The "phone away from home" is now being subjected to an intensive program of studies. New coin mechanisms and modern techniques promise to make the well known public telephone an even more attractive, efficient and useful instrument.

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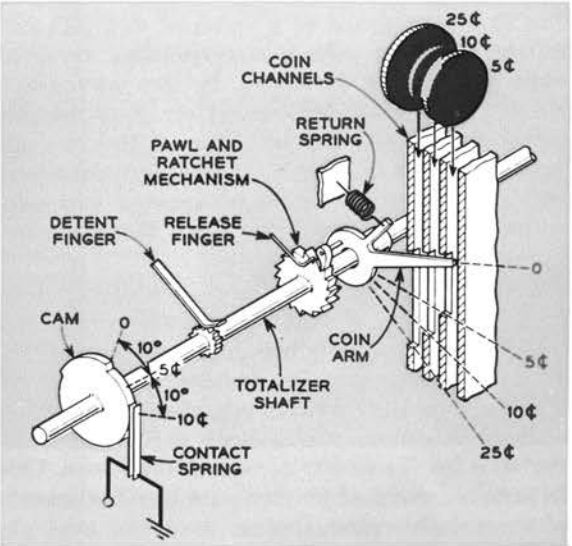
A New Coin Telephone

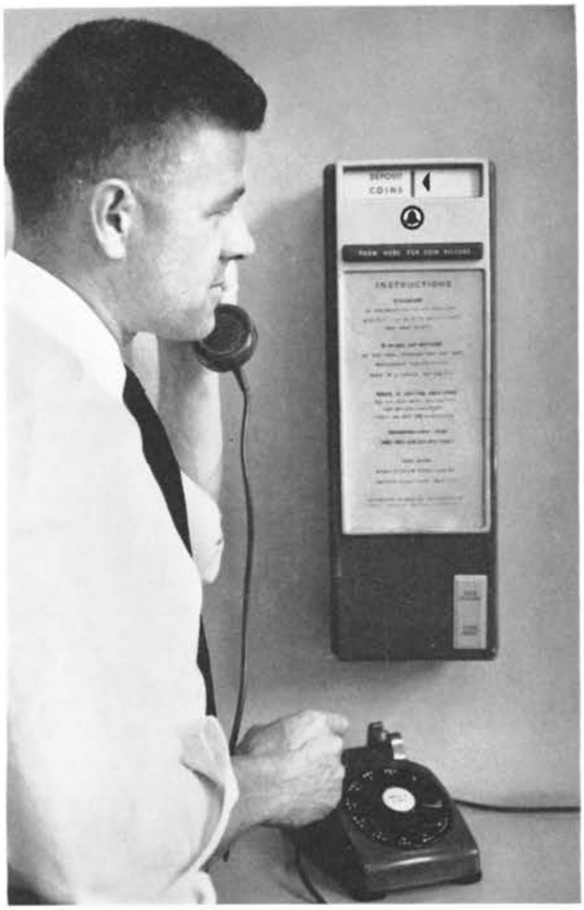
Some time during the coming year the total number of public telephones in the Bell System will reach one million. This millionth coin-operated telephone may be installed in an outdoor booth, a "drive-up" booth, an indoor unit, or on the wall of a business or public establishment. It will symbolize the great extent of this type of service, which, except for the war years, has been growing continuously. This growth record is evidence that public telephones serve the American public well and produce sufficient revenue for the Operating Companies to warrant continued studies directed toward further improvements in service.

The first major post-war improvement in coin telephones was a new coin chute, introduced in 1947. This new chute was given a high priority when it became evident that rapidly rising costs would require higher basic rates for coin service. Other changes in the familiar design included a push button for clearing out coins, and a "pull-bucket" arrangement for the refund opening.

It was long recognized that other improvements should be introduced in the coin telephone. The basic instrument and circuit had its origin in the early days of telephony, and many of the mechanisms and circuits were designed for methods of manufacture and operation existent at that time. The post-war development effort perforce was directed toward necessary immediate modification of the existing plant, and did not satisfy the need for an over-all new design. More



Details of the "read-in" portion of the new coin totalizer. Basic operation is to rotate totalizer shaft in proportion to amount of deposit. Rate can be adjusted by repositioning cam at left.



The author demonstrating an appearance model of the new design coin telephone. External appearance of coin unit was styled by Henry Dreyfuss.

recently, therefore, a complete re-evaluation of all parts of coin telephone apparatus and operation has been undertaken.

