No. 894,044. PATENTED JULY 21, 1908.

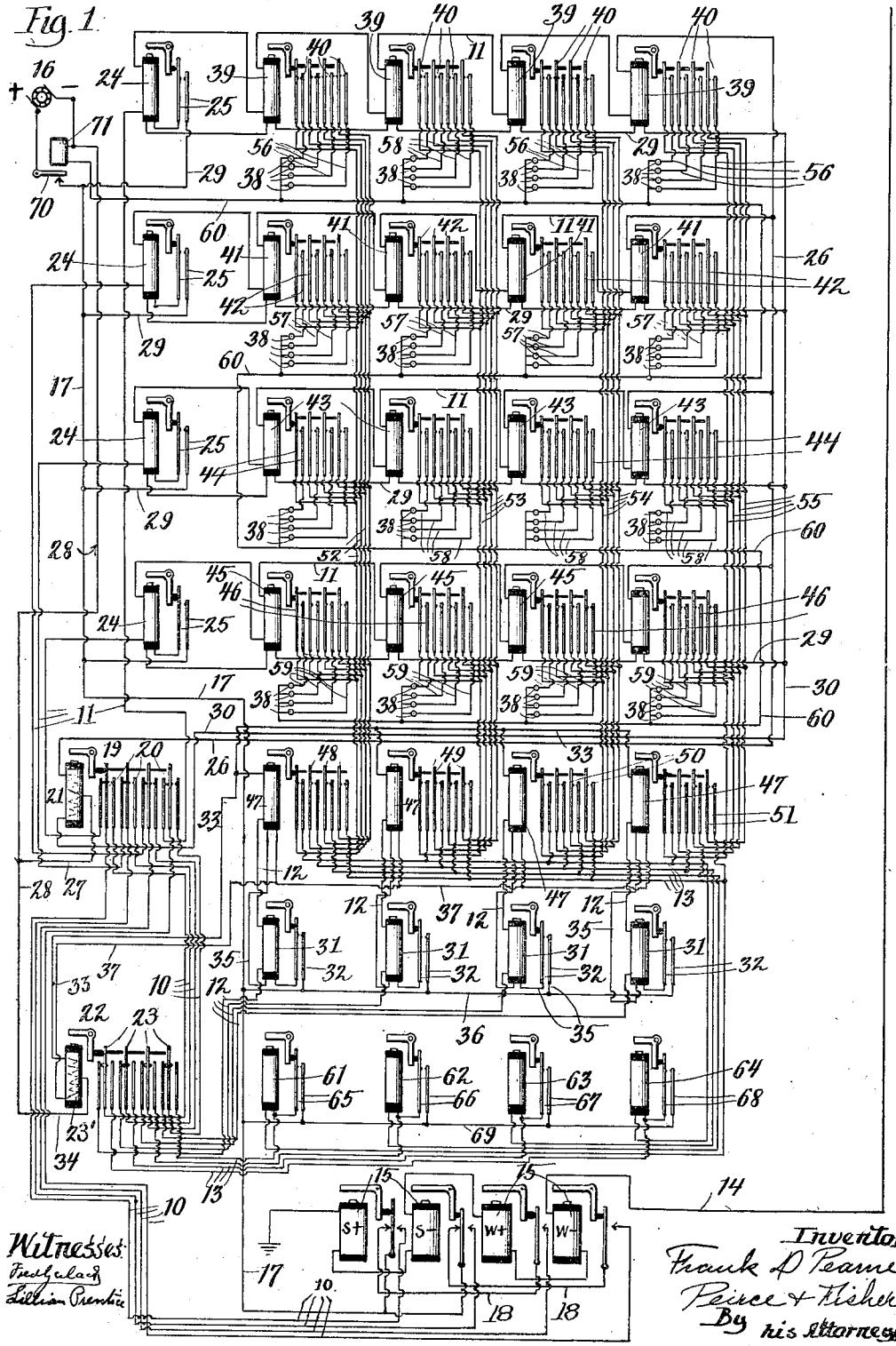
F. D. PEARNE.

ELECTRIC SELECTIVE SYSTEM.

APPLICATION FILED JULY 11, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Fred G. Lacy
Lillian Prentice

