R. I. UTTER.

RELAY INTERRUPTER.

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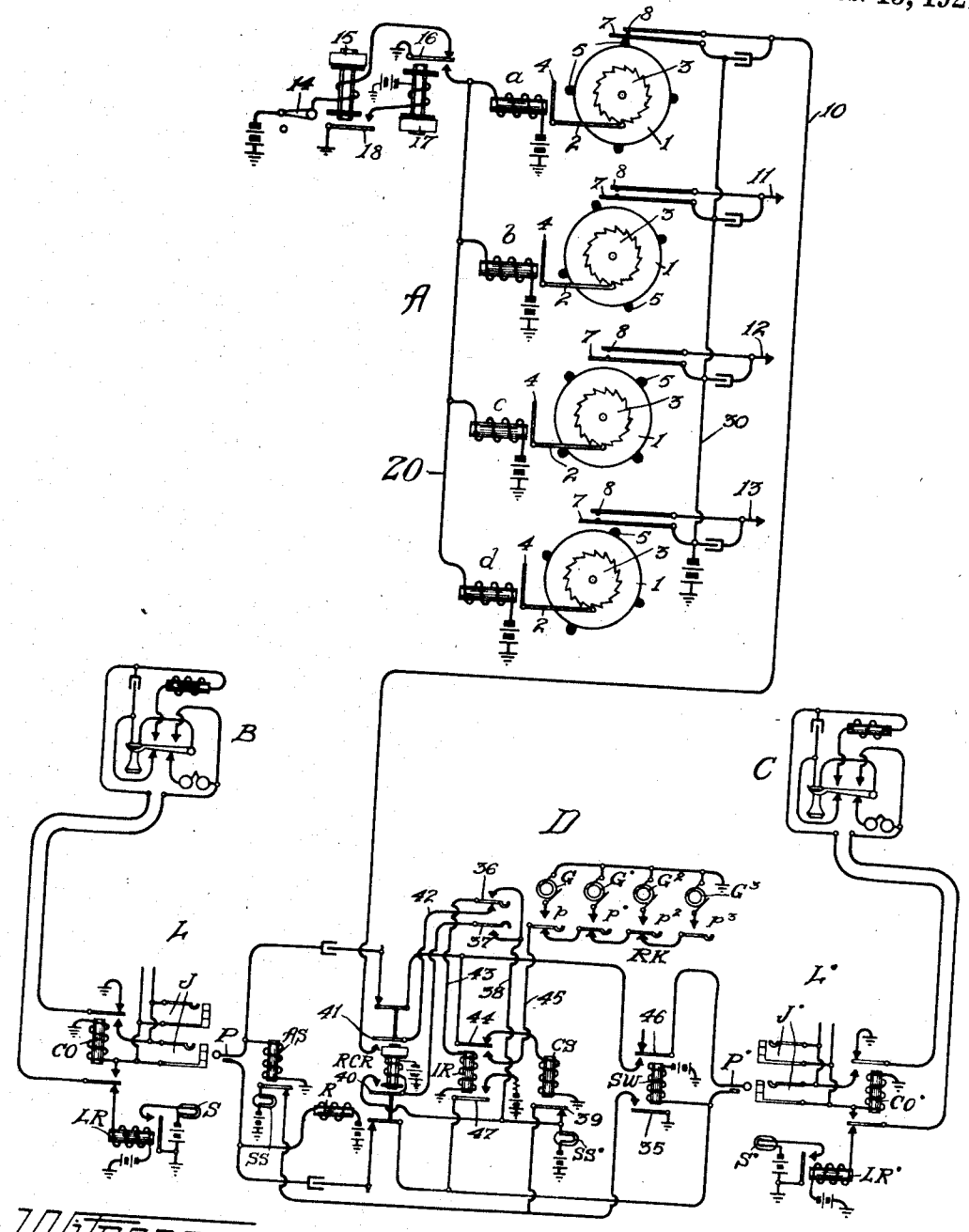

Witnesses:

G. Yanochowski.

W. M. Berghahn

Inventor:

Richard I. Utter.

By Curtis B. Camp.

Attorney.

UNITED STATES PATENT OFFICE.

RICHARD I. UTTER, OF OAK PARK, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

RELAY-INTERRUPTER.

1,368,376. Specification of Letters Patent. Patented Feb. 15, 1921.

Application filed March 24, 1917. Serial No. 157,067.

To all whom it may concern:

Be it known that I, RICHARD I. UTTER, a citizen of the United States of America, residing in Oak Park, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Relay-Interrupters, of which the following is a specification.

