No. 851,690. PATENTED APR. 30, 1907.

F. C. NEWELL.

ELECTRIC SWITCH MECHANISM.

APPLICATION FILED AUG. 11, 1902.

7 SHEETS--SHEET 1.

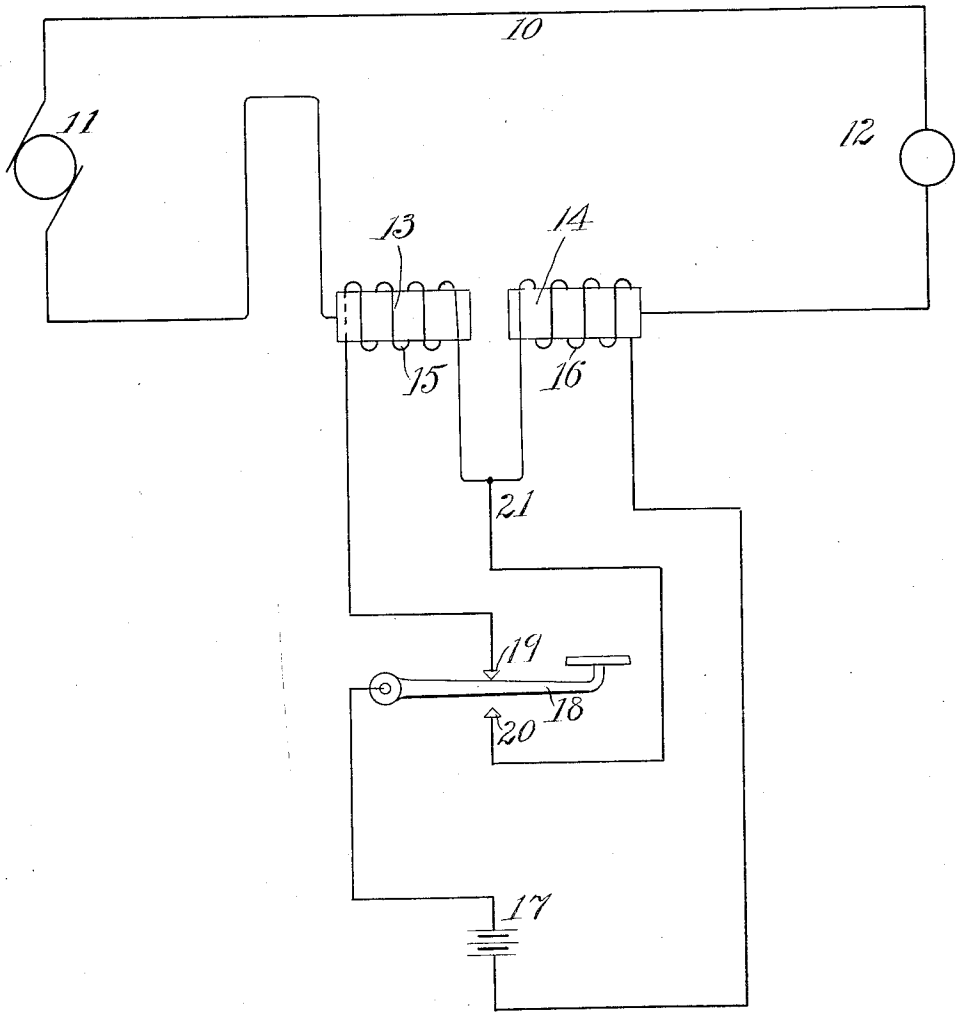

Fig. 1

WITNESSES:

Chas. H. Ebert

W. M. Garland

INVENTOR,

Frank C. Newell.

By Paul Synnestvedt Att'y.

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7 SHEETS—SHEET 2.

