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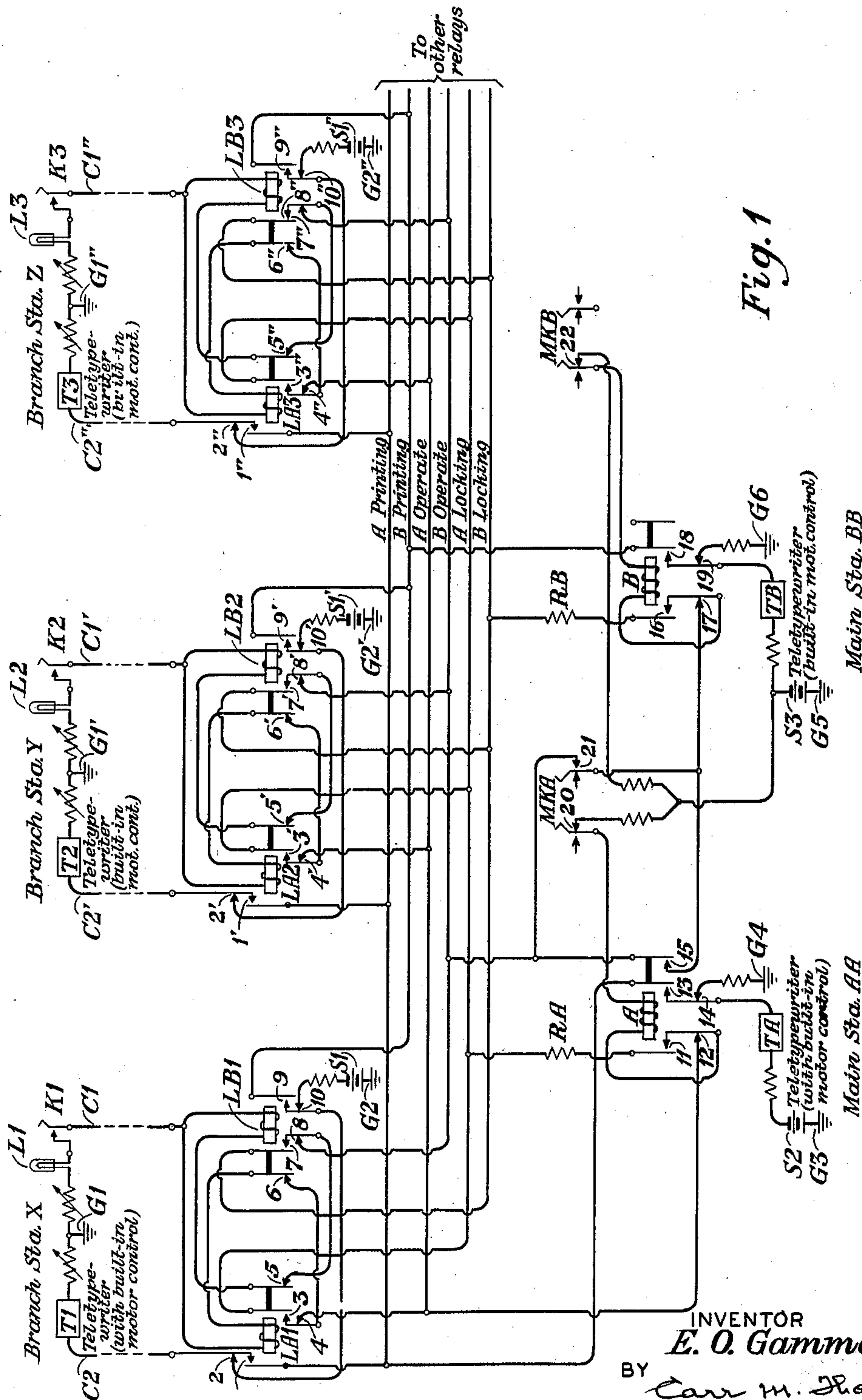
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2,315,413

