(No Model.) 2 Sheets—Sheet 1.

H. M. PILKINGTON & R. S. WHITE.

MEANS FOR OPERATING AMMETERS AND OTHER ELECTRICAL APPARATUS.

No. 477,223. Patented June 21, 1892.

Fig. 1.

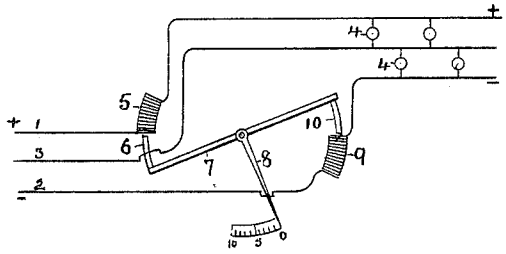
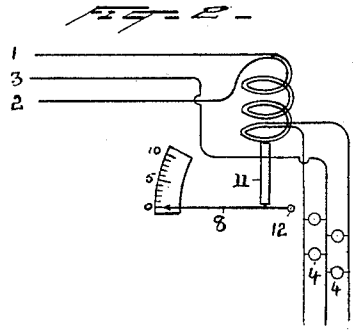


Fig. 2.



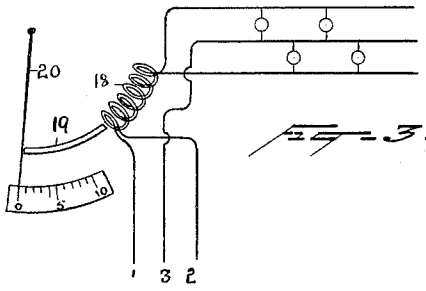


Fig. 3.

Fig. 6.

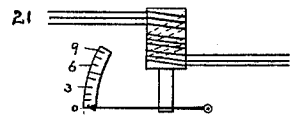


Fig. 4.

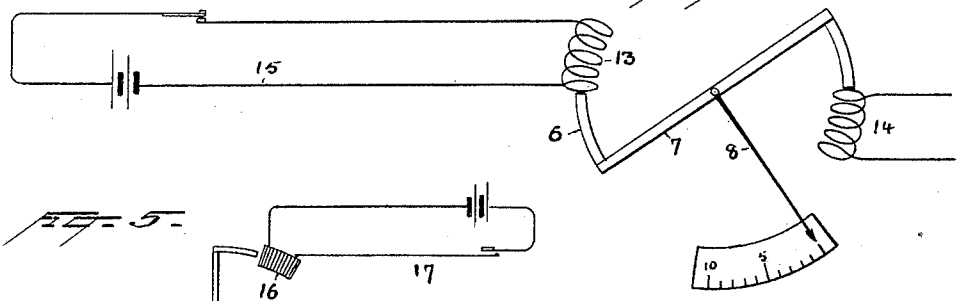
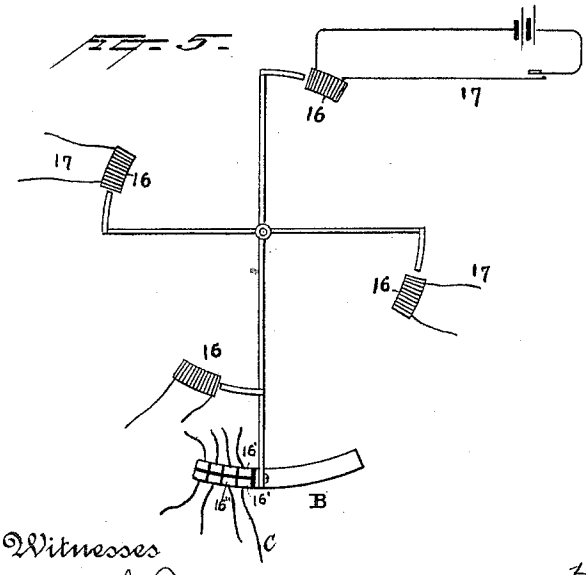


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

H. M. PILKINGTON & R. S. WHITE.

MEANS FOR OPERATING AMMETERS AND OTHER ELECTRICAL APPARATUS.

No. 477,223. Patented June 21, 1892.

Fig. 7.

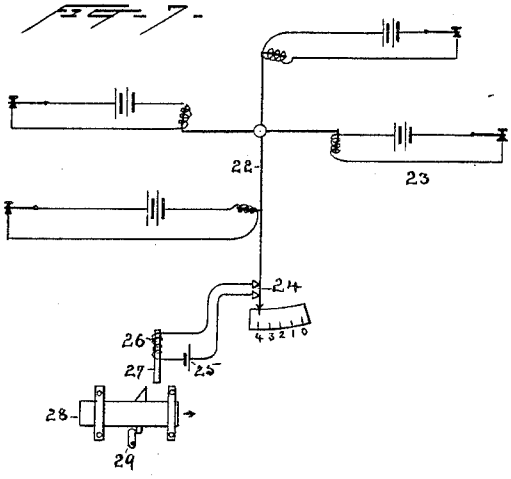


Fig. 8.