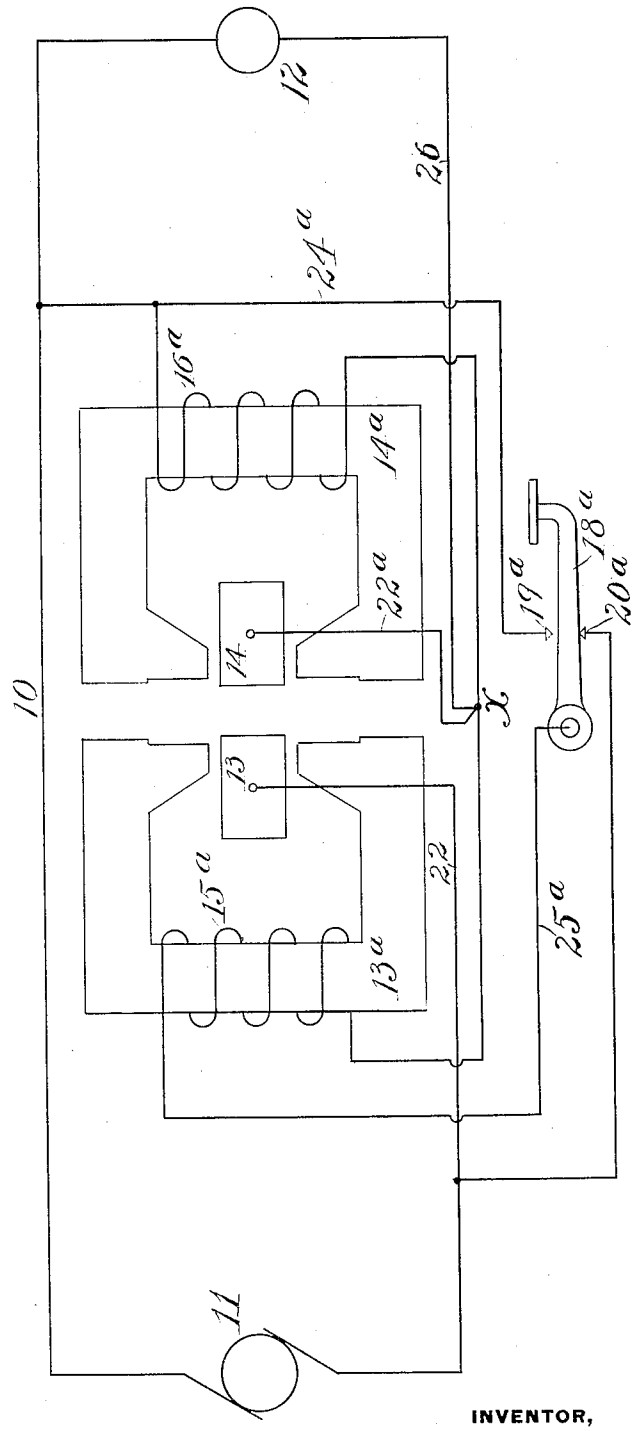

Fig. 2

WITNESSES:

Chas H. Ebert

J. R. N. Garland

INVENTOR,

Frank C. Newell

By Paul Synnestvedt Att'y.

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F. C. NEWELL.

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7 SHEETS—SHEET 3.

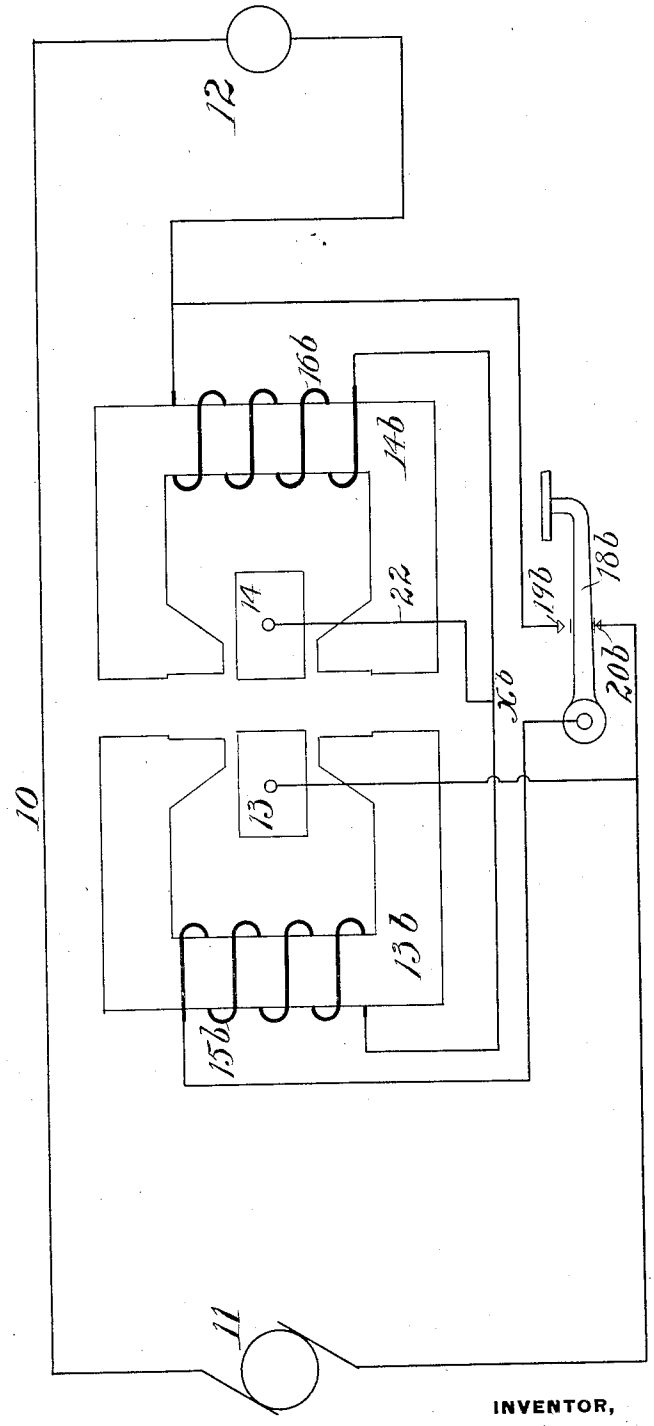

Fig. 3

WITNESSES:

Elias H. Ebert

A. M. Garland

INVENTOR,

Frank C. Newell

By Paul Synnestvedt Att'y.

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F. C. NEWELL.

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7 SHEETS—SHEET 4.

