W. SCHWAGERMANN.

ELECTRIC CONTROLLER.

APPLICATION FILED MAY 12, 1920.

1,438,727.

Patented Dec. 12, 1922.

2 SHEETS—SHEET 1.

Fig:1.

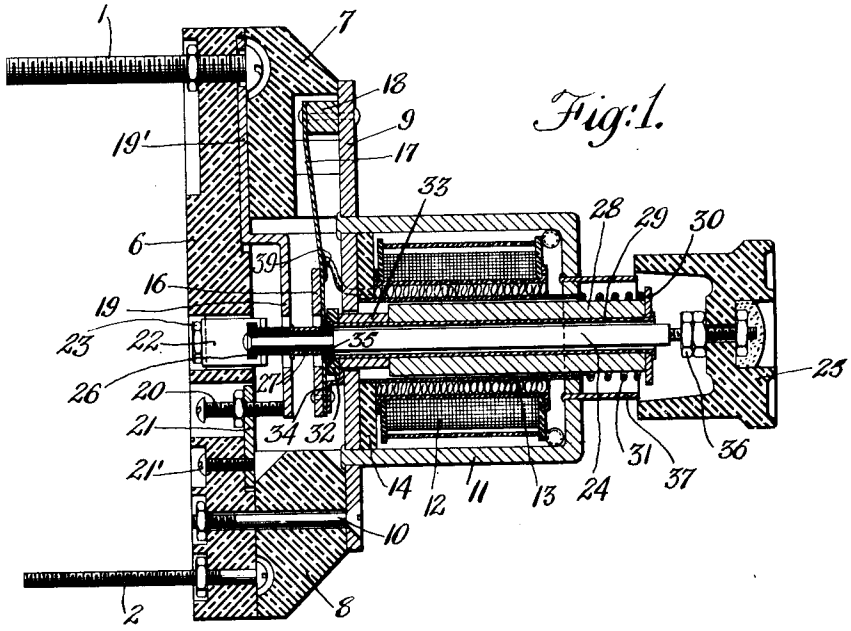


Fig:2.

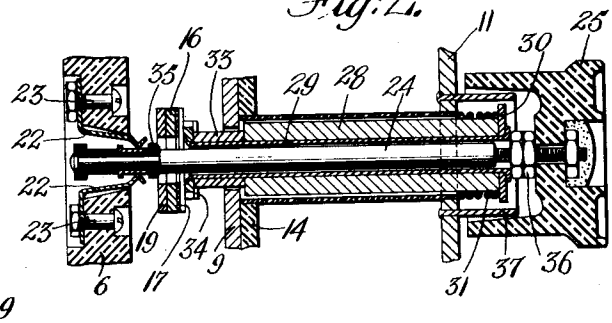


Fig:4.

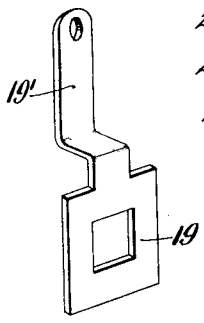


Fig:3.

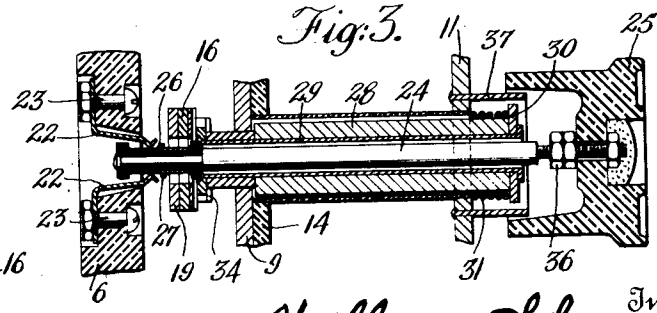
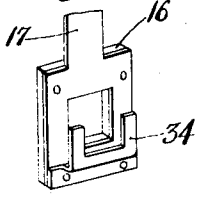


Fig:5.



