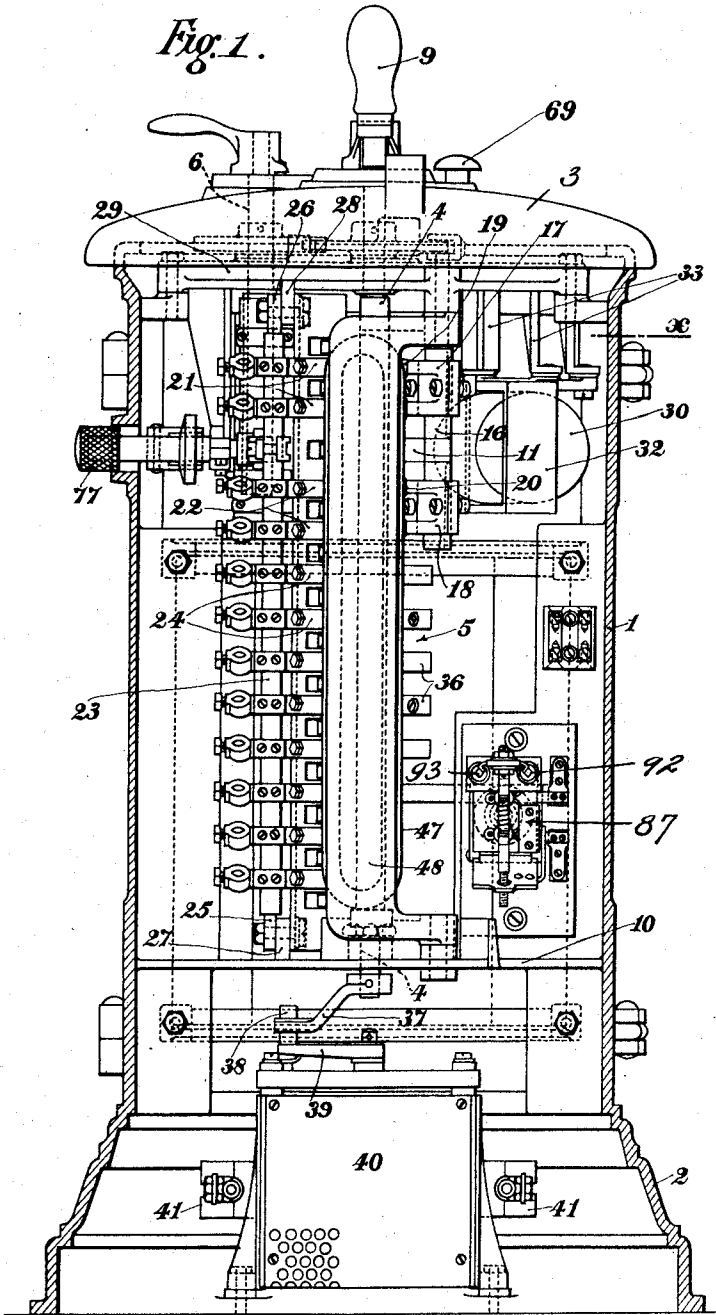


J. R. GARNER & M. R. H. MUELLER.
 CONTROLLER FOR ELECTRIC MOTORS.
 APPLICATION FILED JUNE 30, 1911.

1,024,985.

Patented Apr. 30, 1912.

3 SHEETS—SHEET 1.



WITNESSES

[Handwritten signatures of witnesses]

