

Human Errors and the Dial Telephone

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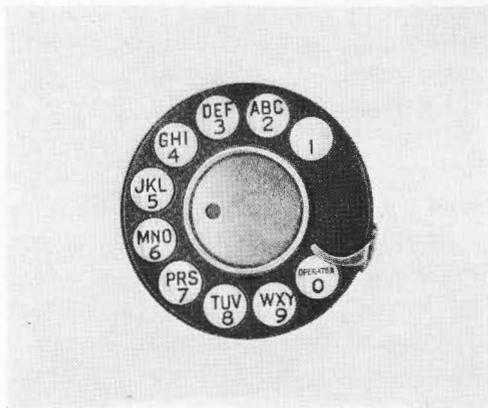
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DRAWING or making meaningless marks on a memorandum pad is a commonplace diversion while using the telephone, particularly while one is waiting for the person called to answer or to get some information. Spinning the dial, if a dial telephone is being used, is equally instinctive; it is an attractive and apparently harmless occupation for idle fingers. Turning the dial, however, momentarily breaks the circuit and would cause a disconnection had not such a possibility been fore-

during the return of the dial to normal position, opens the line circuit once for each numbered position that the dial moves. The opening of the line is an indication that the conversation has been completed and that the circuits associated with the call can disconnect. Since rotating the dial causes a series of line-opens the result of idly playing with it during a conversation would normally be a disconnection.

The disconnect signal in the manual system is caused by holding down the switchhook which lights a lamp in front of the operator. When the subscriber moves the switchhook up and down rapidly, however, a series of short flashes results which the operator knows is not a signal to disconnect, and she listens in on the line to discover what is wanted. To simulate the manual operator in this respect it is necessary to arrange dial-circuits so that momentary line-opens can be tolerated.

In the panel system* a definite time interval has been introduced through the action of an interrupter which guards against disconnection on short line-opens but yet recognizes long line-opens as a disconnect signal. The time interval is such that a line-open must be in excess of a quarter second



The dial, as it looks to the subscriber

seen by the designers of the system and steps taken to prevent it.

Mounted back of the dial, and controlled by it, are two sets of springs with contacts. One of them, operated at the first movement of the dial away from the normal position, by-passes the transmitter and cuts the receiver out of the circuit; the other, operated

* This article deals only with the panel system; analogous precautions embodied in the step-by-step system will be described in a future issue of the RECORD.

in order to cause disconnection. It would be desirable to permit a longer period, but, due to variations in the apparatus, it is not practicable to do so and at the same time insure that a subscriber will not meet with delay in originating another call.

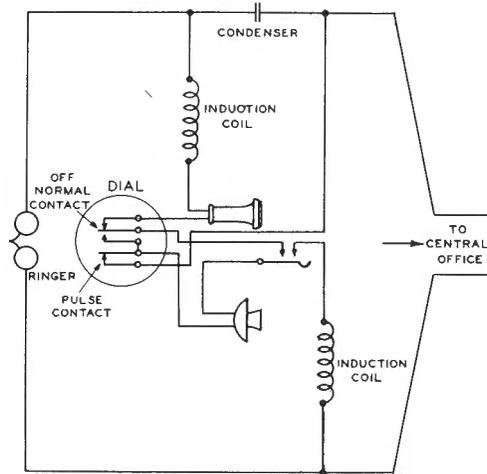
The time interval introduced does not, of course, prevent all possible disconnects due to short line-opens but reduces the number of them and eliminates particularly those which are most likely to be accidental.

When dialing a number with a repeated final digit such as Chelsea 1000, it is quite possible for the subscriber to become uncertain regarding the number of zeros so that in many cases an extra one is dialed. Here again if it were not for the time-delay feature preventing disconnect, the line-opens caused by dialing an extra digit would result in a disconnect. As it is, however, any final digit may be repeated without causing trouble.