My invention relates to interrupters, and has to do more particularly with interrupters for ringing circuits such as are used in connection with telephone systems. In telephone systems of the class in which so-called automatic or machine ringing is used, the ringing current is usually intermittently applied to signal the called-for substation. For this purpose interrupter devices of various kinds are used for intermittently energizing and deënergizing the ringing relays to secure these intermittent ringing periods. In connection with such systems, it is desirable that the exchange be divided into sections so that the ringing current is taken from the ringing generator at different periods in order to more equally distribute the load. Therefore, the interrupter devices are usually arranged so as to provide a number of different interrupter circuits. Motor driven interrupters are commonly used but are found comparatively expensive for small exchanges.

One of the objects of my invention is to provide a simple, compact and comparatively inexpensive interrupter device, and to this end I use a pair of master relays and a number of relays, equal to the number of interrupter leads desired, of the step-by-step type, that is, relays of the type which control ratchet and pawl mechanism for advancing the ratchet one step upon each complete energization and deënergization of the magnet.

In the accompanying drawing, I show four relays of the step-by-step type, this combination giving four interrupter leads operating at different times. That is, the four interrupter leads are closed and opened successively at different periods. Of course, it is to be understood that the four shown are for the purpose of illustration only as it will be readily seen that any number of relays may be used and that other circuit arrangements may be provided.

My invention is adapted for other uses, but for the purpose of illustrating it I have shown the interrupter circuit operating in connection with a cord circuit equipped with automatic ringing. Referring now in general to the interrupter circuit A in which the apparatus is shown in an unactuated position, it comprises relays 15 and 17 which are preferably slow-acting, and which I call "timing" or "master" relays. The said relays are provided with copper sleeves to make them slow in releasing their armatures but any other of the well known means may be provided to accomplish this purpose.

I also provide four relays of the above-mentioned step-by-step type, namely: relays *a*, *b*, *c* and *d*, which I will term "motor" or "stepping" magnets. I will now briefly describe relay *a*. A disk 1 associated with the magnet *a* is mounted upon the forward end thereof and is provided with a ratchet 3, which is preferably formed integrally with the disk 1. A pawl 2 is operatively associated with the ratchet 3, the said pawl 2 being pivotally supported upon an armature 4 of the magnet so that upon each actuation of the magnet the disk 1 is rotated one step. A plurality of insulation buttons or studs 5 are mounted on the periphery of the disk 1, and for the purpose of illustrating and describing my invention I show the buttons 5 equally spaced on the periphery of the disk so that on each fourth actuation of the disk 1 a button 5 will engage the spring 7 of a pair of springs 7 and 8, which springs are operatively associated with the relay *a*. The operation of spring 7 by a stud 5 brings about the closure of the contact springs 7 and 8 to connect its associated interrupter lead 10 to battery, as will be more fully described in the ensuing specification.

To further illustrate my invention, I have shown the cord circuit D for interconnecting two substations B and C which terminate in the line circuits L and L^1 respectively, comprising line relays LR, cut-off relays CO, line signals S, and multiple jacks J. The cord circuit D is designed for automatic ringing, and I have shown the interrupter circuit A in operative relation therewith. The cord circuit D comprises the usual answering and calling plugs P and P^1, answering and calling supervisory relays AS and CS and

supervisory lamps SS and SS[1]. The automatic ringing apparatus of the cord circuit D comprises a party line ringing key RK, four ringing generators G, G[1], G[2] and G[3], a ringing control relay RCR, an interrupter relay IR, and a switching relay SW.

To more fully explain my invention, it will be assumed that the interrupter circuit A is associated with a twelve-position switchboard, equipped with cord circuits as D. The interrupter A has four interrupter leads 10, 11, 12 and 13 controlled by the operation of the different magnets *a*, *b*, *c* and *d* of the interrupter circuit and are multiply connected to the different positions of the switchboard, preferably as follows: The lead 10 is common to the cord circuits D of the first, fifth and ninth positions, lead 11 to the second, sixth and tenth positions, lead 12 to the third, seventh and eleventh positions, and lead 13 to the fourth, eighth and twelfth positions. The interrupter circuit A is continually operating, but may be cut off by a switch 14 in the battery lead. Only one interrupter lead is closed at a time, and in the drawings I show the interrupter lead 10 connected so that upon the first energization of magnet *a* the button 5 disengages the spring 7 to open the contact springs 7 and 8 to disconnect the interrupter lead 10 from battery. The disk 1 associated with the magnet *b*, as shown, will have to be stepped once to bring about the closure of its contact springs 7 and 8, and the disk 1 associated with magnet *c* will have to be stepped twice to bring about the closure of its contact springs 7 and 8. The disk 1 associated with magnet *d* will have to be stepped three times to bring about the closure of its contact springs 7 and 8.

