W. KAISLING.

SWITCH.

APPLICATION FILED FEB. 6, 1909.

975,529.

Patented Nov. 15, 1910.

2 SHEETS—SHEET 1.

Fig. 1

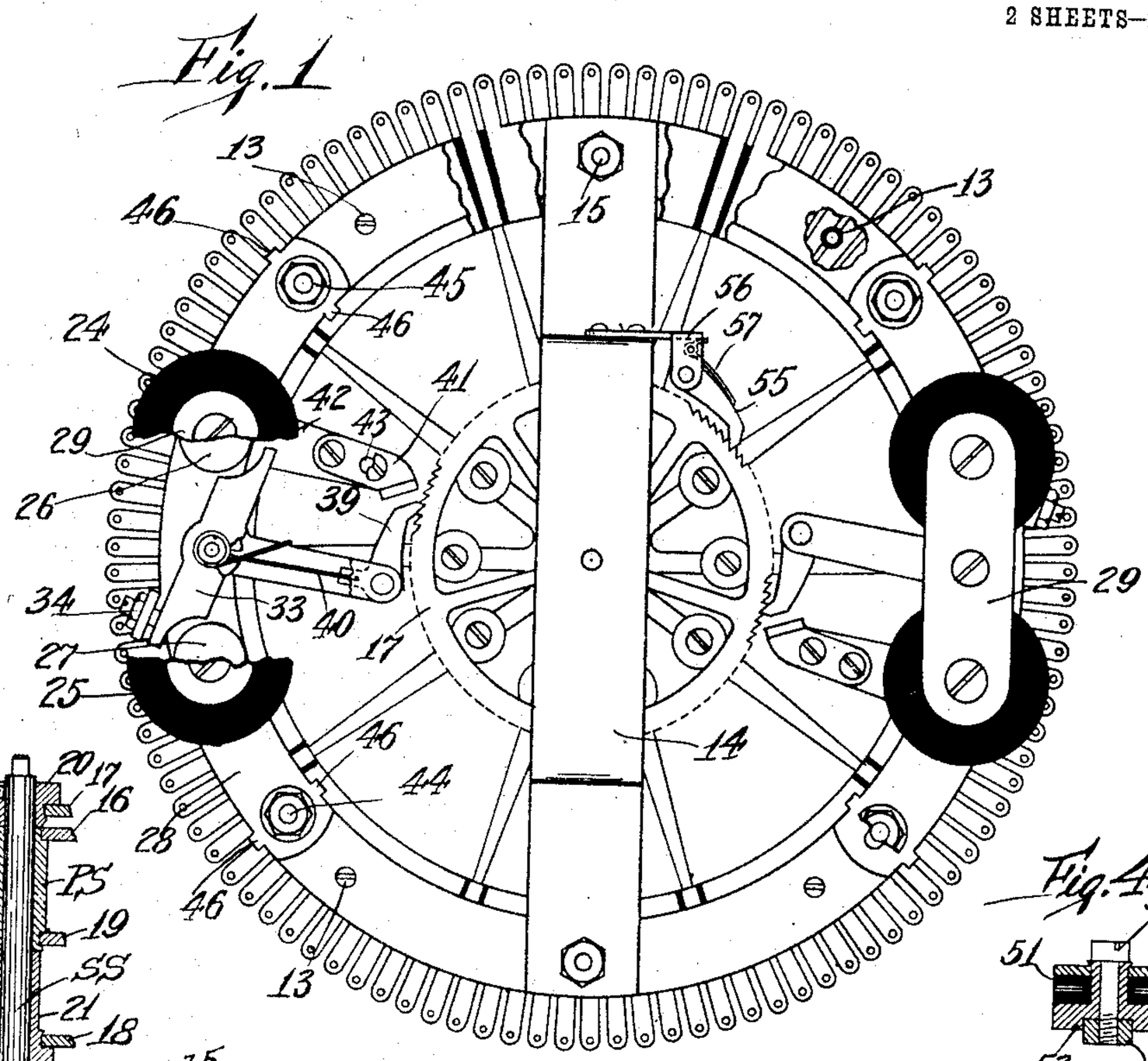


Fig. 3

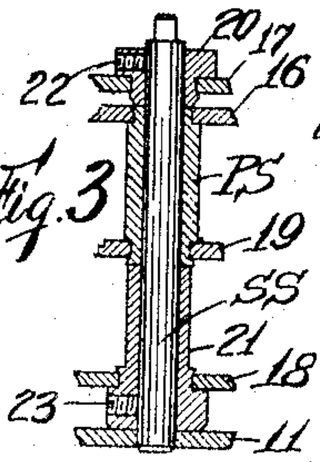


Fig. 4

