No. 775,145. PATENTED NOV. 15, 1904.

W. MEYER.

ELECTROMAGNET.

APPLICATION FILED AUG. 26, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

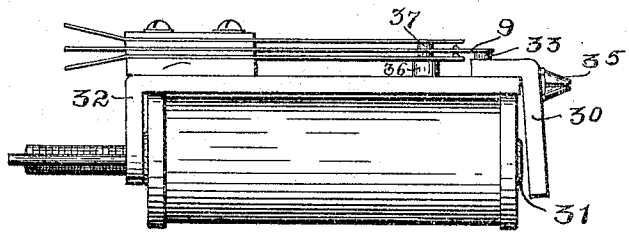


Fig. 2.

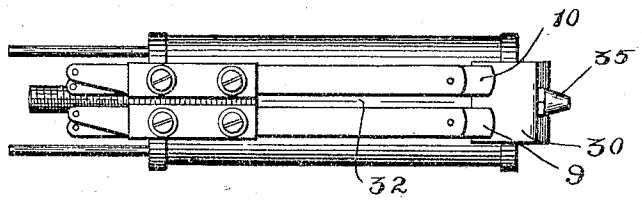


Fig. 3.

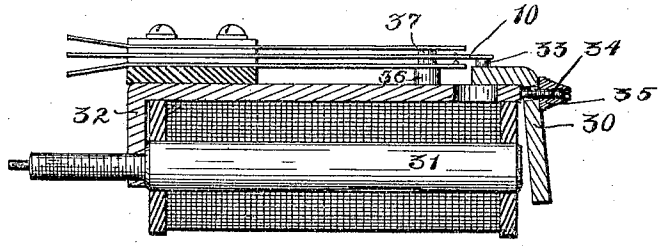
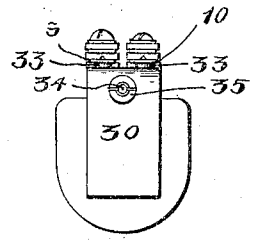


Fig. 4.



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ELECTROMAGNET.

APPLICATION FILED AUG. 26, 1901.

NO MODEL. 2 SHEETS—SHEET 2.

