

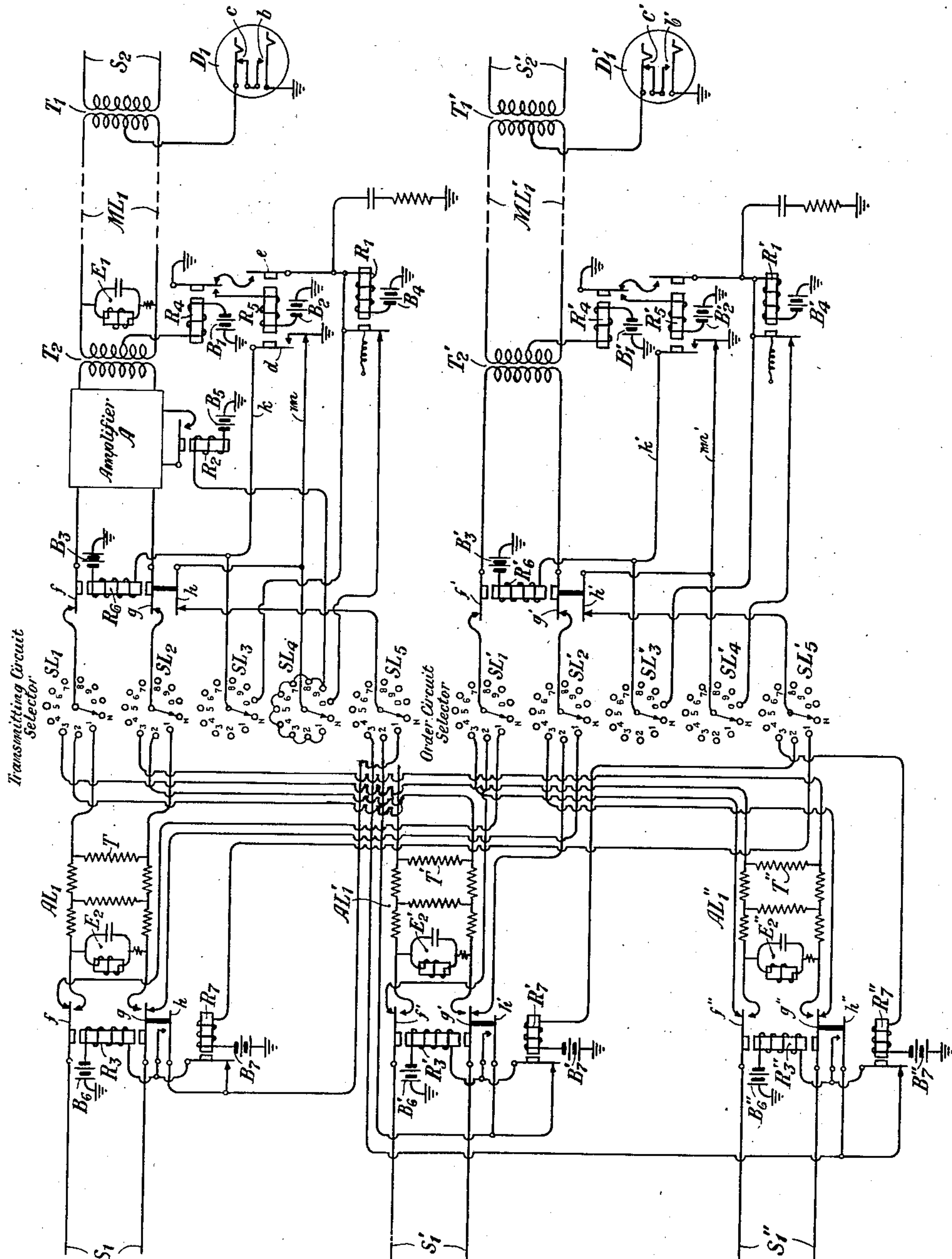
Aug. 5, 1930.

E. R. TAYLOR

1,772,167

SIGNALING SYSTEM

Filed Dec. 31, 1926



INVENTOR.

E. R. Taylor

BY

g. e. taylor

ATTORNEY

UNITED STATES PATENT OFFICE

EDMUND R. TAYLOR, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND
TELEGRAPH COMPANY, A CORPORATION OF NEW YORK

SIGNALING SYSTEM

Application filed December 31, 1926. Serial No. 158,317.

This invention relates to signaling systems, and particularly to arrangements for interconnecting a plurality of program sources to one or more program transmitting stations so that one or more program transmitting stations may transmit the program originating at any one of the program sources.

