

March 9, 1937.

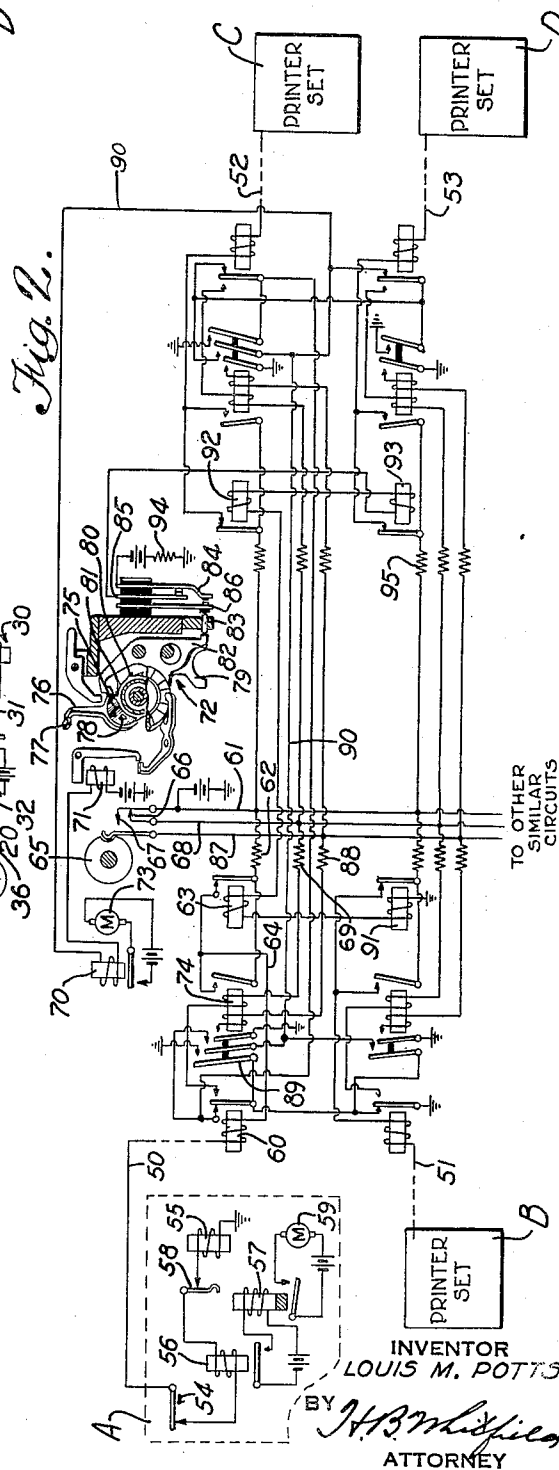
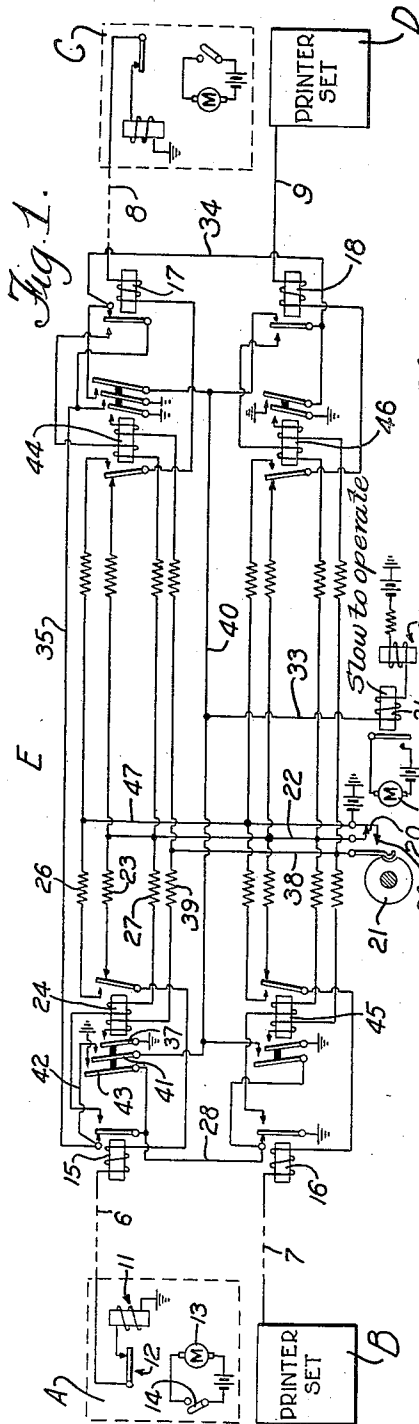
L. M. POTTS

2,073,266

CONCENTRATION AND BROADCASTING SYSTEM

Filed Nov. 30, 1934

2 Sheets-Sheet 1



March 9, 1937.

