to benefit from the quick, efficient, and economical access to customer records afforded by the TRANSACTION telephone, which links clerks or customers to a central computer.*

TRANSACTION* Telephone

Gets the Facts at the Point of Sale

V. SCOTT BORISON

THE "CASHLESS SOCIETY" is proving a mixed blessing to business people. Deluged with credit and courtesy cards—consumers hold more than 500 million—merchants and bankers need faster ways of verifying customer accounts. To satisfy that need, scientists and engineers at Bell Laboratories have developed the Transaction telephone.

To use the Transaction telephone for credit authorization or check verification, a clerk lifts the receiver and slides a magnetically encoded dialing card through a reader on the back of the set. The dialing card contains the telephone number of the remote data center that the set will dial and a number identifying the point of sale. The clerk then slides the customer's card containing the customer's number and expiration date through the card reader. While the set is automatically dialing the number of the data center, and the connection through the switched network is being set up, the clerk punches in the amount of the transaction on a manual entry pad. The clerk

may also ask the customer to enter a personal identification number on an optional remote manual entry pad. This extra identification would ensure that a card could not be used by someone who stole or found it. At each step, the clerk is prompted by sequenced instruction lamps adjacent to written instructions on the faceplate.

When the call reaches the data center, a data set answers automatically and the Transaction telephone starts transmitting information that has been stored from the magnetically encoded cards and the manual entry pad. Shortly, the computer at the data center answers the inquiry via an audio response unit—a machine that assembles an answer from prerecorded human voice sounds using instructions from the computer. Ordinarily, the computer approves the transaction. Sometimes it may ask for more information which can be keyed-in on the manual entry pad.

The Transaction telephone is a versatile instrument. Besides its uses in credit authorization and check verification, it serves as a business telephone and, with specially encoded

*Trademark of AT&T Co.



Guidance. Sequenced lamps on the Transaction telephone faceplate guide the user by indicating the instructions for the next step. Usually the sequence illustrated here is followed: the dialing card is inserted in the magnetic reader, the cus-

tomers card is inserted, and the transaction amount is entered manually. Two lamps just to the right of the pushbuttons provide an alternative to a voice response from the computer; a green lamp indicates "yes" and an amber one indicates "no."

dialing cards, it can serve as a card dialer to dial frequently called numbers automatically. Card storage slots at the back of the set hold the various dialing cards.

For merchants who frequently call one data center, the set offers a "one-number repertory." This feature allows the set to store information from a dialing card for future use. In this case it is not necessary to re-insert the data center dialing card—only the customer card need be used to initiate dialing.

Applications for the Transaction telephone vary from inventory control to checking balances on customer accounts. Appropriate instructions may be printed on the face of the set next to the lamps that tell a caller what step to take next.

There are other applications in which a detailed response is not required, but where a simple yes or no answer will be sufficient. For these applications two response lamps—for "yes" and "no"—are provided on the face of the Transaction telephone. The lamps are operated by signals from the data center.

Because over 200 financial institutions in the United States now have audio response units, these firms can make immediate use of the Transaction telephone. Often the set can fit right into an existing system with little hardware or software change. Until now many banks and data centers have been using card dialers or TOUCH-TONE® telephones in these systems. Now, by using the Transaction telephone, they can reduce their error rate, reduce computer port time (the time that individual lines to the computer are tied up), and save their clerks' time. The time is saved because the Transaction telephone temporarily stores information, allowing data to be keyed-in during the time the set is automatically dialing a telephone number and the telephone connection to the data center is being set up.

Market Study

The trigger for the start of the project was an inquiry to Bell Laboratories from Ohio Bell in May, 1972. The features of the Transaction telephone arose from a market study and product trial begun in the fall of 1973. The trial was begun to give Bell Laboratories engineers direct experience with this type of equipment and to help evaluate compatibility with data center procedures and software. In the trial, a total of 33 preliminary-design Transaction telephones were installed in 13

merchant locations in Ohio for purposes of credit authorization.

The Transaction telephone was used concurrently with an existing system in which a clerk looked up a prospective customer's number in a warning bulletin. If the sale were for a sufficiently large amount, the clerk placed a call to the credit authorization center. At the center, an attendant answered the incoming call and typed information received from the clerk into a computer terminal. Upon receiving response information on a display, the attendant gave the information to the clerk. (This method is typical of credit authorization procedures in use today.)