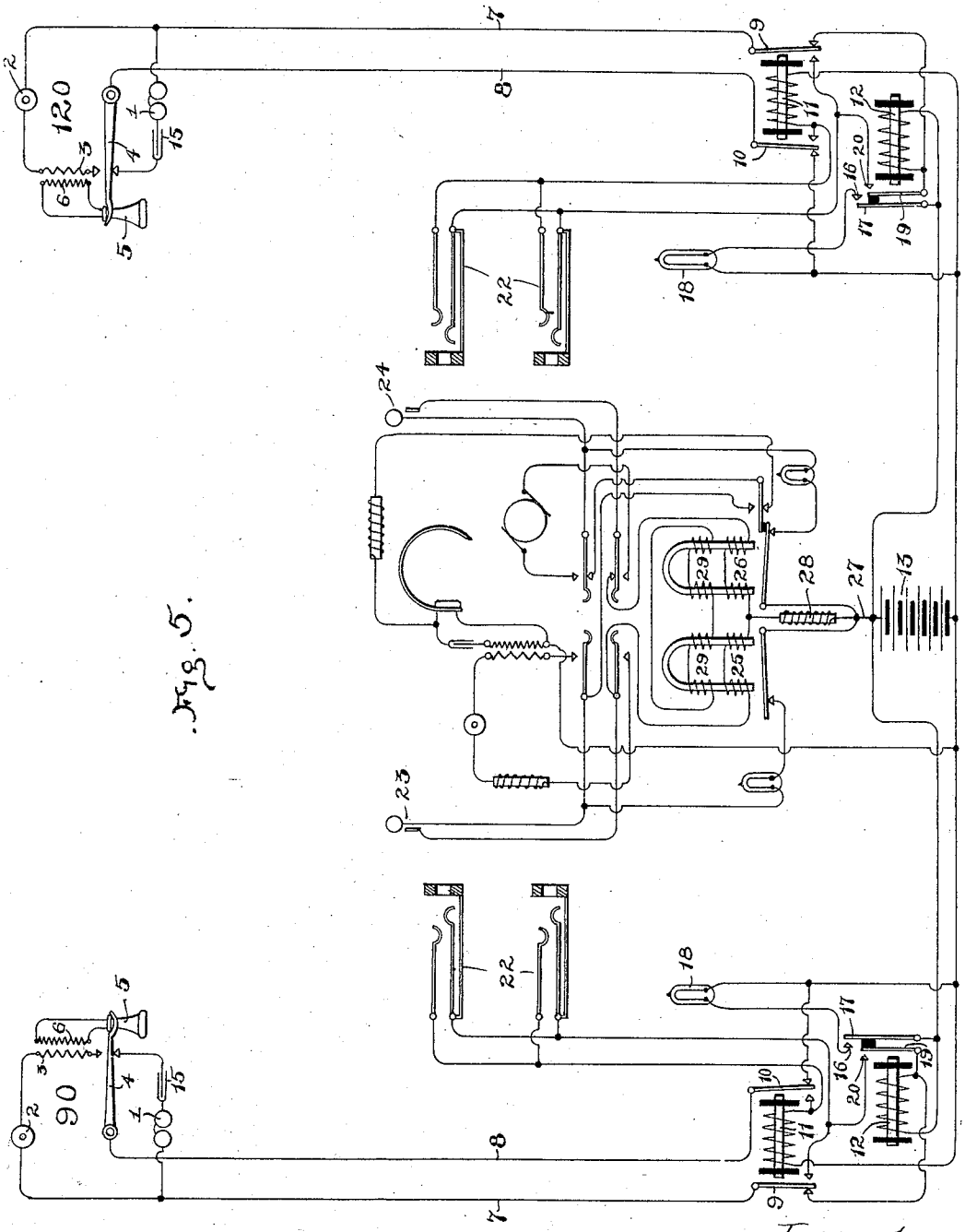

Fig. 5.

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No. 775,145. Patented November 15, 1904.

UNITED STATES PATENT OFFICE.

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

ELECTROMAGNET.

SPECIFICATION forming part of Letters Patent No. 775,145, dated November 15, 1904.

Application filed August 26, 1901. Serial No. 73,357. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MEYER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electromagnets, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to electromagnets, and has for its object the provision of an improved construction thereof to procure more efficient operation, and to simplify its mechanism.

My invention further relates to relays comprising the combination of my improved electromagnet with circuit-changing switching mechanism controlled thereby.

My invention may generally be described as comprising an electromagnet having a magnetic circuit that is practically closed, this magnetic circuit including a movable armature having an angular extension, preferably also composed of iron, to thereby constitute a bell-crank lever, which armature is arranged to engage the free end of a circuit-changing spring or springs near its pivotal mounting, whereby a most compact and efficient structure is secured. The armature of the electromagnet entering into the construction of the relay is preferably free of any pivot or trunnion pins or screws, being mounted to have the corner formed by the sides thereof engaged by the corner portion of a bar composed, preferably, of metal and preferably constituting part of the magnetic circuit. This armature in the form of a bell-crank and the said bar are prevented from displacement by means of a single screw passing through the armature into the bar. The construction is thus very much simplified and the cost of the parts materially reduced. To secure the most effective operation, the arms or sides of the bell-crank lever are displaced slightly more than ninety degrees, the displacement being sufficient to secure the required rotation of the armature.

I will explain my invention more fully by reference to the accompanying drawings, in which—

Figure 1 is an elevation of my improved electromagnetic mechanism; Fig. 2, a plan view of the structure illustrated in Fig. 1; Fig. 3, a longitudinal sectional elevation of the structure; Fig. 4, a front view thereof. Fig. 5 illustrates the adaptation of the relay to a telephone-exchange system, the relay serving, as illustrated in this figure, as a cut-off relay.