INVENTORS Joseph R. Garner

Max R. H. Mueller

by *[Handwritten signature of attorney]*

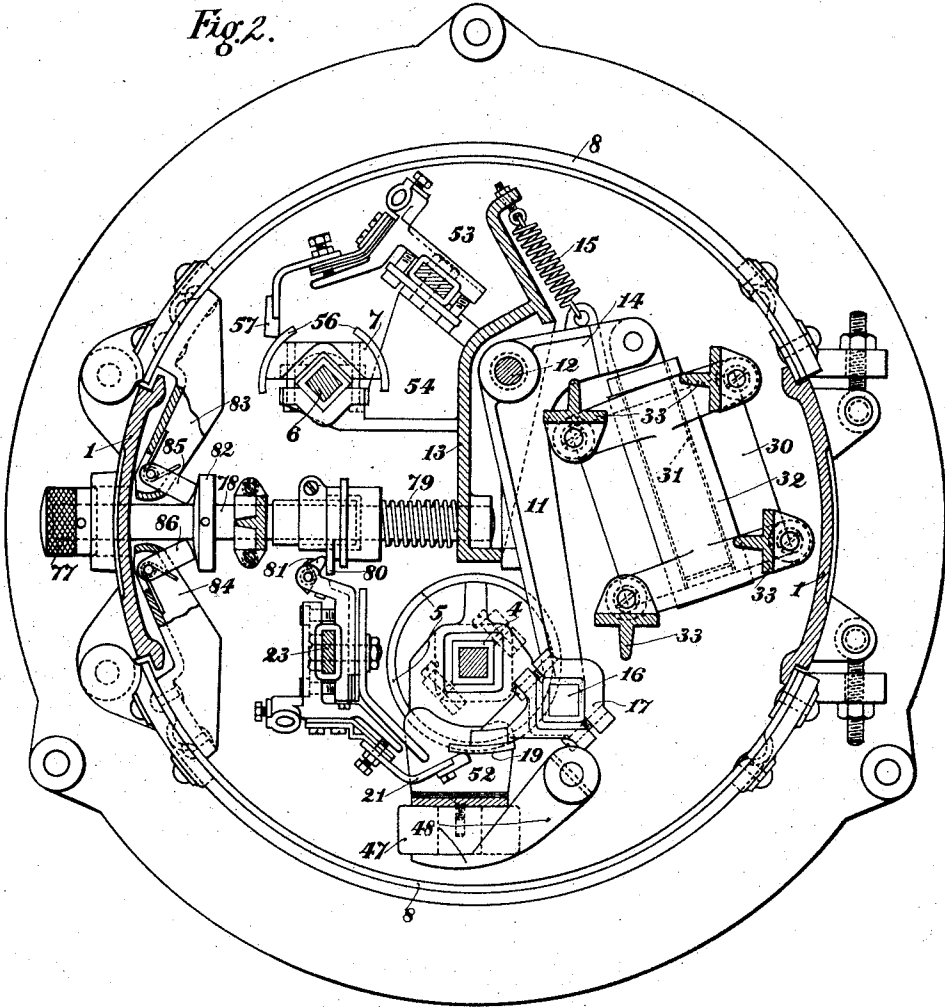
J. R. GARNER & M. R. H. MUELLER.
CONTROLLER FOR ELECTRIC MOTORS.
APPLICATION FILED JUNE 30, 1911.

1,024,985.

Patented Apr. 30, 1912.

3 SHEETS—SHEET 2.

Fig. 2.



WITNESSES

[Handwritten signatures of witnesses]