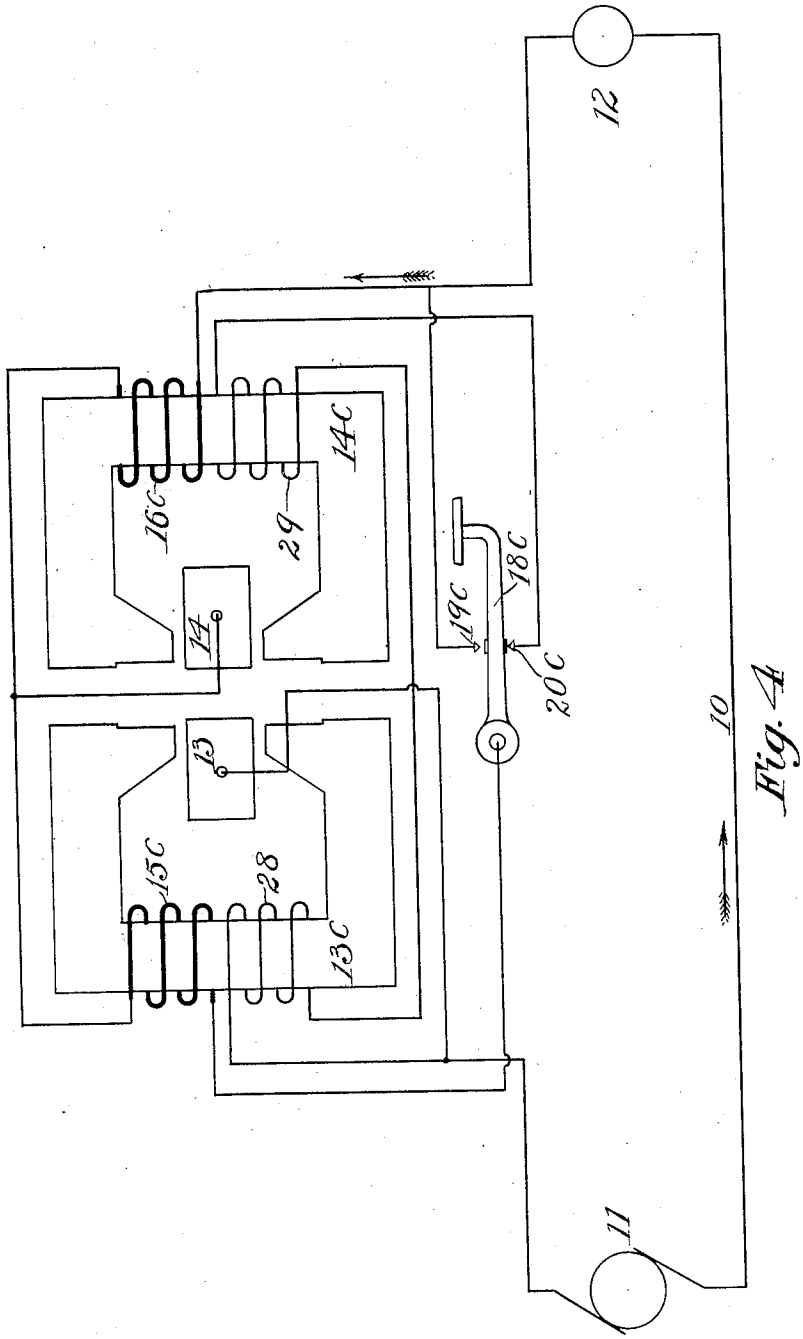

Fig. 4

WITNESSES:

Chas. H. Ebert

D. M. Garland

INVENTOR,

Frank C. Newell

By Paul Synnestvedt

Att'y.

No. 851,690. PATENTED APR. 30, 1907.

F. C. NEWELL.

ELECTRIC SWITCH MECHANISM.

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7 SHEETS—SHEET 5.