TELETYPEWRITER SELECTION SYSTEM

Filed July 18, 1940

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

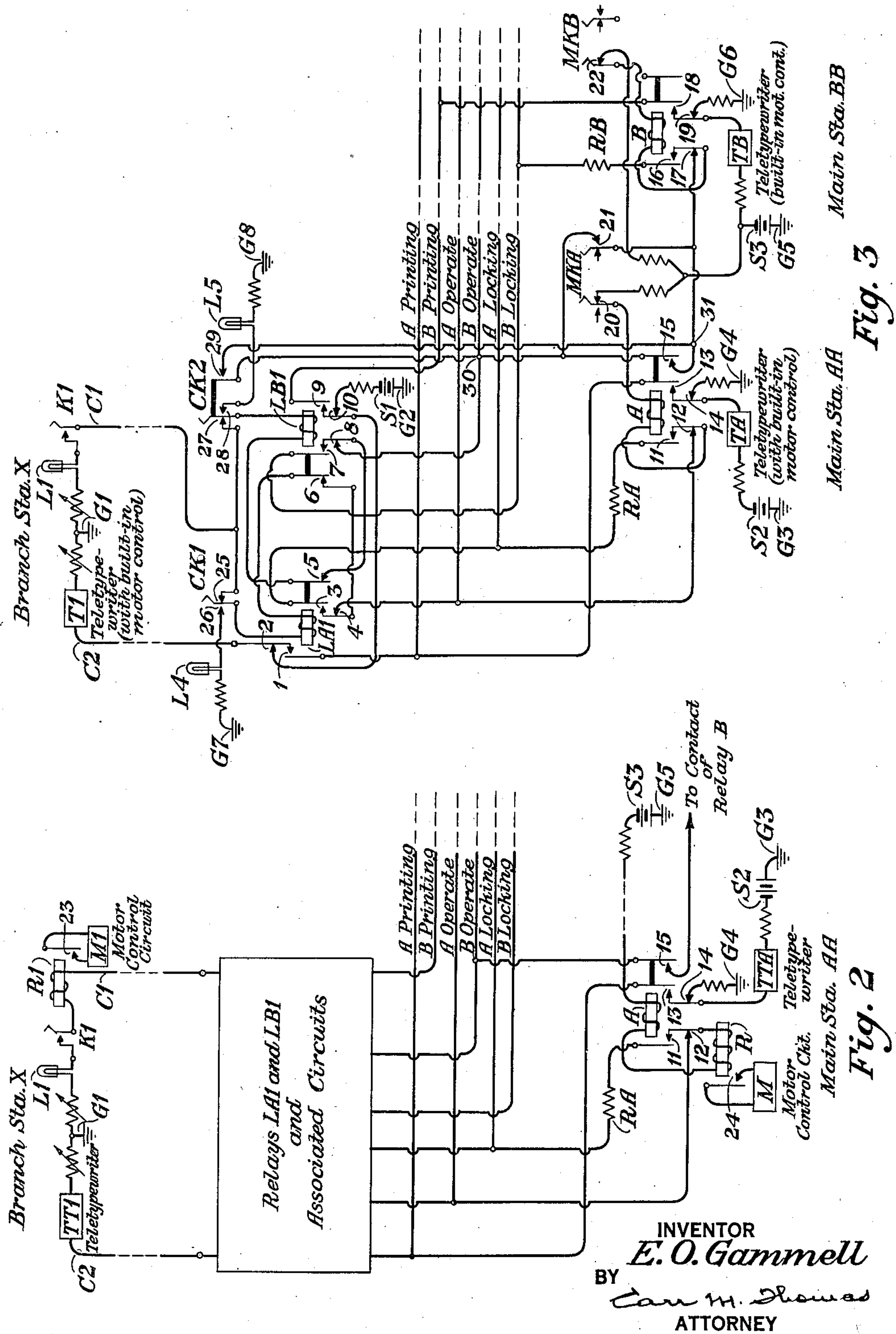


Fig. 3

Main Sta. AA Main Sta. BB

Fig. 2

Main Sta. AA

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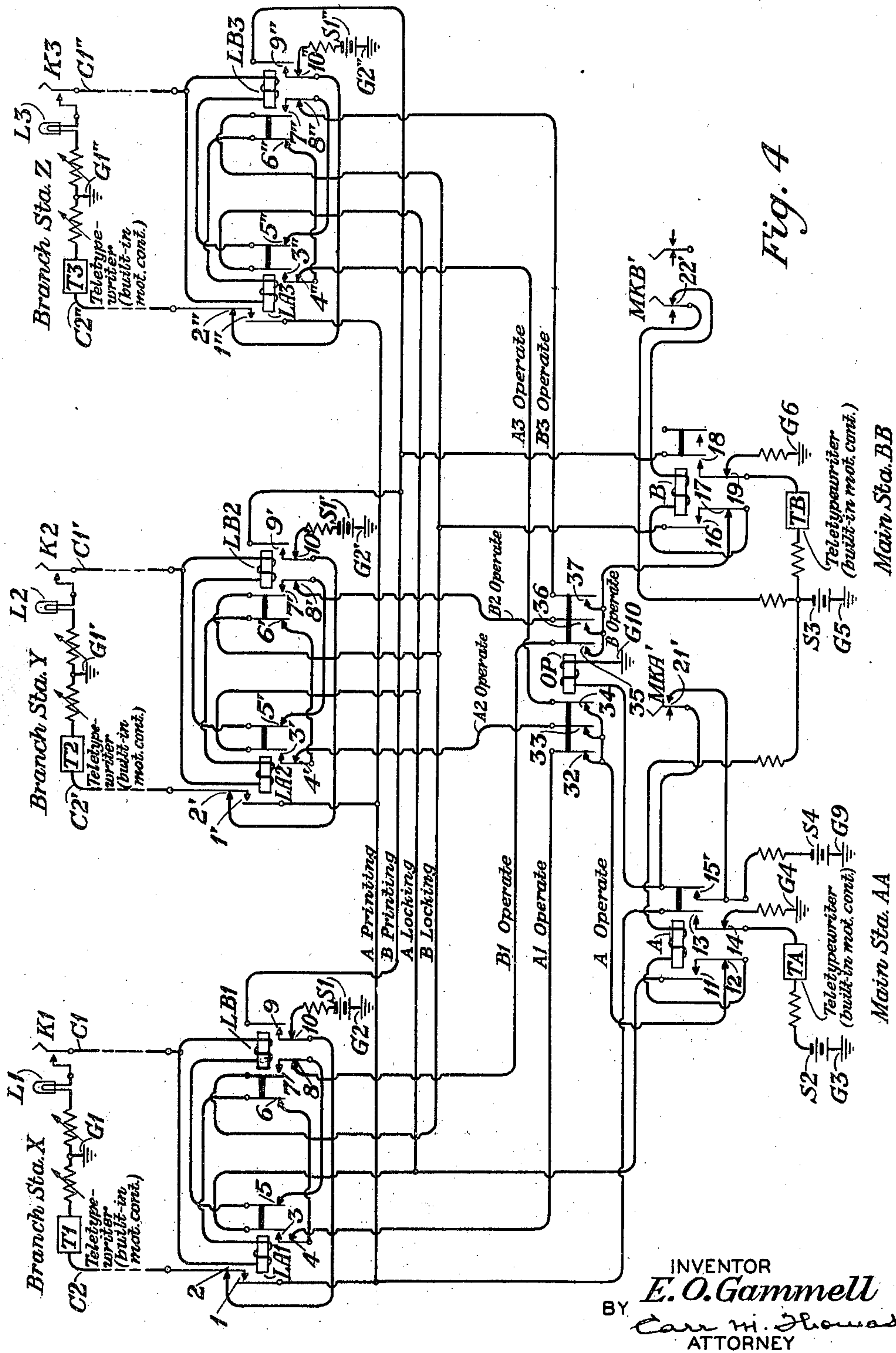
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,315,413