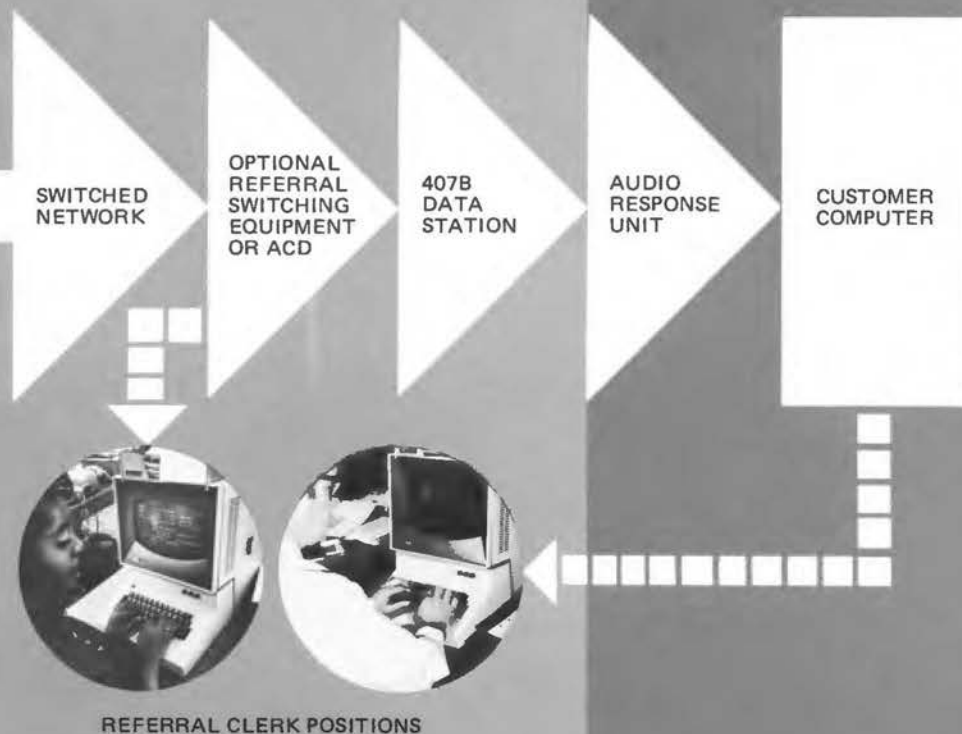
In a five-month period over 25,000 transactions were completed. Merchants were satisfied with the Transaction telephone because it gave them a quick and reliable way to authorize credit sales. The credit authorization center was also satisfied because the set was economically justifiable and could reduce credit card fraud. The two-card approach with a dialing card and a customer card turned out to be easy for merchants to use.

The System

The Transaction telephone is intended to work in a system that includes a 407B data set, an automatic call distributor or a CALL DIRECTOR® telephone, and the switched telephone network, all provided by the Operating Telephone Company. The customer provides an audio response unit and computation facilities. To use all of the Transaction telephone's features, all of these components are required.

The 407B data set was designed concurrently with the Transaction telephone. The decision to use a 407-type data set was based on the desire to use Touch-Tone signaling as the means of sending data to the data center, to ensure compatibility with existing systems that use the Touch-Tone telephone. The 407-type data set converts Touch-Tone signals to logic signals for a computer or audio response unit and provides a voice path to the telephone line from the audio response unit. The set detects the ringing signal, answers incoming calls, and sends an answer tone to indicate that it is ready for data. The data set can also connect the caller to an attendant.

To accommodate the Transaction telephone applications, the new 407B data set will tell the calling clerk when the audio response unit is not working and will also provide a "terminal initiated referral" feature.



The system. The Transaction telephone system includes the switched network, optional referral switching equipment (such as an Automatic Call Distributor or Call Director set), and the

407B data set, as well as the Transaction telephone and customer-furnished equipment such as the computer, audio-response unit, and referral clerk positions.

In case the audio response unit is not working, the 407B data set automatically lights a "computer unavailable" lamp on the Transaction telephone. This response lamp is usually labeled "Follow Special Instructions." Such instructions—provided by the data center—might tell the clerk how to complete the transaction without data center assistance. Until now, many data centers have simply given the clerk either a "no answer" or a busy signal when the computer was unavailable.

The "terminal initiated referral" feature allows the clerk using the Transaction telephone to request an attendant even when the audio response unit or computer is unavailable. The clerk does so by pressing the ATTN button on the face of the Transaction telephone. When the 407B detects this signal, it alerts an attendant through referral switching equipment—either an Automatic Call Distributor (ACD) or a Call Director telephone.

The ACD (see *Meeting Business Needs with the No. 2B ACD*, RECORD, April 1975) pro-

vides a convenient means of referring calls to attendants. The call distributor queues incoming calls, concentrates referral requests, and notifies the computer via a Touch-Tone signal when an attendant is found. Alternatively, a Call Director telephone can be used.