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2 SHEETS—SHEET 2.

Fig: 8.

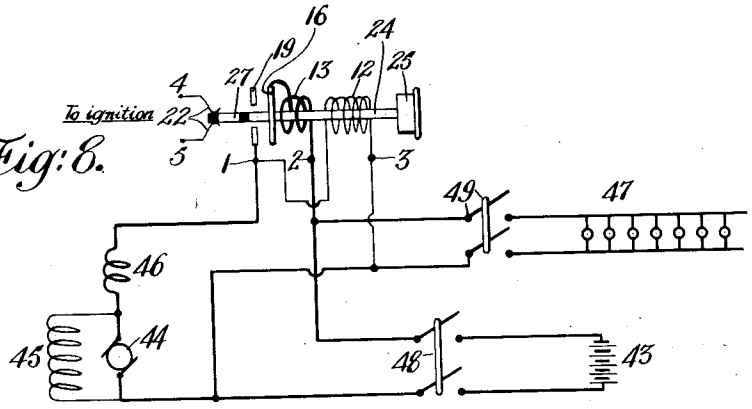


Fig: 6.

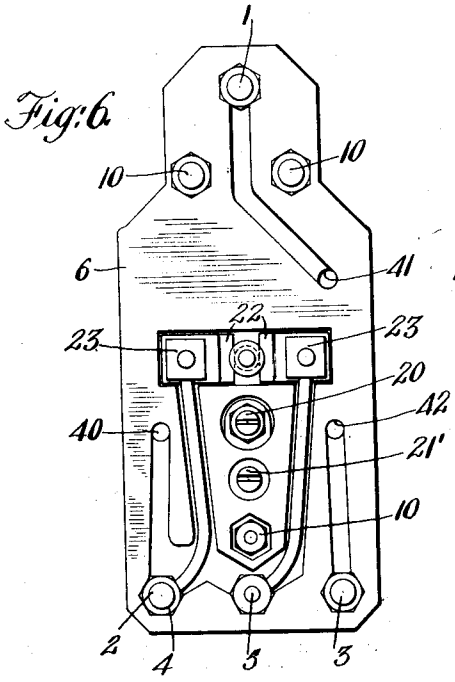
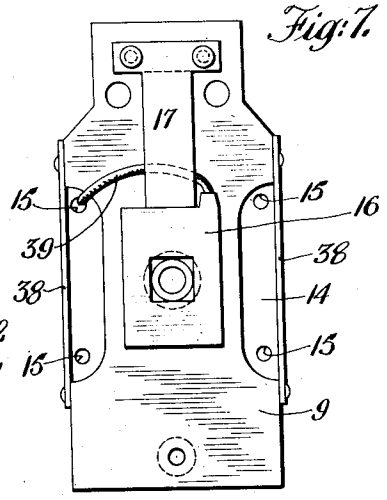


Fig: 7.



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UNITED STATES PATENT OFFICE.

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ELECTRIC CONTROLLER.

Application filed May 12, 1920. Serial No. 380,716.

To all whom it may concern:

Be it known that I, WILLIAM SCHWAGERMANN, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electric Controllers, of which the following is a specification.

This invention, although capable of other uses, is particularly applicable to the control of circuits of small isolated plants, such as include a gas engine, a dynamo, a storage battery and one or more distributing circuits.

By my invention I provide automatic means for protection of the circuits and apparatus and likewise combine therewith manually operated means which insures the proper sequence of closing the circuits and of opening the circuits. I preferably provide a single manually operated element for properly closing the main circuit and also any auxiliary circuit, as desired, in proper sequence, the parts being thereafter automatically controlled unless it is desired to manually open the circuits when the same manually operated element may be used for opening the circuits.