Inventor:
Frank D. Pearne
Pearce & Fisher
By his Attorneys

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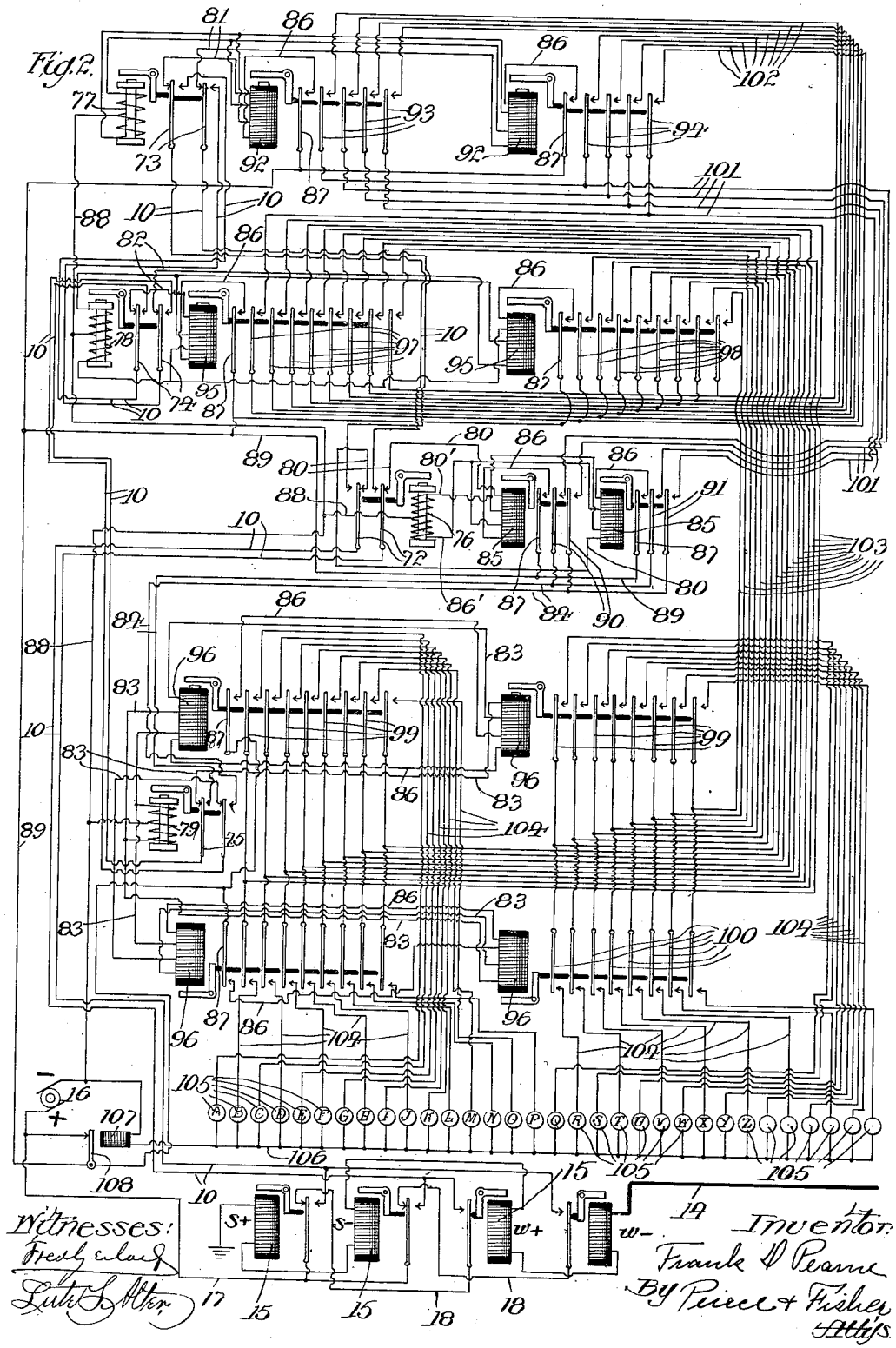
2 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
Fred'k Edwards
Luth. L. Miller

Inventor:
Frank D Pearne
By Pierce & Fisher
Attys

UNITED STATES PATENT OFFICE.

FRANK D. PEARNE, OF CHICAGO, ILLINOIS, ASSIGNOR TO M. E. SWART, OF CHICAGO, ILLINOIS.

ELECTRIC SELECTIVE SYSTEM.

No. 894,044. Specification of Letters Patent. Patented July 21, 1908.

Application filed July 11, 1904. Serial No. 216,009.

To all whom it may concern:

Be it known that I, FRANK D. PEARNE, a citizen of the United States, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Electric Selective Systems, of which the following is declared to be a full, clear, and exact description.

The improvement relates to electric selective systems by which a number of devices at one or more distant stations may be selectively operated.

In particular, the improvement relates to selective systems for printing telegraphs and seeks to provide an effective arrangement by which the signals or characters may be transmitted with rapidity and accuracy.

The invention consists in the combinations and arrangements of parts and circuits hereinafter set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a diagram of the arrangement of parts and circuits in accordance with the present invention. Fig. 2 is a diagram of a modified arrangement.

While it may be employed for other purposes, the present system is particularly applicable for selectively and rapidly operating a number of devices, such as the parts of a typewriting machine, at a distant station, so that messages may be rapidly and automatically printed or the signals otherwise made in accordance with the impulses transmitted.

The operating circuits comprise a set of main circuit conductors and separate sets of branches, together with transfer switches for automatically connecting the set of main conductors to the separate sets of branches as the current impulses representing the signals or characters are received. Means controlled by the separate branch circuits are arranged to operate the devices to be selected for printing or otherwise making the signals. In the arrangement shown in Fig. 1, each signal is made by three line impulses, a set of four operating circuits are employed and sixty-four characters or signals may be selectively operated. The number of line impulses and operating circuits may be varied as desired, in keeping with the number of signals to be selected.