The Transaction telephone can be operated without an ACD or Call Director telephone if users don't require the referral feature.

For ease in maintenance, a special Transaction telephone test-line station has been designed. This device, located in a central office, can test all of the features of the Transaction telephone automatically. To initiate a test the Transaction telephone customer calls a predetermined test line number using the Transaction telephone, inserts a special test card and presses in sequence all of the buttons on the manual entry pad. The test-line station monitors this information and responds with an indication of success or failure. If the test fails, the user can call the local repair service bureau to have the trouble corrected.



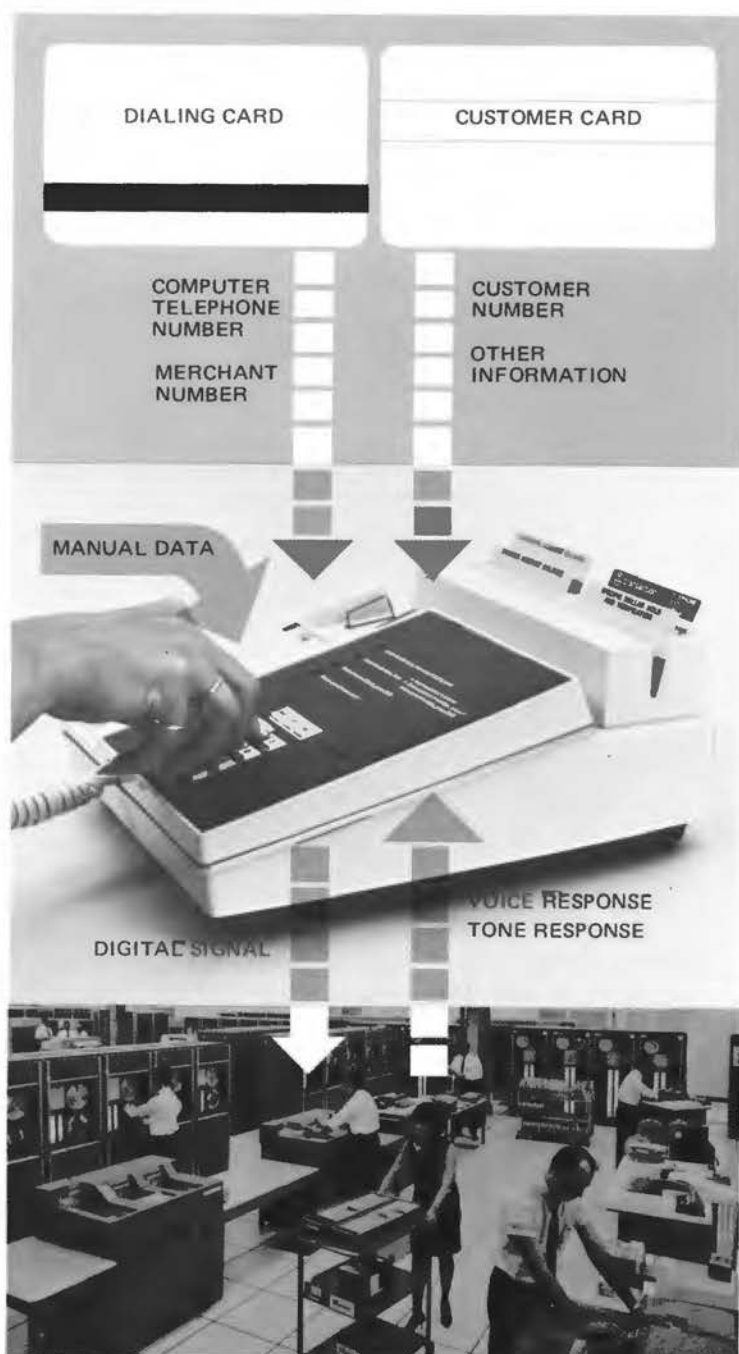
Clerks in the Hinky-Dinky grocery stores in Nebraska use Transaction telephones to withdraw and deposit money for customers having savings accounts with First Federal Savings and Loan Association of Lincoln, Nebraska. Here Margie Gunsolley, a customer in Lincoln, fills out a withdrawal slip and presents her card to the clerk.

Transaction telephone at work



The clerk, Bonnie Weimer, runs the dialing card and customer card through the Transaction telephone and, while the connection is made to a 407B data set, keys in the amount and type of the transaction.

Approval received, the clerk transfers the cash amount of the withdrawal to the customer. This type of service allows savings account customers to keep their money for everyday access and use in interest-bearing accounts.



Information flow. Information is put into the Transaction telephone through the dialing card, the customer card, and the manual data entry pad. An optional remote manual entry pad can be used which allows the customer to secretly enter a personal code. The data entered are stored and sent out as Touch-Tone signals when the data center is connected.