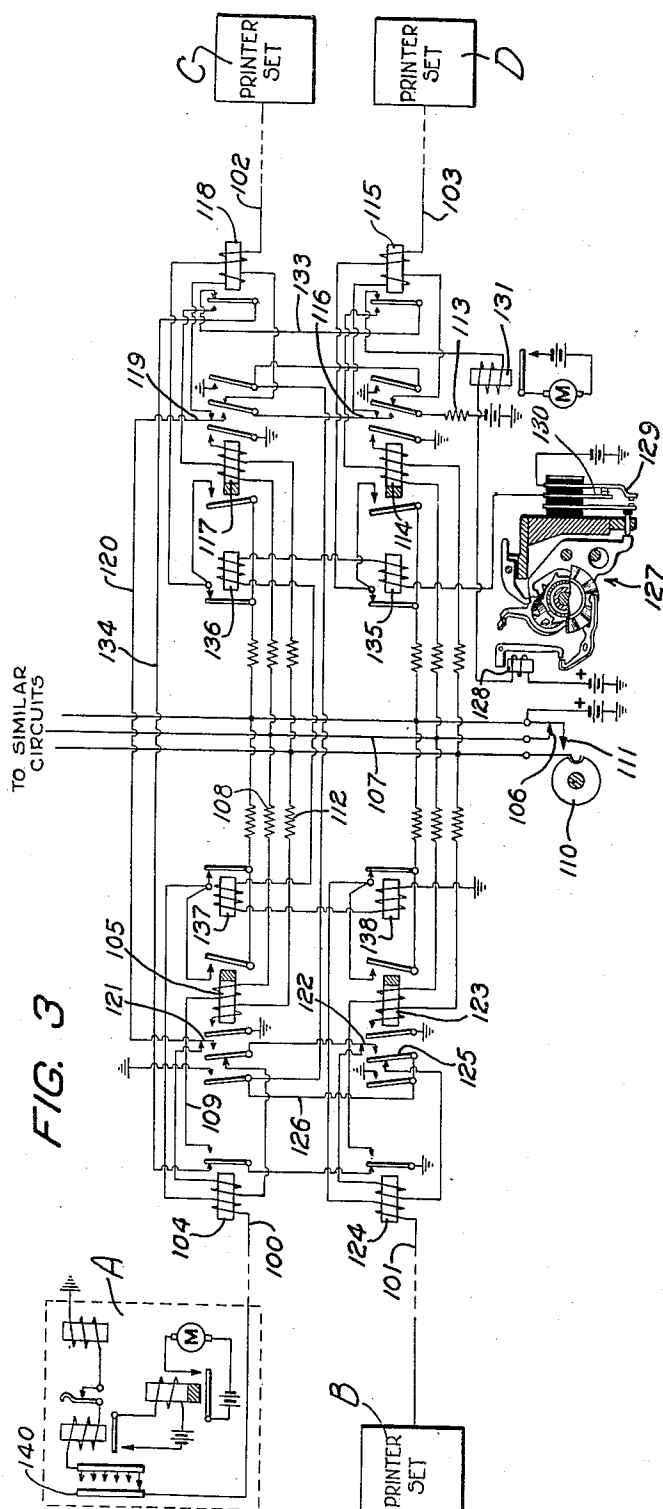
L. M. POTTS

2,073,266

CONCENTRATION AND BROADCASTING SYSTEM

Filed Nov. 30, 1934

2 Sheets-Sheet 2



INVENTOR
LOUIS M. POTTS
BY *H.B. Whitfield*
ATTORNEY

UNITED STATES PATENT OFFICE

2,073,266

CONCENTRATION AND BROADCASTING
SYSTEMLouis M. Potts, Evanston, Ill., assignor to Tele-
type Corporation, Chicago, Ill., a corporation
of Delaware

Application November 30, 1934, Serial No. 755,254

19 Claims. (Cl. 178—2)

This invention pertains to telegraph systems and more particularly to switching arrangements for printing telegraph systems.

5 An object of the invention is to provide a switching system common to a plurality of stations and capable of operation to select a station and exclude all other stations.

10 Another object of the invention is to provide a telegraph system having a central station with a plurality of lines radiating therefrom and arranged with switching means responsive to the selection of a line for rendering regenerative repeating apparatus operative from the selected line to repeat into all other lines impulses equivalent
15 in strength and wave form to the original impulses.

20 A feature of the invention is the provision of apparatus and circuits effective on the establishment of a connection with a line to prevent the transmission of reflection signals into the line on which the impulses are impressed originally.

25 Another feature of the invention is the provision of facilities whereby one station may interrupt the transmission of another station only when there has been a cessation of transmission for a predetermined period.

30 The above and other objects of the invention are attained by the arrangement of the various lines of a corresponding number of stations with start-stop printing telegraph apparatus, which when operated initially establishes conditions at a central station embodying printing telegraph receiving apparatus whereby connections are completed with the receiving apparatus and the lines
35 of the other stations are temporarily disabled for communication purposes. The several stations may also be connected in a common network or broadcasting arrangement which will permit any station to transmit through a regenerative start-stop repeater impulses to all other stations of the
40 system.

Specifically, the invention contemplates a system of relays energized upon a station initiating a call to connect such station with a receiving
45 printer at the central station and exclude all other stations. The connection of all stations in a broadcasting group is accomplished by having a single regenerative repeater common to all stations and a series of relays energized by the
50 initiation of a call by one station for connecting the repeater to be responsive to impulses therefrom and to repeat the impulses to the lines of all other stations of the broadcasting group. Reflection signals into the line of the originating station are prevented through the particular ar-

55 rangement of the relays and the circuits under their control.