TELETYPEWRITER SELECTION SYSTEM

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15 Claims. (Cl. 178—2)

This invention relates to signaling systems of the radial type and, more particularly, to printing telegraph systems in which any one of a plurality of branch stations is to be connected with a main station or one of a group of main stations having unattended receiving apparatus such as a receiving teletypewriter.

The invention is applicable especially to a communication system in which transmitting teletypewriters at outlying or branch stations are used to transmit messages to any one of a number of "main" stations each equipped with a receiving teletypewriter which is not continuously attended, it being immaterial which one of the "main" stations receives the message.

The principal object of the invention is to provide one-way communication of the type indicated hereinbefore with economy of apparatus, attendance and time.

In general, a system embodying the invention comprises one or a plurality of main stations, a plurality of branch stations, and selective switching means operating automatically in response to the closing of a key to complete a connection between a branch station and an idle main station.

While the invention is directed primarily to the selective establishment of connections for one-way communication from branch station to main station and may be embodied in a system having sending only equipment at the branch stations and receiving only equipment at the main stations, it will be made clear hereinafter that the arrangement may be readily adapted to operate with provision for two-way communication between branch station and main station.

The invention will be clearly understood from the following detailed description of one desirable form of embodiment thereof, with certain modifications of that form, which description is to be read with reference to the accompanying drawings.

Figure 1 of the drawings shows diagrammatically, and in part schematically, an arrangement of a system designed for automatic selective switching to complete connection between a plurality of branch station teletypewriters and either one or two main station teletypewriters, the teletypewriters having built-in motor control.

Fig. 2 shows by diagram and scheme a part of the system of Fig. 1 modified to provide for the relay control of the teletypewriter motors.

Fig. 3 shows diagrammatically a circuit modification, with respect to Fig. 1, whereby the system is arranged for two-way teletypewriter com-

munication between a main station and a branch station.

Fig. 4 shows a modification of the selection circuit of Fig. 1 which may be desirable in some cases to insure positive operation of the switching apparatus.

Like characters of reference in the several figures of the drawing designate corresponding elements of the system.

With reference to the details of the drawing, and first with reference particularly to Fig. 1, there is disclosed a signaling system of the radial type including main stations AA and BB and outlying branch stations X, Y and Z representative of any suitable number of branch stations. Teletypewriters TA and TB are schematically indicated at main stations AA and BB, respectively, and teletypewriters T1, T2 and T3 are similarly shown at branch stations X, Y and Z, respectively. As indicated on the drawings, each of these teletypewriters is equipped with built-in motor control. For a more detailed description of this teletypewriter apparatus, well known in the art, reference may be had to U. S. Patent No. 1,904,164 to Morton, Krum and Kleinschmidt, issued April 18, 1933. It will be understood that for the purpose of the present discussion interest is had in T1, T2 and T3 as transmitting teletypewriters and in TA and TB as receiving teletypewriters.

The "selecting" switches take the form of relays A and B, more directly associated with the main stations, and relays LA1 and LB1, LA2 and LB2, and LA3 and LB3, more directly associated with control conductors extending to the branch stations. It is to be understood that the main stations AA and BB may be in one building or may be widely separated, and that the switching relays, while preferably located in proximity to a main station, are not necessarily so located.

The invention as disclosed and hereinafter claimed is useful not only in the case of a plurality of main stations but also in a case in which, because of the limited number of branch stations or because of limited traffic requirements, one main station is sufficient. In association with the main stations AA and BB of Fig. 1 there are disclosed "make busy" keys MKA and MKB: the operation of either of these keys will remove the corresponding teletypewriter TA or TB from effective association with the system. It will be further understood that if only one main station is required for any purpose, the system as disclosed in Fig. 1 may be simplified in an obvious manner. Likewise, it should be noted that there

is indication in Fig. 1 of the wiring for additional branch stations. It will be understood, furthermore, that a third main station may be included, with the addition of another relay such as A or B and additions to the relay groups LA1 and LB1, LA2 and LB2, etc. It appears that traffic requirements calling for more than three main stations can be best met by duplication of the system, with respect to the main stations and selective switching relays, and the division of the branch circuits between the two systems.