In systems for the transmission of programs originating at a plurality of program sources through a plurality of program transmitting stations, it is often the practice to route the circuits interconnecting the program sources and the transmitting stations through a central point where any one of the program sources may be connected to any one or more of the transmitting stations.

In the systems heretofore known, the program sources were disconnected from, and connected to, the appropriate transmitting stations manually. The manual operation of these circuits is considered inefficient and uneconomical because one or more men need constantly be available to make changes in the connections of the circuits, i. e., a program transmitting station must very often be switched from the circuit of one program source to the circuit of another program source. Thus, it becomes apparent that certain advantages would ensue if the control of the circuits between the various program sources and the various transmitting stations could be placed entirely in the hands of the operator or operators at the transmitting stations.

In order to provide a system in which the operator at any one transmitting station may connect his transmitter to any one of a plurality of program sources, it is necessary that the operator at the transmitting station be able to connect the transmitting circuit which lies between his transmitting station and the central switching point to any one of a plurality of circuits between the central switching point and the corresponding program sources, in such a manner that the resultant

overall circuit will have a suitable transmission characteristic and so that the signal to noise ratio will be satisfactory. The operator must also be able to connect a second circuit known as an order circuit, i. e., a circuit over which supervisory signals may be transmitted, which also lies between the transmitting station and the central switching point, to the circuit of any one of a plurality of program sources, which is not being used for the transmission of program matter.

Accordingly, it is one of the objects of this invention to provide a system for the connection of a transmitting station to a plurality of program sources, often referred to as pick-up points, which shall be under the control of the operator at the transmitting station. It will be apparent that to carry this object properly into effect, the interconnected circuit must have a suitable transmission characteristic as well as a satisfactory signal to noise ratio.

It is another object of this invention to provide a system for the interconnection of a transmitting station to which two circuits are associated, one for the transmission of program matter, and the other for the transmission of supervisory signals, to a plurality of program sources, or pick-up points, so that program matter coming from one of the program sources may be transmitted over one of the circuits to the transmitting station and so that supervisory signals from another of the program sources may be transmitted to the same transmitting station over the other of the circuits. It is a further object to provide such a system in which these connections may be made rapidly and accurately. These latter objects may be accomplished by a suitable combination of machine switching apparatus, with various apparatus now in use for the supply of program matter coming from various studios over wire circuits to various broadcasting stations, as will be

shown and described in some detail hereinafter.

While this invention will be pointed out with particularity in the appended claims, the invention, itself, both as to its further objects and features will be better understood from the detailed description hereinafter following, when read in connection with the accompanying drawing, showing one embodiment of the invention merely for the purpose of illustration.

The embodiment of this invention shown merely for the purpose of illustration discloses a system for automatically switching a transmitting station connected to the leads of S_2 to any one of a plurality of program sources connected to the leads S_1, S_1', S_1'' . At the central switching point there is machine switching apparatus comprising selecting means for selectively connecting any one of the program sources to the transmitting station through a line ML_1 and for selectively connecting another one of the program sources to the same transmitting station through another line ML_1' . Two selectors, one, the transmitting circuit selector, and the other, the order circuit selector, are shown in the drawing, each of which has five rotatable arms, all located about the same shaft, so that as the shaft is rotated, the five rotatable arms revolve about the shaft in synchronism. One end of the shaft has a notched wheel (not shown). Two relays R_1 and R_1' control the rotation of the selector arms of the corresponding selectors. A ratchet arm (not shown) is associated with the armature of each of the relays, R_1 and R_1' , so that when the winding of either of these relays becomes energized, the corresponding ratchet arm moves across the notched wheel, the notched wheel not being rotated thereby. When the relay which was previously energized becomes deenergized, a spring which is attached to the armature of the relay moves the armature back to its normal position and the ratchet arm rotates the notched wheel in a clockwise direction, thereby advancing the position of each of the selector arms one step. It is well known in the art of machine switching, that all of the selector arms move together, i. e., in synchronism.

The selector arms SL_1 to SL_5 , inclusive, are associated with the main line ML_1 and function to selectively connect any one of the program sources to the transmitting station for the transmission of program matter there-through. The selector arms SL_1' to SL_5' are associated with the main line ML_1' and function to similarly connect one of the program sources to the transmitting station for the transmission of supervisory or monitoring signals. Each selector shown is limited in capacity to nine program sources. Obviously, one hundred point selectors, or even larger selectors, could equally well be employed

herein, and these selectors would accordingly increase the number of program sources controllable through the central switching point, all of which is within the scope of this invention.