A better understanding of the invention may be had from the following description, taken in connection with the accompanying drawings, 5 wherein:

Fig. 1 shows a system involving a plurality of independent lines extending to a central station equipped with printing telegraph apparatus responsive to the signals impressed on any of the
10 individual lines.

Fig. 2 shows a system involving a plurality of stations equipped with printing telegraph apparatus and having their lines extending to a central station where start-stop regenerative repeating
15 apparatus is located responsive to impulses received from any of the stations for transmitting to all other stations of the system corresponding impulses, and

20 Fig. 3 is a modification of the system disclosed in Fig. 2 wherein the line relays of the individual lines are provided with locking windings to prevent the line relays from creating reflection signals.

25 As disclosed in Fig. 1, the system embodies a plurality of subscribers' stations A, B, C, and D having their individual lines 6, 7, 8, and 9 respectively terminated at a central station E. While the system disclosed in Fig. 1 includes only four subscribers' or branch stations, it is obvious
30 that the system could be expanded to provide additional stations.

Each of the subscribers' stations is provided with a receiving printer 11 and a transmitter 12, which are shown diagrammatically for stations A
35 and C. Of course, all other subscribers' or branch stations such as B and D are similarly equipped. There is also arranged at each of the branch stations a motor 13 serving to supply motive power to the receiving printer 11 and transmitter 12, as
40 is well known. The circuit of the driving motor 13 is controlled by a manually operated switch 14.

As previously indicated, each of the lines 6, 7, 8, and 9 extends from the respective branch stations to the central station E, and included in
45 each of the lines is a line relay 15, 16, 17, and 18 respectively. These relays are normally energized from a source of current at the central station E under the control of contacts 20 operated by a cam 21 which is driven synchronously
50 with the operation of the transmitter 12 at each of the branch stations. The circuit for effecting the energization of the line relays 15, 16, 17, and 18 extends from battery through normally closed contact 20, conductor 22, resistance
55

23, back contact and armature of relay 24, winding of relay 15, normally closed contact of transmitter 12, and the winding of the selecting magnet of the receiving printer 11 to ground. The circuits for the other line relays 16, 17, and 18 may be similarly traced.

Common to the lines 6, 7, 8, and 9, and located at the central station E is a receiving printer 30, also shown diagrammatically, since any well known type of printer might be used for receiving and recording impulses from any of the branch stations. Embodied in the circuit of the receiving printer 30 is a control relay 31 which, through its armature and contact, controls the application of power to a motor 32 which drives the receiving printer 30. With line relays 15 to 18 normally energized, relay 31 is also energized over a circuit extending from battery, winding of the selecting magnet of printer 30, winding of relay 31, conductor 33, conductor 40, front contact and armature of relay 16, conductor 34, front contact and armature of relay 17, conductor 35, front contact and armature of relay 15, conductor 28, and the front contact and armature of line relay 16 to ground.

The circuit of line relay 15 was traced through the right-hand back contact and armature of relay 24. Upon the initiation of a call from station A, line relay 15 is deenergized, due to the opening of the line at the transmitter 12 of station A, to effect the transmission of a start impulse. Upon the deenergization of line relay 15, an energizing circuit is completed for relay 24 extending from battery through contact 20, resistance 27, right-hand winding of relay 24, back contact and armature of line relay 15, conductor 28, front contact and armature of line relay 16, (connected in line 7 individual to station B) to ground. Relay 24 is thus energized and opens through its right-hand contact and armature the original energizing circuit for line relay 15.

As a result of the deenergization of line relay 15, the selecting magnet of the receiving printer 30 and relay 31 are likewise deenergized. Relay 31 in deenergizing closes through its contacts the circuit including the source of power and the driving motor 32, which thereupon functions to drive the operating parts of the receiving printer 30. The selecting magnet of the receiving printer 30 upon its deenergization operates mechanism for releasing control cam 21, which makes one cycle of rotation for each functional operation of the receiving printer 30.

Cam 21 in rotating opens contact 20 and closes contact 36. Due to the closure of contact 36 and the attraction of armature 37 of relay 24, a locking circuit is established for relay 24. This circuit may be traced from battery, through contact 36, conductor 38, resistance 39, the left-hand winding of relay 24, and the contact and armature 37 of relay 24 to ground. Relay 24 is thus maintained energized, notwithstanding the opening of the back contact and armature of relay 15, for a cycle of rotation of cam 21. Relay 24, in addition to closing its locking circuit as just traced, connects the receiving printer 30 through conductors 33, 40, and armature 41 of relay 24, conductor 42, to the front contact of line relay 15 and connects the back contact of relay 15 through armature 43 and front contact to ground thus providing a circuit for the receiving printer 30 under sole contact of line relay 15 and independently of the described front contacts of line relays 16, 17, and 18 now to be de-

energized. Consequently, upon the energization and deenergization of line relay 15, the receiving printer 30 will be actuated to record the characters transmitted through the operation of transmitter 12 at station A, for line relay 15 will respond to each successive actuation of transmitter 12. When cam 21 opens the contact 20, the described energizing line circuits are interrupted for line relays 16, 17, and 18 which accordingly release their armatures. In relays 17 and 18 the armatures open the described energizing circuit for the receiving printer 30 but contacts of these armatures have been shunted by armature 41 in relay 24. In relay 16, the armature removes ground from conductor 28 and armature of relay 15 but this ground connection has been substituted by operation of armature 43 in relay 24.