One object of my invention is to provide a controller of the above character which will form a unitary device adapted to be mounted upon a conveniently located panel and which will be compact, durable and of simple construction. Another object is to render such a device proof against unskilled use in the control of the circuits and to protect all the parts from tampering or adjustment by enclosure so that only the manually operated element is exposed. Another object is to so construct the contacting parts and their relationship to each other as will insure continued use without material deterioration of the parts and reduce to a minimum the arcing at the contacts.

Other objects of my invention will be understood from the following description and accompanying drawings.

Fig. 1 is a vertical central section of one embodiment of my invention showing the parts in open circuit position; Fig. 2 is a horizontal section of a portion of the device showing the parts in closed circuit position; Fig. 3 is a view similar to Fig. 2 showing the auxiliary circuits open circuited, and the main circuit close circuited; Figs. 4 and 5 are perspective views of the fixed and movable main contacts; Fig. 6 is a rear elevation of the controller; Fig. 7 is a rear view of the supporting plate of the magnet and of the movable contact, and Fig. 8 is a diagram of connections.

The controller with the combined automatic and manually operated means is a unitary device and as shown has rearwardly extending contacts 1, 2, 3, 4 and 5 for mounting the device upon a panel, and for making the circuit connections thereto. The base 6 of the controller is preferably of molded insulating material having provision for reception of the contacts and connecting leads, being of the form shown in Fig. 6 and of the full length and width of the device. At the upper and lower ends of the base plate 6 are blocks 7 and 8 preferably of molded insulating material which are recessed and drilled to receive the parts as hereafter referred to. Bridging the blocks 7 and 8 is a sheet iron plate 9 secured to the blocks and base 6 by screws 10, which pass through the blocks and base and engage nuts which are recessed in the rear face of the base 6.

A controlling magnet is mounted on the plate 9 and has a U-shaped metal frame 11 of sheet iron having its inner ends fixed to the plate 9. Within the magnet frame is a shunt winding 12 and a series winding 13. A sheet of insulating material 14 is located at the inner ends of the windings on the face of the plate 9 and provides holes 15 through which leads from the coils are passed to the inner parts of the controller, the plate 9 being cut away at the sides as shown in Fig. 7 and thus permits the insulating plate 14 to extend over the cut away portions.

The movable main contact 16 of sheet metal and having a central opening is located in the middle portion of the device and supported by a strip 17 of phosphor bronze or other suitable material, which in turn is mounted at its upper end on a block 18 secured to the inside face of the plate 9 and located in a recessed portion of the block 7. The fixed contact 19 is shown of sheet metal and faces the movable contact 16 and has an upwardly extending offset portion 19′ located in a recess on the front of the insulating plate 6 and being

secured in place at its upper end by the terminal connection 1 passing through the plate 6. Back of the lower part of the contact 19 is an adjustable screw 20 for properly locating the lower end of the fixed contact. This screw is located in a recess in the base 6 and supported by a metal plate 21, which in turn is fixed in a recess in the base 6 by a screw 21′ extending through the base 6 from the rear.

Mounted on the middle portion of the base 6 and extending forwardly through a central opening therein are a pair of oppositely located spring contacts 22. These contacts of sheet metal have rear extensions in recessed portions of the base 6 by which these contacts are supported by means of screws and nuts 23.

A rod 24 passes freely through the center of the controlling coils and has fixed to its outer end a knob or handle 25 of insulating material. The rod 24 is axially movable and passes through the openings in the contacts 16 and 19. At the inner end of the rod is a sleeve 26 of insulating material, which is located between and engages the spring contacts 22 when the controller is in open circuited position or when it is desired to break the auxiliary circuit of contacts 22 without breaking the circuit of the main contacts 16, 19. Near the inner end of rod 24 is a metal sleeve 27 insulated from the rod and adapted to engage and make connection between the spring contacts 22 when the rod 24 is pushed inwardly.