I will now describe one complete cycle of operation of the interrupter. Assuming that the apparatus is in position as illustrated, a circuit for the relay 15 is first established from battery through the switch 14, the winding of relay 15, to ground at normal contact 16 of relay 17. The closing of alternate contact 18 of relay 15 closes an energizing circuit for the relay 17 traced from battery through the winding of the said relay 17, to ground at alternate contact 18 of relay 15. The closure of alternate contact 16 of relay 17 establishes an energizing circuit for the magnets *a*, *b*, *c* and *d*, the circuit of magnet *a* being traced from battery through the winding of the magnet *a* to ground at alternate contact 16; the circuit of magnet *b* from battery through the winding of the magnet *b*, and over conductor 20 to ground at alternate contact 16; the circuit of magnet *c* from battery through the winding of the said magnet *c*, and over conductor 20 to ground at alternate contact 16; the circuit of magnet *d* from battery through the winding of the said magnet *d*, and over conductor 20 to ground at alternate contact 16. The magnets *a*, *b*, *c* and *d* are thus simultaneously energized, attracting their respective armatures 4. The pawl 2 of each armature 4 engages a tooth of the ratchet 3 upon each respective disk 1, rotating each disk 1 of the magnets *a*, *b*, *c* and *d* one step. A further result due to the energization of magnet 17 is the opening of its normal contact 16, thereby opening the energizing circuit for the magnet 15. The magnet 15 deënergizing, brings about the opening of its alternate contact 18, thus opening the energizing circuit of the magnet 17. The relays 15 and 17 being slow-acting relays, that is, slow to release, release their respective armatures in about one-half second of time and keep in continuous operation. The rotation of the disk 1 of magnet *a* one step causes a button 5 to disengage the spring 7, thus opening the closed contacts 7 and 8, and disconnecting the interrupter lead 10 from its associated first, fifth and ninth positions of the exchange switchboard.

The closure of the magnet *b* steps its associated disk 1 one step which brings one of its buttons 5 into engagement with the spring 7, thus closing the contact springs 7 and 8 and connecting battery over conductor 30 and through the now closed contacts 7 and 8 to the interrupter lead 11, which interrupter lead is associated with the second, sixth and tenth positions of the exchange switchboard. The energization of the magnet *c* steps its associated disk 1 one step, bringing one of its buttons 5 into position so that on the next energization of the magnet *c* its contacts 7 and 8 will be closed. The energization of the magnet *d* steps its associated disk 1 one step and brings one of its buttons 5 to a position so that upon its second following energization it will bring about the closure of its associated contact springs 7 and 8.

The opening of normal contact 16 opened the energizing circuit for relay 15 and the closure of contact 16 with its alternate contact closed the circuit for relays *a*, *b*, *c* and *d*, as before described. When the armature of relay 15 finally falls back, it opens the energizing circuit of relay 17, and then when the armature of relay 17 falls back, the circuit of relays *a*, *b*, *c* and *d* is opened, thus permitting them to deënergize. A further result due to the deërgization of relay 17 is the closure of a circuit for relay 15 through its normal contact 16. Relay 15 upon energizing closes a circuit for relay 17 through its normal contact, and relay 17 upon energizing starts the same cycle of operation over again.

From the foregoing description, it will be readily seen that upon each fourth step of magnet *a*, one of its buttons 5 operates to close its contact springs 7 and 8, and this

is also true of the other magnets *b*, *c* and *d*. I have found by experiment that in timing the relays so that one cycle of operation occurs in four seconds very satisfactory results are obtained, as this brings each interrupter lead in operative relation with its associated cord circuits for one second of time and disconnects each one for a period of three seconds.

I will now describe the interrupter circuit A operating in connection with the cord circuit D, which I will assume is one of the cord circuits of the first position with which the interrupter lead 10 is common. Assuming that the subscriber at the substation B wishes to converse with the subscriber at the substation C, the removal of the receiver at the substation B closes an energizing circuit for the line relay LR to light the line signal S. The operator now inserts the plug P into the jack J, operating the cut-off relay CO over a circuit traced from battery through the impedance coil R, the sleeve contacts of the plug P and jack J, and through the winding of the cut-off relay CO to ground. Relay CO upon energizing interrupts the energizing circuit of the line relay LR to efface the line signal S. Answering supervisory relay AS is also operated from battery through the coil R, sleeve contacts of the connected plug and jack, through the calling substation B, tip contacts of the connected plug and jack and through the winding AS to ground. Relay AS upon energizing, opens its normal contact to prevent the premature lighting of the supervisory signal SS.