The original energizing circuit for relay 15 was traced through the extreme right-hand armature and back contact of relay 24 and contact 20 controlled by cam 21. However, with the initiation of rotation of cam 21, contact 20 is opened, and due to the energization of relay 24, the extreme right-hand contact and armature of relay 24 is opened, so that the original energizing circuit for line relay 15 is opened. The attraction of the extreme right-hand armature of relay 24 closes its front contact and extends the circuit of line relay 15 over resistance 26, and conductor 47 to battery. Thus, upon the actuation of transmitter 12 at the station A, line relay 15 will respond and control through its front contact and armature the energizing circuit of the selecting magnet of the receiving printer 30, which will record the intelligence characters transmitted through the operation of transmitter 12 at station A.

If a station such as station C desires to be connected with the receiving printer 30, operations corresponding to those described for station A will be performed, and as a result thereof its line relay 17 will first be deenergized, the motor control relay 31 as well as the selecting magnet of the receiving printer 30 will be deenergized, motor 32 will be started, the cam 21 will be rotated, and relay 44 associated with line relay 17 will be energized and locked up in a manner similar to that described for relay 24. Through the operation of relay 44 the line relays 15, 16, and 18 of stations A, B, and D respectively will be deenergized and rendered ineffective for the selection and operation of the receiving printer 30 during a character cycle of operation of the transmitter at station C.

Likewise for stations B and D, there is arranged a relay 45 and 46 respectively. Each of these relays 45 and 46 functions to achieve the same result described for relays 24 and 44 allotted to line relays 15 and 17 respectively.

Relay 31 is shown connected in series with the selecting magnet of receiving printer 30. Relay 31 however will not respond to each energization of line relay 15 due to the fact that it is of the slow-to-operate type and will not become effectively energized for opening the operating circuit of the driving motor 32 upon each momentary operation of line relay 15.

By the arrangement of the circuits disclosed in Fig. 1, any of the branch stations A, B, C, or D may be connected to the central office printer 30 to the exclusion of all other stations.

Assuming that station A desires to communicate with the central station E, and provided none of the other branch stations is in communica-

tion with the central station, which will be evident by the absence of a busy signal, as described later herein, the operator at station A operates switch 14 for closing the operating circuit of driving motor 13, which conditions the substation for transmission of signals. The transmitter 12 may then be operated in successive code cycles, each producing a succession of cycles of operation at the central office. The starting impulse generated through the operation of the transmitter 12 deenergizes line relay 15 which closes the energizing circuit of relay 24 and opens the circuit of the selecting magnet of the receiving printer 30 and of the motor control relay 31. The selecting magnet of the receiving printer 30 in deenergizing releases cam 21 for rotation, which in rotating opens contact 20 and closes contact 36. Relay 24 is locked over the circuit previously traced, and cam contacts 20 render line relays 16, 17, and 18 ineffective by removing battery from the winding of each of line relays 16, 17, and 18.

Impulses generated through the operation of transmitter 12 cause the corresponding energization of line relay 15 and the operation of the selecting magnet of the receiving printer 30 to record the characters indicative of the impulses transmitted through the operation of transmitter 12.

Upon the completion of each code cycle, cam 21 opens contact 36 and closes contact 20, thereby again connecting the source of current to the winding of each of the line relays 15, 16, 17, and 18. Due to the continued operation of transmitter 12, the receiving printer 30 is operated in response to the operation of line relay 15 to record the message transmitted from station A.

The current on non-operating lines of the several lines 6, 7, 8, and 9 is removed and applied for each cycle of operation of cam 21, thus deenergizing and energizing the magnets at all of the non-transmitting stations and operating the armatures of the selecting magnets of the receiving printers at the non-transmitting stations to give an audible signal, indicating that the central office is in communication with one of the other branch stations.

Since cam 21 restores contacts 20 and 36 to normal at the end of each code signal cycle, a non-transmitting station may interrupt transmission by opening a break key such as is illustrated at 58, Fig. 2, which at the end of the then instant cycle will energize one of the relays 44, 45, 46, and will deenergize magnet 30. Cam 21 will not stop and contact 20 will remove current from line 6 thus "breaking" transmission from substation A.

Upon the termination of the message from station A, the operator thereat opens switch 14 and disconnects the source of power from the driving motor 13, and since the transmitter 12 is no longer operated, the circuits at the central office E which at the termination of each code signal had been restored to the condition disclosed in Fig. 1, now are permitted to remain in that condition with all of the line relays 15, 16, 17, and 18 energized in addition to which relay 31 attracts its armature and stops the motor 32.

Referring now to Fig. 2, there is disclosed an embodiment of the invention similar in some respects to the system disclosed in Fig. 1, except that according to the arrangement disclosed in Fig. 2 any of the branch stations may communicate with all other branch stations; that is, a branch station may transmit a message to all

other branch stations connected in the system, thereby constituting what may be classified as a broadcasting system.

