

E. E. CLEMENT.
 SELECTIVE APPARATUS FOR SYSTEMS OF COMMUNICATION.
 APPLICATION FILED OCT. 11, 1906.

939,186.

Patented Nov. 2, 1909.

2 SHEETS—SHEET I.

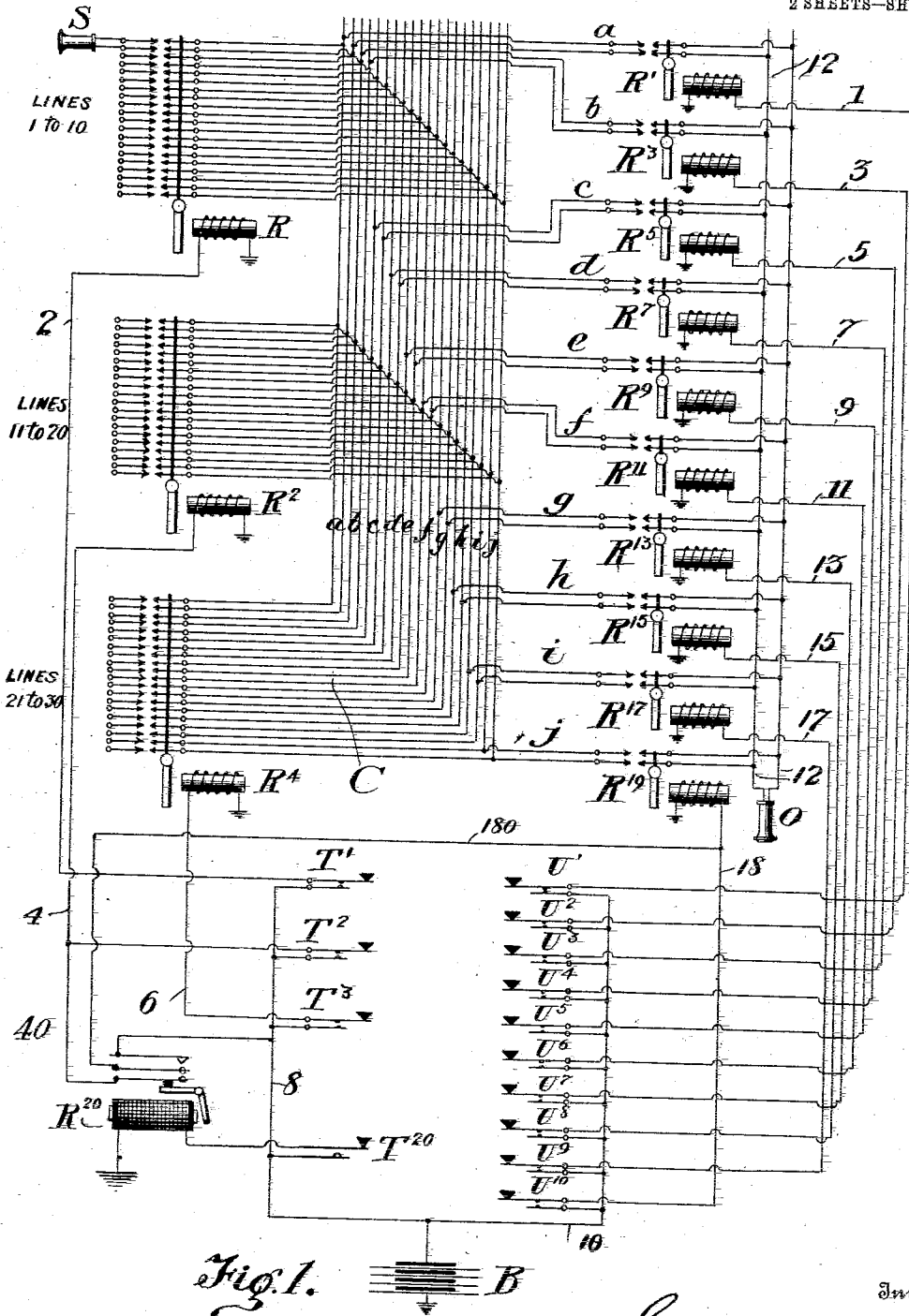


Fig. 1.