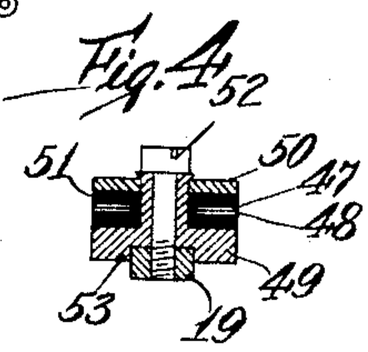
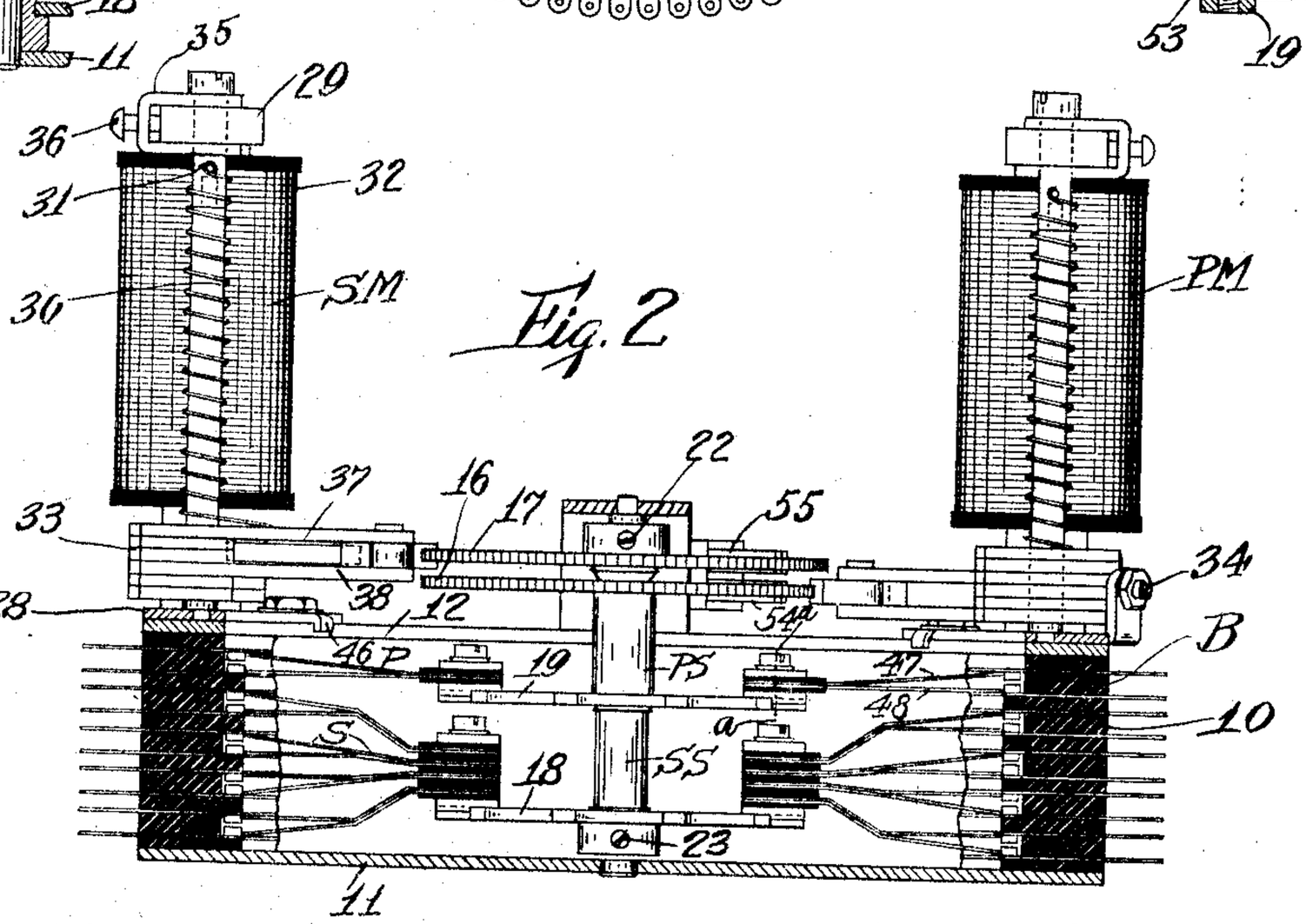


Fig. 2



Witnesses
G. E. Mueller
L. D. Kellogg

Inventor
William Kaisling
by Thomas H. Ferguson
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2 SHEETS—SHEET 2.