Each of the branch stations A, B, C, and D has an individual line 50, 51, 52, and 53 respectively. Also, at each of the branch stations there is a transmitter 54, a receiving printer 55, a set of motor control relays 56 and 57, and a break key 58, the motor control relays 56 and 57 serving to control a driving motor 59.

Each of the lines 50, 51, 52, and 53 to their respective branch stations includes a line relay such as 60 indicated for line 50. Line relay 60, as is equally true of the line relays for the other lines 51, 52, and 53, is normally energized from grounded battery, over conductor 61, resistance 62, front contact and armature of relay 63, conductor 64, winding of relay 60, conductor 50, normally closed contact of transmitter 54, winding of relay 56, normally closed contact of break key 58, and the winding of the selecting magnet of the receiving printer 55 to ground. As was noted for the arrangement disclosed in Fig. 1, battery at the central station is controlled by a cam 65 operated in timed relation with the operation of the transmitter 54 at station A. Cam 65 controls contacts 66 and 67. When relay 60 is deenergized, due to the initial operation of transmitter 54 an energizing circuit is completed for relay 74 through the back contact and armature of relay 60. The energizing circuit for relay 74 may be traced from grounded battery, through contact 66, conductor 68, resistance 69, right-hand winding of relay 74, back contact and armature of relay 60, and the front contact and armature of the line relay connected in line 51 to ground. A locking circuit for relay 74 is later established so that the relay remains energized independently of line relay 60.

When line relay 60 is energized, motor control relay 70 and selecting magnet 71 of a start-stop regenerative repeater 72 of the form and construction disclosed in copending application Serial No. 711,479, filed February 16, 1934 are energized, and relay 70 renders the driving motor for the start-stop regenerative repeater 72 inoperative. However, upon the deenergization of relay 60 in response to the initial operation of transmitter 54, motor control relay 70 is deenergized and closes through its contacts the operating circuit of motor 73. Consequently, power is communicated from motor 73 to the parts of the regenerative repeater shown diagrammatically at 72.

According to the disclosure of the aforementioned copending application, the regenerative repeater is similar in construction to the printing telegraph device described in Patent No. 1,821,110 issued to S. Morton et al., September 1, 1931 and embodying a cam barrel 75 arranged with a stop arm 76 normally in engagement with a fixed stop 77. The cam drum 75 has six pairs of cams 78 which control six selecting levers 79 in accordance with six received intelligence impulses to operate the selector levers in sequence to register each intelligence signal impulse of a code as the impulses are received, after which a transfer action occurs to transfer the six registrations simultaneously to the selector mechanism and to the printing mechanism of the receiving printer. Also carried by drum 75 are two multiple cam rings 80 and 81 which are shaped to represent all of the cams 78 and in longitudinal alignment therewith two additional cams representing start and stop signals of a

start-stop code. Arranged in coaxial alignment with the six selector levers 79 is a selector lever 82 moved into marking and spacing positions in a manner similar to the operation of selector levers 79, but operating for every impulse of the entire signal including the start and stop impulses. With every movement of lever 82 a striker 83 is operated to change the operative relation of contacts 84, 85, and 86 for the purpose of transmitting impulses in a controlled line section corresponding in strength and wave shape to the impulses received for controlling the operation of cam drum 75.

Normally cam drum 75 is in its marking position with selector magnet 71 normally energized, in which case the stop arm 76 is in engagement with the fixed stop 77. Upon receipt of a spacing signal indicative of a start condition generated by transmitter 54, electromagnet 71 will be deenergized to move cam drum 75 to free stop arm 76 from stop 77, and since driving motor 73 is now supplying power to the regenerative repeater as a result of the deenergization of relay 70, cam drum 75 is likewise rotated. Selecting magnet 71 will respond to the operation of the transmitter 54 and cause the cam drum 75 to be moved correspondingly and thus bring the cam rings 80 and 81 into operative relation with the selector lever 82 for causing the corresponding operation of contacts 84, 85, and 86. Simultaneously with the operation of selector lever 82, the selecting levers 79 will be operated through cams 78 for setting the selector mechanism of the printer to record the corresponding characters. The operation of contacts 84, 85, and 86 will generate in the line conductor or conductors connected thereto impulses corresponding to the impulses which effected the energization of selecting magnet 71.

Referring now specifically to the circuit arrangements disclosed in Fig. 2, it was indicated that cam 65 is rotated in timed relation with the operation of transmitter 54. Actually, cam 65 constitutes a part of the regenerative repeater 72, and when cam barrel 75 is released for rotation, cam 65 likewise rotates and in rotating opens contact 66 and closes contact 67. The closure of contact 67 connects the grounded battery with the locking winding of relay 74 over conductor 87, through resistance 88, left-hand winding of relay 74, and front contact and armature thereof to ground. Thus, relay 74 will be maintained energized during one cycle of operation of cam 65. Relay 74 in attracting its armature 89 and the adjacent armature applies shunts to the operating contacts of all of the line relays for lines 51, 52, and 53, leaving the contacts of line relay 60 free to control the energization of selecting magnet 71 of the regenerative repeater 72 by application of a ground connection through front contact and armature of relay 74, armature and front contact of line relay 60 and another contact and armature of relay 74 to conductor 90 and over conductor 90 to the winding of the selecting magnet 71 of the regenerative repeater 72. Thus, relay 60 in following the signals generated as a result of the operation of transmitter 54, will open and close its front contact for causing the corresponding energization of the selecting magnet 71 over conductor 90.