In Fig. 1 the four main circuits 10 are arranged to coöperate with the separate sets of branches 11, 12 and 13. Means are provided for selectively controlling or energizing the sets of circuits and the set of main circuit conductors 10 could for this purpose, be extended to the transmitting station. Preferably however, they are selectively controlled by a line 14 which extends from a distant station, through a series of line relays 15 at the receiving station and to ground or back through a return wire to the transmitting station.

The several relays are arranged to be operated by modified code impulses transmitted over the line. For example, the first relay may respond to a strong positive impulse, the second to a strong negative impulse and the third and fourth to weak positive and negative impulses respectively. The armatures of the first and second line relays are connected to a dynamo or battery 16 or other source of power by a conductor 17. The armature of the third and fourth relays are respectively connected by conductors 18 to the back contacts of the first and second relays. The conductors 10 are connected to the front contacts of the several relays. A strong line impulse, positive or negative, will actuate either the first or the second line relay and connect the corresponding main conductors 10 to the battery. The strong impulse will also operate either the third or fourth line relay, but the corresponding main conductor will not be connected to battery since the circuit from battery by conductors 17 and 18 is broken by the operation of the first or second relay. A weak line impulse, positive or negative will however operate either the third or fourth line relay without affecting either the first or second and connect the corresponding main conductors to the source of power. Other means controlled by the line circuit could be employed for selectively connecting the set of main conductors 10 to the battery if desired.

A transfer switch 19 comprising four sets of contacts 20, is provided to control the connection of the set of main conductors 10 with the sets of branches 11 and 12. Each of the four sets of contacts 20 comprises a back contact, a front contact and an intermediate shifting contact and the shifting contact of each set is arranged to be actuated by the armature of a relay or magnet 21. The set of main circuit conductors 10 are connected to the central shifting contacts and to the front contacts and the set of branches 11, are connected to the back contacts, so that the circuit through the set of main conductors is

normally broken at this point and connection made with the first set of branches 11. At the operation of the transfer switch 19, the circuit through the set of main conductors is closed at this point and the connection with the first set of branches broken.

The main circuit conductors 10 lead from the transfer switch 19 to a second similar transfer switch 22, having four sets of contacts 23 arranged to be actuated by the armature of a relay or magnet 23′. The second set of branch conductors 12 are connected to the back contacts of transfer switch 22, the third set of branches 13 to the front contacts and the main conductors 10 to the intermediate shifting contacts. The connection between branches 12 and the main conductors 10 is thus normally closed at this point and that between the main conductors and the branches 13 normally open. By this arrangement, the operation of the switch 19 serves to shift the connection of the set of main conductors from the first set of branches 11 to the second set 12, and the operation of switch 22, shifts the connection of the main conductors from the second to the third set of branches 13. The first and second set of branches 11 and 12 control the operation of the transfer switches and the operation of the selective switch mechanism, while the third set of branches 13 control the final operation of the selected devices and the restoration of the switch mechanism to normal condition.

Each branch 11 extends through one of a set of four locking magnets or relays 24 and each of these magnets controls a normally open locking switch comprising a pair of contacts 25. The operating relay or magnet 21 for the transfer switch 19, is provided with a coil divided to form opposed sections or with two coils wound in opposite directions. The several branches 11 extend from the respective, locking magnets 24 to a common return wire 26, which leads through one coil of relay 21 and by wires 27 and 28 back to the dynamo 16 or other source of power. The locking switches or pairs of contacts 25 control locking branch circuits 29, which lead from battery wire 17 through the contacts 25 and through second coils on the respective locking magnets 24 and thence to a common return wire 30, through the other coil of relay 21 and by wire 27 to the other battery wire 28.

At the first line impulse, current may be traced from dynamo 16 or other source of power, by battery wire 17, to the armature of one of the line relays 15 (operated in accordance with the character of the line impulse) thence by one of the main circuit conductors 10, to the contacts 20 of transfer switch 19, through one of the branches 11 and coil of the corresponding locking magnet 24, by wire 26, through one coil of relay 21 and by wires 27 and 28 back to the source of power. The circuit thus closed operates one of the locking relays 24, and a circuit is closed from battery wire 17, through the actuated pair of switch contacts 25 and through the second coil on the corresponding relay or magnet 24 and from thence by wire 30 through the opposite coil of relay 21 and by wire 27 to the return battery wire 28.

The several locking relays 24 operate more quickly than the transfer switch relay 21, so that the circuit through both the opposed coils of the latter is closed before it can be operated. And as long as current flows through both coils, the transfer switch 19 remains in normal position. At the cessation of line impulse however, the selected line relay 15, is restored to normal condition and the circuit through the selected main conductor 10 and corresponding branch 11, and through one of the opposed coils on relay 21 is broken. But, inasmuch as the operation of the selected locking relay or magnet 24, closed the circuit through its own coil and holds or locks it in closed condition, the circuit through the other coil of the relay 21, remains closed and the transfer switch 19 is then operated to shift the connection of the main circuit conductors 10 to the second set of branches 12. The first line impulse, thus serves to select one of the branches 11 and the corresponding locking circuit 29 locks the latter in closed condition and at the cessation of the impulse, the transfer switch 19 is operated to connect the second set of branches 12 to the set of main conductors 10. By thus holding the transfer switch 19 in normal condition until the cessation of the line impulse, the current through the selected branch 11 is held in closed condition as long as the line impulse persists, and the selecting devices controlled by the branches 11 will be operated with certainty. But no time is lost, since the cessation of the line impulses is utilized to shift the transfer switch 19 and connect the second set of branches to the main conductors. The transfer switch is of course, held in shifted position by the locking circuit. In a similar manner, each of the branches 12 extends through the coil of one of a set of four locking relays or magnets 31, each of which controls a locking switch comprising a pair of normally open contacts 32. From the magnets 31, the branches 12 extend to a common conductor 33, through one of a pair of opposed coils in relay 23′ and from thence by a conductor 34 to battery wire 28. The pairs of locking contacts 32 control locking circuit conductors 35 which lead by a common conductor 36 from battery wire 17, through second coils upon the corresponding locking magnets 31 and by a common conductor 37, through the other coil of relay 23′.