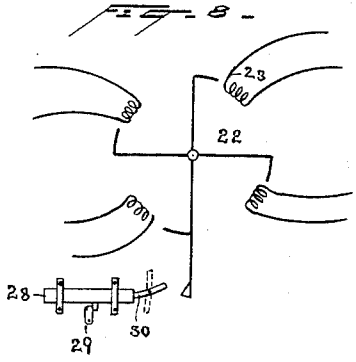


Fig. 9.

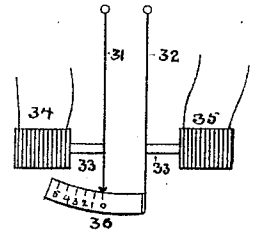
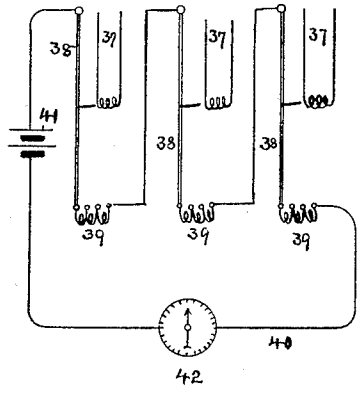


Fig. 10.



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UNITED STATES PATENT OFFICE.

HERBERT M. PILKINGTON AND ROGER S. WHITE, OF BROOKLYN, NEW YORK.

MEANS FOR OPERATING AMMETERS AND OTHER ELECTRICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 477,223, dated June 21, 1892.

Application filed September 24, 1891. Serial No. 406,630. (No model.)

To all whom it may concern:

Be it known that we, HERBERT M. PILKINGTON and ROGER S. WHITE, both citizens of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Means for Operating Ammeters and other Electrical Apparatus, of which the following is a specification.

Our present invention relates to electrical devices of various kinds, but more particularly to ammeters. According to our invention said apparatus is operated, not by a single circuit in the usual manner, but by two or more circuits, the effect of the current in each circuit being added to that of the other circuits to accomplish the entire desired result, although in some cases the effect of the current in a single one of the circuits is complete in itself, but constitutes only a fraction of the entire operation which the apparatus is designed to perform.

In the drawings, which illustrate the invention, Figures 1 to 10, inclusive, are diagrams showing ten different forms in which the invention may be embodied.

In Fig. 1, 1 2 3 are the positive, negative, and neutral mains of a three-wire system, and 4 are translating devices connected thereto in the usual manner. In the wire 1 is a coil 5, having an armature 6, supported by the pivoted lever 7. 8 is a pointer movable over the graduated scale, as indicated. This arrangement constitutes an ammeter for measuring the current on the positive side of the system. 9 is a similar coil in the negative wire 2 and has an armature 10 connected to the same lever 7. This arrangement constitutes an ammeter for measuring the current on the negative side of the system; but it will be seen that instead of having two separate ammeters the arrangement constitutes a single instrument. If one side of the system only is in use, one coil only will affect the pointer, but if both sides are in use both coils will operate in conjunction with—that is, in the same direction on—the pointer, and their effect will be added. If, for example, all of the translating devices connected to the conductor 1 are in circuit and five ampères are flowing, the hand 8 will indicate five ampéres on the scale. If now all of the translating devices connected to conductor 2 are also thrown into circuit, and, say, five ampéres are flowing, the hand 8 will point to the figure "10." It will be seen that the coils 5 and 9 perform complete operations when used singly; but neither one can perform the entire duty which the instrument is designed to perform. To do this requires the added effect of the two coils.

Fig. 2 illustrates a second three-wire system, the several parts being numbered as in Fig. 1 so far as possible. In this construction, instead of having two armatures and two separate coils, a single armature 11 is used, and the wires 1 2 are formed into a hollow solenoid, into the center of which the armature extends. The pointer 8 is pivoted at 12 and is connected to said armature. The operation is substantially the same as in Fig. 1.

Fig. 3 illustrates another ammeter for three-wire systems. The positive and negative wires are wound side by side to form one solenoid 18, the two coils being alike, so that equal currents will have equal effects on the armature 19, carried by the pivoted hand 20, which is adapted to move over the scale.

Fig. 4 shows a construction similar to that of Fig. 1, except that the coils 13 14 are in separate entirely independent electrical circuits 15, instead of being in the two sides of a three-wire system. This device may constitute an ammeter for independent circuits, or it may be used as an annunciator, indicator, or other apparatus for said circuits.

Fig. 5 is a device having a larger number of operating-coils 16, four being shown. These coils are in independent circuits 17. One coil and circuit are sufficient to move the pointer far enough to move the switch-blade B onto the first pair of insulated blocks 16′, to which the terminals of a circuit C are connected. This closes the first circuit. If two coils are in circuit at the same time, the first and second circuits will be closed, and so on for the other coils and circuits, and the several circuits may mutually operate to accomplish any unitary result.