A dial D_1 and a repeating coil T_1 are connected to the main line ML_1 for impressing dialing impulses on the transmission line ML_1 . By manipulating the dial D_1 , impulses are transitted across the line ML_1 , which rotate the selector arms SL_1 to SL_5 , inclusive, in order to connect a desired program source to the transmitting station. An amplifier A of any well known type, preferably of the vacuum tube type, and an equalizer E_1 which may preferably comprise inductance and capacity in shunt relationship and in series with resistance, are provided at the central switching point in connection with the transmission of program matter over the main line ML_1 . A relay R_2 is employed to close the filament circuit of the amplifier A when the amplifier is to be set into operation. Means may be included in the amplifier for controlling its gain to overcome the different attenuation magnitudes of the wire circuits, usually of different lengths, which lead to the various program sources. In the arrangement shown for the purpose of illustration, however, the gain of the amplifier A is preferably maintained constant and a simple distortionless artificial line AL_1 and an equalizer E_2 are suitably combined with the circuit of each program source so as to accomplish just what the gain controlling means would ordinarily accomplish, i. e., provide the same overall losses for the circuits of different program sources. The arrangement shown will cause no substantial change in the signal to noise ratio, inasmuch as both the noise and the signal are equally attenuated by the artificial line. The amplifier A may be considered to have a high impedance input circuit so that two or more of these amplifiers may be connected to the same program source without appreciably affecting the transmission characteristic of the overall circuit. The artificial lines AL_1, AL_1' and AL_1'' are terminated by the terminating resistances T, T' and T'' , respectively. It will be understood, however, that while each program source is shown connected to an artificial line, an equalizer and a terminating resistance, only the terminating resistance is essential to the system, and either or both of the others, i. e., the artificial line and the equalizer, may be added thereto if conditions require it.

When supervisory, monitoring or like signals are to be transmitted from one of the program sources to the transmitting station, the line ML_1' is brought into operation and the signals are transmitted thereover. For the transmission of such signals, each equalizer, artificial line and transmitting resistance may preferably be removed from the con-

5 nected circuit. Accordingly, relays R_3 , R_3' and R_3'' are provided, one corresponding to each program source, each relay disconnecting the corresponding artificial line equalizer and terminating resistance when the supervisory, monitoring, or like signals are to be transmitted from the associated program source to the transmitting station. The relays R_3 , R_3' and R_3'' are so arranged that when an associated program source is connected to a transmitting station for the transmission of supervisory signals, that program source will not be connected to a transmitting circuit selector, but may be connected to one or more other order circuit selectors. Yet when a particular program source is connected to a transmitting station for the transmission of program matter, these relays will prevent the connection of that program source to an order circuit selector.

Whenever a program source is connected to the transmitting station through the order circuit selector, connection is made through repeating coils T_1' and T_2' and line ML' without the terminating resistance, the artificial line and the equalizer. Nevertheless, this circuit may also be employed for the transmission of program matter if the apparatus above mentioned is connected to the combined circuit at either the program source or at the transmitting station. Clearly, the addition of this equipment will provide means for operating the order circuit for the transmission of program matter during emergencies.

35 The dialing system presupposes that 0 be dialed before the number corresponding to one of the program sources is dialed. The current drains from the battery or batteries are very low except during the process of dialing. If a great number of program sources were to be connected to various transmitting stations in a large installation, it would perhaps be desirable to employ a closed circuit dialing system, i. e., a system in which current flows from the battery or batteries only at times when a transmitting station is connected to a pick-up point. Such a system would eliminate the necessity of dialing 0 first and would give a constant indication at the transmitting station whenever a selector was in use. Such a system can be provided by utilizing the principles of standard machine switching arrangements.

55 The operation of the system shown in the drawing is as follows: The operator at the transmitting station pulls the dial D_1 "off normal" by closing the contact b . Relay R_4 then operates because of the flow of current from battery B_1 , the circuit including the battery B_1 , the winding of relay R_4 , the main line ML_1 , contacts c and b of the dial D_1 and ground. Relay R_5 , preferably a slow-release relay, operates on the closure of the front contact of the armature of relay R_4 . The circuit to relay R_5 includes a battery B_2 , the winding