Individual to each of the line relays is a relay 63, 91, 92, and 93 respectively. All of the relays 63, 91, 92, and 93 are connected in a series circuit controlled by contacts 84 and 85 of the regenerative repeater 72. The circuit for the noted relays

may be traced from battery, through resistance 94, contacts 84 and 85, winding of relay 93, winding of relay 92, winding of relay 63, and the winding of relay 91 to ground. The armatures of each of relays 63, 91, 92, and 93 control the application of battery to their respective lines 50, 51, 52, and 53. The circuit for line 53 may be traced from battery, through resistance 95, front contact and armature of relay 93, winding of the line relay in line 53, to the branch station D, and to ground thereat.

Relays 63, 91, 92, and 93 are controlled, as previously indicated, by contacts 84 and 85. When these contacts are operated as a result of the operation of cam drum 75 in response to the energization of electromagnet 71, relays 63, 91, 92, and 93 will be correspondingly energized, and impulses will be transmitted over the line conductors 51, 52, and 53 corresponding to the energization of relays 91, 92, and 93. The transmission of impulses from the regenerative repeater through the operation of relay 63 into line 50 is prevented due to the closure through the right-hand armature and contact of relay 74 of a shunt circuit around the armature and contact of relay 63.

The circuits controlled by contacts 66 and 67 are shown extending to the relays allotted to stations A, B, C, and D, but obviously the circuits may be extended to similar relays for other stations, allowing for an increase in the number of stations included in the broadcasting group.

Assume that station A desires to broadcast a message to stations B, C, and D, break key 58 will be momentarily opened, resulting directly in deenergization of relays 56 and 60 and indirectly in starting all motors in the system, since deenergization of relay 56 energizes relay 57 which energizes motor 57 at station A, while deenergization of relay 60 interrupts the normal holding circuit of relay 70 and magnet 71 by which relay 70 energizes motor 73 and magnet 71 releases cam barrel to rotate to open contact 84 from contact 85 thereby deenergizing all repeating relays 91, 63, 92, 93 and repeating the breaking signal generated by break key 58 into lines 51, 52, and 53 and to substations B, C, and D where in each substation a relay 56 is deenergized, a relay 57 is resultantly energized and a motor 59 is energized. Upon the reenergization of relays 56 and 60 at the closure of key 58, and upon cam 65 reaching its normal stop position, the central office apparatus and all substation apparatus will be restored to the state illustrated in Fig. 2, except that for a period all slow-to-release relays 57 at all substations will retain their armatures and will keep all motors 59 energized and slow-to-operate relay 70 at the central station will not attract its armature and will keep motor 73 energized. During that period the operator at substation may begin transmission, after which the spacing impulses of combinational code signals will ensure continuous operation of the started motors.

The above mentioned normal holding circuit for the selector magnet 71 and the motor control relay 70 extends from grounded battery through winding of magnet 71, winding of relay 70, conductor 90, front contact and armature of the line relay of line 53, front contact and armature of the line relay of line 52, front contact and armature of line relay 60, and front contact and armature of the line relay of line 51 to ground with driving motor 59 of branch station A operating transmitter 54 can be operated and relay 60 will

respond thereto, and the selector magnet 71 of the regenerative repeater 72 will function correspondingly over circuit 90 previously traced and will cause the actuation of contacts 84 and 85 to in turn cause the energization of relays 63, 91, 92, and 93 operating to impress on line conductors 51, 52, and 53 impulses corresponding in strength and wave shape to the impulses generated through the operation of transmitter 54 at station A. Consequently, the printing telegraph apparatus at stations B, C, and D will be operated for recording the impulses transmitted from station A. Relay 63 of course responds like relays 91, 92, and 93, but inasmuch as relay 74 is energized and closes a shunt circuit around the contact and armature of relay 63, impulses will not be repeated into line 50 as a result of the operation of contacts 84 and 85. Any receiving station may open a break key 58 and interrupt the transmission at the end of the then instant code signal cycle.

If there is a cessation of transmission, relay 56 will be energized for a period long enough to allow relay 57 to become completely deenergized, the operating circuit of motor 59 will be opened, and the driving power for the transmitter 54 and receiver 55 discontinued. Also relay 70 will attract its armature to open the operating circuit of motor 73.

Following the transmission from station A as previously described, any of the other stations B, C, or D may seize the communicating circuit and broadcast a message to all other stations of the system in a manner previously described for station A in broadcasting to stations B, C, and D.

In the modification shown in Fig. 3, each of the line relays included in each of the lines extending to the branch stations is provided with a locking winding; that is, a winding which is energized upon the energization of a relay auxiliary to the line relay of each of the lines for maintaining the other line relays energized during each cycle of operation. There is also embodied in the arrangement disclosed in Fig. 3 the feature of having each of the auxiliary relays of the slow-to-release type, so that a branch station other than the branch station which is then transmitting to the other stations cannot seize the circuit unless there is a predetermined cessation of transmission from the station previously transmitting. Of course, the feature of providing each of the line relays with a locking winding may be incorporated in either of the arrangements disclosed in Figs. 1 and 2. Moreover, the feature of having the auxiliary relay of the slow to release type may be incorporated, if desired, in the circuit arrangements disclosed in either Fig. 1 or Fig. 2.