Development of the Transaction Telephone

Design of the Transaction telephone for production began early in 1974, with a goal of having sets off the production line in April 1975. At that time there were three important design decisions to make. What technology would be used for the set's logic function? What mechanical design and appearance would the new telephone take? And how could a magnetic-stripe credit card reader be designed that would require minimal maintenance over its lifetime and yet be simple and inexpensive to manufacture?

The choice of logic design was controlled by the time available to get the set into manufacture and the complexity of the functions required. Thus, a custom LSI (Large Scale Integration) design—in which thousands of logic elements are contained in a single custom-designed integrated circuit chip—was ruled out because of the limited development time available. An MSI (Medium Scale Integration) design would be ready sooner, but would require a large number of components and thereby pose reliability problems.

Consequently a design approach using a microprocessor was examined. A microprocessor is a general purpose LSI device in which specific logic functions are controlled by program steps stored in a Read Only Memory (ROM)—an easily designed custom logic chip. Thus, a circuit incorporating a microprocessor could be designed while the ROM was being developed. Development and production of the ROM each take relatively little time; the design task is similar to programming a computer. The microprocessor design is cost-competitive with the MSI design, and at the same time reduces the component count significantly, thereby improving reliability.

The microprocessor performs most logical operations in the set, which also includes additional components for timing, driving lamps and relays, generating the Touch-Tone signals, and decoding the data-set answer tone. Once it had been decided to use the microprocessor, the road was opened to expand logic capability without significantly affecting the cost of the set by adding program steps in the ROM. The "computer unavailable" lamp and the green (yes) and yellow (no) response lamps could then be provided at very small additional cost.

An existing housing, for which dies were already available, was selected for the Trans-

action telephone. This meant that development time could be greatly reduced. A TRIM-LINE® hand telephone set was used to provide voice communication even when local ac power fails.

The card reader posed a different problem. Previous card readers had complicated moving parts that either drew the card over the reading head or drew the head over the card. The new sliding card design, in which the user provides the needed motion, was developed and field tested in pilot installations of Transaction telephones. A slot contains the read head, moving parts are eliminated, and reliability is increased many fold.

The reader was designed to read the American Bankers Association stripe ("stripe two") used on the back of many credit and bank cards. A dialing card design similar to the stripe-two format was selected so that manufacturers of credit and bank cards could also make dialing cards. (It is intended that dialing cards for the Transaction telephone should be furnished by the same companies who make credit cards, and not by the Bell System.)

Transaction Telephones in Use

Commercial service began with 32 preliminary-design sets in October 1974. Transaction telephones have been installed as check verification terminals, as teller terminals, and as customer inquiry terminals. In one installation, Transaction telephones are being used by a savings and loan association as electronic funds-transfer terminals.

As check verification terminals, Transaction telephones were installed in grocery store courtesy booths. Grocery store customers who want to cash checks present their magnetically encoded check-cashing cards along with the checks. An attendant then uses a dialing card in the Transaction telephone to call the audio response system at the bank to verify that the account has sufficient funds to cover the check.

As teller terminals, Transaction telephones are being used for the exchange of information between the teller and the record-keeping computer in a savings and loan institution. Here, the teller fills out a receipt for the customer after using the Transaction telephone to update the computer files.

A similar approach is used in the electronic funds-transfer application where Transaction telephones were installed in June 1975. Here,



Account balance. Customers of Central Trust Company in Cincinnati use Transaction telephones to check the balance in their checking and savings accounts. Here, Carolyn Chitwood of Cincinnati Bell runs her bank card through the card reader and keys in her personal code. She will soon hear the balance over the audio response system. An advantage of the audio response is that only the customer can hear a balance, whereas anyone nearby could see a visual display.

a person who wants to make a deposit or withdrawal in a savings account presents a card to a clerk at a grocery store courtesy booth. Transaction telephones are then used to transfer information to, and get information from, the savings bank's computer.

As an inquiry terminal, a number of Transaction telephones have been installed in bank lobbies. Individuals who want to find their checking or savings account balances need only lift the receiver on the Transaction telephone, insert the proper dialing card and the customer card, and key-in a personal identification number. The balance is then given over the phone.

From these few applications it is evident that the Transaction telephone already has a wide range of applications. The Transaction telephone can be regarded as a card dialing telephone with special memory capabilities, and is intended to facilitate or speed up any kind of a transaction requiring both a telephone connection over the ordinary switched voice network and information magnetically encoded on a plastic "credit" card. With these capabilities, it seems likely that as customers become more familiar with its advantages, an even greater range of applications will evolve and that usage will grow proportionately. □