of the relay R_5 , the armature of the relay R_4 and ground. Inasmuch as the relay R_5 is a slow-release relay, it will ordinarily remain operated as long as the dial D_1 remains "off normal." Operation of the relay R_5 causes the operation of relay R_6 , current flowing from battery B_3 through the winding of relay R_6 , armature d of the relay R_5 and ground. As the relay R_6 operates, its armatures f and g are attracted, disconnecting the input of the amplifier A from the selector arms SL_1 and SL_2 . Closure of the contact of armature d of relay R_5 puts ground on the selector arm SL_3 . Closure of the armature e of the relay R_5 connects the back contact of relay R_4 to the winding of the relay R_1 . When contact b of the dial D_1 starts to return to its normal position, the pulsing contact c of the dial D_1 opens and closes periodically in a well known manner. When the dial pulsing contact c opens, the winding of the relay R_4 becomes deenergized, so that its armature becomes disconnected from the winding of relay R_5 and becomes connected to the front contact of armature e of the relay R_5 . Since the relay R_5 is already operated, as noted above, ground is connected to the winding of the relay R_1 , causing the operation of the relay R_1 , the circuit of relay R_1 including battery B_4 , the winding of the relay R_1 , armature e of the relay R_5 , the armature of the relay R_4 and ground. When the dial pulsing contact c closes, the winding of the relay R_4 again becomes energized, attracting its armature and deenergizing the winding of the relay R_1 . Accordingly, the selector arms SL_1 to SL_5 , inclusive, are advanced one contact. Successive operations of the pulsing contact c of the dial D_1 bring about further movements of the selector arms SL_1 to SL_5 , until these selector arms reach the 0 position. The ground on the selector arm SL_3 furnished by closure of the armature d of the relay R_5 then holds the relay R_1 operated until the dial returns to its normal position, the circuit for the winding of the relay R_1 including battery B_4 , the winding of the relay R_1 , contact 0 and selector arm SL_3 , armature d of relay R_5 and ground. After the dial has returned to its normal condition, the winding of the relay R_5 becomes deenergized. Thereafter, the winding of relay R_1 also becomes deenergized, advancing selector arms SL_1 to SL_5 , inclusive, to position N . If, however, the selector arms had originally rested on the position N and if, therefore, the number of pulses dialed was only sufficient to carry the selector arms to position 0 on release of the relay R_5 , the ground applied to the selector arm SL_4 would also have caused the winding of relay R_1 to become energized by the flow of current from the battery B_4 through the winding of the relay R_1 , the armature of relay R_1 , the selector arm SL_4 and ground. By opening this circuit at the armature of relay

R₁, relay R₁ becomes deenergized, whereupon all of the selector arms SL₁ to SL₅, inclusive, are moved to position N. It will, accordingly, become apparent that in any case, after
 5 0 has been dialed, the selector arms move a step further to position N so that the operator at the transmitting station may then dial a number corresponding to any one of the program sources. When the number correspond-
 10 ing to one of the program sources is being dialed, the selector arms rotate in synchronism in the manner described hereinabove until finally, upon the release of the relay R₅, the selector arms move to the desired posi-
 15 tion. When the selector arms reach the proper position, relay R₆ releases, connecting the input of the amplifier A to the selector arms SL₁ and SL₂.

Ground on the selector arm SL₄ causes the
 20 filament circuit of the amplifier A to become closed by the flow of current from the battery B₅ through the winding of relay R₂, selector arm SL₄, conductor *m* and ground. It is to be remembered that in the arrangement
 25 of this invention shown and described herein, the filament circuit of the amplifier is closed only while program source is connected to a transmitting station. Relay R₃ is
 30 operated because of the flow of current through its winding in the circuit which includes conductor *m*, armature *h* of the relay R₆, the selector arm SL₅, the armature of the relay R₇, the winding of the relay R₃, bat-
 35 tery B₆ and ground. As the relay R₃ becomes energized, the back contact of relay R₇ is short-circuited by the armature *h* of relay R₃. The program source connected to the leads S₁ becomes connected through the ar-
 40 matures *f* and *g* of the relay R₃ to the equalizer E₂, the artificial line AL₁ and the terminating resistance T. These are connected with other points corresponding to that par-
 45 ticular program source in multiple on the arcs traversed by the selector arms SL₁ and SL₂ of the transmitting circuit selector. When the relay R₃ is not operated, the program
 50 source is then connected through the back contacts of relay R₃ to the upper two arcs of the order circuit selector, the connections be-
 55 ing made through the contacts of these arcs numbered 1. As pointed out above, the circuit to relay R₃ passes through normally made contacts of relay R₇ which is associated with the conductors going in multiple to the
 60 order circuit selector (only one of which is shown), so that whenever the program source is connected to the order circuit selector, relay R₇ is operated, and hence the program
 65 source can not be seized for connection to the transmitting circuit selector. However, armature *h* of relay R₃ and its contact are in parallel with armature of relay R₇ and its contact, whenever relay R₃ is operated. Consequently, when relay R₇ becomes operated, it can not release relay R₃. Back contacts of

the relay R₃ connect the program source to a number of order circuit selectors in multiple (only one of which is shown) so that when-
 70 ever a program source is not connected to a transmitting circuit selector, it may be connected to one or more order circuit selectors.