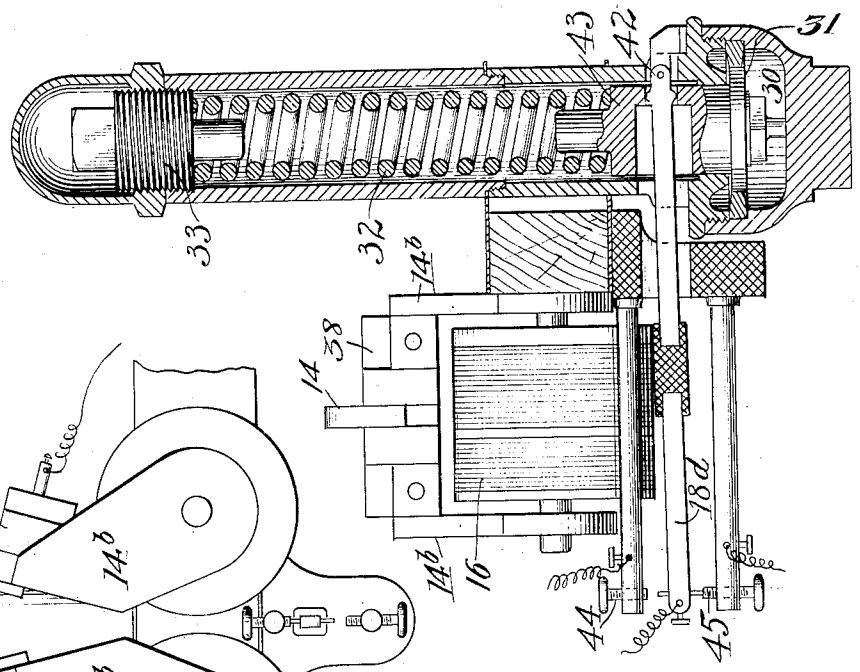

Fig. 6

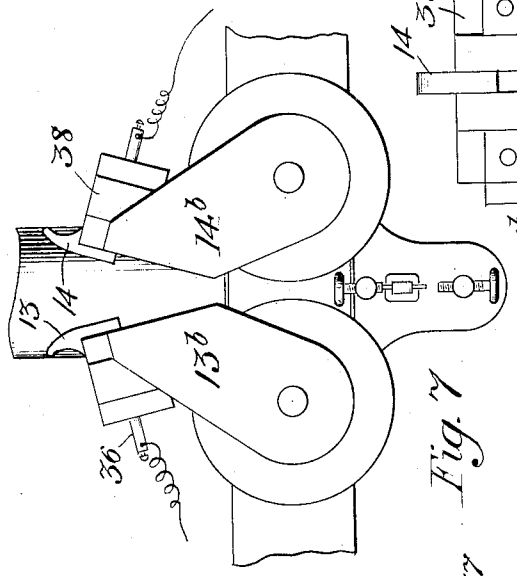

Fig. 7

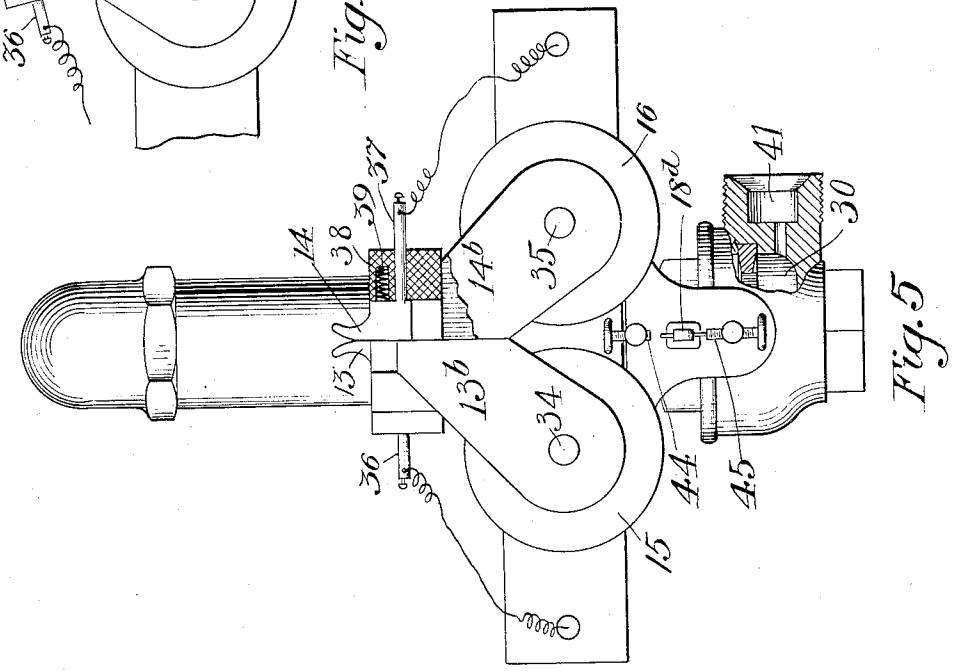

Fig. 5

WITNESSES

Chas. H. Ebert

W. M. Garland

INVENTOR,

Frank C. Newell

By Paul Synnestvedt

Att'y.

No. 851,690. PATENTED APR. 30, 1907.

F. C. NEWELL.

ELECTRIC SWITCH MECHANISM.

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7 SHEETS—SHEET 6.