It will be noted that with all teletypewriters idle a circuit is closed through teletypewriter T1 at branch station X, for example, from ground at G1, through the teletypewriter, over the printing conductor C2, normally closed contacts 2 and 10, and battery S1 to ground at G2. Similarly, teletypewriter TA at main station AA, for example, has a circuit closed from ground at G3, through battery S2, the teletypewriter, and normally closed contact 14 to ground at G4. The purposes of the maintenance of these circuits under idle conditions are well known to those skilled in the art. In general, this arrangement prevents the printing of false characters, i. e., characters that are brought through by the opening and closing of a printing circuit by switching operations instead of teletypewriter operations.

Let it be assumed now that an operator at branch station X wishes to send a message to a main station at a time when, as a matter of fact, no connection over the system has been previously established. The operator closes the call key K1, with the result that a circuit is completed as follows: from ground at G1, through a variable resistance, supervisory lamp L1 and the call key, over control conductor C1, the winding of relay LA1, contact 6, contact 4, contact 12, the winding of relay A, contact 20 of key MKA, and battery S3 to ground at G5. The circuit is completed through the windings of relays LA1 and A, and not through the windings of relays LB1 and B, because contact 15 of relay A is open. The completion of the circuit traced hereinbefore causes the operation of relays LA1 and A. The operation of LA1 makes contact 1 and, subsequently, breaks contact 2, while the operation of relay A makes contact 13 and, subsequently, breaks contact 14. These operations complete the printing circuit as follows: from ground at G1, through a variable resistance, teletypewriter T1, printing conductor C2, contact 1, contact 13, main station teletypewriter TA and battery S2 to ground at G3. Thus far there has been seen the operation of what will be termed the "A operate" circuit, which in turn has resulted in the completion of the "A printing" circuit between teletypewriter T1 at branch station X and teletypewriter TA at main station AA.

In order that the switching relays may be held in operated condition an "A locking" circuit is provided, as follows: from ground at G5, through battery S3, contact 20 of key MKA, the winding of relay A, contact 11 (closed by the operation of relay A before the opening of contact 12 of the "operate" circuit), fixed resistance RA, contact 3 (closed by the operation of relay LA1 before the breaking of contact 4 included in the "operate" circuit), contact 6, winding of relay LA1, control conductor C1, call key K1, lamp L1, and a variable resistance to ground at G1.

It will be noted that as long as relay A is held

operated contact 12 is open and contact 15 is closed. It will be noted, further, that contact 12 is in the "A operate" circuit and that contact 15 is in the "B operate" circuit.

With a circuit completed through the winding of relay LA1 the supervisory lamp L1 at branch station X will light. Thus, the lighting of this lamp serves as an indication that teletypewriter T1 is connected with a teletypewriter at one of the main stations and, conversely, the failure of the lamp to light in response to the closing of call key K1 is an indication that no connection has been made because no main station is idle.

Let it be assumed next that while the connection is maintained between branch station X and main station AA, the operator at branch station Y wishes to send a message to a main station. The closing of call key K2 initiates the desired connection. This connection cannot be completed through the windings of relays LA2 and A because the "A operate" circuit is broken at contact 12 of relay A. However, the connection can be completed over the winding of relay LB2 since the "B operate" circuit has been prepared for operation by the closing of contact 15 associated with relay A. This "B operate" circuit, completed upon the operation of key K2, is traced as follows: from ground at G1', through the variable resistance, lamp L2 and the key, over control conductor C1', the winding of relay LB2, contact 5' (relay LA2 being unoperated), contact 8', contact 15, contact 17, the winding of relay B, contact 22 of key MKB, and battery S3 to ground at G5. Relays LB2 and B now operate and the printing circuit to connect branch station Y and main station BB is completed as follows: from ground at G1', through a variable resistance, teletypewriter T2, printing conductor C2', contact 2' (relay LA2 being unoperated), contact 9' (relay LB2 being operated), contact 18 (closed upon the operation of relay B), teletypewriter TB, and battery S3 to ground at G5. The "B locking" circuit is traced from ground at G5, through battery S3, contact 22 of key MKB, winding of relay B, contact 16, fixed resistance RB, contact 7', contact 5', winding of relay LB2, control conductor C1', call key K2, lamp L2, and variable resistance to ground at G1'. The supervisory lamp L2 at branch station Y lights upon the completion of a circuit such as the "B operate" circuit described hereinbefore, and is held lighted by the "B locking" circuit just described, an indication thus being given to the operator at station Y that that station is connected with one of the main stations.

If, while the connections initiated at branch stations X and Y, respectively, are both maintained, the operator at branch station Z operates call key K3, no circuit will be completed to a main station since the "A operate" circuit is open at contact 12 of relay A, and the "B operate" circuit is open at contact 17 of relay B. The fact that no main station is immediately available to receive the message from station Z is indicated at that station by the failure of lamp L3 to light. If, however, the operator at station Z subsequently operates the call key K3 and either of the main stations has by that time become idle, a connection will be completed from Z to the idle main station. If the operator at station X restores key K1 to the unoperated position the circuits completed in response to the operation of that key will be restored to normal, and the reclosing of contact 12 of relay A will make the "A operate" circuit available to serve branch station Z and

to connect its teletypewriter T3 with teletypewriter TA at main station AA. This connection may be completed as soon as station AA becomes available, regardless of the condition of station BB. If, however, the connection between branch station Y and main station BB is broken before the breaking of the connection between branch station X and station AA, then the connection from branch station Z will be to station BB (the "operate" circuit being completed over contacts 15 and 17) instead of to station AA.