A cylindrical plunger 28 of magnetic material is located within the controlling windings and surrounds the rod 24, being carried by a sleeve 29 of non-magnetic material. The outer end of this sleeve carries a disk 30 between which and the magnet frame is a spiral spring 31 encircling the outer end of plunger 28 and tending to hold the same in its outer position. The inner end of sleeve 29 carries a collar 32 retained in place by the end of the sleeve being turned outwardly and also by a spacing sleeve 33 between the collar and the plunger 28. A sheet metal part 34 having offset and upwardly extending arms, is secured to the lower outer face of the movable main contact 16, the upwardly extending arms embracing the collar 32. This connection causes the contact 16 to be moved and controlled by movement of the plunger 28. A collar 35 of insulating material is carried by the rod 24 near the contact sleeve 27 so that sufficient outward movement of rod 24 will cause this collar to engage the inner end of the sleeve 29 and thereby cause outward movement of the plunger by outward movement of the handle and rod 24 when desired. This arrangement also permits independent inward movement of rod 24 without movement of the plunger 28 until the nut 36 on the rod 24 engages the outer end of the plunger.

A cylindrical metal shield 37 is mounted on the outer part of the magnet frame and encloses and protects the spring 31. The handle 25 is recessed at its inner end so as to permit a telescoping action of the handle over the shield 37 and thus effectively enclose the parts in all positions of the handle. On opposite sides of the magnet frame and extending to the base plate 6 are two metal plates 38 which with the magnet frame and plate 9 effectively enclose the controlling coils and contacts. These plates 38 are preferably locked with a seal when leaving the manufacturer so as to avoid unauthorized tampering with the parts.

A flexible lead 39 has one end in electric connection with the movable contact 16 and passes through one of the holes 15 at one side of the insulating plate 14 and connects with one end of the series coil 13. The other end of the series coil passes through one of the holes 15 of the plate 14 and through an oppositely located hole 40 in the plate 6, and then extends through a recess in the base of the plate 6 to the terminal 2, as indicated in Fig. 6. A lead from one end of the shunt winding 12 passes through one of the holes 15 of plate 14 and then through an oppositely located hole 41 in the base plate 6 and passes through a recessed groove in the back of the plate 6 to the terminal connection 1. The other end of the shunt winding is passed through the remaining hole 15 of the plate 14 and through an oppositely located hole 42 in the base plate and then through a groove in the back of the base plate to terminal 3. In this instance, the contacts 22 have leads extending therefrom through grooves in the back of the plate 6 to the terminals 4 and 5 respectively, the terminal 4 in this instance happening to serve also as a terminal 2, as indicated in Fig. 6.

The diagram Fig. 8 illustrates one application of a controller of this type to a system having a generator, storage battery and distributing circuit, the battery being indicated at 43, the generator armature at 44 having a shunt field 45 and series field 46, the distributing circuit being indicated at 47 and having incandescent lamps connected in multiple thereto. The parts of the controller are numbered in Fig. 8 to correspond with the numbers to designate the parts above described. One line of the generator is connected to the terminal 1 and fixed contact 19, the movable contact 16 being connected through the series coil 13 to the terminal 2 and thence to the battery, back to the other terminal of the generator through a switch 48 for connecting or disconnecting the battery. The distributing circuit 47 is

connected through a switch 49 in parallel with the battery. The shunt winding 12 is shown connected from one side of the generator circuit at terminal 1 to the other side of the generator circuit, by connection extending from terminal 3. The spring contacts 22 in this instance are provided for controlling the ignition circuit of the gas engine which normally drives the generator, the ignition circuit of the gas engine not being shown.

In this particular instance my improved controller is intended for use as a starting switch for closing the generator circuits from the battery to cause the generator to act as a motor for turning over and starting the gas engine, which normally drives it, the controller also securing proper sequence of control of the ignition circuit and main circuit during starting and stopping the engine and for providing automatic protection during running conditions.