At the second line impulse, one of the line relays 15 is operated, and current may be traced from dynamo 16 or other source of power; by conductor 17 to the armature of

the selected line relay, through one of the main conductors 10 and through the shifted contacts 20 of transfer switch 19, to the contacts 23 of transfer switch 22, from thence by one of the branches 12 through the coil of one of the locking magnets 31, by conductors 33, through one of the coils of relay 23′ and by wires 34 and 28 back to the source of power. One of the locking magnets 31 is thus energized, and current may be traced from battery wire 17, conductors 36 and 35 the selected switch contacts 32, and through the second coil of the selected locking magnet 31; from thence by the conductor 37, through the other coil of relay 23′ and wire 34 to the opposite battery wire 28. Since locking magnets 31 are provided with light springs and arranged to operate quickly, the current through both opposed coils of relay 23′ is closed before the transfer switch 22 can be operated. The switch 22 thus remains in normal position until the cessation of the line impulse, when the current through the selected main conductor 10, the selected branch 12 and one of the coils of relay 23′, is opened. Transfer switch is then shifted to connect the third set of branches 13 to the main conductors 10. The second line impulse thus selects one of the second set of branches, and its corresponding locking circuit, which remains in closed condition and, at the cessation of the second line impulse, the connection of the main conductors 10 is shifted from the second to the third set of branches 13. As stated, the signal, characters or other devices to be selectively operated are each represented, in the arrangement shown in Fig. 1, by a combination of three line impulses, differently modified in accordance with the various characters.

The last impulse of the signal, serves to select one of the third set of branches, and suitable means controlled by the separate sets of branches are utilized to make the signal. Such means may be widely varied within the scope of the invention, as for example, the various parts of different forms of typewriters may be electrically operated to record the received message.

In Fig. 1 the selective system is shown as selectively operating a number of different devices or operating magnets 38, which in turn may be employed to control the operation of the different parts of a typewriter. The magnets or other controlling devices 38 are divided into groups of four each as indicated, and the circuits through these magnets are controlled by selective switch mechanism, comprising a number of normally open spring contacts correspondingly divided into groups of four. These switch contacts are controlled by the sets of branches 11 and 12. For this purpose each locking circuit conductor 29, corresponding to the separate branches 11, extends through a group of magnets arranged to operate certain of these switches. The locking circuits 29 corresponding to the first branch conductor 11, extends through a group of relays or magnets 39 arranged to shift the switch contacts 40 of four groups or sixteen in all to closed position. Correspondingly the locking circuits 29 of the second, third and fourth of the set of branches 11 extends through the groups of relays 41, 43 and 45 arranged respectively to shift the switch contacts 42, 44 and 46 to closed position.

The first line impulse serves to select any one branch 11, as above described, close the corresponding locking circuit 29 which is held in closed condition after the cessation of the first impulse and thus shift and hold any one of the set of switches 40, 42, 44 or 46 in closed condition. If a single relay or magnet were employed to actuate all sixteen of any set of switches, it would necessarily be large and heavy to perform this duty and consequently somewhat slow in action. For this reason four light, quick operating magnets or relays are preferably used for operating each set of switches and more could be employed if necessary for rapid work.

The branch circuits 11 as well as the corresponding locking circuits 29, are also extended through coils in the separate groups of magnets 39, 41, 43 and 45. But the double coils on these relays included in the branches 11 and in the locking circuits 29 are wound in the same direction and do not oppose each other. The coils are of the same number of turns and the object of this arrangement is to interpose equal resistances in each branch 11 and the locking branch 29 controlled thereby, so that the current flowing through the opposed coils of transfer switch relay 21, which are included in these circuits, may be properly balanced, thus insuring that the transfer switch 19, will not be shifted until the cessation of the line impulse. For a similar reason, each locking magnet 24 has double coils of the same size and wound in the same direction, one in the locking circuit and the other in the corresponding branch 11. The same effect could be produced by interposing resistance in the branches 11 if desired, but such an arrangement would tend to cut down the speed of operation. Where the branches are extended through the selective switch relays, each switch 25 controlling the locking circuit 29 could be actuated by one of the relays of the corresponding group. But, as it is highly desirable that the locking circuits shall be quickly closed, separate light locking magnets 24 are preferably employed for this purpose.