Fig. 6 shows an ammeter or an indicator for a larger number of independent circuits 21, three such circuits being shown.

The use of the principle of additive effects is not confined to indicators, meters, and switches or circuit-closers, as described, but may be applied in many other forms of apparatus. Such applications are shown in Figs. 7, 8, 9, and 10. 22 in Figs. 7 and 8 are structures similar to that shown in Fig. 4, having coils in different circuits 23. 24 are contacts connected to a local battery 25 or other source of current, the circuit of which includes a coil 26, having an armature 27, which armature when the circuit is closed, as shown in the drawings, is raised to its full-line position, so that the bolt 28 can be moved in the direction of the arrow by the key 29; but when the circuit is open the armature will be in its lower position and will lock the bolt, so that it cannot be shot or withdrawn by means of the key. The use of this device is obvious. For example, the bolt may control a safe, and the several circuits 23 may each be controlled by a different bank officer, so that the safe cannot be opened until each of the officers has closed his own circuit.

In Fig. 8 the detent for the lock is a mechanical one, consisting of pivoted lever 30, which is tilted out of the way of the lock by the added or mutual effect of the coils.

In Fig. 9 is shown an indicator employing two separately-pivoted arms 31 32, each of which is provided with an armature 33. 34 35 are coils in separate circuits in position to attract the armature. The coil 34 acting alone will move the arm 31 a certain distance over the scale 36, while the coil 35 acting alone will move the arm 32 and scale 36 carried thereby a certain distance under the stationary pointer; but if the two coils are simultaneously in circuit the pointer will be moved in one direction and the scale in the opposite direction, and the two indications will therefore be added. These coils act in conjunction on the same indicator, although they act on separate parts instead of acting on a single pointer.

In Fig. 10 the separate circuits 37 include coils which operate on the armature-levers 38, one end of each of which is adapted to travel over the contacts of an adjustable resistance 39, the resistances being in a local circuit 40, with a source of current 41 and a galvanometer or other instrument 42, which instrument will indicate the total current in the several lines, since the amount of resistance in the circuit 40 will depend on the positions of the levers 38.

It is evidently immaterial in what order the several coils are energized; but all the circuits must normally be in condition for use, so that they can be used separately in any order or together, as desired. When energized, each coil attracts its armature or the armature if only one is used and performs its proportion of the work. In the ammeters the scales are graduated to indicate any current from the smallest limit up to the sum of all the currents which can be used at one time in the circuits. In the apparatus described and illustrated the hands, pointers, or armature-levers constitute the parts which we term the "movable members" of the apparatus. In the ammeters and indicators the only work the movable member has to do is to point on the dial or scale to the proper subdivision. In the apparatus shown in Fig. 7 the movable member operates the circuit-controller, while in Fig. 8 it mechanically operates the detent. While the coils of the ammeters are so made that a current of certain strength in one coil will have the same effect on the armature as the same current in either of the other coils, this is not essential in the other apparatus.

What we claim is—

1. The combination, in an electrical apparatus of the character described, of one or more movable members, an armature or armatures for operating the same, and two or more coils for said armature or armatures in separate line-wires, all of said wires being simultaneously in condition for use, the construction and arrangement of the coils and armatures being such that the added effect of all of the coils will be sufficient to effect an entire operation of said device, substantially as described.

2. The combination, in an electrical apparatus, of a movable member, one or more armatures for said member, and several coils, each normally in position to act thereon, each coil being arranged to perform a certain fraction of the work required to effect an entire operation of said movable member and the construction and arrangement of the coils and armature being such that the added effect of all of said coils will be sufficient to effect said entire operation, substantially as described.

3. The combination, in an electrical apparatus, of a movable member, one or more armatures for said member, and several coils, each normally in position to act thereon, each coil being arranged to perform a certain fraction of the work required to effect an entire operation of said movable member and the construction and arrangement of the coils and armatures being such that the added effect of all of said coils will be sufficient to effect said entire operation, said coils being in line-wires connected to separate generators, substantially as described.

4. The combination, in an ammeter or similarly-operated indicator, of a movable member, such as an index-hand, one or more armatures connected therewith, and several coils in separate line-wires acting in conjunction on said armature or armatures, substantially as described.

5. The combination, in an ammeter, of one or more movable members, one or more armatures connected therewith, and coils in the

said armature or armatures and through the same on said movable member or members, substantially as described.

6. The combination, in an ammeter or indicator, of several coils in separate line-wires, a single pointer, a single scale, and means acted upon in conjunction by said coils for

This specification signed and witnessed this 3d day of September, 1891.

HERBERT M. PILKINGTON.
ROGER S. WHITE.

Witnesses:
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