B

Inventor

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Witnesses:

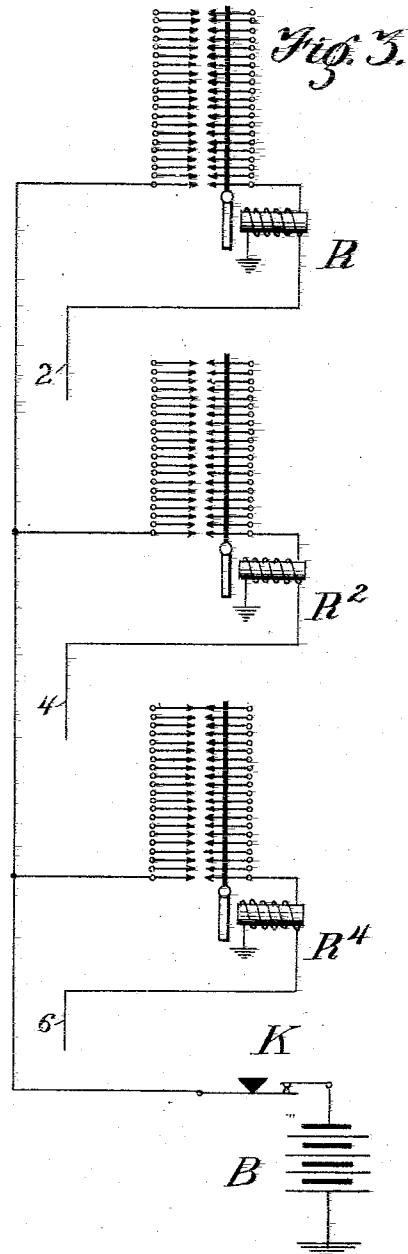
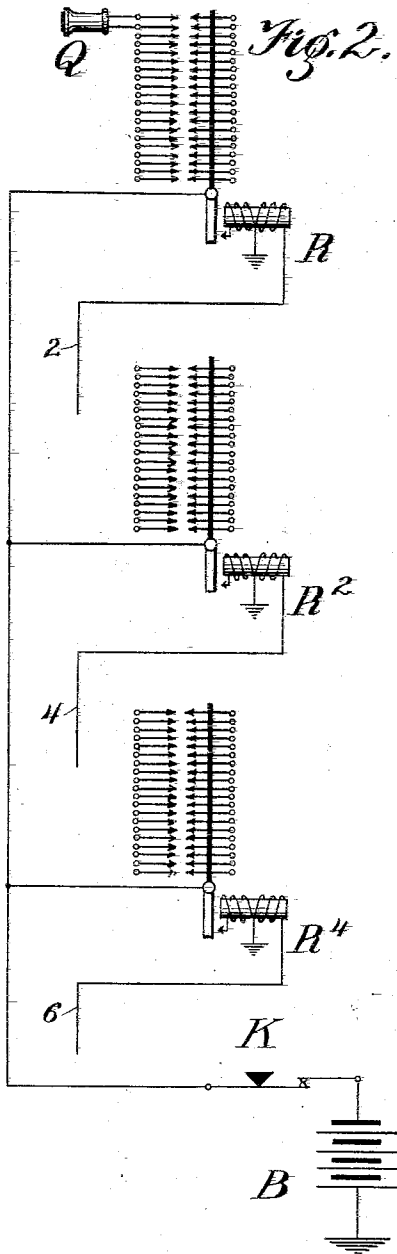
H. A. Whiting

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UNITED STATES PATENT OFFICE.

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SELECTIVE APPARATUS FOR SYSTEMS OF COMMUNICATION.

939,186.

Specification of Letters Patent.

Patented Nov. 2, 1909.

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To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Selective Apparatus for Systems of Communication, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to systems of communication and has for its object the production of a simple and efficient means of selecting any one of a suitable number of pieces of apparatus or circuits to be affected in due course.

Briefly stated, my invention consists in making combinations of relays which control the apparatus or circuits in question, the number of relays being less than the total number of circuits or pieces of apparatus to be controlled. The relays themselves are then actuated or energized in proper order and in the proper combination by means of circuit closers of suitable type. In the present case these circuit closers are illustrated and described as simple keys or push buttons.

For purposes of illustration I have shown one telephone circuit which may be connected to any one of thirty others through the agency of thirteen relays, each relay having its own key, and the number of keys therefore also being thirteen, ten in one set and three in the other.

The underlying principle of the invention is this, that by requiring a circuit to be closed at two points, in order to effect its completion, combinations of circuit closers may be effected. In the present case I divide the thirty individual circuits into three groups of ten each, which are normally disconnected from anything. Each group, however, goes to ten pairs of contacts on a relay which closes them all at once, thereby connecting each circuit to a short branch, corresponding branches from all of the relays being connected together in parallel. The single circuit on the other side of the system, which is to be connected to any one of the thirty mentioned, is connected in multiple to pairs of contacts in all of the ten individual or units relays, and the corresponding contacts are connected separately and respectively to the ten multiple branches of the three group relays.

Assuming that circuit No. 26 is to be con-

nected to the common circuit, the third group of "tens" relays is energized and the 6th single or units relay. The circuit is thus closed through No. 2 branch of the group relay, and through No. 6 extension of the 6th single relay, which is the only one of the group that is closed all the way through.