Assuming that the substation C is wanted and that the line is idle, the operator inserts the plug P^1 into the jack J^1, closing an energizing circuit for the cut-off relay CO^1 and the switching relay SW in series over a circuit traced from battery through the winding of the relay SW, sleeve contacts of the connected plug and jack and through the winding of the relay CO^1 to ground. The relay SW upon energizing, closes its alternate contact 35, thereby closing a circuit for the supervisory signal SS^1 which signal remains lighted until the called-for subscriber answers. The operator now fully depresses the proper ringing plunger *p*, p^1, p^2 or p^3 of the party line ringing key RK. Assuming it is the plunger *p* which is depressed, the end springs 36 and 37 momentarily assume their alternate position, the springs 37 closing an energizing circuit for the ringing control relay RCR, traced from battery through the winding of the relay RCR, the closed contact 37, conductor 38 and the normal contact 39 of relay CS^1 to ground at alternate contact 35 of relay SW. Although the circuit of relay RCR is interrupted at contact 37 when the operator removes pressure from the actuated plunger, the relay RCR has previously closed a locking circuit for itself traced from battery through the winding of the said relay, alternate contact 40 of the said relay RCR, normal contact 39 of relay CS to ground at alternate contact 35 of relay SW. Upon the energization of the relay RCR, its alternate contact 41 is closed which connects interrupter lead 10 of the interrupter circuit A with the interrupter relay IR of the cord circuit D. Assuming that the disk 1 of the magnet *a* is in a position as illustrated, its associated contacts 7 and 8 are closed, thus establishing an energizing circuit for the interrupter relay IR traced from battery, over conductor 30, through closed contacts 7 and 8 of the magnet *a*, the interrupter lead 10, alternate contact 41 of relay RCR, conductor 42, normal contact 36 of the end springs, conductor 43, and through the winding of the interrupter relay IR to ground. Upon the energization of the interrupter relay IR, it closes its alternate contact 44 which connects ringing current to the called line from the ungrounded pole of the generator G, through alternate contact *p* of key RK over conductor 45, through alternate contact 44 of relay IR, alternate contact 46 of relay SW, tip contacts of the connected plug P^1 and jack J^1 through the condenser and call bell to the called substation C, back through sleeve contacts of the connected jack J^1 and plug P^1, the alternate contact 47 of relay IR to battery and ground. The relay IR is energized each time the interrupter lead 10 is connected to battery through contacts 7 and 8 of the magnet *a*. As before described, the interrupter relay IR is energized each time the contact springs of the magnet *a* are in position as illustrated, thus connecting ringing current with the wanted line for about one second of time, and allowing the silent interval of about three seconds. It is to be understood that ringing periods and silent periods of any duration may be used instead of the arbitrarily assigned ones.

When the called subscriber answers, an energizing circuit for the relay CS is established over the line causing its energization. Relay CS upon energizing, opens contact 39, thereby interrupting the locking circuit of relay RCR causing it to deënergize and open the circuit of the relay IR at its alternate contact 41. The opening of alternate contact 41 disconnects the interrupter lead 10 which prevents the relay IR from again energizing. The opening of contact 39 of relay CS also effaces the supervisory signal SS^1. When conversation has been completed and the receivers have been replaced on their respective switch hooks, the relays AS and CS deënergize and again light the supervisory signals SS and SS^1, respectively, whereupon the operator withdraws

the plugs P and P^1 from the jacks J and J^1, restoring the cord and line circuits to normal.

From the foregoing, it will be seen how the four magnets *a*, *b*, *c* and *d* successively energize the interrupter leads 10, 11, 12 and 13, respectively, the slow relays 15 and 17 giving ringing and silent periods of any desired duration. It will also be apparent that the number of magnets may be increased or diminished so that various numbers of ringing leads may be provided. I also contemplate using my invention in various other ways than that shown and, therefore, I do not desire to be limited to the exact features as shown and described but aim to cover all that which comes within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent is:

1. An interrupter system of the character described, including a plurality of step-by-step magnets, means for simultaneously energizing and deënergizing said magnets, a source of current, interrupter leads associated with said magnets, and means controlled by said magnets for differently intermittently connecting said source of current to said interpreter leads.

2. An interrupter system of the character described, including a plurality of magnets, means for simultaneously energizing and deënergizing said magnets, a source of current, interrupter leads, and means controlled by said magnets for intermittently connecting said source of current to the different leads at different periods.