Fig. 5

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UNITED STATES PATENT OFFICE.

WILLIAM KAISLING, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, A CORPORATION OF ILLINOIS.

SWITCH.

975,529. Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed February 6, 1909. Serial No. 476,511.

To all whom it may concern:

Be it known that I, WILLIAM KAISLING, a citizen of the United States, and resident of Chicago, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Switches, of which the following is a specification.

The present invention relates generally to electrically controlled switches of the type employed in automatic telephony and more particularly to that class of such switches in which the moving contacts, or wipers, are given primary and secondary movements to bring them to their desired contacting positions, the primary movement causing the selection of a group of fixed contacts, and the secondary movement the selection of a contact in that group.

The principal object of the present invention is to provide a switch of this general type which shall be simple and economical in construction while maintaining a high degree of efficiency in operation. To this end, all the fixed contacts, whether primary or secondary, are located in a single arcuate bank which forms a complete unitary structure in itself. The primary and secondary wiper members are mounted concentrically within the contact bank and are readily removable for purposes of repair, the several sets of wiper contacts being also assembled as independent elements. The driving magnets and associated parts by which the primary and secondary wipers are given their movements also form independent elements which are conveniently located upon opposite sides of the contact bank which constitutes the principal support of the switch structure. With this arrangement, the several parts of the switch are readily removable for purposes of substitution and repair and the bank contacts may be readily wired into the circuit in which the switch is to be employed.

The above and other features of the invention will be more fully understood upon reference to the following detailed description taken in connection with the accompanying drawings, and the scope of the invention will be particularly pointed out in the appended claims, many of the features being capable of use in other connections than herein disclosed.

In said drawing, Figure 1 is a plan view of a switch constructed in accordance with my invention; Fig. 2 is a side elevation of the same with parts shown in section; Fig. 3 is a vertical section through the primary and secondary wiper shafts; Fig. 4 is a vertical section through one set of primary wiper contacts at their point of attachment to the hub of the primary shaft; and Fig. 5 is a circuit diagram illustrating one circuit in which the switch illustrated in the previous figures may be employed.

Throughout these figures, like characters refer to like parts.

Referring to the drawings in detail, B designates the bank of fixed contacts; P the primary wipers mounted on the primary shaft PS; S the secondary wipers mounted on the secondary shaft SS; PM the primary driving magnet; and SM the secondary driving magnet. The contact bank is composed of sets of contacts which may be varied in size, connection and division, according to the requirements of any given case. An arrangement suited to the circuits of Fig. 5 is illustrated in that figure. Suitable insulation 10 separates the contacts in any desired manner. The bank thus formed of contacts and insulation is mounted upon a circular base plate 11, and an angular plate 12 forms a covering at its top. All the parts are held together preferably by screws 13 which extend through the top plate 12 and the insulation 10 into threaded engagement with the bottom plate 11, the adjacent bank contacts being cut away to provide space for the screws, as illustrated in Fig. 1, where the top plate is partially broken away. A bridge 14 extends between opposite sides of the bank and is secured to the top plate 12 by any suitable means, as the bolts 15. The center of the bridge is off-set so as to provide additional space for the primary and secondary ratchet wheels 16 and 17, respectively. The bridge also provides a bearing for one end of the secondary shaft SS, the other end being journaled in the base plate 11. This shaft carries the secondary wiper hub 18 at its lower end and, as clearly illustrated in Fig. 3, provides a bearing for the sleeved primary shaft PS, which in turn carries the primary wiper hub 19. The primary ratchet wheel 16 is secured to the upper end of the primary shaft PS, and the secondary ratchet wheel 17 is secured to the upper end of the secondary shaft SS.