Like parts are indicated by similar characters of reference throughout the different figures.

I will first describe the telephone-exchange system in connection with which my improved instrument is employed and will thereafter more particularly set forth details of the instrument's construction.

For the sake of clearness I have diagrammatically shown the cut-off relay in the drawings as provided with two armatures, one mounted at either extremity thereof, while it is readily understood that in the preferred embodiment of my invention I have but a single spring-actuating armature.

At the substations 90 and 120 are illustrated well-known types of telephonic apparatus. At each station there is provided a signal-receiver 1, a telephone-transmitter 2, a primary winding 3, and a switch-hook 4 for including the bell 1 in circuit when the receiver 5 is in place upon the hook and for excluding this bell from circuit and including instead thereof the transmitter 2 with the primary winding 3 when the receiver is removed from its hook. There is also included in a local circuit with the receiver 5 the secondary 6 of a transformer. Other types of telephone-station apparatus, however, may be employed.

Telephone-lines extend by their limbs 7 and 8 to the springs 9 and 10 of the cut-off relay 11 of my improved form. The limb 7 extends when the spring 9 is in engagement with its normal contact through the winding of the relay 12 to one terminal of the common battery 13, in this instance the positive terminal, the limbs 7 thus when idle having common

connection with this terminal of the battery. The limb 8 by reason of the engagement of the spring 10 with its normal contact is normally connected with the remaining terminal of the battery. Thus the battery is normally in bridge of the telephone-lines; but the condensers 15 at the substations prevent the flow of this battery by way of the telephone-lines when the telephone-receivers are upon their switch-hooks.

When a subscriber initiates a call by removing his receiver from its telephone switch-hook, the common battery 13 is closed through the winding of the relay 12, which thereupon attracts its armature, thereby uniting the contacts 16 and 17 to actuate the corresponding line-indicator 18, that is thus included in a local circuit with a common battery, and also closes the terminals 19 and 20 together, whereby one terminal of the common battery, in this instance the negative terminal, is connected with the test-thimbles of the spring-jacks 22, distributed over the various sections of the multiple switchboard. Cord-circuits may be employed, one of which is illustrated, comprising in this instance answering and connecting plugs 23 and 24, the tips whereof are united by a tip strand, while the sleeves are united by a sleeve-strand that includes in circuit therewith the operating-windings of the supervisory relays 25 and 26, a bridge conductor 27 being included between these windings and including a resistance 28, whereby the control of these supervisory relays may be independently effected by the corresponding subscriber's apparatus, each supervisory-relay coil being provided with a supplemental winding 29, these windings being included in a closed local circuit. It is not deemed that a further description of the cord-circuit is essential, as such circuits generally are well known to those skilled in the art.

The operator in connecting subscribers for conversation closes circuit through the windings of the cut-off relays, the armatures thereof serving to move the springs 9 and 10 from their normal to their alternate contacts, thereby removing the line-indicators.