It is obvious that the circuit closers instead of being keys or buttons may be relay contacts, switch contacts or any other desired circuit closers.

My invention is illustrated in the accompanying drawing in which—

Figure 1 is a diagram showing one embodiment of my invention. Fig. 2 is a view illustrating a locking circuit. Fig. 3 is a view showing a modified form of locking circuit.

Referring to Fig. 1 diagram shows thirty line terminals on one side, any one of which can be selected and connection effected therewith from the other side. In this diagram, I have shown three relays marked respectively R , R^2 , and R^4 , each of which controls 10 pairs of contacts. These I call the "tens" relays. On the other side I have shown 10 relays marked R^1 , R^3 , R^5 , R^7 , R^9 , R^{11} , R^{13} , R^{15} , R^{17} and R^{19} , which I shall call "units" relays. Each of these relays controls a single pair of contacts. The reason for showing pairs of contacts is that the circuits controlled by the relays are metallic. The tens relays are connected by wires 2, 4 and 6 respectively to keys T^1 , T^2 , and T^3 . All of these keys are connected by a common wire 8 to a suitable battery B . The return from the relays to the battery is effected through the ground, but of course may be by means of a wire or wires if desired. The units relays R^1 , R^3 , R^5 , etc., are connected through wires 1, 3, 5, 7, 9, 11, 13, 15, 17 and 19 to the keys U^1 , U^2 , U^3 , U^4 , U^5 , U^6 , U^7 , U^8 , U^9 , U^{10} , respectively. These keys are connected to the battery B through a common wire 10. Between the two sets of relays a cable C passes, which is composed of 10 pairs of wires, which may be designated by the letters a , b , c , d , e , f , g , h , i , j , and which are connected and disposed as follows: All of the pairs are multiplied to the 10 pairs of contacts on each of the tens relays. Thus, the first pair a goes to the first pair of contacts on each of the relays R , R^2 , R^4 . The second pair b goes to the second pair of contacts on each of these relays, and so on. The

corresponding or coöperating contacts of the relays are connected to the individual lines or circuits to be selected, thus, in the relay R appear the terminals of lines #1 to #10; in relay R² appear the terminals of lines #11 to #20; and in relay R⁴ appear the terminals of lines #21 to #30. Each of the pairs *a*, *b*, *c*, etc., is connected to the single pair of contacts in one of the units relays R', R³, R⁵, etc. Thus, the pair *a* appears only in the relay R', the pair *f* appears only in the relay R¹¹, and so forth. I have shown the contacts of all the units relays connected on one side to a common circuit 12, to which is connected a telephone O. I have shown line #1, which is the first outside line on relay R, connected to a telephone S, and it is to be understood that all the other terminals may be connected to similar or any desired apparatus.

The operation of selecting any one of the lines represented on the tens relays is as follows: Suppose it be desired to connect the telephone O with the telephone S; the line circuit leading to S is #1, which appears only in the terminals on relay R. Hence the operator presses the key T' to energize the relay R through the following circuit; B, 8, T', 2, R and ground. Relay R in pulling up connects all of the lines #1 to #10 onto the pairs of wires *a*, *b*, *c*, *d*, etc., in the cable C. As these pairs are distributed among the relays R', R³, R⁵, etc., it follows that we have thus connected the lines #1 to #10 to the units relays respectively from R' to R¹⁰, and by energizing any desired one of these relays we may select any one of the individual lines which have become thus connected. In the present case the operator depresses the key U', which closes the circuit of the relay R' as follows: B, 10, U', 1, R' and ground. Relay R' in pulling up connects the pair of wires *a* to the pair 12 leading to the telephone O, and thus as long as the two keys T' and U' are depressed this connection will remain established.

To take another example, suppose it be desired to select and connect with line #17: the keys T², and U' are depressed. Similarly by varying the combination of tens and units keys and thereby energizing the tens and units relays in corresponding combinations, any desired line or lines may be selected.

I have employed the keys herein shown for purposes of illustration because they constitute the simplest and best known form of circuit closers, but in practice other forms of circuit closers are more frequently employed. Thus in adapting this arrangement to a signaling or telephone system, instead of depressing two keys in order to select a desired circuit, it is simpler to simultaneously close two contacts constituting terminals of the desired relays. Such an arrange-

ment which is shown in my prior application 296,833, filed January 19, 1906, is also shown herein in respect to line 20. A key T²⁰ controls a relay R²⁰, which when energized completes the battery circuit through wires 40 and 180 to the relay circuits 4 and 18, simultaneously. Thus the depression of the key T²⁰ or the energization of the relay R²⁰ will always connect the line 20 to the circuit 12.