As illustrated more particularly in Fig. 3, the secondary ratchet wheel 17 and the secondary wiper hub 18 are secured to the secondary shaft SS through the agency of the collars 20 and 21 and the set screws 22 and 23, respectively. The primary and secondary magnets PM and SM, and the associated parts by which the primary and secondary ratchet wheels are actuated, are similar in construction and it will therefore suffice to describe one of them, as, for example, the secondary magnet and its associated mechanism. This magnet includes two magnet spools 24, 25, located upon two suitable cores 26, 27, firmly secured together at their lower ends by the plate 28 and at their upper ends by a yoke 29. A shaft 30 is located midway between the spools 24 and 25 and is journaled at its lower end in the plate 28 and at its upper end in a rotatable stud 31 which extends through an aperture in the center of the yoke 29 and is provided at its upper end with a screw head for adjustment. A spiral spring 32 is secured at one end to the stud 31 and at its opposite end to the armature 33, the intervening portion lying closely about the shaft 30. The spring is put under tension by rotating the stud 31, thereby forcing the armature 33 against its back stop 34 which comprises an adjustable screw extending through a lug upturned from the plate 28. The stud 31 is held in its adjusting position by the yoke 35 which has its two arms perforated for the passage of the stud and which, when drawn against the side of the stud by the action of the screw 36 against the yoke 29, frictionally holds the stud against rotation. The armature 33 is composed of a series of plates of suitable magnetic material bound together and suitably cut away at their ends to closely engage the circular face of the magnet pole-pieces as clearly illustrated in Fig. 1. Two of the magnet plates have projections 37 and 38 which extend substantially at right angles to the armature and carry the driving pawl 39 at their outer end. This pawl is journaled between the plates and its tail is split for the reception of an actuating spring 40 which co-acts between the pawl and the armature to throw the pawl into a position to engage the teeth of the secondary ratchet wheel 17. A stop 41, carried upon a projection 42 of the plate 28, coöperates with the end of the pawl 39 to limit its forward movement. This stop is held in place by two screws which extend through slots 43 so that the stop may be adjusted so as to give the correct stroke to the pawl. The plate 28, which carries the magnet structure, is held in place upon the switch bank by any suitable means such as the bolts 44, 45, and the lugs 46 enable it to be readily and accurately set in position on the top plate 12. By this construction, it thus follows that the magnet and its associated parts may be readily detached from the rest of the switch structure for purposes of repair or substitution.

The bank contacts are arranged in oppositely disposed rows lying in proximity to each other so that their contacting ends may be bridged by the coöperating wiper contacts. Thus the primary wiper contacts 47, 48 operate to bridge the bank contacts of the first row with those of the row just beneath it. These wiper contacts, as clearly illustrated in Figs. 1 and 4, are narrow strips of spring metal which are bound together at their inner ends and given a tension so that their outer ends will press firmly into engagement with the coöperating bank contacts. As illustrated, the outer ends of these contacts are laterally curved so as to readily wipe over the bank contacts. As clearly illustrated in Fig. 4, the inner ends of the wiper contacts 47, 48 are perforated for the passage of a tubular rivet 49. The latter is provided with a washer 50 by which the wiper contacts, with intervening washers 51 of insulating material, are firmly pressed together and held in position upon the attaching member thus formed by riveting down the upper end of the tubular rivet 49. This provides a compact wiper structure which may be manufactured independently of the remainder of the switch and assembled as a unit with the other parts. Obviously, the wiper contacts 47, 48 may be variously electrically connected at their inner ends. In the present instance, they are in electrical contact and insulated from the remainder of the attaching member, as clearly illustrated. To attach these wiper contacts, it is only necessary to slip the outer ends of the contacts 47, 48 between the coöperating rows of bank contacts and then fasten their inner ends to the appropriate arm of the wiper hub. This latter connection may be accomplished in any desired manner, but preferably a screw 52 extends down through the bore of the tubular rivet 49 into threaded engagement with the outer end of the hub arm. To lock the wipers against rotation about the pivot 49, the under face of the latter is provided with projections 53, which bear against the sides of the arm when the screw is screwed home.

With the structure arranged as illustrated and described, the driving magnets and attaching parts may be individually removed from the rest of the structure as we have just seen. Similarly, the wiper and ratchet members may be removed from the rest of the structure by removing the bridge 14, detaching the various wiper contacts, or swinging them out of engaging position and then simply lifting the whole wiper and ratchet structure away from the contact bank. In order to retain the ratchet wheels in their

various positions, the switch is provided with primary and secondary retaining pawls 54, 55, which are pivotally secured to a bracket 56 secured to the bridge 14. Springs 57, associated with these pawls, normally press them into their engaging positions.