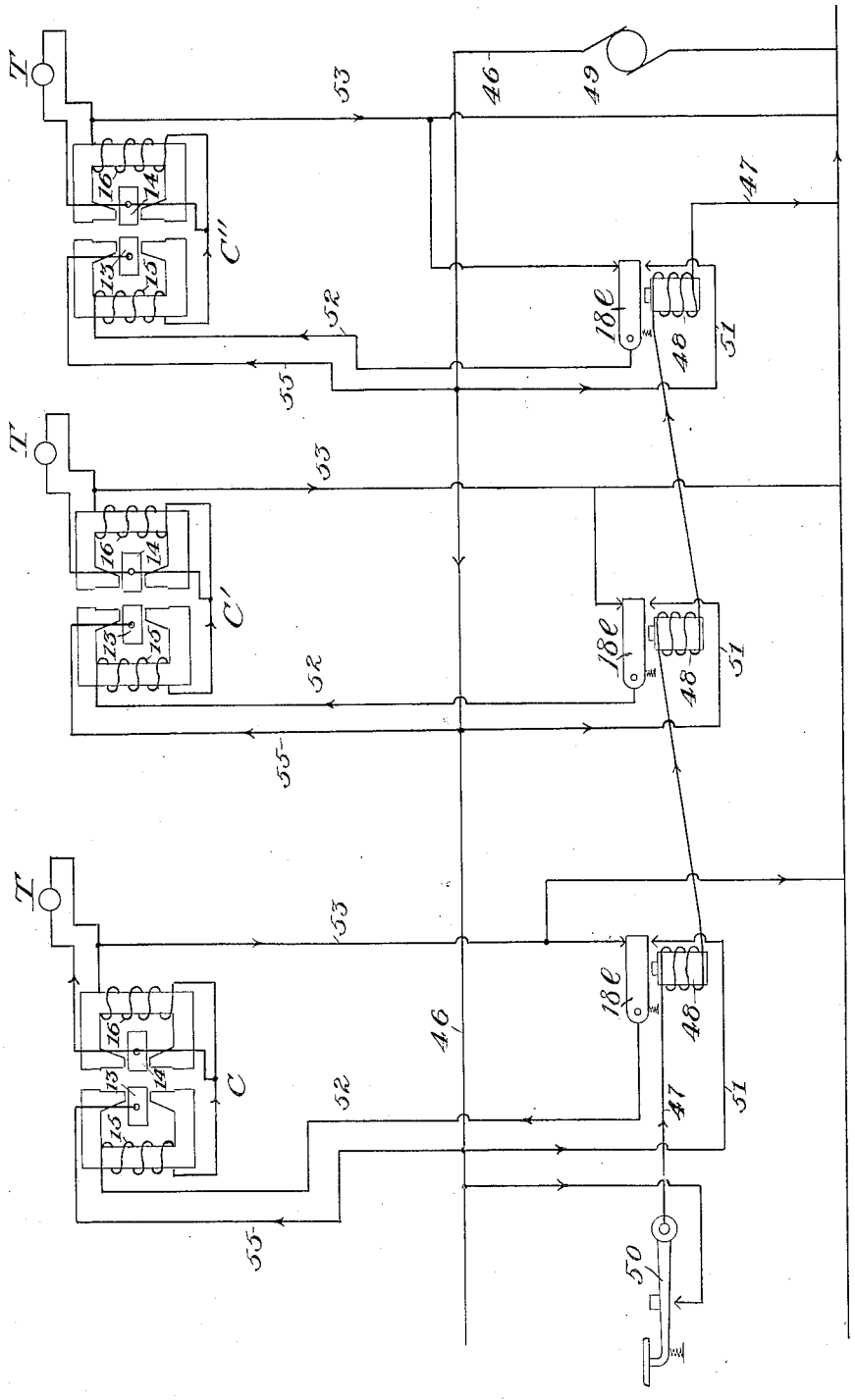

Fig. 8.

WITNESSES:

Chas. H. Ebert

W. M. Garland

INVENTOR,

Frank C. Newell

By Paul Synnestvedt
Att'y.

No. 851,690. PATENTED APR. 30, 1907.

F. C. NEWELL.

ELECTRIC SWITCH MECHANISM.

APPLICATION FILED AUG. 11, 1902.

7 SHEETS—SHEET 7.

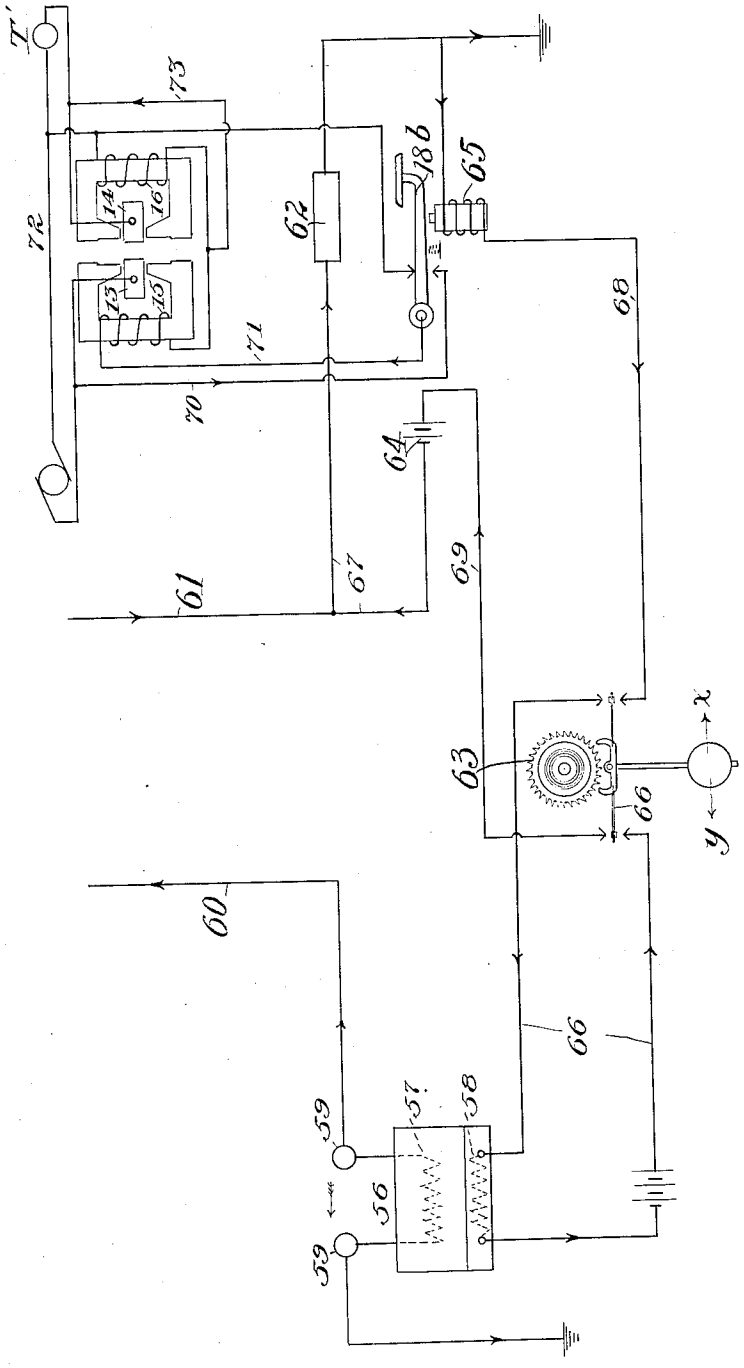

Fig. 9.