It will be understood that the keys and the relays shown herein are merely used for purposes of illustration, the invention lying not in the circuit closers used in the initial control of the circuit system, but in the arrangement of the tens and units relays, and their circuits, used in various combinations so as to produce a total number of possible selections and connections greater than the number of relays employed. It should be observed that the relation of these relays is not limited to a decimal relation. Thus, the number of contacts carried on the relays R, R², etc., is limited only by the requirements of good practice, and the possibility of obtaining sufficient power in the actuating electromagnet. Similarly, the number of relays R, R² and R⁴ which may be employed is not limited, nor is the number of the units relays R', R³, etc. For example, twenty relays R, R², etc., could be provided each of which had its ten pairs of contacts multiplied in a manner similar to those in the figure. Any one of two hundred lines could thus be selected. Or, ten relays R, R², etc. may be provided each with twenty pairs of contacts. It would then be necessary to provide twenty pairs of wires in the cable C, and twenty individual relays R', R³, R⁵, etc. Numerous other arrangements will suggest themselves.

In applying this invention to a telephone exchange, the circuits 1 to 30 shown herein would be subscribers' lines, and the circuit 12 a trunk or other connective circuit.

I have described my controlling relays as single wound, and depending entirely upon the selective circuit closers. By providing each relay with a second winding, and a pair of controlling contacts therefor on its armature, and by running a common battery wire to all of these contacts as shown in Fig. 2 each relay may be made to close its own circuit when it is energized, so that it will remain energized as long as the common battery locking wire is intact. To unlock the relay I place a key in this common battery wire so that it may be opened at will for restoring purposes. A still simpler arrangement, which is also self-locking, is to connect one of the contacts on the relay armature with the battery wire, and the other with a point on the battery side of the single winding. This arrangement is shown in Fig. 3. Thus a temporary closure

of the relay circuit through the controlling device will cause it to pull up and maintain the battery connections on its single winding as long as the locking wire is intact. Such self-locking relays are well known in the art, but their application to my type of selecting system I consider involves invention, and I shall therefore claim the combination.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. In an electrical system a series of circuits, a set of relays each containing terminals of a plurality of said circuits, a cable or set of trunk wires connected in multiple to corresponding terminals in all of said relays, and a supplementary set of relays, each supplementary relay controlling a branch from one only of the cable wires.
2. In an electrical system, a series of circuits, a set of relays each containing terminals of a plurality of said circuits, a cable or set of trunk wires connected in multiple to corresponding terminals in all of said relays, a supplementary set of relays each controlling one only of the cable wires, and a circuit closer for each main and supplementary relay, whereby the operation of said circuit closers in pairs will effect complete selection and connection of any one of the circuits.
3. In an electrical system, a series of circuits, a set of relays each containing terminals of a plurality of said circuits, a cable or set of trunk wires connected in multiple to corresponding terminals in all of said relays, a supplementary set of relays each controlling one only of the cable wires, and a circuit closer for each main and supplementary relay, with self-locking means on each relay, and means for controlling the same, associated with the actuating circuit closer.
4. In an electrical system, a series of circuits, a set of relays each containing terminals of a plurality of said circuits, a cable or set of trunk wires connected in multiple to corresponding terminals in all of said relays, a supplementary set of relays each controlling one only of the cable wires, and a circuit closer for each main and supplementary relay, together with a supplementary

tary locking winding on each relay, a locking circuit for said windings closed when a relay is energized, and means for opening the same associated with the circuit closers.

5. Means for effecting connection between any one of a plurality of circuits, and a common circuit, comprising a set of relays each containing contacts of a group of said circuits, a second set of relays corresponding in number to the number of circuits in a group, a stub cable or trunk wires also equal in number to the number of circuits in a group, and respectively connected in multiple to corresponding contacts of the several groups, also having each wire connected by itself to the contacts of a particular relay to the second set, whereby a circuit may be identified and connected by first selecting the group in which it is to be found, and also selecting the unit wire in that group with which the desired circuit is connected.

6. In an electrical system, means for selecting and connecting any one of a plurality of circuits which consists of a plurality of sets of elements, with intermediate extension circuits or branches extending between them less in number than the total number of circuits to be served and a final extension circuit common to them all, each element of the first set adapted when actuated to select and connect to the intermediate extensions all of a group of circuits, and each element of the second set adapted when actuated to select and connect through to the common circuit a single unit out of the group, corresponding to the circuit to be selected.

7. Means for electrical selection of circuits comprising a plurality of sets of elements, with trunk circuits between them less in number than the total number of circuits to be served, said trunks having access in multiple to every element of a preceding set, but being distributed among elements of a succeeding set, together with means for selectively actuating the elements.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD E. CLEMENT.

Witnesses:

E. EDMONSTON, Jr.,
JAMES H. MARR.