Having now fully described the structure of the switch, attention may be directed to the diagram of Fig. 5 which illustrates the manner of connecting up the switch contacts in accordance with one circuit arrangement. Obviously, in other circuits, the switch might be differently connected. In the diagram, the primary bank contacts are divided into ten sections m', n', o', p', q', etc., each comprising two oppositely disposed individual contacts and a common contact opposite a plurality of individual contacts. In the diagram, the individual contacts opposite the common contact are only three in number instead of ten, as in the switch construction. This substitution is made in order to simplify the diagram. As before explained, these primary contacts are the contacts of the first two rows of the switch. Similarly, the second pair are divided into sections m^2, n^2, o^2, etc.; the third pair into sections m^3, n^3, o^3, etc.; the fourth pair into sections m^4, n^4, o^4, etc.; and the fifth pair into sections m^5, n^5, o^5, etc. The sections of the second and third pairs are the same as the sections of the first pair and the individual contacts in these, as well as in the first pair, are so positioned that the coöperating wipers will disengage one before engaging the next, The contacts of the fourth pair are similar to those of the first, second and third pairs, but the individual contacts are of sufficient length to allow the coöperating wipers to engage one before leaving another. The contacts in the fifth pair comprise two oppositely disposed individual contacts, and two oppositely disposed contact strips adapted to be bridged by the wiper in all positions except the normal. In this circuit, a primary conductor 58 is connected to the common contact of section m' of the primary portion of the switch, conductors 58^a, 58^b, etc., extending from the coöperating individual contacts to the common contacts m^2, n^2, etc., of the secondary portion of the switch, and conductors 59^a, 59^b, etc. extending from the individual contacts of section m^2 to different other switches or to subscribers' stations (not shown). Similarly, a secondary conductor 60 is connected to the common contact of section n' of the primary portion of the switch, and conductors 60^a, 60^b, etc. extend from the coöperating individual contacts to the common contacts m^3, n^3, etc. of the secondary portion of the switch, and conductors 61^a, 61^b, etc. extend from contacts coöperating with common contact m^3 to the switches or substations to which conductors 59^a, 59^b, respectively, extend. Similarly, a local conductor 62 extends to the common contact of section o' of the primary portion of the switch, and conductors 62^a, 62^b, etc. extend to common contacts m^4, n^4, etc. of the secondary portion of the switch, and conductors 63^a, 63^b, etc. extend from the individual contacts of section m^4. The contacts in sections m^5, n^5 perform the well known secondary off-normal switch functions of this class of switches, while the contacts in sections p', q' perform the well known primary off-normal switch functions.

With this statement of the arrangement of connections to the switch contacts, the operation of the circuit may be briefly pointed out.

The switch is adapted to be controlled from station A. Its primary movements are brought about by the operation of key 64, and its secondary movements by the operation of key 65. Switch 66 closes a circuit for the primary and secondary relays PR and SR from batteries B′, B^2 and thereby causes them to normally hold their armatures attracted. The subsequent operation of key 64 deënergizes relay PR and completes a circuit for primary magnet PM which may be traced from the live pole of the grounded battery B^3, through the winding of said magnet, normal contact 67, bridged secondary off-normal contact 68—69, contact 70 of the primary relay PR, and contact 71 of secondary relay SR to ground. The resulting energization of the primary magnet PM advances the primary wipers P from their first to their second position, thereby uniting conductors 58—58^a, 60—60^a, 62—62^a, and connecting conductor 72 to ground and conductor 73 to the grounded interrupter 74. If it is desired to extend the main circuit from station A to the first group of conductors extending from the secondary portion of the switch, then the key 64 is not further operated. If it were given another step, the primary magnet would be again energized and the wipers P advanced to their third position. This would merely change the connections of conductors 58, 60 and 62 without changing the connections of conductors 72 and 73. However, assuming that but one step has been given to the primary portion of the switch and that this is followed by a single operation of the secondary key 65, then relay SR will be deënergized and a circuit thereby completed for the secondary relay SR′ from the live pole of grounded battery B^4, through the winding of said relay, secondary off-normal contacts 75, 76, and contacts 77 and 78 of relays SR and PR to ground. The resulting energization of relay SR′ opens its contacts 79, 80 to interrupt the main conductors 59, 60, so as to prevent possible interference with conversations (if

