Oct. 2, 1928. 1,685,835

H. M. BASCOM ET AL

PROGRAM SELECTING ARRANGEMENT

Filed Dec. 22, 1925 2 Sheets-Sheet 1

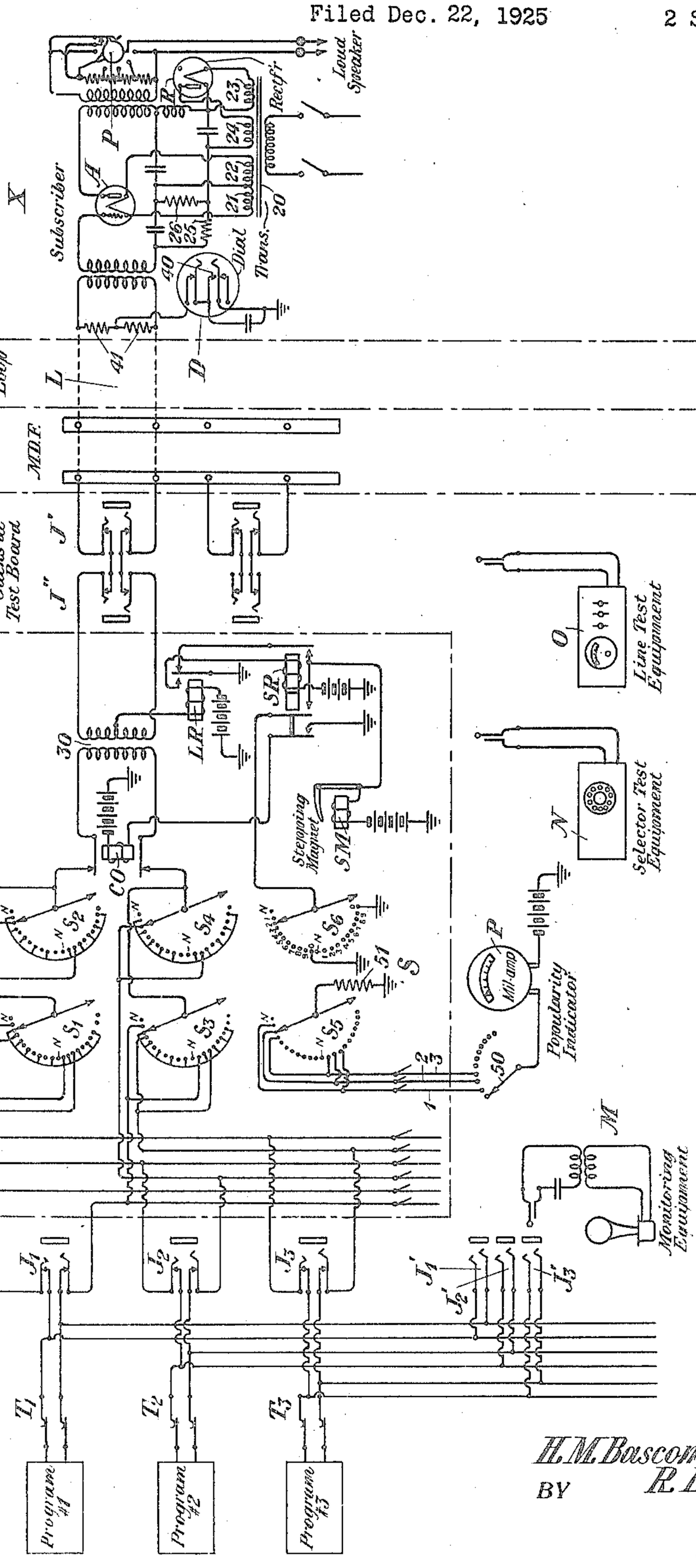

Fig. 1

INVENTORS
H. M. Bascom, O. M. Arnold and
BY R. L. Pentland
ATTORNEY

Oct. 2, 1928. 1,685,835