INVENTORS *Joseph R. Garner*
Max R. H. Mueller

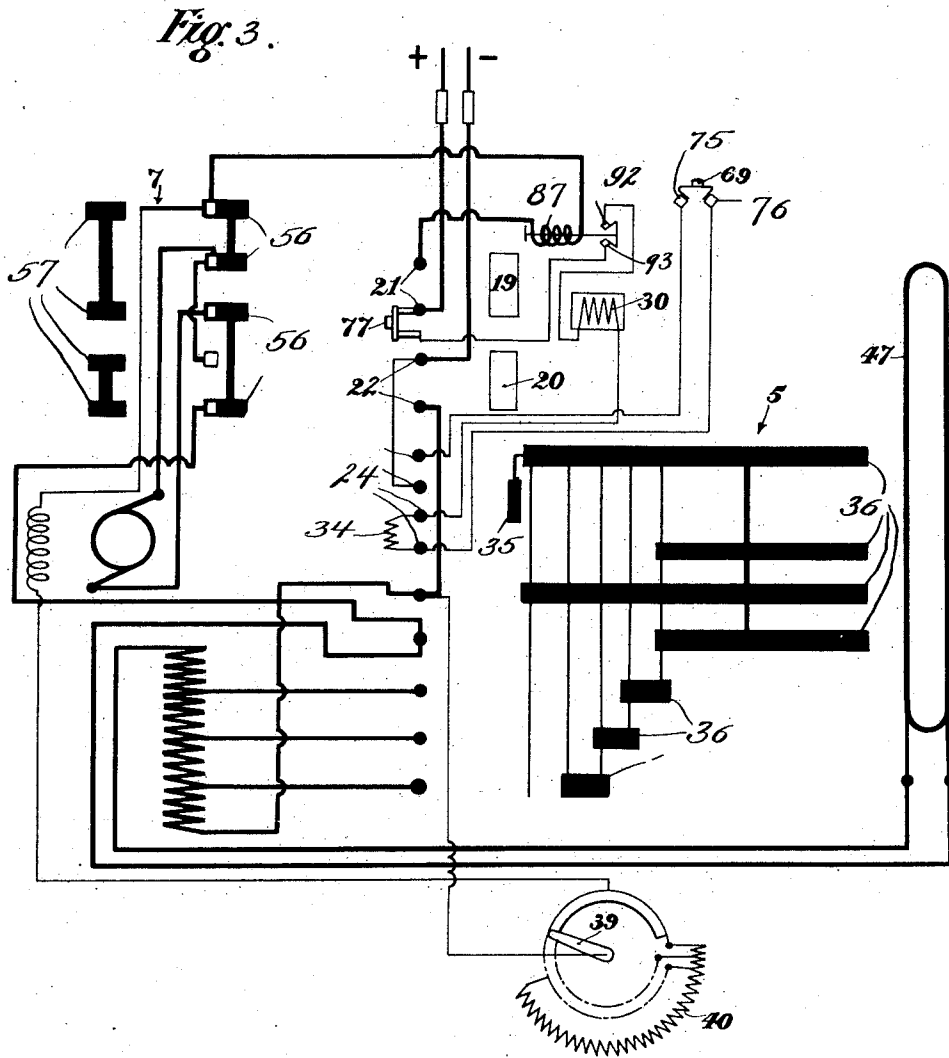
By *James L. Norris* Atty.

J. R. GARNER & M. R. H. MUELLER.
 CONTROLLER FOR ELECTRIC MOTORS.
 APPLICATION FILED JUNE 30, 1911.

1,024,985.

Patented Apr. 30, 1912.

3 SHEETS—SHEET 3.



WITNESSES.

[Handwritten signatures of witnesses]

INVENTORS

Joseph R. Garner
Max R. H. Mueller
 by *Amos A. Norris* *Att'y.*

UNITED STATES PATENT OFFICE.

JOSEPH RICHARDSON GARNER AND MAX RICHARD HUGO MUELLER, OF ASTON, BIRMINGHAM, ENGLAND, ASSIGNORS TO ELECTRIC AND ORDNANCE ACCESSORIES COMPANY LIMITED, OF ASTON, ENGLAND, A CORPORATION OF GREAT BRITAIN.

CONTROLLER FOR ELECTRIC MOTORS.

1,024,985.

Specification of Letters Patent.

Patented Apr. 30, 1912.

Application filed June 30, 1911. Serial No. 636,233.

To all whom it may concern:

Be it known that we, JOSEPH RICHARDSON GARNER and MAX RICHARD HUGO MUELLER, subjects of the King of Great Britain and the German Emperor, respectively, residing at Aston, Birmingham, England, have invented certain new and useful Improvements in Controllers for Electric Motors, of which the following is a specification.