If a main station is available and an "operate" circuit is closed, the printing and locking circuits controlled in part by relay LA3 or relay LB3 at branch station Z correspond to those discussed hereinbefore in connection with calls initiated at stations X and Y.

Thus it is seen that if the operator at any one of the branch stations closes the call key at that station to initiate a connection with a main station, the connection is automatically completed if an idle main station is available, and the completion of the connection is indicated by the lighting of the supervisory lamp at the calling branch station. If, on the other hand, there is no main station immediately available to receive the message which it is desired to send, that fact is indicated to the calling operator by the failure of the branch station lamp to light. The subsequent restoration of a branch station key will render one of the main stations available and a new call will result in a connection to that main station, whichever one it may be.

If by chance the operators at two or more branch stations close their respective call keys simultaneously, the "A operate" circuit, for example, may be closed through two or more branch stations. In this case, however, the lamps will light only dimly, and the operators will thus have indication that a proper connection has not been completed and will reopen their keys. The lamps will light only dimly because they are connected in parallel with respect to the source S3 and, accordingly, the current will be divided among the several branches of the circuit.

In the system of Fig. 1, with its two main stations, if it is desired for any reason to take out of operation the teletypewriter at a main station, provision is made whereby this can be readily done and all calls will be routed to the other main station. If the "make busy" key MKA is operated to open contact 20 and close contact 21, the "A operate" circuit is disabled and the "B operate" circuit is completed over contacts 21, 17 and 22. Similarly, if key MKB is operated to open contact 22, the "B operate" circuit is disabled at that point without affecting the "A operate" circuit, provided, of course, that key MKA is now in the position to close contact 20.

It will be understood that while the advantages of a selection system embodying the invention are most striking in the case of a system such as that disclosed in Fig. 1, in which there is a plurality of main stations, the invention has considerable utility in the case in which only one main station is necessary because of a limited number of branch stations or limited traffic requirements. In the latter case, the advantages are that there is no requirement of continuous attendance at the main station and that the connection from any branch station to the main station is automatically completed without waste of time, the completion of the call being promptly and automatically indicated by the lighting of the branch station supervisory lamp. It will be ob-

vious that if the main station AA of Fig. 1, for example, is the sole main station, the effective circuits controlled by relay A will be those so controlled when key MKB of Fig. 1 is operated to open contact 22, and it will be equally obvious that the relays B, LB1, LB2 and LB3 can be dispensed with.

With reference to Fig. 1, it remains to point out the reason for inclusion of the fixed resistances RA and RB in the "A locking" and "B locking" circuits, respectively. It is important that the initial closing of an operating circuit, for example that including the windings of relays LA1 and A, produce a positive operation of the relays. For this reason the adjustable resistance shown between ground G1 and lamp L1 at station X, for example, should be adjusted to give adequate current through the relay windings upon the completion of the "operate" circuit. If this current is not adequate to such positive operation there may be a "chattering" of the relays, because of the draining of current away from the winding of relay LA1 over a circuit such as the following: from ground at G1, over a variable resistance, lamp L1, key K1, control conductor C1, winding of relay LA1, contact 6, contact 4, the "A operate" conductor, contact 4' (of relay LA2), contact 6', winding of relay LA2, winding of relay LB2, contact 5', contact 8', the "B operate" conductor, contact 8 (of relay LB1), contact 5 (of relay LA1), winding of relay LB1, etc. If the operation of relay LA1, for example, is positive, it is obvious that such an undesired circuit will not be completed because contact 5 is held open. With the variable resistance shown between ground G1 and lamp L1 adjusted to give this high current in the "A operate" circuit, it is desirable to provide for the reduction of the current flowing through the windings of relays such as LA1 and A over the "locking" circuit by the inclusion of the fixed resistance RA in the latter circuit. Similarly, it is desirable to include fixed resistance RB in the "B locking" circuit. If, by reason of the system condition, such as the inclusion of a large number of branch stations, the arrangement of Fig. 1 does not give assurance of proper operation of the switching relays, an alternative arrangement may be resorted to such as that disclosed in Fig. 4. This alternative arrangement will be described and discussed hereinafter.

If, instead of the built-in motor control indicated in Fig. 1, the teletypewriters are operated with relay control of the motors, the circuit of Fig. 1 can be modified as disclosed in Fig. 2. This figure shows branch station X with teletypewriter TT1 and motor control circuit M1 both schematically indicated, and main station AA with teletypewriter TTA and motor control circuit M. It will be understood that modifications similar to those disclosed would be made at branch stations Y, Z, etc., and at the additional main stations such as station BB of Fig. 1.

Between the call key K1 of branch station X and the control conductor C1, there is inserted relay R1. If the connection to a main station initiated by the closing of key K1 is completed to an idle main station, relay R1 operates and closes contact 23 to complete the motor control circuit M1. Similarly, relay R has its winding included in the circuit associated with relay A between contact 12 and the winding of relay A. Upon the completion of the "operate" circuit relay R operates to close contact 24 and complete the motor control circuit M associated with the main station teletypewriter TTA.