H. M. BASCOM ET AL

PROGRAM SELECTING ARRANGEMENT

Filed Dec. 22, 1925 2 Sheets-Sheet 2

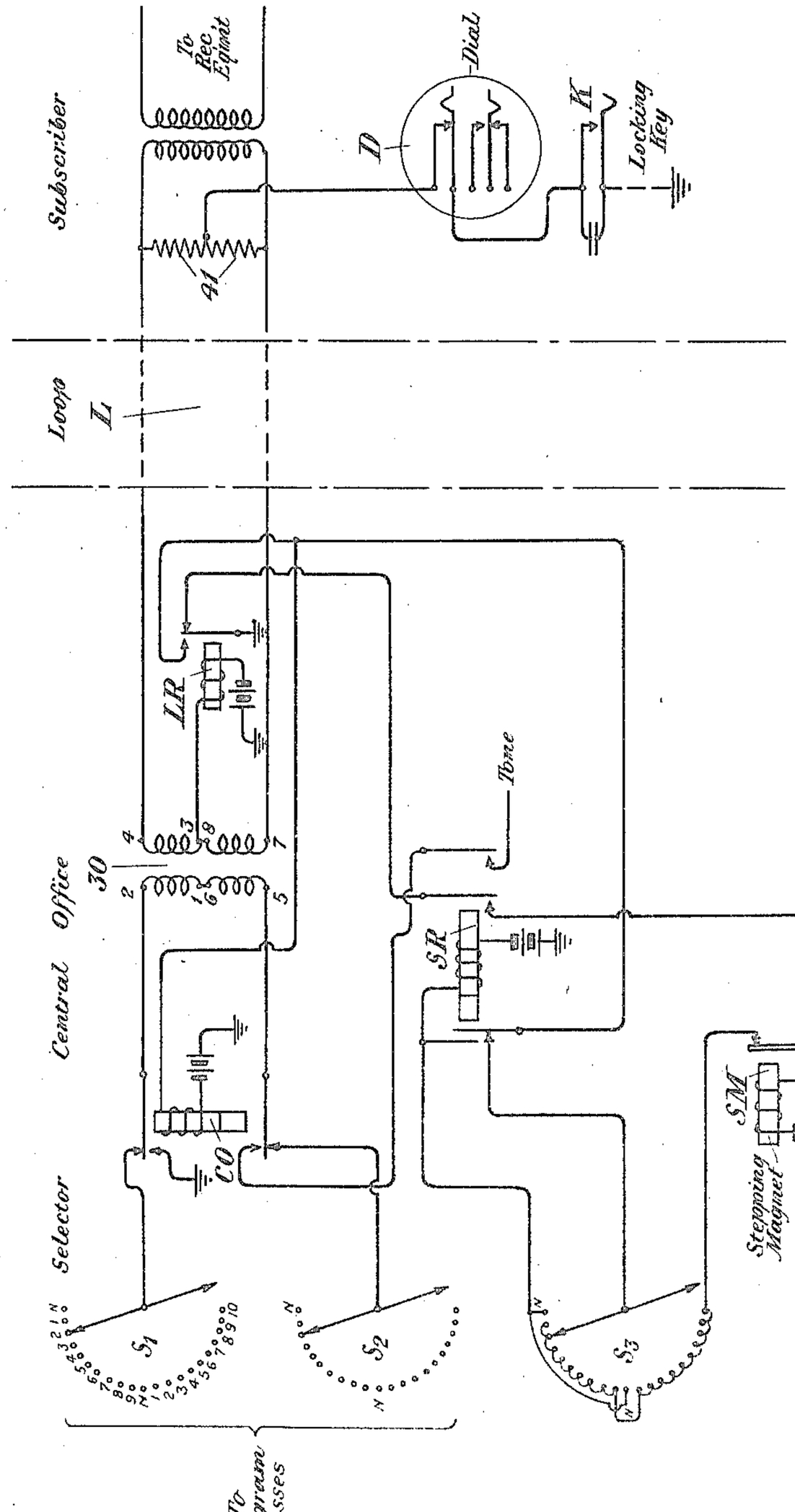

Fig. 2

INVENTORS
H. M. Bascom, O. M. Arnold and
BY R. L. Pentland
ATTORNEY

Patented Oct. 2, 1928. 1,685,835

UNITED STATES PATENT OFFICE.