The systems, transmission and apparatus problems of providing public telephone service have now been studied intensively. This effort resulted in the development and construction of laboratory models of coin telephone apparatus containing many new features. These devices and circuits were assembled in an exploratory coin telephone and were placed on trial for study in Woodbridge, New Jersey, during the summer of 1958. The units, installed for public use on a test basis, gave the necessary opportunity to observe use of the equipment by customers and operators. The results of this study of the new features were favorable. The coin telephones tried at Woodbridge were the forerunners of an entirely new coin set presently being designed for production at the Indianapolis location of Bell Laboratories. An appearance model of the new design, styled by Henry Dreyfuss, is shown in the accompanying photograph (*left*).

The procedures for placing a call from a public telephone are so well known that a requirement for any new design is to leave them unchanged so far as possible. For local calls, prepay service would be continued, with dial tone withheld until after the correct deposit is made.

A second requirement in the new design is more flexible control of the basic rate—that is, the amount the user must deposit to get dial tone and dial his call without the assistance of an operator. Convenience of adjusting local rates is one advantage, of course, but another consequence of flexible rate control is new possibilities for automatic dialing of multi-unit calls. One application, for example, is the placing of special coin telephones along highways so that travelers can directly dial a considerable distance into the next large city.

For this purpose, a new "coin totalizer" device was developed. This is an electromechanical mechanism assembled on the lower section of the coin chute. It can be adjusted in 5-cent steps for any basic rate up to 25 cents merely by changing the position of a cam, or, depending upon the exact design, by using different cams. In the drawing opposite a cam can be seen mounted on the left part of a shaft included in the mechanism.

This illustration shows some of the details of the "read-in" portion of the totalizer. Coin channels *(right in drawing)* guide the nickels, dimes and quarters to strike a coin arm which protrudes into an opening in the channel plates. The falling coin causes rotation of the arm assembly about the totalizer shaft. After a small initial rotation, a ratchet mechanism is engaged, and the arm assembly and totalizer shaft rotate together. Then, after the coin leaves the arm, the arm assembly returns to the start position, drawn by the return spring. The totalizer shaft, however, remains in the rotated position, held by the "detent finger" seen beside the cam. The angle through which the shaft advances is equivalent to 10° for a nickel deposit, 20° for a dime and 50° for a quarter.

In this particular drawing, the cam is arranged to close a set of contacts after 20° of rotation, or 10 cents. At this point, the problem is to "count" the amount deposited by resetting the totalizer shaft — that is, by rotating it back to its original position. For this purpose, a self-stepping relay *(not shown in the drawing)* is brought into play. In stepping the totalizer shaft back to its start position, this relay operates once for each 10° (5 cents) of rotation. The customer

This arrangement demonstrates how trial models of new coin-telephone work. The author, left, holds handset that is comparable to operator's headset, and L. A. Strommen holds new coin-signal network in his right hand.

hears dial tone only after the shaft reaches the start position.

A third requirement for the exploratory development is to improve the coin signals. Instead of using the traditional "gong and chime" type sounds to identify nickels, dimes and quarters, it was desirable to develop a system that would be more adaptable to automatic methods. In the new set, a transistor oscillator is switched on briefly each time the stepping relay operates.

Tone Signals

For example, suppose a user has deposited 10 cents (either two nickels or a dime). In "erasing" this amount, the stepping relay operates twice; thus, it triggers the oscillator twice and sends two "beeps" to the central office. Thereafter, if an operator helps establish a longer-distance call, she hears one "beep" for a nickel, two for a dime, and five for a quarter. These signals are electrically more discrete than the older gongs and chimes, and therefore are more easily incorporated into systems of direct distance dialing from coin telephones, where no operator would be required.

The next drawing *(right, below)* is a block diagram of the trial coin-telephone circuit. The rate cam is designated T_1, and T_2 is a totalizer contact that short-circuits the telephone set whenever the totalizer is storing information on coin deposits. If two nickels are used to start a local call, T_1 and T_2 first advance to their 5-cent positions, and the coin-relay contact *(bottom part of the diagram)* closes. At this point the central office places battery and dial tone on the line, but this tone cannot be heard in the receiver and the number cannot be dialed. When the second nickel is deposited, however, short circuits are removed from the telephone set and from the stepping relay. The rate relay *(center of the diagram)* operates and the totalizer shaft is reset. The rate relay then remains operated for the duration of the call and permits the totalizer to be reset immediately after any subsequent deposit of coins. Each time the stepping relay operates, the coin-signal network is energized to produce a pulse of tone.

The coin-signal network is also shown in schematic form on the next page. The transistor is arranged in the common-emitter configuration with a tuned collector circuit. Inductors L_1, L_2 and L_3 are wound on a common core. When a voltage is applied across the telephone line, the oscillator is triggered, and feedback from L_1 to L_2 sustains oscillation. The output appears across L_3 in the line. Components were mounted on an etched-wire board and encased in epoxide resin.