In Fig. 3 there is disclosed a modification of circuits such as those disclosed in Fig. 1, whereby, without reducing the efficiency of the system to provide automatic selection for one-way communication from branch station to main station, provision is made for the initiation at a main station of communication with a branch station. The circuits more directly associated with the main station teletypewriters TA and TB, and the switching apparatus more directly associated with branch station X, are shown in detail, it being understood that changes similar to those disclosed in connection with station X will be made for branch stations Y, Z, etc.

It should be added that in the case of Fig. 3 the branch station teletypewriters represented by T1 and the main station teletypewriters TA and TB will be sending and receiving machines. Furthermore, it is obvious that for suitable operation at a main station the call keys added to the circuits of Fig. 1 should be at the appropriate main station printing point.

In the circuits including the windings of relays LA1 and LB1, there are added call keys CK1 and CK2, respectively. These are the call keys available at the main stations for calling branch station X for communication with main station teletypewriters TA and TB, respectively.

Let it be assumed that an attendant at main station AA wishes to transmit a message from teletypewriter TA to teletypewriter T1 at station X. Key CK1 is operated to open contact 25 and close contact 26. The "A operate" circuit is now traced from ground at G7, through contact 26, winding of relay LA1, contact 6, contact 4, contact 12, winding of relay A, contact 20 of "make busy" key MKA, and battery S3 to ground at G5. The operation of relays LA1 and A will complete the "A printing" circuit as in the case of Fig. 1, and the "A locking" circuit is completed over contact 25 to ground at G7, instead of over the branch station control conductor C1 as in the case of Fig. 1.

In the case of the initiation of a connection to station X from the main station BB, if station AA is idle and key CK1 is open, contact 15 of relay A will be open and suitable provision must be made for the completion of the circuit through the winding of relay B. For this reason call key CK2 has not only contacts 27 and 28 corresponding to contacts 25 and 26, respectively, of key CK1, but also a contact 29. If this key is operated to open contact 27 and close contacts 28 and 29, the "operate" circuit is completed from ground at G3, through contact 28, the winding of relay LB1, contact 5, contact 3, point 30 on the "B operate" circuit, contact 29, point 31, contact 17, winding of relay B, contact 22 of "make busy" key MKB, and battery S3 to ground at G5. The printing circuit is now completed through the closing of contacts 9 and 18, and the "B locking" circuit is completed over contact 28 to ground at G3.

It will be noted that with the keys CK1 and CK2 of Fig. 3 in the unoperated position, the effective circuit is the full equivalent of the corresponding portions of the system disclosed in Fig. 1.

If, in the arrangement of Fig. 3, main stations AA and BB are widely separated, it becomes necessary to provide for suitable indication at a main station of the completion of a connection initiated at that station. For this purpose supervisory lamps such as L4 and L5 may be included. Lamp L4 is connected in the circuit

controlled by call key CK1, between ground G7 and the key, and will light when the corresponding "operate" circuit is completed, to indicate to an operator at station AA that such completion is effected. Similarly lamp L5 is included in the circuit controlled by key CK2, and serves to give the desired indication to an operator at station BB. It will be understood that lamps L4 and L5 serve stations AA and BB, respectively, in connection with calls from a main station to the branch station X shown in Fig. 3, and that additional lamps will be provided at the main stations to indicate the completion of calls to the other branch stations, such as Y and Z of Fig. 1.

As indicated hereinbefore, there may be circuit conditions which will render the provisions of Fig. 1 for the positive action of the switching relays inadequate. In such cases, in place of the adjustment to high current and the inclusion in the locking circuits of fixed resistances RA and RB, resort may be had to the circuit of Fig. 4. It will be observed that the system as disclosed in this figure corresponds to the system of Fig. 1 with the exception that the "A operate" and "B operate" circuits are divided in correspondence with the number of branch stations, and an additional relay OP, which may be termed the "operating" relay, is provided. The circuits are shown for the case of three branch stations. It will be understood that an increase of the number of branch stations calls for further division of the "operate" circuits, and additional armatures and contacts for the relay OP.

It will be observed that the "A1 operate" circuit extends from contact 4 of relay LA1 to contact 32 of relay OP. Similarly, the "A2 operate" circuit extends from contact 4' of relay LA2 to contact 33 of relay OP, and the "A3 operate" circuit extends from contact 4'' of relay LA3 to contact 34 of relay OP. Similarly, the "B operate" circuit is divided and its branches are associated with contacts 35, 36 and 37, respectively, of relay OP. It should be noted, furthermore, that a slight modification appears in the "make busy" key MKA'.

With the "make busy" keys in the normal position and all stations idle, the operating circuit of relay OP is broken at contact 15'. Upon the operation of relay A contact 15' is closed and a circuit is completed from ground at G9, through battery S4, contact 15', and the winding of relay OP to ground at G10. The operation of this relay opens contacts 32, 33 and 34 and closes contacts 35, 36 and 37, thus maintaining in complete separation the "A operate" and the "B operate" circuits. Accordingly, relays LA1 and A, for example, will receive the full benefit of the current applied to the "operate" circuit.

If the branch station X and main station AA are connected, and a call is initiated at station Y, for example, the operating circuit will be completed over the winding of relay LB2, the "B2 operate" circuit, and closed contact 36 to relay B. Since contact 36 is closed, contact 33 will be open and the separation between the A and B operating circuits maintained.