HENRY M. BASCOM, OF BROOKLYN, OSCAR M. ARNOLD, OF LEONIA, AND ROBERT L. PENTLAND, OF BROOKLYN, NEW YORK, ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

PROGRAM-SELECTING ARRANGEMENT.

Application filed December 22, 1925. Serial No. 77,116.

This invention relates to systems for transmitting programs over wires, and more particularly to arrangements for permitting a subscriber to select the program.

In a system for supplying a subscriber with news, music, entertainment and the like over wires, it is desirable that more than one program be available to the subscriber at a given time, and consequently, some method of selection under the control of the subscriber becomes necessary. It has been proposed that the subscriber be provided with a dial to operate step-by-step switches to select the program in a manner analogous to that employed in machine switching methods of connecting telephone subscribers. The problem of dialing a program, however, cannot be solved by the direct application of machine switching methods, since certain special problems are involved due to the fact that when the switching operation is effected, a plurality of subscrbers' lines are connected in multiple to the same trunk, and also due to the fact that the receiving equipment used by the subscriber for program purposes is a loud speaker which would be very sensitive to ordinary dialing operations.

It is one of the purposes of the invention, therefore, to devise a system of dialing of such character that a minimum amount of interference between lines will occur during the operation of dialing due to the fact that a plurality of lines are connected to each switching point.

Another object of the invention, is to provide a dialing system which will produce a minimum amount of interference in the subscriber's loud speaker.

Another object of the invention is to provide a dialing system which will give an indication of the number of subscribers listening to any given program at any given time.

These and other objects of the invention may be attained by means of the arrangements set forth in detail in the following description and illustrated in the accompanying drawing, the figures of which illustrate two circuit arrangements embodying the principles of the invention.

Referring to Figure 1, L designates a subscriber's loop of a program distributing system, said subscriber's loop extending from a subscriber's station X to a central office Y. At the subscriber's station the line terminates in program receiving apparatus comprising a vacuum tube amplifier A having a suitable potentiometer P interposed between its output circuit and a loud speaker (not shown). The current supply for the amplifying tube A may be provided from an ordinary alternating current house system through a transformer 20, a rectifying tube R being provided for rectifying the alternating current. The filament of the amplifier A is energized by unrectified alternating current through windings 21 and 22 of the transformer 20, these windings being balanced with their terminals connected to the filament terminals and with their midpoint connected to the plate of the tube. The filament of the rectifier R is energized through the secondary winding 23, while the rectified current for the plate circuit of the amplifier A is supplied through the secondary winding 24 of the transformer, said winding being connected in series with the rectifier R. By means of suitable resistances 25 and 26, the proper operating potential may be applied to the grid of the tube.

At the central office Y, the line passes through the main distributing frame MDF and through the suitable test jacks J′ and J″ to a transformer 30, through which the program may be applied to the line. The primary circuit of the transformer 30 may be switched into communication with any one of several programs supplied over trunks T_1, T_2, T_3, etc., through step-by-step switching devices indicated generally at S. These switching devices may be operated by means of a suitable dial D at the subscriber's station, said dial being connected over a simplex circuit of the line L to operate a suitable line relay LR, through which the impulses for actuating the stepping magnet SM may be relayed.