Assuming that it is desired to start the engine by operating the generator as a motor, the battery switch 48 will be closed and the operator will push the knob or handle 25 inwardly. This gives a sequence of control as follows: The rod 24 will first move inwardly leaving the plunger 28 stationary and cause the metal sleeve 27 to engage and close the ignition circuit through the spring contacts 22, thus insuring the closure of the ignition circuit of the engine before the starting current is applied. Continued inward movement of the handle and rod 24 will next cause the nut 36 to force the plunger 28 and movable contact 16 inwardly and cause the latter contact to engage the fixed contact 19 and close the main circuit from the battery through the generator, the length of the metal sleeve 27 being such as to continue to connect the contacts 22, thus bringing all of the contacts to the closed circuit condition as shown in Fig. 2. The engagement of the main contacts causes a cooperating large current to flow through the series coil 13 which creates a strong magnetic field to pull the plunger 28 inwardly and force the movable contact 16 quickly into firm engagement with the face of the fixed contact 19 insuring excellent electrical connection between these contacts and the avoidance of any appreciable sparking in closing the circuit; because no matter how slowly the operator may push the handle in, the instant any contact at all is made between the main contacts, the flow of current through the series coil will quickly and strongly attract the plunger against the pressure of spring 31 and so insure a firm and adequate contact in any case.

The operator will hold the handle 25 in its inner position until the engine has started which then drives the dynamo as a generator to charge the battery and supply current to any translating devices connected to the distribution circuits. The charging current obviously flows in the opposite direction to the starting current through the series coil 13 which charging current then acts cumulatively with the shunt coil 12 in holding the plunger 28 in its inner position and thereby continues to hold the main contacts closed during normal running conditions. In case however of a reverse current flow of predetermined amount through the series coil 13 due to abnormal slowing down of the gas and generator, the series coil will then oppose the magnetization created by the shunt coil and permit the spring 31 to force the plunger outwardly and break the charging circuit at the main contacts 16, 19 automatically with a quick movement of the movable contact 16. This quick break under these conditions avoids any material arcing at the main contacts. This automatic action thus protects the generator and battery from the continuance of any abnormal reverse current flow.

In case it is desired to stop the engine and disconnect the battery during normal running conditions, the operator will pull the handle 25 outwardly a short distance to the position shown in Fig. 3, which merely causes the ignition circuit of the gas engine to be interrupted by the sleeve 27 passing out from under the spring contacts 22; and the operator need not attempt to force the main contacts apart manually against the magnetic pull of the magnet. The engine will then stop and as the speed of the generator drops, a reverse current flows through the series coil of the controller, which then permits the main contacts to be automatically opened as above described without material arcing. If desired the operator may in stopping, pull the handle 25 out sufficiently to not only break the ignition circuit, but also separate the main contacts by causing the collar 35 to engage the inner end of the plunger sleeve. In doing this, however, a considerable force is necessary to overcome the magnetic pull on the plunger in order to separate the main contacts, and although a considerable current may be flowing, the break will be rapid and so tend to minimize the arcing by the quick break, because when the magnetic pull of the plunger is overcome, and once starts to move, it moves quickly owing to the rapidly decreasing magnetic effect of the controller coils.

It is thus apparent that by means of this construction considerable advantage in proper control of the contacts is obtained by the telescope feature in causing the ignition auxiliary circuit to be closed before the main circuit and yet, by reverse movement of the handle, cause the ignition or auxiliary circuit to be opened before the main circuit instead of having the circuits opened in re-

verse order to their closing. It is also apparent that in case the engine should stop from failure of gasolene supply or other causes, the controller will be automatically opened by action of the series coil upon the occurrence of a reverse current flow as above described.

Although I have described one embodiment of my invention and one application thereof, various modifications may be made and its various features utilized for other purposes than the particular one described herein.

I claim :—

1. A controller comprising main contacts and auxiliary contacts, and means comprising a manually movable element and a second relatively movable element extending in a direction parallel to said first named element for causing the auxiliary contacts and main contacts to be successively closed by movement of said manually movable element in one direction and then opened in the same sequence as in closing by movement of said manually movable element in the opposite direction.