The locking circuit conductors 35 corresponding to the second set of branches 12, extend each through one of a group of mag-

nets 47 which respectively control the separate groups of selective switch contacts 48, 49, 50 and 51. Each group comprises four pairs of normally open spring contacts arranged to be shifted to closed position by the operation of the corresponding relay. The second line impulse serves to select any one of the set of branches 12 as above described, close the corresponding locking circuit 35, which is held in closed condition after the cessation of the second line impulse, and thus shift and hold any one of the groups of switches 48, 49, 50 and 51 in closed condition. The branch conductors 12 also extend through coils wound upon the relays 47, and the double coils on these relays and upon the locking magnets 31, which are included respectively in the separate branches and the corresponding locking circuit conductors, are of the same size and wound in the same direction, so that they do not oppose each other. But equal resistances are thus interposed in each circuit and the current flowing through the opposed coils of the relay 23′ will be accurately balanced, and the transfer switch 22 will be held in normal position until the cessation of the second line impulse. The third set of branches 13 are divided in four separate sets of sub-branches or actuating circuit conductors 52, 53, 54 and 55. The sets of actuating circuits are respectively controlled by the separate sets of switches 48, 49, 50 and 51 which are interposed in these circuits as shown. Each of the four sets of actuating circuit conductors is divided into four separate sets of branches 56, 57, 58 and 59 and the several groups of devices or magnets 38 are interposed in these actuating circuit branches. The several sets of switches 40, 42, 44 and 46 are interposed respectively and control the separate sets of actuating circuit branches 56, 57, 58 and 59. By this arrangement the first line impulse shifts one of the set of switches 40, 42, 44 and 46 and closes one of the sets of branches 56, 57, 58 and 59. The second line impulse shifts any one of the set of switches 48, 49, 50 and 51 and closes one of the sets of actuating circuit conductors 52, 53, 54 and 55 so that one of the groups of magnets 38 is selected. The third line impulse closes the circuit through one of the four magnets 38 as follows: from dynamo 16 or other source of power by conductor 17 to the armature of one of the line relays 15, thence by one of the main conductors 10, through the transfer switch contacts 20 to the switch contact 23, (both switches 19 and 22 have been shifted by the first and second line impulses) thence by one of the sets of branches 13 to the one of the groups of contacts 48, 49, 50 or 51 which has been shifted by the second line impulse; thence, by one of the actuating circuit conductors to the one of the groups of contacts 40, 42, 44 or 46 close by the first impulse, thence through one of the selected group of magnets 38, and by return wires 60 and 18 back to dynamo 16 or other source of power. All of the devices or magnets 38 are connected to the common return wire 60 as shown.

Locking magnets 61, 62, 63 and 64 are interposed, as shown, in the several branches 13, and are arranged to actuate locking switches 65, 66, 67 and 68. The latter comprises pairs of normally open spring contacts and are connected on one side to battery wire 17 by a common conductor 69 and on the other side to the coils of the respective locking magnets. The locking magnets are very sensitive and operate very quickly, so that as soon as the circuit is closed through one of the branches 13 as described, the corresponding locking magnet is quickly actuated and current may be traced from power wire 17 through one pair of locking switch contacts, through the coil of the corresponding relay and through the actuating branch conductors, the selected magnet 38 and back to battery as before. The circuit is thus locked through the selected device, independently of the continuation of the line impulse and the actuation of the selected device is insured even though the line impulse may be very short.

The circuits and switches are restored to normal as follows: A normally closed switch 70 is interposed in the power or battery wire 17 and an actuated magnet 71, therefore is interposed in the return wire 60 from the magnets 38. Magnet 71 is thus energized when any one of the devices to be selected is operated, and the locking circuits are thus opened or unlocked and the transfer and selecting switches returned to normal position. The unlocking switch may be otherwise actuated, for example, if a typewriting machine is operated by the selecting system, switch 70 may be arranged to be operated mechanically by some of the moving parts of such machine.

It will of course be understood that the number of devices to be selected, the number of main and branch conductors and the number of line impulses required to complete the various signals, may be varied as desired. In the arrangement shown in Fig. 2, the selective operation of thirty-two magnets or other devices and five line impulses are necessary to complete each signal. Only two main conductors 10 are employed and these may be controlled by two line relays, or by a single polarized line relay, responding to line impulses of different polarity or otherwise modified. Preferably, however, the arrangement of the line relays is the same as in Fig. 1, and one of the main conductors is connected to the front contacts of both the first and fourth, and the other conductor to

the front contacts of both the second and third. By this arrangement one conductor 10 may be selected either by a strong, positive or by a weak, negative impulse and the other by a strong, negative or by a weak, positive impulse, so that in any given signal, weak and positive impulses may always alternate on the line to aid in clearing the static charge of the line and assist in the rapid transmission of signals.