The program trunks T_1, T_2, etc., are connected to the switching terminals of the switches, such as S, through cut-off jacks J_1, J_2, etc., whereby any group of subscribers may be disconnected from a given trunk as a group whenever such disconnection becomes desirable. The monitoring jacks such as J_1', J_2', etc. are associated with the trunks to enable the operator to monitor the program through a suitable monitoring equipment M. The jacks J′ and J″ are provided in order

that the operator may use selector test equipment and line test equipment schematically indicated at N and O, respectively. A popularity indicator P is provided for determining the number of subscribers listening to a program at a given time. This device will be described more in detail later.

The selective switching apparatus S comprises in effect two switching units s_1 and s_2, each having three rows of contacts arranged in the form of a semi-circle, so that wipers may be operated step-by-step by the stepping magnet SM to engage the various contacts successively. Each row of contacts involves two complete groups of contacts, each group comprising a normal contact and a set of ten switching contacts individually connected in multiple with the corresponding contacts of the other group so that when the wiper of the switch is advanced to any particular switching contact of the first group, it is restored to normal by being advanced to the normal contact in the second group. If the wiper is then advanced to another switching contact, it is restored to normal by being advanced to the end of the next quadrant, whereupon a second wiper comes into play and rests on the normal contact of the first quadrant. In this way, the restoring operation always takes place by a forward motion of the same character as the selecting operation.

The two selector bank units s_1 and s_2 are arranged to be operated from the same stepping magnet, and the various trunks are so wired to the contacts of the corresponding rows of the two switching units s_1 and s_2 that the even-numbered trunks will be connected to the even-numbered contacts of say the switching unit s_1, and the odd-numbered trunks will be wired to the odd-numbered contacts of the other switching unit s_2. The intermediate unwired contacts of each switch will be clipped short so that the wiper, in being stepped around, does not make contact with them, and preferably they will be wired together and grounded. This construction will reduce the interference during the switching operation due to leakage between adjacent contacts. That is to say, considering a given selector bank, as the wiper passes from a contact wired to a given trunk to the next adjacent contact, that contact will be dead and will not be connected to another trunk. Consequently, leakage currents cannot pass from a program trunk connected to the second contact across to the first contact of the trunk and thence to lines switched to the program trunk connected to the first contact, owing to the fact that there is no program trunk connected to the second contact. This method of wiring the switches, while it involves the use of two selector banks as compared with one, has the effect of doubling the distance between adjacent line contacts, while at the same time permitting the use of standard switches operated by standard step-by-step magnets taking the usual and necessary short steps. Further details of the invention will be clear from a description of the operation, which is as follows:

Assuming that the switching mechanism has been previously advanced to select some previous program trunk, and that it is desired to select a different program, the subscriber first manipulates the dial D to dial O. As the dial is moved off normal, the off-normal contact 40 is closed, so that ground is connected to the midpoint of the bridge 41, and the circuit is completed over the two sides of the line in parallel to the midpoint of the secondary winding of transformer 30, and thence to the winding of the line relay LR to battery. Line relay LR, upon being energized, completes a circuit over its front contact for slow release relay SR. Relay SR, in turn, at its outer left-hand front contact, completes a circuit for the cut-off relay CO which operates to disconnect the input side of the transformer 30 from the switching apparatus during the switching operation. This prevents the dialing impulses from being transmitted over the various switching contacts to other subscribers' lines already listening to the programs wired to those contacts. As soon as the dial is released, it returns and sends interrupted impulses to the line relay LR. The slow release relay SR holds up during these interruptions, and each time the line relay falls off, a circuit is completed over its back contact and the right-hand front contact of the slow release relay SR to the stepping magnet SM. The stepping magnet then proceeds to step the wipers at the switch banks in a counter-clockwise direction until the wipers rest upon the next zero contact of each bank. This will in general require less than all of the ten pulses of the zero group. When this point is reached, ground is connected over the zero contact of row s_6 and over the inner left-hand front contact of slow release relay SR to the winding of the stepping magnet SM. This holds the stepping magnet SM locked up during the transmission of the remaining pulses of the zero group of ten. At the end of the last pulse, the slow release relay SR releases and disconnects the ground from the stepping magnet, which, upon being released, advances the switch to the next contact, which is the normal or N contact.