3. An interrupter system including a pair of coöperating relays, circuits extending between said relays for effecting an automatic, continuous, consecutive energization and deenergization thereof, a source of current, step-by-step magnets provided with contacts, interrupter leads connected to said contacts, said step-by-step magnets being controlled by said relays to connect said source of current intermittently to said interrupter leads.

4. An interrupter system of the character described, including a plurality of relays, a source of current, circuit connections extending between said relays for effecting an automatic, continuous, consecutive energization and deënergization thereof, a plurality of step-by-step magnets, circuits for said magnets controlled by said relays, and interrupter leads extending through the contacts of said magnets whereby said source of current is successively connected to and then successively disconnected from said leads.

5. An interrupter system of the character described, including a pair of relays, a source of current, circuit connections between said relays whereby one relay controls the energization of the other, step-by-step magnets controlled by said relays, a plurality of interrupter leads extending from contacts controlled by said magnets, interrupter leads connected to said contacts, said contacts being so arranged that said interrupter leads are intermittently closed at different periods for the different leads.

6. An interrupter system of the character described, including relays, a source of current, circuit connections between said relays for effecting an automatic, continuous, sequential operation thereof, step-by-step magnets, circuits for said magnets controlled by one of said relays, and interrupter leads extending from contacts of different ones of said magnets whereby said leads are intermittently energized at different periods for the different leads.

7. An interrupter system of the character described, comprising a plurality of relays, a source of current, circuit connections between said relays for effecting an automatic, continuous, sequential energization and deenergization thereof, a plurality of step-by-step magnets, circuits for said magnets controlled by one of said relays, and a plurality of interrupter leads connected to contacts of said magnets whereby successive energizations of said leads are effected.

8. An interrupter system of the character described, including a plurality of step-by-step magnets, means for simultaneously energizing and deënergizing said magnets, a plurality of interrupter leads, a source of current, contacts for said magnets for connecting said source of current to said interrupter leads, said contacts being so arranged that said interrupter leads are successively connected to said source of current.

9. An interrupter system of the character described, including a plurality of step-by-step magnets, relay means for simultaneously and intermittently energizing and deenergizing said magnets, a source of current, interrupter leads, and contacts controlled by said magnets for intermittently sequentially connecting said source of current to said interrupter leads.

10. An interrupter system including a pair of coöperating relays, circuits extending between said relays for effecting an automatic, continuous, consecutive energization and deënergization thereof, a source of current, step-by-step magnets provided with contacts, interrupter leads connected to said contacts, said step-by-step magnets being connected in parallel and energized and deenergized by said relays to connect said source of current intermittently to said interrupter leads, and condensers connected across said contacts.

11. An interrupter system of the character described, including a plurality of step-by-step magnets, a plurality of slow-acting relays coöperating to cause a continu-

ous energization and deënergization thereof, means including said relays for simultaneously energizing and deënergizing said magnets, a plurality of interrupter leads, a source of current, contacts for said magnets for connecting said source of current to said interrupter leads, said contacts being so arranged that said interrupter leads are successively connected to said source of current, and condensers connected across said contacts.

12. An interrupter system of the character described, including a plurality of magnets, means for simultaneously energizing and deënergizing said magnets, a source of current, interrupter leads, means controlled by said magnets for intermittently connecting said source of current to the different leads at different periods, and a pair of relays included in said first means.

13. An interrupter system of the character described, including a plurality of magnets, means for simultaneously energizing and deënergizing said magnets, ratchet and pawl mechanism associated with each of said magnets, contacts controllable by said ratchet and pawl mechanism, and a source of current and interrupter leads associated with said contacts, said contacts being so operated that said source of current is intermittently connected to the different leads at different periods of time.

14. An interrupter system of the character described including a plurality of magnets, automatic continuously operating electromagnetic means for simultaneously energizing and deënergizing said magnets, interrupter leads, a source of current, and means controlled by said magnets for connecting said source of current at different periods to the different leads.

15. A system of the character described including a plurality of electromagnets, a pair of coöperating slow-acting relays for simultaneously energizing and deënergizing said electromagnets, interrupter leads, a source of current, and means controlled by said magnets for connecting said source of current to the different leads.

16. A system of the character described including a plurality of electromagnets, electromagnetically driven means for simultaneously energizing and deënergizing said electromagnets, interrupter leads, a source of current, and contacts controlled by said magnets for intermittently connecting said source of current upon alternate energizations thereof to the interrupter leads.

Signed by me at Chicago, in the county of Cook and State of Illinois, in the presence of two witnesses.

RICHARD I. UTTER.

Witnesses:
G. YANSCHOSKI,
M. R. ROCHFORD.