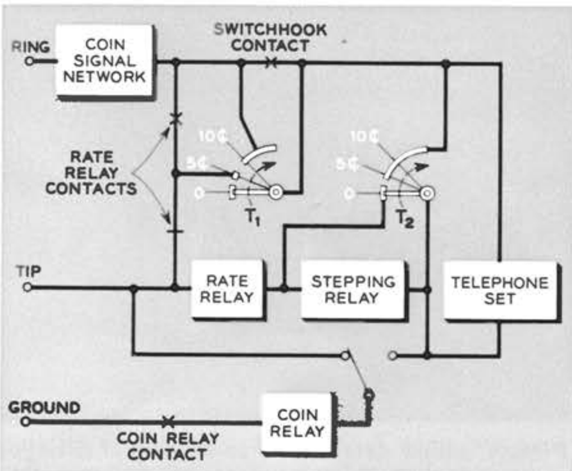
Laboratory and Woodbridge tests were conducted to find acceptable values for the coin signals. A tone of 1016 cps was used, with each pulse lasting about 50 milliseconds. The signals were easily recognizable at pulse rates of 10 to 15 per second. Studies are continuing to determine the optimum signal.

A fourth major improvement was the development of coin mechanisms that would reject a high percentage of slugs and spurious coins. In the exploratory unit, the upper section of the coin chute contains such mechanisms, and has a single opening for accepting nickels, dimes and quarters.

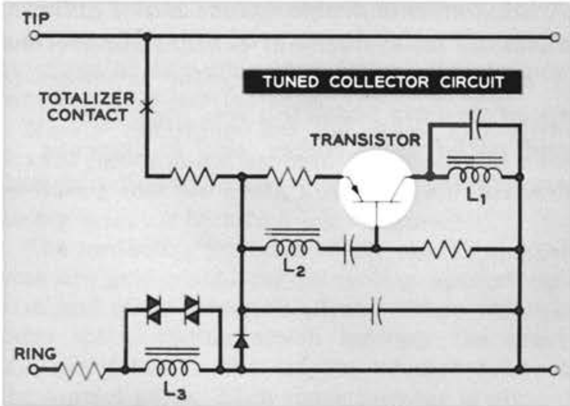
All inserted pieces are tested to detect washers and to determine weight, thickness, maximum diameter, minimum diameter and ferromagnetic properties. Another coin chute under development will also test for eddy-current properties and will give additional protection against fraud.

The new design introduces a clear-out feature whereby the customer operates a bar to have coins returned. In existing coin telephones, rejected pieces drop right through to the refund receptacle, but in the new design, such pieces are trapped in the chute until the customer presses the bar. This new procedure permits better rejection techniques, a saving of space, and more effective clearout of slugs.

A fifth objective — improved coin disposal — is now possible becaues of a new coin relay developed at the Indianapolis Laboratory (RECORD, *November*, 1959). This relay provides a replacement mechanism for existing coin telephones, and preliminary models were used in the equipment for the Woodbridge trial. It permits operation of a coin telephone at a greater distance



Block diagram of trial circuit. Contacts T_1 and T_2 add amount deposited; stepping relay "counts" the amount by stepping totalizer shaft back to its original position and sending out tone signals.



Schematic of coin signal network. Transistor oscillator generates pulse ("5 cents") whenever voltage is applied to line, left, by coin deposit.

from the central office, and is both more reliable and more economical than the coin-disposal unit it replaces.

The functions of storing coins after they are collected, and of tranferring them to the refund opening, were also considered in the studies. A larger and more secure cash compartment was tested in the laboratory, along with a more tamper-proof device covering the refund opening. These were new, untried designs, however, and have been reserved for future field testing.

Twelve exploratory models were used in the Woodbridge trial. In brief, they indicated that the new operating method, with a single slot for all coins, was practicable. The need to operate the "coin-return bar" to retrieve rejected coins did not appear to be objectionable. Reaction to the new coin tones was generally favorable, with indications that the new type signals would be increasingly satisfactory with larger percentages of the station plant operating on that basis. Subsequent to this trial, the Indianapolis group began further development work aimed at refining the components and designing an entirely new enclosure. This phase of the work will consider the security aspects of coin-set design required to minimize loss through theft, damage and fraudulent operation.

For the more distant future, the Laboratories, in cooperation with the Customer Products group of the American Telephone and Telegraph Company, is studying many new ideas for further improvements in public telephone service. Among these are credit-card operation, change-making devices, and more efficient and comfortable booth facilities. In this way, we intend to continue the fine record of offering excellent service at the "phone away from home."