The subscriber now dials the digit of the program desired. Again, as soon as the dial is moved off normal, the line relay LR is energized to pull up the slow release relay SR and again operate the cut-off relay CO. Upon releasing the dial, the pulses are again transmitted, and the line relay LR operates

the stepping magnet SM to advance the wipers to the particular contact desired. This will not result in connecting ground over row s_6 of the bank, since the wiper is being advanced at this time from its normal position, and hence would not be advanced as far as the zero contact.

It will be observed that during the dialing operation the impulses are transmitted over a simplex circuit. The subscriber's set may be connected to the line during this operation without causing the impulses to produce loud and annoying clicks in the loud speaker. Also, the cut-off relay is operated during each dialing operation to prevent the impulses from being transmitted to other lines connected to the program trunk which is wired to the contacts upon which the wipers of the operated switching mechanism rest at that instant. The wiring of the trunks to alternate contacts of the switch banks, as already described, will reduce and practically eliminate interference due to leakage between adjacent contacts at the time a switch is being advanced from one switching point to the next switching point.

At any time the operator may monitor the program transmitted over a given trunk by plugging the monitor equipment M into one of the jacks J_1', J_2', etc. The operator may also test the selector switches by plugging the selector test equipment M into the jack such as J''. This test equipment is of a type well known in the art and need not be described in detail. Similarly, the operator may make line test measurements by plugging the line test equipment O into the jack J'. These line test measurements and the apparatus used for making the tests are well known in the art and need not be described in detail here.

At any given time, an attendant may desire to know approximately how many subscribers are listening to a given program. For this purpose, the s_5 rows of the switch banks of the various subscribers' switching equipments at the central office are wired in multiple to a set of conductors 1, 2, 3, etc., leading to corresponding contacts of a hand-operated switch or dial 50. Each wiper corresponding to the s_5 row of the switch bank is connected through a resistance 51 to ground, and the wiper of the hand-operated switch 50 is connected through a suitable milliammeter P to battery. At any given instant, the resistances corresponding to 51 of all subscribers' switches which are connected to a given trunk, will be connected to the conductor 1, 2 or 3, as the case may be, corresponding to that trunk. The attendant, by moving the switch 50 to the contact corresponding to the trunk, will, by observing the reading of the milliammeter, be able to determine approximately how many subscribers are connected to the trunk in question, since the current flowing through the milliammeter will depend upon the number of resistances such as 51 connected in parallel to the conductor 1, 2 or 3, as the case may be.

The arrangement above described involves the restoring of the switching mechanism from a previous selection by dialing an extra digit, which in the case assumed was zero. A slightly modified arrangement of the dialing circuit is illustrated in Fig. 2, and in this form of the circuit the restoring of the switches is controlled by a special locking key K, so that the additional dialing operation is not necessary. In Fig. 2, the details of the subscribers' equipment other than the dial and its connections to the line are not illustrated and are supposed to be the same as those illustrated in Fig. 1. Likewise the network from the trunks to the switching equipment is omitted and the extra rows of switch contacts s_2 and s_4 are likewise not shown, in order to simplify the drawing. Here, also, it is assumed that the extra rows of contacts and the wiring to the trunks will be the same as in Fig. 1, and that the various jacks and testing equipment will be provided as in Fig. 1.