WITNESSES:

Chas. H. Ebert

D. W. McGarland

INVENTOR,

Frank C. Newell

By Paul Synnestvedt Att'y.

UNITED STATES PATENT OFFICE.

FRANK C. NEWELL, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTRIC SWITCH MECHANISM.

No. 851,690. Specification of Letters Patent. Patented April 30, 1907.

Application filed August 11, 1902. Serial No. 119,290.

To all whom it may concern:

Be it known that I, FRANK C. NEWELL, a citizen of the United States, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electric Switch Mechanism, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to electric switch mechanism designed to produce efficient opening and closing of main circuit terminals by means of a pilot or controlling switch, and has for its primary object a construction of apparatus of the type referred to which will close the circuit with certainty and quickness, and also break the circuit in a manner to prevent or largely reduce the amount of arcing, while at the same time acting to dissipate any arc that may be produced.

In order that my invention may be better understood, I will describe it in connection with the accompanying drawings, in which it is shown diagrammatically and also embodied in a preferred form of apparatus.

Figure 1 is a diagrammatic representation of an apparatus in which the pilot circuit is a separate circuit and supplied from a separate source of electricity from the main circuit.

Figure 2 is a diagram of an apparatus designed to carry heavy currents, and in which the pilot circuit takes its current from the main circuit in a manner explained hereinafter.

Figure 3 is a similar diagram of an apparatus in which the pilot circuit also takes its current from the main circuit, but having coils of relatively low resistance, this being designed particularly for use with apparatus employing light currents.

Figure 4 is a diagram of a modified form of the apparatus of Figure 3, the coils in the same being supplemented in this case by additional coils of high resistance, for a purpose hereinafter explained.

Figure 5 is a side elevation of an operative switch mechanism designed for use as a fluid pressure or pump controller, the same embodying my present invention.

Figure 6 is a central vertical section of the switch control device shown in Figure 5, showing one of the coils in elevation and a spring balanced actuator for the pilot switch.

Figure 7 is a partial end elevation of the same device, omitting the spring casing and showing the contacts as driven apart.

Figure 8 is a diagram representing one of the applications of my improvement, the same being for multiple control of a series of motors, as upon a train of cars, and

Figure 9 is a diagrammatic representation of another application of my improvement, wherein the pilot switch is actuated by means of mechanism such as a coherer, similar to that employed in wireless telegraphy.

Referring first to Figure 1, it will be seen that in a main circuit 10, which has current from a generator 11,—the same being utilized in some translating device as indicated at 12,—there are two main circuit terminals, 13 and 14, shown as cores of a solenoid. One or both of these terminals 13 and 14 are movable, and they are provided respectively with magnetizing coils 15 and 16, the said coils being in a pilot circuit that has its separate source of current, such as the battery indicated at 17, and is provided with a pilot switch 18, operating between contacts 19 and 20.

In this figure the winding of the coils 15 and 16 about their cores is so disposed that when the circuit from the battery 17 passes through the said coils in series the cores are energized with like polarity at adjacent ends, which serve to drive the two terminals 13 and 14 apart, breaking the main circuit and at the same time, by means of the magnetic lines of force between the poles, blowing out any arc that may occur. The flow of current in the coils 15 and 16 in series is produced by the contact of the pilot switch 18 with contact 19, in which position the pilot circuit is completed, as shown in Figure 1, the connection 21 being open at the terminal 20. If now the pilot switch 18 be moved down to contact with the terminal 20, the current in coil 16 continues as before, but that in coil 15 being cut out, this core is dead, and the terminal 14 acts as a simple magnet upon terminal 13 as an armature, drawing the latter into contact with the terminal 14, and closing the main circuit 10.

In the arrangement just described, and shown in Figure 1, it is to be observed that the pilot circuit is separate from the main circuit and supplied from a separate source, this being a form of wiring which may be

best to use in connection with my invention in certain places; but in the preferred form, for use more universally, it is arranged as shown in Figure 2. In this the main circuit 10 is provided with generator 11, and translating device 12, as before, and two main circuit terminals 13 and 14, the same being also relatively movable toward and from each other. But in this instance, a separate source of current is not employed for the pilot circuit,—of which the pilot switch 18^a forms a part,—but current is taken from the main circuit in the manner shown, the pilot switch contact 20^a being connected with the main circuit on one side, and contact 19^a with the main circuit on the other side by means of the wire 24^a. The main switch terminal 14 is connected by wire 22^a to a point intermediate between the two coils 15^a and 16^a, which latter are wound respectively about the cores 13^a and 14^a. These cores, if made relatively movable, may themselves constitute the contact points if desired, but I prefer to use separately movable blocks 13 and 14 to gain certain advantages in breaking contact, as hereinafter explained. The contacts 13 and 14 may either be attached to the cores, as in Figure 5, or they may be of iron and unconnected with the cores, as in Figure 2, in which case it is evident that the magnetization of the cores 13^a and 14^a will by induction cause the blocks 13 and 14 respectively to act in accordance with the law governing the polarity on the two cores in every instance. The coils 15^a and 16^a therefore act to magnetize the terminals as required.