2. A controller comprising main contacts and auxiliary contacts, two relatively movable elements extending in a direction parallel to each other for controlling said contacts respectively, and means comprising a handle whereby said contacts may be opened in the same sequence as in closing said contacts.

3. A controller comprising main and auxiliary contacts, two axially movable elements for controlling said contacts respectively, said elements having a common axis, and means for controlling the movement of said elements comprising a handle whereby said contacts may be opened in the same sequence as in closing said contacts.

4. A controller comprising a pair of contacts, electromagnetic means for automatically controlling said contacts, a second pair of contacts, a movable element for controlling said second pair of contacts, said electro-magnetic means and element being functionally related.

5. In a controller, a pair of contacts, a magnet and a magnetic element for controlling said contacts, a second pair of contacts, and a manually movable element extending through said magnetic element for controlling said second pair of contacts.

6. A controller comprising a pair of main contacts, a magnet having its magnetic element connected to one of said contacts and biased to open said contacts, auxiliary contacts, and a movable element for controlling the circuit of said auxiliary contacts and movable relatively to said magnetic element and also adapted to control the movement of said main contacts.

7. A controller comprising main contacts, auxiliary contacts, a manually movable element and a relatively movable element concentric therewith for successively closing said auxiliary contacts and main contacts, and electromagnetic means for automatically moving one of said elements for controlling the opening of said main contacts.

8. A controller comprising main contacts, auxiliary contacts, a manually movable element and a second relatively movable element for first closing the auxiliary contacts and then the main contacts by movement of said elements in one direction and by movement in the opposite direction to first open said auxiliary contacts, and electromagnetic means for controlling the movement of one of said elements for causing the opening of said main contacts.

9. A controller comprising main contacts, auxiliary contacts, an axially movable element for closing the auxiliary contacts and main contacts, and electro-magnetic means having an axially movable plunger for controlling the opening of one of said contacts, said plunger being axially movable relatively to said element and having a common axis therewith.

10. A controller comprising a plurality of contacts, enclosing means for said contacts, a controlling magnet mounted upon the outside of said means and having its axis perpendicular thereto, said magnet having an axially movable plunger for automatically controlling certain of said contacts, and a manually movable element passing through said plunger and movable relatively thereto for controlling certain of said contacts.

11. A controller comprising main contacts and auxiliary contacts, enclosing means for said contacts, a controlling magnet having the axis of its windings perpendicular to said enclosing means, said magnet having an axially movable element for automatically controlling the opening of said main contacts, and a manually movable element passing through said magnetic element and movable relatively thereto for controlling said main contacts and auxiliary contacts.

12. A controller for controlling the circuit of a battery and dynamo driven by a gas engine comprising main contacts in the dynamo and battery circuit and auxiliary contacts for controlling the ignition circuit of the engine, a manually movable element for first closing said auxiliary contacts and then closing said main contacts by movement in one direction and first opening said auxiliary contacts by movement in the opposite direction, and electromagnetic means for controlling the opening of said main contacts.

13. A controller for controlling the circuit of a battery and dynamo driven by a gas engine comprising main contacts in the dynamo and battery circuit and auxiliary contacts for controlling the ignition circuit of

the engine, a manually movable element for first closing said auxiliary contacts and then closing said main contacts by movement in one direction and first opening said auxiliary contacts by movement in the opposite direction, and electromagnetic means for controlling the opening of said main contacts upon the flow of reverse current from the battery.

14. A controller for controlling the circuit of a battery and dynamo driven by a gas engine comprising main contacts in the dynamo and battery circuit and auxiliary contacts for controlling the ignition circuit of the engine, a manually movable element for first closing said auxiliary contacts and then closing said main contacts by movement in one direction and first opening said auxiliary contacts by movement in the opposite direction, and electromagnetic means for controlling the opening of said main contacts, said means comprising a shunt coil and series coil acting cumulatively during normal running conditions.

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