Further details of the circuit will be clear from a description of the operation, which is as follows:

Assuming that the switch has been previously advanced to select a particular program, and that the subscriber desires to select a new program, the locking key K is first actuated, thus connecting ground to the simplex circuit over the line L to energize the line relay LR. The ground connection of the simplex circuit is maintained as long as the locking key K remains locked up. As soon as the line relay LR is energized, it connects ground over its front contact to energize the cut-off relay CO, thereby disconnecting the primary winding of the transformer 30 from the switching terminals to prevent interference with other lines. The cut-off relay CO in this case is made slow to release so that its armature does not fall off during dialing impulses. The line relay LR also connects ground over the left-hand back contact of the slow release relay SR to the wiper of the row s_3 of the switch bank and through the various off normal contacts of said switch, over the back contact of the stepping magnet SM and through the winding of said magnet to battery. This causes the selector magnet to buzz and step the selector switch around to the normal terminal N. Upon reaching this terminal, the back contact of the stepping magnet SM is opened and a circuit is completed from ground over the front contact of the line relay LR, over the left-hand back contact of the slow release relay SR, normal contact of the s_3 arc of the switch bank and through the winding

of the slow release relay SR to battery. This energizes the slow release relay which is at once locked up over its left-hand front contact to ground at the line relay LR independently of the wiper of the third arc of the switch bank. A tone is now applied to the subscriber's line over the outer right-hand front contact of the slow release relay SR and the lower front contact of the cut-off relay. The subscriber, upon hearing this tone in his receiving set, knows that the circuit is restored to normal and that he may proceed to dial the desired program. Accordingly, he moves the dial off normal and upon releasing it, the ground circuit through the line relay LR, as previously described, is interrupted, thereby transmitting pulses from ground over the back contact of the line relay and the inner right-hand front contact of the slow release relay to the stepping magnet. The slow release relay SR and the cut-off relay hold up during the transmission of the interrupted pulses. The pulses cause the stepping magnet to advance the wipers of the switch, which were previously resting on their normal contacts, to the contact corresponding to the desired trunk. The subscriber then releases the locking key K in a well-known manner, thereby opening the circuit for the line relay LR. This, in turn, restores the slow release relay SR to normal and also deenergizes the cut-off relay CO so that the subscriber's line is cut through to the desired trunk. The cut-off relay, it will be noted, was operated during the entire switching operation to prevent interference with other lines.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a program selecting system, a subscriber's line, a plurality of program trunks, switching arrangements for interconnecting the subscriber's line with any desired trunk, means to control the operation of said switching apparatus, a subscriber's program receiving equipment associated with the line, a circuit extending from the subscriber's station over the line to said switch controlling means, means controllable at will by the subscriber over said circuit for restoring the switching apparatus to normal prior to the switching operation, and means controlled by the subscriber over said circuit for thereafter selectively operating the switching arrangement to select the desired trunk.

2. In a program selecting arrangement, a subscriber's line, a plurality of trunks leading to program stations, means to interconnect said subscriber's line with any desired trunk comprising a selector switch, said selector switch involving a plurality of rows of contacts forming two sets, and connections whereby alternate trunks are connected to the odd-numbered contacts of one set of rows of contacts and another set of alternate trunks are connected to the even-numbered contacts of the other set of rows of contacts.

3. In a program selecting arrangement, a subscriber's line, a plurality of trunks leading to program stations, means to interconnect said subscriber's line with any desired trunk comprising a selector switch, said selector switch involving rows of contacts forming two sets, and connections whereby alternate trunks are connected to the odd-numbered contacts of one set of rows of contacts, and another set of alternate trunks are connected to the even-numbered contacts of the other set of rows of contacts, the alternate contacts of each set which are not wired to any trunk being so arranged that the wipers of the switch cannot make contact therewith.

4. In a program selecting system, a subscriber's line, a plurality of trunks leading to program stations, a selector switch for connecting the line to a desired program, means to dial the switch over said subscriber's line and means to disconnect the talking conductors of the switch from the line during the selecting operation to prevent the dialing pulses from producing interference upon other lines.

In testimony whereof, we have signed our names to this specification this 21st day of December, 1925.

HENRY M. BASCOM.
OSCAR M. ARNOLD.
ROBERT L. PENTLAND.