The operation of the order circuit selector or selectors is similar to the operation of the transmitting circuit selector or selectors, ex-
 75 cept that in the embodiment of the invention shown herein, no filament circuit relay R₂ is employed, and relay R₇ is operated instead of relay R₃.

Although only three program sources, often known as pick-up points, are shown herein, as
 80 many as nine program sources or pick-up points may be accommodated with the apparatus used, and as many more program sources or pick-up points may be accommodated as found desirable, with slight modification of
 85 the arrangement shown, within the scope of this invention. It seems hardly necessary to repeat that the connections to the contacts on the upper two arcs having the selector arms
 90 SL₁ and SL₂ and on the last arc having a selector arm SL₅ are multiplied to corresponding contacts on a number of other transmitting circuit selectors and that the contacts
 95 on the upper two arcs and on the last arc of the order circuit are similarly multiplied to corresponding contacts on other order circuit selectors.

While this invention has been shown in one particular embodiment merely for the pur-
 100 pose of illustration, it is to be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the
 105 appended claims.

What is claimed is:

1. In a signaling system, the combination of a plurality of program sources each at a distant station, a transmission circuit at another station, a plurality of transmitting me-
 110 dia, two extending from the transmission circuit to each program source, one transmitting medium transmitting program matter from each source to be transmitted by the transmission circuit, another transmit-
 115 ting medium transmitting supervisory signals between the transmission circuit and each program source, two selectors associated with each program source, means for transmitting coded signals from the transmission
 120 circuit to the various selectors so that only one of the selectors may become responsive to connect a corresponding program source to the transmission circuit through one trans-
 125 mitting medium for the transmission of supervisory signals, and means for transmitting coded signals from the transmission circuit to the various selectors so that another se-
 130 lector may become responsive to connect another program source to the transmission

circuit through the other transmitting medium so that the program of said source may be transmitted by said transmission circuit.

2. In a signaling station, a plurality of
5 sources of program each at a distant station, a transmission circuit to which a radio transmitter may be connected at another station, a control station, a plurality of transmitting media one interconnecting the station of each
10 program source with the control station, two transmitting media interconnecting the transmission circuit with the control station, two selective switching arrangements, means for transmitting a coded impulse from the
15 transmission circuit to the control station over one of the transmitting media therebetween to render one of the selective switching arrangements responsive to connect the station of a desired program source with the
20 transmission circuit for the transmission of program matter, and means for transmitting another coded impulse from the transmission circuit to the control room to render the other of the selective switching arrangements
25 responsive to connect the station of another program source with the transmission circuit for the transmission of supervisory signals.

3. In a program selecting system, the combination of a transmission circuit, a plurality of program sources each located at a distant station, a plurality of relays one corresponding to each program source, each relay controlling the connection of the corresponding program source to the transmission circuit, and means including apparatus for producing dialing impulses and apparatus responsive to said impulses for selectively
35 switching the transmission circuit from one of said program sources to any other of said program sources without the introduction of program matter from still other of said sources, said means including arrangements for effectively operating the relay corresponding to any desired program source to the exclusion of the other of said relays.
45

4. In a program selecting system, the combination of a plurality of program sources each located at a distant station, a control room, a transmission circuit which may be
50 connected to a radio transmitter located at another station, said transmission circuit extending to the control room, a plurality of transmitting media each of which extends from one of the program sources to the control room, a plurality of relays one corresponding to each program source, each relay controlling the connection of the corresponding program source to the transmission circuit through the transmitting medium corresponding to the program source, selecting
60 apparatus at the control room for selectively switching the transmission circuit from one program source to another without the introduction of program matter from still other
65 of the program sources, said selecting ap-

paratus including means for effectively operating the relay corresponding to any desired program source to the exclusion of the other of said relays, a signaling device for transmitting over the transmission circuit to
70 said selecting apparatus a coded signal characteristic of the program source intended to be connected thereto, and means for rendering said selecting apparatus responsive to
75 said coded signal to connect the intended program source to the transmission circuit.

In testimony whereof, I have signed my name to this specification this 29th day of December, 1926.

EDMUND R. TAYLOR. 80

85

90

95

100

105

110

115

120

125

130