As disclosed in Fig. 3, as was described for Figs. 1 and 2, there are a plurality of branch stations A, B, C, and D. Each of the branch stations is connected to a central station by conductors 100, 101, 102, and 103 respectively. Typical of each of the lines 100, 101, 102, and 103, there is included in line 100 a line relay 104. Line relay 104, in addition to having an operating winding, has a locking winding under the control of an auxiliary relay 105. When line conductor 100 is opened at branch station A, it becomes deenergized and closes at its right-hand back contact a circuit for the operating winding of relay 105 which may be traced from grounded battery, through contact 106, conductor 107, resistance 108, right-hand winding of relay 105, conductor 109, back contact and armature of relay 104, and the front

contact and armature of the relay 124 associated with line 101 to ground. Like the circuits disclosed in Figs. 1 and 2, a cam 110 operating in timed relation with respect to the operation of the transmitter at the branch stations is provided for controlling contacts 106 and 111. When contact 106 is opened and contact 111 is closed, a locking circuit for relay 105 is established extending from grounded battery, through contact 111, resistance 112, the left-hand winding of relay 105, and the front contact and armature thereof to ground. Relay 105 is thus maintained energized during the cycle of rotation of cam 110. The energization of relay 105 establishes an energizing circuit for each of the line relays for lines 101, 102, and 103. The circuit thereof may be traced from grounded battery, resistance 113, armature and back contact of relay 114, left-hand winding of line relay 115, normally closed contact 116 of relay 114, armature and back contact of relay 117, left-hand winding of line relay 118, normally closed contact 119 of relay 117, conductor 120, closed contact 121 and armature of relay 105, contact 122 of relay 123, right-hand winding of relay 124, armature and contact 125 of relay 123, conductor 126, and the extreme left-hand armature and contact of relay 105 to ground. Line relays 115, 118, and 124 of lines D, C, and B respectively are thus maintained energized, notwithstanding the fact that their line circuits may be opened and closed at the contacts of the repeater 127.

Repeater 127 is similar in construction to repeater 72 described in connection with Fig. 2, comprising a selector magnet 128 with its associated instrumentalities for operating contacts 129 and 130. Also included in circuit with the selector magnet 128 is a motor control relay 131 functioning in the manner described for relay 70 of Fig. 2. The circuit for the selecting magnet of repeater 127 may be traced from grounded battery, through the winding of selector magnet 128, winding of motor control relay 131, front contact and armature of relay 115, conductor 133, front contact and armature of relay 118, conductor 134, front contact and armature of relay 104, and the front contact and armature of relay 124 to ground. Over the circuit just traced the selector magnet 128 will respond in accordance with the opening and closure of the front contact of line relay 104.

Included in circuit with contacts 129 and 130 of the regenerative repeater 127 are relays 135, 136, 137, and 138. Each of these relays operates, as was described in connection with relays 63, 91, 92, and 93 of Fig. 2, to open and close line conductors 101, 102, and 103. Relay 137 of course responds to the operation of contacts 129 and 130, but without effecting line conductor 100, since during such period auxiliary relay 105 is energized and closes through its right-hand armature and front contact a short circuit around the armature and contact of relay 137.

In accordance with Fig. 3, auxiliary relay 105, as is equally true of auxiliary relays 114, 117, and 123, is of the slow-to-release type, so that when a branch station seizes the circuit and undertakes the transmission of a message to all other stations of the system as a result of the operation of the regenerative repeater 127, the other stations cannot seize the circuit since relay 105 retains its armatures during the normal stop impulses of start-stop transmission and will not open the circuits under its control unless there is a cessation

of transmission from station A for a predetermined period.

The use of a slow-to-release auxiliary relay such as 105, 114, 117, and 123 is particularly advantageous when using an automatic tape transmitter 140 disclosed diagrammatically for station A. When transmission from station A ceases for a sufficient time interval to permit the release of the armature of the auxiliary relay 105, 114, 117, or 123 associated with the line then transmitting, normal conditions will be restored throughout the central office, and any of the other branch stations may seize the system, or, if the feature is embodied in the arrangement disclosed in Fig. 1, the central office receiving printer.

The invention has been described in connection with specific systems which are capable of modification without departing from the spirit or scope of the invention, the invention being limited only by the scope of the appended claims.

What is claimed is:

1. In a telegraph system, a plurality of telegraph lines, signal responsive apparatus individual to said lines and responsive to signals originated upon said lines individually, telegraph apparatus common to said lines, means controlled from any line to seize said telegraph apparatus, and means for disabling said signal responsive apparatus individual to all lines other than the seizing line.

2. In a telegraph system, a plurality of radial lines, signalling relays one responsive to control from each one of said lines, and means associated with one of said relays for electrically energizing all others of said signalling relays.

3. In a telegraph system, a plurality of radial lines, signalling relays one responsive to impulses on each one of said lines, and means associated with one of said relays for rendering all others of said signalling relays unresponsive to line signals.