Referring now more particularly to Figs. 1, 2, 3, and 4, the electromagnet of each relay has its armature in the form of a bell-crank 30, pivoted at its elbow. For the purpose of a good magnetic circuit the entire bell-crank lever is preferably composed of soft iron, though the structural advantages possessed by the electromagnet may be obtained without constructing the bell-crank lever entirely of iron. The armature portion of the bell-crank lever is directly opposed to the core 31 of the electromagnet, which at its upper end is united to an angular bar 32, composed, preferably, of iron to secure a good magnetic circuit. This bar 32 projects over the top of the electromagnet into engagement with the horizontal extension of the armature, which rocks upon the bar. The upper or horizontal arm of the bell-crank lever is disposed beneath the springs 9 and 10, the said arm having insulating-buttons 33 33, that engage the springs and serve upon the actuation of the armature to move the arms from the normal to the alternate contacts. In order to effectually insulate the front ends of these springs from each other and from the bar 32 and to hold them in their proper relative positions, an insulating-pin is provided for each set. This pin has an enlarged head 36 adapted to rest upon the metallic bar 4, while its shank 37 extends through an aperture in the lower spring of the set, the said aperture being too small to permit said enlarged head of the pin to pass therethrough. The central spring, such as 9 or 10, of the set is provided with an enlarged aperture through which the shank 37 of the pin freely passes, while the outer or upper spring of the set is adapted to rest upon the ends of the said shank 37. The inner and outer springs being given a normal tension or trend toward the support or bar 32, the insulating-pin holds them in proper normal position, while the middle spring is permitted to freely vibrate therebetween. At the same time the pin itself is held in place upon the bar 32 by the inner spring of the set pressing against its enlarged head. The springs 9 and 10 at the buttons are free and are anchored at the other end of the electromagnet. I prefer to pivot the bell-crank lever upon the engaging strip or bar by having one corner of the bar engage the inner corner of the bell-crank lever, whose arms are preferably displaced slightly more than ninety degrees to permit the bell-crank lever to rotate upon this corner throughout a sufficient range to secure proper operation of the magnet. To prevent a displacement of the bell-crank lever, I provide the same with an aperture through which a screw 34, secured to the bar 32, is passed, a split nut 35 engaging the screw to prevent endwise displacement of the bell-crank lever.

Where it is desired to secure a good magnetic circuit, the horizontal extension of the arm, or a portion thereof, should be made of iron to form with the bar 32 and the core of the magnet the magnetic circuit.

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

1. In an electromagnet, the combination with a U-shaped frame, of magnetic material, one leg thereof forming the core and provided with an energizing-coil, of an angular armature poised on the end of the other leg and adapted by attraction by the core to close the magnetic circuit through the core and said other leg, substantially as described.

2. In an electromagnet, the combination with a magnet-core, of a bar of magnetic material connected therewith at one end, and an angular armature poised upon and in contact

with the other end of the bar and adapted, upon being attracted by the core, to form a closed magnetic circuit with said core and said bar, substantially as described.

3. The combination with an electromagnet provided with a bar of magnetic material, of an armature for the magnet made in the form of a bell-crank lever poised upon and in contact with the end of said bar, said bar being adapted by means of said armature to form a closed magnetic circuit with the magnet-core, substantially as described.

4. The combination with an electromagnet, of an angular-shaped bar of magnetic material, one of whose portions is arranged across the end of the electromagnet and connected with the core thereof, and the other of whose portions extends from end to end of the magnet along the side thereof, and an armature made in the form of a bell-crank arranged at the end of the magnet opposite that of the cross portion of the said bar, the said armature being poised upon and in contact with the adjacent end of said bar, one of its portions extending along the same and the other extending downwardly into position opposite the end of the magnet-core, substantially as described.

5. In an electromagnet, the combination with a U-shaped frame of magnetic material having its legs disposed one above the other, the lower leg forming a core, of a helix wound upon said core, an inverted-L-shaped armature poised so that the inner face of the bend thereof engages the front edge of the upper leg of said frame, said armature being adapted upon energization of said helix to be attracted toward said core portion to form a closed magnetic circuit with the legs of said frame, substantially as described.

6. The combination with a magnet, of an armature therefor having two arms at an angle to each other, a support for the armature having an edge upon which as a fulcrum said armature is carried intermediate of its ends and may rock, said armature being adapted to be actuated by said magnet when the same is energized, and parts adapted to be actuated by said armature, substantially as described.

7. The combination with a magnet, of an armature therefor comprising two arms extending at an angle to each other, a member having a corner or edge fitting with the apex of said angle and forming a support for the armature upon which as a fulcrum it may rock, said armature tending when the magnet is energized, to shorten the path for the magnetic lines of force, and parts adapted to be actuated by said armature, substantially as described.

8. The combination with a magnet, of an armature therefor having two arms extending at an angle to each other, a support having a knife-edge to form a support for the armature intermediate of its ends and upon which as a fulcrum it may rock, one of said arms of the armature serving to complete the magnetic circuit of the magnet, and parts adapted to be operated by said armature when it is actuated.