This is only one of the many possible human errors in dialing that have been foreseen and forestalled by building into both panel and step-by-step systems special mechanisms to lighten the subscriber's responsibility. To better understand how this is accomplished in the panel system it will be necessary to take a bird's-eye view of the operation of completing a call.

When a subscriber in a manual office removes the receiver from the switchhook a lamp associated with the line is lighted at the switchboard. The operator answers by plugging a cord into the jack indicated by the lamp and switching the talking key so as to obtain the desired number from the calling subscriber. In the panel system the first operation, similarly, is to find the calling line. This is accomplished by a "line finder"

which, associated with a district selector, corresponds to the operator's cord. The district selector in turn connects to a sender, and this entire group of operations is usually completed before the subscriber can lift the receiver to his ear. The sender corresponds to the operator and re-



Wiring diagram for subscriber's set showing how dialing opens the circuit

records all the information required for completing the call. A relay in the sender circuit is bridged directly across the subscriber's circuit and pulses caused by the opening and closing of the dial contacts are transmitted by this relay to a registering circuit which records each digit dialed.

A subscriber, due to some mishap such as dropping the desk stand immediately after removing the receiver from the switchhook, may flash the receiver hook before dialing the first digit. This causes a momentary opening in the circuit and is equivalent to dialing 1. The digit 1 is now falsely recorded in the sender circuit so that a wrong number would result. The subscriber probably does not realize what has occurred and continues dialing. The sender circuit, however,

has been arranged to cancel this first false pulse. This is made possible by designing the sender registering circuit so that if a 1 is dialed as the first digit of an office code the following digit instead will be recognized as the first.

Instead of recording all the dial pulses caused by the second operation of the dial, the first pulse is cancelled and the remaining pulses are added to the 1 which is already recorded. Thus if a 1 were dialed followed by a 5, only four of the five pulses from the dial would be used, and these added to the 1 already recorded would result in a correct registration of 5. This makes it possible for the subscriber to obtain the correct number even though a false pulse has been sent prior to dialing the first digit of the office code. It eliminates, however, the possibility of having an office with 1 as the first digit.

Another error likely to occur during dialing is caused by confusing the letter O with the number o. The ten positions of the dial are numbered consecutively from one to nought and eight of them, two to nine inclusive, have each three letters in addition, Q and Z alone being omitted. In large areas each subscriber's number requires seven or eight dialing operations, three to locate the central office for which the letters are used, and the remaining four or five to locate the subscriber within that office. If a call were to be made to an office such as Monument which contains an O in the first three letters the subscriber might easily dial the number nought in place of the letter O. The correct office code would be the equivalent of dialing 666, each operation of the dial making six successive breaks in the cir-

cuit, but if the number o were dialed in place of the letter O the resultant office code would be 6o6, so that the second dialing operation would make ten breaks in the circuit.

Although the subscriber alone is responsible for this, it is advisable to make such an error harmless. The difficulty has been overcome by designing the sender circuit to recognize the letter O—six breaks—or the number o—ten breaks—when dialed as part of the office code, as being identical. This makes it possible for the subscriber calling a person in the Monument office to dial 6oo, 6o6, 66o, or 666 as the office code and still be directed to the proper office. This same immunity can not be given when the number o is dialed in error for the first letter, as the number zero is reserved to call the operator; the subscriber's service is safeguarded, however, by the operator being brought in on the connection.

The foregoing gives some idea of the various small details that must be considered in attempting to render better telephone service. The effort has been made not only to develop a system that will work satisfactorily if it is handled correctly but one in which no likely mistake in the use of the dial can cause inconvenience to the subscriber.

The foregoing gives only a few of the human errors possible in dialing and explains how they are rendered harmless in the panel system. Similar methods are used in the step-by-step system to accomplish the same purpose. The effort has been made not only to develop a system that will work satisfactorily if it is handled correctly but one in which no likely mistake in the use of the dial can inconvenience the subscriber.