the main circuit be used as a conversational circuit) over the multiple terminals of the lines extending from the individual contacts of the secondary portion of the switch, such as 59^a—61^a—63^a, 59^b—61^b—63^b, etc. The energization of relay SR′ also closes a circuit for secondary magnet SM′ extending from the live pole of the grounded generator 81, through the winding of said magnet, contact 82 of relay SR′, and normal contact 83 of release relay RR to ground. The resulting energization of magnet SM causes the secondary wipers S to move to their second position, thereby uniting conductors 58^a—59^a, 60^a—61^a, and 62^a—63^a. The circuit herein shown is a "selector" circuit which, as is well known, is arranged so that the secondary portion of the switch will continue its travel until an idle set of conductors is encountered and will then stop in engagement with such conductors. Accordingly, if the first set of conductors 59^a—61^a—63^a are in use by reason of some multiple connection, then the secondary wipers S will be moved to their third position to extend the conductors of the seeking line to the second set of conductors 59^b—61^b—63^b. Thus if the conductors 59^a—61^a—63^a are those of a busy line, conductor 63^a will be connected to ground through its multiple tap 84, contacts of section m^4 of another switch, conductor 62^a of that switch, contacts of section o' of that switch, and the associated conductor 62, contacts 85, 86, winding of release relay RR to ground either via conductor 72 and the contacts of section p', or conductor 87 and the contacts of section m^5. Consequently relay SR′ of the seeking line, having its initial energizing circuit interrupted at secondary off-normal contacts 75, 76, will be maintained energized over a path extending through normal contact 88 of relay RR, alternate contact 85 of relay SR′, conductors 62, 62^a and 63^a to ground. Relay SR′ will continue to be thus energized until the secondary wipers move to a position in which an encountered conductor 63^a, 63^b, etc. is ungrounded. As soon as this occurs, the maintaining circuit for relay SR′, just traced, will be interrupted, with a consequent interruption of the energizing circuit of secondary magnet SM.

As clearly shown, the first movement of the secondary wipers S opens the connection to magnet PM at contacts 68—69, grounds conductor 87, opens the initial energizing circuit of relay SR′ at contact 75—76, and grounds conductor 89. Upon the deënergization of relay SR′, following the selection of an idle conductor, conductors 58, 60, have their parts united by contacts 79 and 80, thereby providing continuous strands from station A through the primary and secondary portions of the switch. Assuming that the primary and secondary portions of the switch are given only one step each, then such strands are the heavily marked strands of the diagram. These strands include the condensers 90, 91. In releasing, the switch will advance its wipers to normal. This is brought about by opening the circuit of the primary and secondary relays PR and SR, as by switch 66. As soon as this is done, contacts 92 and 93 of said relays are closed and release relay RR is thereupon energized by a circuit extending from the live pole of battery B^4, through protective resistance 94, contacts 92, 93, contact 95—85—86 of relay SR′, winding of release relay RR and to ground through the parallel conductors 72, 87. Since the primary and secondary wipers may have to be moved through different distances to bring them to normal, the relay RR is maintained energized either via conductor 72 or 87 until both portions of the switch have reached normal. The energization of relay RR closes a circuit for primary magnet PM which includes battery B^3, the winding of said magnet, alternate contact 67 of relay RR, conductor 73 and interrupter 74. This circuit will be maintained and relay PM will be alternately energized and deënergized to advance its wipers P until that wiper, engaging the contacts of section q', passes to its normal position. At the same instant, the ground connection through relay RR via conductor 72 will be broken. Upon its energization, relay RR closes a locking circuit for itself. This circuit also includes the winding of relay SR′. It may be traced from the live pole of battery B^4, through the winding of relay SR′, alternate contact 88, the winding of relay RR and to ground via conductors 72 and 87. If the primary portion of the switch reaches normal first, this circuit is maintained through conductor 87 until the secondary portion reaches normal. On the other hand, if the secondary portion of the switch reaches normal first, this circuit is maintained through conductor 72 until the primary portion reaches normal. The resulting energization of relay SR′ opens conductors 58 and 60 to disconnect the switch contacts during the return movement of the switch parts. Its energization also closes an energizing circuit for secondary magnet SM which is maintained until the secondary wipers S reach normal. This circuit extends from alternating current generator 81, through winding of magnet SM, contact 82, alternate contact 83, and conductor 89 to ground through secondary off-normal contacts of section n^5. This circuit will be interrupted at the contacts of this section as soon as the engaging wiper passes to its normal position and further advance movement of this portion of the switch will be prevented.