The main conductors extend first to the contacts 72 of a transfer switch relay 76 and then successively to the contacts 73, 74 and 75 of the transfer switch relays 77, 78 and 79. Sets of branch conductors (two in each set) 80, 81, 82 and 83 lead respectively from the back contacts of the transfer switch relays 76, 77, 78 and 79, and the set of branches 84 lead from the front contacts of the relay 79, so that the successive operation of the several transfer switches serves to successively connect the separate sets of branches to the main conductors. As in the arrangement shown in Fig. 1, the several transfer switch relays are provided with opposed coils arranged respectively in the separate sets of branches and in corresponding locking circuits controlled thereby. Relays or magnets included in and controlled by the branch and locking circuits actuate the selective switch mechanism. The branches 80 extend through coils of relays 85, and the corresponding locking circuits 86 extend through similar coils on these relays. Switch contacts 87 controlling the locking circuits, are operated directly by the relays 85 instead of by separate magnets, as in the arrangement shown in Fig. 1. At the first line impulse, current is traced from dynamo or battery 16, or other source of power by wire 17 to the selected line relay, by one of the main conductors 10 to switch contacts 72 and by one of the branches 80 through one of the relays 85, thence by a common wire 80′ through one of the coils of relay 76 and by conductor 88 back to battery. The locking circuit is thus closed from battery by wire 89, one of the switches 87, and by one of the locking circuit conductors 86 through another coil on the selected relay 85 and thence by a common wire 86′ through the opposite coil of relay 76 to return battery wire 88. The operation of one of the relays 85 shifts either the set of selecting switches 90 or the set of switches 91 to closed position and they are held in this position by the locking circuit at the cessation of line impulse. At this time transfer switch relay 76 actuates switch contacts 72 and the connection of the main conductors 10 is shifted from the set of branches 80 to the branches 81. The branches 81 extend in a similar manner through selecting magnets 92 and through one of the opposed coils of transfer switch relay 77, and these magnets also actuate locking switches 87, which controls locking branches 86 extending through coils on the magnets and through the other one of the opposed coils of relay 77. So that the second line impulse energizes either one of the magnets 92, and shifts either one of the sets of switches 93 or 94 to closed position, which is held in this position by the corresponding locking circuit. At the cessation of the second line impulse, transfer switch relay 77 actuates switch contacts 73 to shift the connection of the main conductors 10 from branches 81 to the third set of branches 82.

Magnets 95 and 96 in the third and fourth set of branches 82 and 83 are similarly arranged so that the third line impulse shifts either the set of switches 97 or 98 to closed position, and the fourth impulse closes either the set of switches 99 or 100, and the selected sets of switches are held in closed position by the corresponding locking branch circuits 86. As shown, there are two switches in each of the sets 90 and 91, four in each of the sets 93 and 94, eight in the sets 97 and 98 and sixteen in the sets 99 and 100. There are four magnets 96, two in each of the branches 83, each operating eight switches, since a single magnet to operate the whole sixteen of the set would be too large and slow in operation. Each of the last set of branches 84 are divided and the divisions extend to one of the switches in each of the set 90 and 91. From the front contacts of these switches actuating circuit conductors 101, each of which is correspondingly divided and extend to one of the switches in each set 93 and 94. Similarly actuating circuit branches 102, from the front contacts of switches 93 and 94 to the set of switches 97 and 98 and conductors 103 extend from the front contacts of these switches to the sets of switches 99 and 100. From the front contacts of the latter, conductors 104 extend through the magnets 105 or other devices to be selectively operated, which are all connected to the common return battery wire 106.

At the fifth or final line impulse in any signal, current is traced from dynamo 16, or other source of power to the armature of the selected line relay, thence by main conductor 10, and successively through the transfer switch contacts 72, 73, 74 and 75) all of which have been shifted by the preceding line impulses) to one of the branches 84, to the one of the sets of switches 90 or 91, which have been shifted by the first line impulse, by one of the actuating circuit conductors 101, to the one of the sets of switches 93 or 94 shifted by the second line impulse, by one of the conductors 102 to the one of the sets of switches 97 or 98 shifted by the third line impulse, thence by one of the conductors 103 to the one of the sets of switches 99 or 100 shifted by the fourth impulse, and finally through one of the magnets 105 and by con-

ductor 106 back to battery. To restore the switches to normal, a magnet 107 included in the common return wire 106, is arranged to open a normally closed switch 108 arranged in the locking circuit conductor 89.

It is obvious that the arrangement of circuit and actuating devices may be widely varied without departure from the essentials of the invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In electric selective systems, the combination with a controlling line circuit and with a local main circuit conductor and separate local branches, of transfer switch mechanism electrically acting at the cessation or change in condition of the impulse through the main and one branch conductor to shift the connection of said main conductor to another branch.

2. In electric selective systems, the combination with a main circuit conductor and separate branch conductors, of transfer switch mechanism acting electrically at the cessation of the impulses through the main conductor to shift the connection of said conductor to the branches in regular order, whereby said branches are automatically and successively connected to said main conductors in the same order as the impulses of the signals are received.

3. In electric selective systems, the combination with a local main circuit conductor, separate local branches and a line relay controlling the passage of code impulses through said conductor and said branches, of transfer switch mechanism automatically acting at the cessation of the impulse through the main conductor and one branch to shift the connection of said main to another branch.

4. In electric selective systems, the combination with a controlling line circuit and with a local main conductor and separate local branches, of transfer switch mechanism for successively connecting said main to said branches and opposed relay coils controlled by the flow of current through said branches for actuating said switch mechanism.