9. The combination with a magnet having a core, of a member secured to the rear end of the core and serving to extend the magnetic circuit of the magnet toward the forward end thereof, an armature having two arms at an angle to each other and supported upon a suitable edge upon which as a fulcrum it may rock, said armature tending to bridge the gap between the fixed poles of the magnetic circuit when the magnet is energized, and parts adapted to be actuated by said armature, substantially as described.

10. The combination with a magnet-coil, of a core therefor provided with metallic parts forming an external magnetic circuit normally open at one portion, a bent armature having two arms at an angle to each other so supported as to close the normally open portion or gap in the external magnetic circuit or to shorten the path for the lines of force when the core is magnetized, a support for said armature having an edge upon which it rocks as a fulcrum and a bunched set of flat superposed switch-springs carrying contacts adapted to be operated by one of said arms of the armature when attracted, substantially as described.

11. The combination with a magnet-coil, of a core extending through the coil, a part to which said core is secured at its rear end, said part extending parallel with the coil to a point adjacent to the forward end of the core, an armature for the magnet having two arms at substantially right angles to each other, said armature riding loosely upon the forward end of said part and upon which as a fulcrum it is supported to rock, one arm thereof standing in front of the magnet-core in position to be attracted thereby, said armature having an aperture transversely therethrough, a retaining device passing through said aperture and into said part to secure the armature in place, and a set of switch-contacts actuated by said second arm of the armature, substantially as described.

12. The combination with a magnet coil and core, of a support having an outer surface substantially parallel therewith and terminating at its forward end substantially flush with the end of the core, an armature having two arms extending at an angle slightly greater than a right angle to each other and loosely carried upon said forward end as a fulcrum with one arm extending in front of the coil and core in position to be attracted thereby and the other arm extending back upon said support, switch-springs actuated by said second arm and normally pressing it into engagement with the face of the support, whereby when the coil is energized the one arm of the armature is attracted and the other arm lifted

to actuate the switch-springs, and when the energizing-current is cut off the said springs restore the armature to normal position.

13. The combination with a set of flat superposed switch-springs rigidly secured together, of a supporting and spacing stud for the free ends of said springs, said stud having an enlarged head between one of the springs and an adjacent support, the said spring tending to hold the said stud in place and the said head serving to properly space the spring from the support, the shank of said stud passing through a suitable aperture in the adjacent spring, and a third spring resting upon the end of said shank and being held thereby at the desired distance from said support and first spring, the aperture in the intermediate spring being large enough to permit it to be freely vibrated, substantially as described.

14. The combination with a set of flat superposed contact-springs rigidly secured together, of a support for said springs to which they are firmly secured, an insulating supporting and spacing stud for the free ends of said springs, said stud having an enlarged head between the inner spring and the support to hold said spring at the desired distance from the support and the spring tending to hold the stud in place, said stud having a shank passing through the inner springs of the set, the outer spring resting upon the end of the shank and being spaced thereby at the desired distance from the adjacent spring, the aperture in the intermediate spring being large enough to permit it to freely vibrate between the inner and outer springs, substantially as described.

15. The combination with a magnet-coil, of a member extending longitudinally thereof, an armature for the magnet having two arms extending at an angle to each other, one arm passing transversely across the end of the magnet in front of its pole so as to be actuated thereby while the other arm extends back over the said member, a set of superposed switch-springs and alternately-disposed strips of insulation, screws passing through said springs and strips to clamp them together and to the said member, the free ends of said springs terminating adjacent to the said second arm of the armature, and one of said springs extending beyond the others to the said second arm of the armature, whereby when the magnet is energized the said spring is lifted and when the magnet is deënergized the spring returns the armature to normal position, substantially as described.

In witness whereof I hereunto subscribe my name this 1st day of August, A. D. 1901.

WILLIAM MEYER.

Witnesses:

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HERBERT F. OBERGFELL.