The movement to this normal position will also interrupt the ground connection of conductor 87 and allow relays RR and SR′ to return to normal, thus leaving the parts in the condition illustrated. In the diagram, the conductors 96, 97 are provided so as to allow impulses to be transmitted from the relays PR and SR over conductors 58, 60, and their extensions to switches or other apparatus associated with the distant ends of the conductors 59ª, 61ª, etc., in case such switches or apparatus are employed.

It will be apparent to those skilled in the art that many alterations and modifications may be made in the structure of the switch and the arrangement of its parts, as well as in the extent and character of the bank contacts, without departing from the spirit and scope of the invention. I therefore do not wish to be limited to the precise matter illustrated, but aim to cover by the terms of the appended claims all such alterations and modifications.

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

1. A telephone switch comprising primary and secondary concentric shafts, electromagnetically actuating step-by-step mechanism for independently rotating said shafts, wipers carried by and extending radially outward from said shafts, and cooperating bank contacts extending toward said shafts and engageable by said wipers during their step by step movement.

2. A telephone switch comprising primary and secondary concentric shafts, electromagnetically actuated step-by-step mechanism for independently rotating said shafts, wipers carried by and extending radially outward from said shafts, and an arcuate bank of coöperating contacts, adapted to be engaged by said wipers during their step by step movement.

3. A telephone switch comprising an arcuate bank of fixed contacts, rotating wipers individually engageable during rotation with different ones of said contacts, and electromagnetically actuated step-by-step mechanism for individually rotating said wipers.

4. A telephone switch comprising an arcuate bank of fixed contacts, rotating primary and secondary wipers individually engageable during rotation with different ones of said contacts, primary and secondary shafts carrying said primary and secondary wipers respectively, and electromagnetically actuated step-by-step mechanism for individually rotating said shafts.

5. A telephone switch comprising upper and lower frame members, an arcuate bank of fixed contacts located between and firmly secured to said members, two concentric shafts rotatably supported by said members, wipers carried by said shafts and adapted to engage said fixed contacts as said shafts are rotated, and electromagnetically actuated step-by-step mechanism located above and secured to said upper frame member and operative to individually rotate said shafts.

6. A telephone switch comprising upper and lower frame members, an arcuate bank of fixed contacts located between and firmly secured to said members, two concentric shafts rotatably supported by said members, wipers carried by said shafts and adapted to engage said fixed contacts as said shafts are rotated, a ratchet on each of said shafts, driving and retaining pawls for each of said ratchets, and an electromagnet and armature for each driving pawl, said ratchets, pawls, armatures and magnets being located above and supported by said upper frame member.

7. A telephone switch comprising an arcuate bank of fixed contacts, a rotary member located concentrically therewith, and a plurality of sets of wiper contacts secured to said member and adapted to engage said fixed contacts during the rotation of said member, each set being detachable as a unit from said member.

8. A telephone switch comprising an arcuate bank of fixed contacts, a rotary shaft located concentrically therewith, a wiper hub on said shaft, and a set of wiper contacts secured to said hub and detachable therefrom as a unit, said wiper contacts engaging said fixed contacts during the rotation of said shaft.

9. A telephone switch comprising an arcuate bank of fixed contacts, a rotary shaft located concentrically therewith, a wiper hub on said shaft having a plurality of radial arms, and a set of wiper contacts secured to the outer end of each of said arms and detachable therefrom as a unit.

10. A telephone switch comprising an arcuate bank of fixed contacts, a rotary member located concentrically therewith and having a radially extending arm, an attaching member detachably secured to the outer end of said arm, and wiper contacts permanently secured to said attaching member at their inner ends and adapted to engage said fixed contacts at their outer ends.

11. A telephone switch comprising an arcuate bank of fixed contacts, a rotary member located concentrically therewith and having a radially extending arm, an attaching member detachably secured to the outer end of said arm, wiper contacts permanently secured to said attaching member at their inner ends and adapted to engage said fixed contacts at their outer ends, and means for insulating said wiper contacts from said arm.

12. In a telephone switch, a wiper comprising a plurality of metal contact strips perforated at their non-contacting ends; an

attaching member consisting of a rivet extending through the perforations of said strips, a washer coöperating with said rivet and suitable insulation between said strips and rivet and washer; a supporting member; and means for connecting said attaching member to said supporting member.