The operation of the apparatus shown in this figure is as follows: On the pilot switch 18^a coming into contact with the contact 20^a, the main circuit is closed through the switch 18^a and the wire 25^a, passing through coil 15^a and dividing at X between coil 16^a and the conductor 26 leading to the translating device 12, in proportion to their respective resistances. The current thus produced energizes both coils of the terminals 13 and 14 and since they are reversely wound, causes them to be drawn forcibly together, closing the main circuit directly by said main terminals 13 and 14, and thereupon coil 15^a is short-circuited by means of the wires 22 and 22^a, which equalizes the potential between the point 20^a and the point X, while at X the current divides as before and coil 16^a is still in circuit, energizing core 14^a and keeping the circuit closed. The switch 18^a may now be opened easily.

If now the key of the pilot switch be moved up against contact 19^a, it will bring the two coils 15^a and 16^a into parallel relation, the current dividing and passing through both of them, but in a direction to produce like polarity of adjacent ends of cores or of the terminals 13 and 14, and thus by the repellant action thereof, the latter are forcibly driven apart, breaking the main circuit magnetically with great force and rapidity, and at the same time by the forces in the magnetic field which drives them apart, blowing out whatever arc may happen to be formed. In this action the direction of current in the coil 16^a remains as before, but the current in the coil 15^a is reversed in direction, and as a result of this reversal of direction in the coil 15^a, or the energizing of the core 13^a by current flowing in a direction opposite to the direciton by which it had been originally energized, the like polarity of the cores and of adjacent parts of terminals 13 and 14 is obtained. While the two terminals 13 and 14 are in contact, and before the operation of the pilot switch to separate them, the small amount of current flowing through the coil 16^a is sufficient to hold the terminals together, the core 13^a and terminal 13 acting as an armature for the magnet produced by the energizing effect of the coil 16^a on the core 14^a.

In Figure 3 an arrangement is shown similar to that in Figure 2, except in the provision of coils 15^b and 16^b, which instead of being of high resistance, as for example 1000 ohms each,—as are the coils of Figure 2,—are made of comparatively low resistance, as for example in the neighborhood of .04 of an ohm each, and the connections are so made that when the switch 18^b touches contact 20^b, the current flows through coils 15^b and 16^b in series, and then through the translating device 12 back to the source of power, the coils 15^b and 16^b being so wound as to produce unlike polarity when the current flows as just described.

Thus, in this arrangement, the current is first transmitted in series through both of the magnetizing coils and the pilot switch, in order to close the main terminals, and the closing of the main terminals leaves the main current in one coil (16^b) only, the other coil (15^b) having been by the closing operation short-circuited, thus equalizing the potential between the point 20^b and X^b, enabling the pilot switch to be easily opened, as in the case of Figure 2.

By the reverse movement of the pilot switch the coils are brought into parallel relation to each other, the main circuit dividing between the two, which thus, as in Figure 2, reverses the polarity of the one relative to the other, producing like polarity and repellant action, whereby the terminals are forcibly driven apart.

It is to be observed that in apparatus as shown in Figure 3 there may be danger in case the terminals 13 and 14 do not come closely together so as to cut down the resistance and prevent material flow of current in the low resistance coil, that an excessive flow of current may take place through the low re-

sistance coil, with troublesome results; hence it may be desirable when using these low resistance coils to provide,—as shown in Figure 4, and in conjunction with the apparatus shown in Figure 3,—a couple of high resistance coils, 28 and 29, indicated in Figure 4 in position to coöperate with the coils 15^c and 16^c shown on said Figure 4, the rest of the apparatus remaining substantially the same as that of Figure 3. As shown in Figure 4, on the first contact of the pilot switch which closes the circuit, the current flows in series through both the high resistance coils and both the low resistance coils, as will be clear from an examination of said figure, where the switch 18^c makes the contact 20^c, until the terminals 13 and 14 of the main circuit come together, when the high resistance coils 28 and 29 are cut out altogether and one of the low resistance coils, 15^c, is cut out, leaving only one low resistance coil in circuit, the same taking the main current, and operating on the other terminal as an armature in a manner to hold the main terminals 13 and 14 together, as before described. Now when switch 18^c is moved to contact 19^c, the low resistance coil 15^c on one terminal is brought into parallel relation with the low resistance coil 16^c on the other terminal, thus producing the like effect as was produced by the low resistance coils in Figure 3, or by the high resistance coils of Figure 2; that is, the energizing of the terminal magnet so as to obtain like polarity, which operates to drive the contacts apart.

It will be observed that in Figures 2, 3 and 4, I have shown a peculiar form of main circuit terminal magnet, the same being a diagrammatic representation of subtsantially the construction shown in Figures 5 to 7 inclusive, in which I have illustrated an application of my improvement to a pump governor or fluid pressure regulator device, in which the pilot switch is actuated by means of a lever 18^d, which is in reality the lever 18 of the pilot switch of the other figures, but which is pivoted in the casing at 42 and receives its movement by block 43, through the operation of fluid pressure in a chamber 30, under a diaphragm 31, acting against the resistance of a spring 32, the tension whereof is adjusted by means of an adjusting nut 33, as shown.