5. In electric selective systems, the combination with a controlling line circuit and with a local main conductor and separate local branches, of a transfer switch for successively connecting said main to said separate branch conductors, opposed actuating coils for said switch controlled by the flow of current through said conductors and means for locking the circuit through one of said coils in closed condition, whereby on the cessation of the impulse through the main and one branch circuit, the transfer switch is actuated to shift the connection of said main circuit to another branch circuit.

6. In electric selective systems, the combination with a main circuit conductor, and separate branches, of a transfer switch for successively connecting said main circuit to said separate branch circuits, a relay having opposed coils for controlling said switch, one of said coils being in one of said branches and the other in a locking circuit, and means controlled by said branch for holding said locking circuit in closed condition after the cessation of the impulse through or change in condition in said main and branch conductors, whereby said switch is shifted to connect said main circuit conductor to another of said branches.

7. In electric selective systems, the combination with a controlling line circuit and with a local main circuit conductor and separate local branch circuit conductors leading therefrom, of a series of transfer switches controlled by the flow of current through said circuits embodying electro-responsive devices for automatically connecting the main conductor to the separate branches.

8. In electric selective systems, the combination with a main circuit conductor and a series of branches, of transfer switches for successively connecting the main circuit conductor to the separate branches, means for actuating each switch comprising opposed coils controlled by the respective branches and means for locking the circuit through one of said coils after the cessation of the impulse through the branch whereby the balance of the opposed coils is disturbed and the switch actuated to connect the succeeding branch to the main circuit.

9. In electric selective apparatus, the combination with a set of main conductors and separate sets of branches, of transfer switch mechanism embodying electro-responsive devices arranged to shift the connection of said set of main conductors from one set of branches to another.

10. In electric selective systems, the combination with a set of main conductors and with separate sets of branches, of transfer switch mechanism embodying electro-responsive devices acting at the cessation of the impulse through one of a set of branches, to shift the connection of said set of main conductors therefrom to another set of branches.

11. In electric selective systems, the combination with a set of main circuit conductors and with separate sets of branches, of transfer switch mechanism electrically acting to successively shift the connection of said set of main conductors from one set of branches to another at the cessation of the current impulse through or change in the condition of one of said main circuit conductors.

12. In electric selective systems, the combination with a set of local main conductors, separate sets of local branches and line relays controlling the current through said

main and branch conductors, of transfer switch mechanism electrically acting at the cessation of the impulse or change in the condition of current through one of said main conductors and one of a set of branches, to shift the connection of said set of main conductors from said set of branches to the succeeding set.

13. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branch circuit conductors leading from said set of main conductors, of transfer switch mechanism electrically controlled by the flow of current through said circuits to successively connect said sets of branches to said set of main conductors and means controlled by said main and branch circuits for making the signal.

14. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branches, of transfer switch mechanism for successively connecting said sets of branches to said set of main conductors and opposed coils controlled by the flow of current through said branches for actuating said transfer switch mechanism.

15. In electric selective systems, the combination with a set of main conductors and separate sets of branches, of a transfer switch for shifting the connection of said set of main circuit conductors from one set of branches to another, opposed coils controlled by the first of said set of branches for shifting said switch and means for maintaining the circuit through one of said coils in closed condition after the cessation of the impulse through one of said first set of branches, whereby at the cessation of such impulse the switch is actuated to connect the succeeding set of branches to said set of main conductors.

16. In electric selective systems, the combination with a set of main circuit conductors and separate branches, of a transfer switch for shifting the connection of said set of main conductors from one set of branches to another and opposed coils controlling the shift of said switch, one of said coils being common to the branches of the first set and the other included in a locking circuit controlled by said set of branches.

17. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branches, of a transfer switch for shifting the connection of said set of main conductors from one of the sets of branches to another, a relay controlling the shift of said switch having opposed coils, one of said coils being common to and controlled by the first set of branches and the other coil included in a locking circuit and means controlled by said first set of branches for maintaining said locking circuit in closed condition after the cessation of the impulse through one of the sets of branches, whereby at the cessation of said impulse the balance of the opposed coils is disturbed and the switch shifted.

18. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branches, of a number of transfer switches for successively connecting said sets of branches to said set of main conductors, opposed coils controlled by each set of branches for actuating the respective switches, one of said coils being in circuit with each of said sets of branches and the other in a locking circuit controlled by said branches, and means for holding said locking circuit in closed condition after the cessation of the impulse through any one of the respective branches.

19. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branches, of means for selectively controlling the main circuit conductors, transfer switch mechanism embodying electro-responsive devices for shifting the connections of said set of main conductors to said separate sets of branch circuits and means controlled by said branch circuit conductors for making the signal.

20. In electric selective systems, the combination with a set of local main circuit conductors and separate sets of local branch circuit conductors, of a line circuit, means controlled thereby for selectively controlling said main circuit conductors, transfer switch mechanism embodying electro-responsive devices for shifting the connection of said set of main conductors from one set of branch circuits to another and means controlled by said main and branch conductors for making the signal.

21. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branch circuit conductors, of a line circuit, means controlled thereby for selectively controlling said main circuit conductors, transfer switch mechanism embodying electro-responsive devices for shifting the connection of said set of main conductors from one set of branch circuits to another and actuating circuits controlled by said main and branch circuit conductors for making the signal.

22. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branches, of a line circuit, relays controlled thereby for selectively controlling said main conductors, transfer switch mechanism controlled by the flow of current through one of a set of branches to shift the connection of said main conductors to a succeeding set of branches and means controlled by said main and branch conductors for making the signal.

23. In electric selective systems, the combination with a main circuit conductor and

separate branches, of transfer switch mechanism, opposed actuated coils therefor controlled by one branch for shifting the connection of the main conductor to a succeeding branch, one of said coils being in said branch and the other in a locking circuit controlled thereby, actuating circuits controlled by said branches and means controlled by said actuating circuits to open said locking circuit.

24. In electric selective systems, the combination with a set of main circuit conductors and with separate sets of branch circuit conductors, of a number of transfer switches each controlled by one set of branches and acting automatically at the cessation of the impulse through any one of the corresponding set of branches to shift the connection of said set of main conductors to a succeeding set of branches, actuating circuits controlled by said branch circuits, means for locking said actuating and said transfer switches in changed condition and means for restoring said circuits and switches to normal.

25. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branch circuit conductors, of means for selectively controlling said main circuits, transfer switch mechanisms controlled by the separate sets of branches for shifting the connection of said set of main circuit conductors to the succeeding sets of branches, a locking circuit controlled by said branches for holding said switch mechanism in shifted position and means for opening said locking circuit.

26. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branch circuit conductors, of transfer switches controlled by the separate sets of branches for shifting the connection of said set of main conductors to the succeeding sets of branches, actuating circuits for making the signal controlled by said branches, means for locking said actuating circuits in changed condition independent of the continued flow of current through the separate branches and means for restoring said circuits to normal condition.

27. In electric selective systems, the combination with a set of main circuit conductors and separate sets of branch circuit conductors, of transfer switches controlled by the separate sets of branches for shifting the connection of said set of main conductors to the succeeding sets of branches, actuating circuits for making the signal controlled by said branches, a locking circuit for holding said actuating circuits in changed condition after the cessation of the impulses through said branches and means controlled by said actuating circuits for opening said locking circuit.

28. In electric selective systems, the combination with a line circuit, of a local main circuit conductor and separate local branches controlled by said line circuit, switch mechanism controlled by the flow of current through said main and branch conductors for successively connecting the latter to said main conductor, means for holding said switch mechanism in shifted position and means controlled by said branches for making the signal and for releasing said switches.

29. In electric selective systems, the combination with a set of main conductors and separate sets of branches, of switch mechanism for successively connecting said sets of branches to said main conductor as the impulses of the signal are received, means for holding said switches in shifted position and means controlled by said branches for making the signal and for releasing said switches.

30. In electric selective systems, the combination with a line circuit, of a set of main circuit conductors and separate sets of branch conductors controlled by said line circuit, transfer switch mechanism arranged to successively connect said sets of branches to said set of main conductors as the impulses of the signal are received, locking circuits controlled by said sets of branches for holding said switch mechanism in shifted position and means controlled by said sets of branches and said locking circuits for making the signal and for opening said locking circuits.

31. In electric selective systems, the combination with a main circuit conductor and separate branch conductors, of transfer mechanism for successively connecting said branch conductors to said main conductor as the current impulses of the signals are received, relays in said branch conductors, selective switch mechanism controlled by said relays and actuating circuits for making the signal controlled by said selective switch mechanism.

32. In electric selective systems, the combination with a line circuit, of a set of main circuit conductors selectively controlled by said line circuit, separate sets of branch conductors, transfer switch mechanism arranged to successively connect said separate sets of branches to said set of main conductors as the current impulses of the signal are received, relays controlled by said sets of branches, selective switch contacts controlled by said relays and actuating circuits for making the signal controlled by said selective switch contacts.

33. In electric selective systems, the combination with a line circuit, of a set of main conductors selectively controlled by said line circuit, separate sets of branches, transfer switches for successively connecting said sets of branches to said sets of main conductors as the impulses of the signal are received, separate sets of selective switch contacts controlled respectively by said separate sets of branch conductors and actuating circuits for

making the signal controlled by said separate sets of selective switch contacts.

34. In electric selective systems, the combination with a set of main circuit conductors and with separate sets of branches, of transfer switch mechanism embodying electro-magnetic devices for shifting connection of the main conductor from one set of branches to another, and electric means for neutralizing the magnetic energy of said electro-magnetic devices at will.

35. In an electric selective system, the combination with a line circuit and separate local circuits, of relays responding both to positive and negative impulses in said line circuit, electrically operated transfer switch mechanism embodying electro-responsive devices energized by said relays upon the cessation of the line relay impulse for selectively energizing each of said branch circuits, whereby any given signal may comprise alternate positive and negative impulses, and means controlled by said branch circuits for making the signal.

FRANK D. PEARNE.

Witnesses:
ALBERTA ADAMICK,
LILLIAN PRENTICE.