13. In a telephone switch, a wiper comprising a plurality of metal contact strips perforated at their non-contacting ends; insulation between certain of said strips; a washer; a tubular rivet extending through said insulation, washer and the perforations of said strips; a supporting member; and a screw extending through the bore of said rivet into threaded engagement with said supporting member.

14. In a telephone switch, a wiper structure comprising a plurality of narrow contact strips perforated at their non-contacting ends, a tubular rivet having its shank extend through the perforations of said strips, a metal washer against which the end of said shank is riveted, and insulation washers intervening between said strips and metal rivet and metal washer.

15. In a telephone switch, a wiper comprising a plurality of metal contact strips perforated at their non-contacting ends; insulation between certain of said strips; a washer; a tubular rivet extending through said insulation, washer and the perforations of said strips; a supporting member; a screw extending through the bore of said rivet into threaded engagement with said supporting member; and interlocking means for preventing the relative rotation of said supporting member and said rivet about said screw when the latter is screwed home.

16. A telephone switch comprising five self-contained units, a bank member containing primary and secondary fixed contacts, a primary wiper and ratchet member, a secondary wiper and ratchet member, a primary driving magnet member, and a secondary driving magnet member.

17. A telephone switch comprising a circular bank of fixed contacts, primary and secondary shafts mounted concentrically with said bank, wipers carried by said shafts, primary and secondary driving magnets mounted on said bank and lying substantially parallel to said shafts, armatures for said magnets located adjacent to said bank, and driving means operating with said armatures and shafts.

18. A telephone switch comprising primary and secondary fixed contacts arranged in a single bank constituting a single unitary structure, a primary shaft and wiper for engaging said primary fixed contacts, a secondary shaft and wiper for engaging said secondary fixed contacts, primary electromagnetic driving means for driving said primary shaft and wiper and secondary electromagnetic driving means for driving said secondary shaft and wiper.

19. A telephone switch comprising a contact bank having groups of primary contacts each including a common contact opposite a plurality of individual contacts, said bank also having similar groups of secondary contacts, electrical conductors uniting each primary individual contact to a secondary common contact, primary and secondary wipers for bridging said primary and secondary contacts respectively, and means for individually operating said primary and secondary wipers.

20. A telephone switch comprising primary and secondary concentric shafts having rotary motion only, electromagnetically actuated step-by-step mechanism for independently rotating said shafts, wipers carried by said shafts, and bank contacts cooperating with said wipers.

21. A telephone switch comprising primary and secondary concentric shafts and having rotary motion only, electromagnetically actuated step-by-step mechanism for independently rotating said shafts, wipers carried by and extending radially outward from said shafts, and an arcuate bank of cooperating contacts.

22. A telephone switch comprising an arcuate bank of fixed contacts, wipers having a rotary motion only and individually engageable with different ones of said contacts, and electromagnetically actuated step-by-step mechanism for individually rotating said wipers.

23. A telephone switch comprising an arcuate bank of fixed contacts, primary and secondary wipers having a rotary motion only and individually engageable with different ones of said contacts, primary and secondary shafts carrying said primary and secondary wipers respectively, and electromagnetically actuated step-by-step mechanism for individually rotating said shafts.

24. A telephone switch comprising an arcuate bank of fixed contacts, a rotary member located concentrically therewith and having a rotary motion only, and a plurality of sets of wipers secured to said member, each set being detachable as a unit from said member.

25. A telephone switch comprising an arcuate bank of fixed contacts, a rotary shaft located concentrically therewith and having a rotary motion only, a wiper hub on said shaft, and a set of wiper contacts secured to said hub and detachable therefrom as a unit.

26. A telephone switch comprising five self-contained units, a bank member, a primary wiper and ratchet member having a rotary motion only, a secondary wiper and ratchet member having a rotary motion only, a primary driving magnet member, and a secondary driving magnet member.

27. A telephone switch comprising pri-

mary and secondary fixed contacts arranged in a single bank, a primary shaft and wiper having a rotary motion only and operative to engage said primary fixed contacts, a secondary shaft and wiper having a rotary motion only and operative to engage said secondary fixed contacts, primary electromagnetic driving means for driving said primary shaft and wiper, and secondary electromagnetic driving means for driving said secondary shaft and wiper.

In witness whereof, I hereunto sign my name this 3rd day of February, 1909.

WILLIAM KAISLING.

Witnesses:
G. E. MUELLER,
J. G. KELLOGG.