If the "make busy" key MKA' is operated to close contact 21', the operating circuit of relay OP is completed through that contact and battery S4, with the result that contacts 32, 33 and 34 of relay OP are held open and contacts 35, 36 and 37 are held closed. Thus, relay A cannot be operated while the paths are prepared for the operation of relay B.

While the invention has been disclosed in one

desirable embodiment and certain modifications thereof, for the purpose of clear illustration, it is to be understood that the embodiment may take other and widely different forms without departure from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a telegraph system, a main station, a plurality of branch stations, a printer at the main station, a printer at each branch station, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, circuits individual to said branch stations radiating from said main station and adaptable to serve as printing circuits operable only between one branch station printer and the main station printer, means at each branch station for initiating a connection therefrom to the main station over the appropriate circuit, and automatic means directly responsive to the operation of said initiating means when the main station is idle for completing the connection between the appropriate branch station printer and the main station printer.

2. In a telegraph system, a main station, a plurality of branch stations, a printer at the main station, a printer at each branch station, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, circuits individual to said branch stations radiating from said main station and adaptable to serve as printing circuits operable only between one branch station printer and the main station printer, means at each branch station for initiating a connection therefrom to the main station over the appropriate circuit, and automatic means directly responsive to the operation of said initiating means when the main station is idle for completing the connection between the appropriate branch station printer and the main station printer, said completing means being adapted to remain operated until disconnection between said stations.

3. In a telegraph system, a main station, a plurality of branch stations, a printer at the main station, a printer at each branch station, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, circuits individual to said branch stations radiating from said main station and adaptable to serve as printing circuits operable only between one branch station printer and the main station printer, a key at each branch station for initiating a connection therefrom to the main station, and automatic means directly responsive to the closing of said key when the main station is idle for completing the connection between the appropriate branch station printer and the main station printer over the appropriate circuit, the opening of said key effecting the disconnection.

4. In a telegraph system, a main station, a plurality of branch stations, a printer at each of said stations, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, circuits individual to said branch stations radiating from said main station and adaptable to serve as printing circuits operable only between one branch station printer and the main station printer, a key at each branch station for initiating a connection therefrom to the main station over the appropriate circuit, automatic means directly responsive to the closing of said

key when the main station is idle for completing the connection between the appropriate branch station printer and the main station printer, and a lamp at each branch station for automatically indicating the completion of a connection from that station to the main station, the restoration of said key effecting the disconnection between the printers and extinguishing said lamp.

5. In a telegraph system, a main station, a plurality of branch stations, a printer at the main station, a printer at each of said branch stations, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, circuits individual to said branch stations radiating from said main station and adaptable to serve as printing circuits operable only between one branch station printer and the main station printer, a key at each branch station for initiating a connection therefrom to the main station over the appropriate circuit, keys associated with the main station for initiating a connection from said station to any certain one of said branch stations, and automatic means directly responsive to the operation of any one of said keys when the main station is idle for completing the connection between the main station printer and the appropriate branch station printer.

6. In a telegraph system, a main station, a plurality of branch stations, a printer at each of said stations, a source of current associated with each of said printers, means for normally closing a holding circuit through each of said printers and the source associated therewith, a main control relay, a source of current associated therewith, branch control relays individual to said branch stations, a plurality of printing circuits and a plurality of control circuits extending radially from said main station each to one of said branch stations, a signal annunciator at each of said branch stations, a key at each of said branch stations designed to close the appropriate control circuit through the appropriate branch control relay, said main control relay, the source associated therewith and the appropriate annunciator, automatic means responsive to the operation of said control relays for rendering the closing of the key at any branch station subsequent to the closing of the key at another branch station ineffective, and automatic means responsive to the operation of said control relays for closing the printing circuit between said main station and the branch station at which the key has been effectively operated through the main station printer, the current source associated therewith and the appropriate branch station printer, and subsequently opening the holding circuits normally closed through said printers.

7. In a telegraph system, a main station, a plurality of branch stations, a printer at each of said stations, a source of current associated with each of said printers, means for normally closing a holding circuit through each of said printers and the source associated therewith, a main control relay, a source of current associated therewith, branch control relays individual to said branch stations, a plurality of printing circuits and a plurality of control circuits extending radially from said main station each to one of said branch stations, a signal annunciator at each of said branch stations, a key at each of said branch stations designed to close the appropriate control circuit through the appropriate branch control relay, said main control relay, the

source associated therewith and the appropriate annunciator, automatic means responsive to the operation of said control relays for rendering ineffective the closing of the key at any branch station subsequent to the closing of the key at another branch station, automatic means responsive to the operation of said control relays for closing the printing circuit between said main station and the branch station at which the key has been effectively operated through the main station printer, the current source associated therewith and the appropriate branch station printer, and subsequently opening the holding circuits normally closed through said printers, and automatic means responsive to the opening of the key at any branch station for effecting disconnection between said station and the main station and rendering the system operative in response to the opening of the key at any other branch station.

8. In a telegraph system, a plurality of associated main stations, a plurality of branch stations, a printer at each of said stations, circuits individual to said branch stations radiating from said main stations as a group and adaptable to serve as printing circuits each operable only between one branch station printer and a main station printer, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, a key at each branch station for initiating a connection therefrom to a main station, a chain of relays and associated circuits directly responsive to the operation of any one of said keys when a main station is idle for automatically completing a connection from the appropriate branch station to the first in order of the idle main stations, a signal annunciator at each branch station for automatically indicating the completion of a connection initiated at that station, and circuit arrangements whereby the restoration of an effectively operated key at a branch station will automatically effect disconnection from the main station and restoration of the relays previously operated by said key.