4. In a telegraphic repeating system, a central station, a plurality of circuits radiating from said station, a regenerative repeater at said station, means controlled by a signal over any one of the circuits to seize the repeater, and means comprising permanent direct connections between said repeater and all of said circuits to repeat impulses from the seizing circuit into all others of said circuits.

5. In a telegraph repeating system, a central station, a plurality of circuits radiating from said station, a regenerative repeater at said station, a code cycle cam in said repeater, means controlled by a signal over any one of the circuits to seize the repeater, means including said cam to hold said seizure through a period of one code cycle, and means to repeat impulses from the seizing circuit into all others of said circuits.

6. In a telegraph system, a central office, a plurality of lines, a plurality of relays at said central office controlled by said lines, a printer at said central office adapted to be seized by any one of said relays, a code cycle cam in said printer, and means including said cam to lock all others of said relays for one code cycle in response to seizure of said printer by one of said relays.

7. In a telegraph system, a central office, a plurality of lines, a plurality of relays at said central office controlled by said lines, a printer at said central office adapted to be seized by one only of said relays, a code cycle cam in said printer, and means including said cam to disable all others of said relays in response to seizure of said printer by one of said relays.

8. In a printing telegraph system, a single tele-

graphic printer, a plurality of lines connected thereto for printing telegraphic transmission, and means to create a recurrent electrical signal upon all non-transmitting lines when one of said lines is transmitting to said printer.

9. In a printing telegraph system, a single telegraphic printer, a plurality of lines connected thereto for printing telegraphic transmission, printing telegraph apparatus connected to remote ends of said lines, and means to create an audible busy signal at the remote ends of all other lines when one of said lines is transmitting to said printer.

10. In a telegraph system, a central office, a plurality of normally closed radiating circuits, a single recorder at said central office, and means responsive to a starting signal impulse of a permutation code signal to open all of the other circuits in response to the opening of an initiating circuit to assume control of the recorder, and to maintain said other circuits open during the period of transmission of the intelligence impulses of said code signal.

11. In a telegraph system, a plurality of closed circuit telegraph lines, telegraph apparatus common to all said lines, a cam in said telegraph apparatus, means whereby any line may seize said telegraph apparatus, and means including said cam for opening all lines other than the seizing line for a period of one code cycle.

12. In a telegraph system, a central station, a plurality of substations, line circuits incoming to said central station, one from each of said substations, line relays, one for each of said line circuits and controlled by said substations over said line circuits, a regenerative repeater mechanism responsive to any one of said line relays, and means responsive to any of said line relays for shunting contacts in all others of said line relays.

13. In a telegraphic repeating system, a central station, a plurality of circuits radiating from said central station for telegraphic transmission, signalling relays in said central station, one for each of said circuits, signal repeating contacts in each of said signalling relays, a signal repeating circuit connected through all of said signal repeating contacts in series, and shunting circuits responsive to operation of one of said signalling relays for shunting said signal repeating contacts in all others of said signalling relays.

14. In a telegraphic repeating system, a central station, a plurality of circuits radiating from said central station for telegraphic transmission, line relays in said central station, one for each of said circuits, locking windings one for each of said line relays, a locking circuit normally open and connected to all of said locking windings, and means associated with each of said line relays for disconnecting its locking winding from said locking circuit and for closing said locking circuit to lock all other line relays.

15. In a telegraphic repeating system, a central station, a start-stop regenerative repeater at said central station, any number of circuits radiating from said central station for telegraphic transmission, line relays in said central station, one for each of said circuits, locking windings one for each of said line relays, a locking circuit normally open and connected to all of said locking windings, means associated with each of said line relays for disconnecting its locking winding from said locking circuit and for closing said locking circuit to lock all other line relays, and a code cycle cam in said repeater and controlling the duration of closure of said locking circuit.

16. In a telegraph repeating system, a central station, any number of circuits radiating from said station, a regenerative repeater at said station, means controlled by a signal over any one of said circuits to seize said repeater, means to repeat from said seizing means through said repeater into all of said circuits other than said seizing circuit, line relays, one for each of said circuits, a locking winding for each of said line relays, a locking circuit, means for closing said locking circuit in response to a signal over any one of said radiating circuits, and means for disconnecting said locking winding of the said seizing line.

17. In a telegraph repeating system, a central station, a plurality of circuits radiating from said station, a regenerative repeater at said station, a slow-to-release seizing means controlled by a signal over one of said circuits to seize said repeater, and means to repeat from the said one of said circuits into all others of said circuits, said slow-to-release seizing means being adapted to maintain said seizure through marking and

spacing signals of maximum length for normal continuous telegraphic code transmission.

18. In a telegraph repeating system, a central station, a plurality of circuits radiating from said station, a regenerative repeater at said station, means controlled by a signal over any one of the circuits to seize the repeater, means to repeat from the seizing circuit into all others of said circuits, and means to maintain said seizure under control of the seizing one of said circuits.

19. In a telegraph system, a plurality of radial lines, signaling relays, one responsive to impulses on each one of said lines, a common recorder, means associated with all of said relays for recording upon said common recorder signals received by any of said relays, and means associated with said common recorder for disabling all of said relays except the signal originating relay whereby but one communication may occur at one time and whereby all communications are recorded upon said common recorder.

LOUIS M. POTTS.