In this construction the core arms 13^b and 14^b and terminals 13 and 14 are mounted to operate circumferentially about shafts 34 and 35, the wiring of the coils being disposed about the said shafts, and the upper contacting blocks 13 and 14 being movable in the core arms and pressed forward on rods 37 in the heads 38, by means of the spring 39, in order to bear more securely against each other when the main circuit is closed.

In the construction shown in Figures 5 to 7 inclusive it will be obvious that on breaking of the main circuit by separation of the terminals, as indicated in Figure 7, the movement of the parts will be a rotary movement about the shafts 34 and 35, and any arc which may be produced between the shoes 13 and 14 will, by the curved faces of said shoes, be dissipated in an upward direction and blown outward, by means of the action of the repellant magnetic lines of force between the two terminals, so that it will not be liable to injure or destroy the insulation or other parts of the mechanism.

Where the apparatus shown in Figures 5 to 7 inclusive is intended for use for controlling the operation of an electrically driven pump, the chamber 30 will be connected with the receiver or reservior for storage of air through the opening 41, and the spring 32 will be adjusted to allow the pilot switch lever 18^d to be actuated at the proper degree of pressure, the said switch lever being fulcrumed at 42, and actuated by plunger 43, as will be clear from the sectional view given in Figure 6. If a large range of movement of the switch be desired between the starting and stopping of the pump, that is, if the fluctuation of pressure which will actuate the apparatus to start and stop the motor, is desired to be great, the distance between the contacts 44 and 45 can be increased by unscrewing the same; or, if it be desired to have the pump start and stop for a very slight variation of pressure, the said contacts 44 and 45 will be brought closer together, to coöperate more quickly with the pilot switch lever 18^d.

In Figure 8 I have illustrated diagrammatically the use of my invention to control a series of motors, as on a train of cars, for example. The cars are provided each with terminals 13, 14, and mechanism C, C′, C″, as in Figure 2, each having its own pilot switch $18e$, operated by coils 48. These coils are connected through wires 46, 47, in circuit with a source of current 49, and the switch 50 will close this circuit to energize the cores of coils 48. These attract switches $18e$ and the circuits are then made from wire 46 through the switches $18e$ and wires 52, 53, 54, so as to energize the coils 15, 16, and close the terminals 13, 14; whereupon the current from wire 55 passes to the translating device T and through wires 53 to the return wire 54. The motors on the cars are thus all controlled by single switch 50 as heretofore described.

In Figure 9 is illustrated a use of my devices in wireless telegraphy, as to make a heavy circuit by means of the extremely delicate impulses occurring in such apparatus. Thus let 56 represent the transmitting instrument with its secondary coil 57 and primary 58, and 59 the discharge knobs and 60 the sending antenna. The clock escapement device 63 is arranged so that when the pendulum swings toward x the circuit 66 is made

and an impulse is sent from 60. When the pendulum swings back toward *y* the apparatus is ready to receive an impulse through the antenna 61. This may discharge through the coherer 62 to the ground as shown, or be used as desired. If it is desired to start a motor T' by the wireless impulse received; it will be seen that the circuit through 67, 62, coil 65, wire 68, switch at 63, wire 69 and battery 64, will be closed by the action in the coherer 62 (which normally is of too high resistance to close the circuit). This magnetizes the core of coil 65 and sends current from wire 70 through switch 18^b, wire 71, coils 15, 16, back to 72,—thus drawing the terminals 13, 14, together and making the direct circuit 72 through the motor T'.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is the following:

1. An electric switch mechanism comprising two main terminals relatively movable toward and from each other, an electromagnetic coil for energizing each of said terminals, two sets of connections to these coils and a switch interposed between the sets, so arranged that in one position of the switch the coils are energized oppositely to produce a closure of the terminals and in another position are energized similarly to open the terminals.

2. The combination in an electric switch mechanism of two main conductor terminals relatively movable toward and from each other, said terminals being provided with coils to magnetize them whereby they will close the circuit passing through the main terminals by magnetic attraction, and open the said circuit by magnetic repulsion, and means for energizing the coils comprising connections with a source of electricity governed by a switch whereby the direction of current in one coil may be reversed.

3. An electric switch mechanism comprising two main terminals relatively movable toward and from each other, an electro-magnetic coil for energizing said terminals, and a pilot switch with connections whereby to energize said coils in a manner to produce unlike polarity of the terminals, to close the circuit, and to energize said coils in a manner to produce like polarity of the terminals, to open the circuit, substantially as described.

4. The combination in an electric switch mechanism comprising two main terminals relatively movable toward and from each other, an energizing winding for said terminals, and a pilot switch with connections whereby the winding is energized to secure the attraction of the terminals and their closures when the pilot switch is in one position, and to secure the repulsion of the terminals and their opening when the pilot switch is in its other position.

5. The combination in an electric switch mechanism, of two main conductor terminals having magnetizable parts and movable toward and from each other, coils for energizing such terminals, and means whereby the direction of the current through the coils may be governed so that the terminals will either repel each other to break the main circuit or attract each other to close such circuit.

6. The combination with a pair of separable contact terminals having magnetizable parts, of coils for energizing such terminals, and connections and a switch whereby the direction of the current through one of the coils may be reversed so that the terminals will either repel each other or attract each other.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FRANK C. NEWELL.

Witnesses:
PAUL SYNNESTVEDT,
CHAS. H. EBERT.