9. In a telegraph system, a plurality of associated main stations, a plurality of branch stations, a printer at each of said stations, circuits individual to said branch stations radiating from said main stations as a group and adaptable to serve as printing circuits operable only between one branch station printer and a main station printer, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, automatic switching apparatus associated with the main stations, said apparatus comprising a main control relay associated with each main station printer and a plurality of groups of branch control relays individual to said branch stations, a plurality of control circuits each extending from one of said groups of branch control relays to the appropriate branch station, a key at each branch station for directly completing the appropriate control circuit, if a main station is idle, through the winding of the appropriate branch control relay and the winding of the main control relay associated with the printer at the first in order of the idle main stations, and automatic means directly responsive to the operation of the appropriate branch control relay and main control relay for connecting over the appropriate printing circuit the printer at the branch station and the printer at said previously idle main station.

10. In a telegraph system, a plurality of associated main stations, a plurality of branch sta-

tions, a printer at each of said stations, circuits individual to said branch stations radiating from said main stations as a group and adaptable to serve as printing circuits operable only between one branch station printer and a main station printer, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, automatic switching apparatus associated with the main stations, said apparatus comprising a main control relay associated with each main station printer and a plurality of groups of branch control relays individual to said branch stations, a plurality of control circuits each extending from one of said groups of branch control relays to the appropriate branch station, a key at each branch station for directly completing the appropriate control circuit, if a main station is idle, through the winding of the appropriate branch control relay and the winding of the main control relay associated with the printer at the first in order of the idle main stations, automatic means directly responsive to the operation of the appropriate branch control relay and main control relay for connecting over the appropriate printing circuit the printer at the branch station and the printer at said previously idle main station, and a lamp in series with the key at each branch station for automatically indicating the completion of a connection from that station to a main station, the restoration of the key at a connected branch station effecting the disconnection from the main station and extinguishing the lamp.

11. In a telegraph system, a plurality of associated main stations, a plurality of branch stations, a printer at each of said stations, circuits individual to said branch stations radiating from said main stations as a group and adaptable to serve as printing circuits operable only between one branch station printer and a main station printer, means associated with each of said printers for maintaining a holding circuit through the printer in its disconnected condition, a key at each branch station for initiating a connection therefrom to a main station, keys associated with the main stations for initiating a connection from a main station printer to any certain one of the branch station printers, a chain of relays and associated circuits directly responsive to the closing of any one of said keys when a main station is idle for automatically completing a connection between a main station printer and the appropriate branch station printer, provided said branch station is idle, and a lamp associated with each of said keys for automatically indicating the completion of a connection initiated thereby, each of said keys being adapted upon the opening thereof to effect disconnection of the printing circuit completed in response to the closing thereof.

12. In a telegraph system, a plurality of associated main stations, a plurality of branch stations, a printer at each of said stations, circuits individual to said branch stations radiating from said main stations as a group and adaptable to serve as printing circuits operable only between one branch station printer and a main station printer, means at each branch station for initiating a connection therefrom to a main station, means associated with the main stations for initiating a connection from a main station to any certain one of the branch stations, and automatic selecting apparatus directly responsive to the operation of any one of said initiating means when

a main station is idle for completing a connection between a main station and the appropriate idle branch station.

13. In a telegraph system, a plurality of associated main stations, a plurality of branch stations, a printer at each of said stations, circuits individual to said branch stations radiating from said main stations as a group and adaptable to serve as printing circuits operable only between one branch station printer and a main station printer, a key at each branch station for initiating a connection therefrom to a main station, keys associated with the main stations for initiating a connection from a main station to any certain one of the branch stations, and automatic selecting apparatus directly responsive to the operation of any one of said keys when a main station is idle for completing a connection between a main station and the appropriate idle branch station, said apparatus being responsive to the restoration of the operated key to effect disconnection and the restoration of the appropriate portion of the system to normal condition.

14. In a telegraph system, a plurality of associated main stations, a plurality of branch stations, a printer at each of said stations, automatic switching relays associated with said main stations, circuits radiating from said main stations as a group to said branch stations and adaptable to serve as printing circuits terminating at one branch station printer and one main station printer, a key at each branch station for initiating a connection between that station and a main station, said switching relays operating

5 directly in response to the closing of said key to complete the connection to the first in order of such main stations as are idle and in response to the restoration of said key to effect a disconnection, and keys associated with the main stations for initiating a connection from a main station to any certain one of the branch stations, said switching relays operating in response to the closing of a main station key, provided the associated main station and the selected branch station are both idle, to complete the connection to such branch station.

15. In a telegraph system, a plurality of main stations, a plurality of branch stations, a printer at each of said stations, a main control relay associated with each main station, a plurality of groups of branch control relays, each group being associated with a certain one of said branch stations and each relay of a group being associated with one of said main stations, means at each branch station for initiating a connection therefrom to a main station, means directly responsive to said initiating means for operating the appropriate branch control relay and the main control relay associated with the first in order of said main stations not already connected to a branch station, and means at each main station operable when that station is idle for operating the associated main control relay and the appropriate branch control relay associated with a selected idle branch station to establish a connection between such stations.

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