This invention has reference to controllers for use in connection with electro-motors for driving machinery and other purposes, and has for its principal object, to provide a combination apparatus or appliance comprising a barrel-type starter and controller or series regulator (with or without a separate reversing barrel), a magnetically-operated double-pole switch or circuit-breaker, and a shunt regulator, all arranged so that the circuit-breaker can be actuated or controlled, and the main series-controller and shunt-regulator operated by a single handle, and the whole mounted or inclosed together with the motor-armature or series resistances and the shunt resistances, within a pillar-like casing so as to form a complete or self-contained controller unit or shell.

The feature above specified is also present in the construction shown in our companion application Serial No. 636232, but is not made the subject of the claims which that application contains.

Figure 1 of the accompanying drawings is a vertical section through the casing of a combination controller appliance constructed and arranged in accordance with this invention, the internal arrangement being shown in elevation. Fig. 2 is a transverse horizontal section through the appliance on line *x* Fig. 1. This view shows the main switch or circuit breaker in its "on" position. Fig. 3 is a diagrammatic view showing the motor and the electric circuits.

The pillar-like casing 1 of the controller appliance is of upright cylindrical shape, and has its bottom formed as a base or foot 2, while the top is provided with either a fixed or detachable lid or cover 3 having a bearing for the upper end of the shaft 4 of the main controller-barrel 5, as well as a bearing for the shaft 6 of the independently operated reversing barrel 7. The front and back of the pillar have large

openings to permit of access being obtained to all the internal mechanism, and these openings are fitted with hinged doors 8, 8, forming part of the cylinder and provided with suitable fastenings. The said main barrel shaft 4 is arranged vertically in the middle of the pillar casing, but in front of the vertical center line, and its upper end extends through its bearing in the top cover or lid, and is furnished externally with a handle 9 for rotating the said shaft and thereby operating the main controller barrel 5 and the shunt regulating device, while the lower end of the shaft has its bearing in a cross-web or diaphragm (Fig. 1) which may be cast solid with the casing, and separates the hollow base or foot 2 of the said casing from the upper part thereof. This base 2 constitutes a chamber to contain the shunt regulator (hereafter described) while the space above the said web or diaphragm 10 forms another and larger chamber for containing the circuit breaker, the main-controller and reversing barrels with their contacts, together with their various accessory parts, and also the armature resistance elements.

The circuit-breaker or main switch is arranged in the upper part of the top compartment, immediately below the lid or cover, and its moving elements are arranged on one side of the main shaft. This breaker is of the double-pole type being taken into and locked in its circuit-closing position electro-magnetically by a no-volt coil arranged in a shunt circuit which is closed by the initial movement of the main controller barrel away from the "off" position, while the circuit-breaking movement is obtained by a spring. It consists of a bell-crank lever 11 (Fig. 2) keyed to a vertical rock shaft 12 mounted in bearings carried by an upright hanger bracket 13 situated in the center of the casing behind the main shaft, and the short arm 14 of the said lever is connected to one end of a pull-off spring 15 whose other end is anchored to an extension of the bracket 13, while the longer arm carries a vertical bar 16 upon whose opposite ends are mounted by means of insulated clips 17, 18, a pair of brushes or contacts 19, 20, which are adapted, by the angular movement of the lever 11, to make contact with and bridge corresponding pairs of spring fingers or terminals 21, 21, and 22, 22, ar-

ranged respectively in the positive and negative sides of the main circuit. These fingers are carried upon a vertical finger-bar 23 which is suitably arranged in a plane parallel with the mainshaft, but upon the side opposite to the lever 11. The finger-brackets, which are mounted on but insulated from the said bar, support their respective fingers in front of the main shaft and in such a position that the brushes 19, 20, can make effective contact therewith when the said lever is swung forward into the circuit-closing position. The bar 23 is used to also carry the fingers 24 corresponding to the various brushes or contacts on the main controller-barrel 5, and it is detachably mounted within the pillar-casing by providing its opposite extremities with eyes 25, 26, adapted to be secured by bolts to lugs 27, 28 carried respectively by the cross web 10 in the lower part of the said casing, and by a web or bar 29 arranged across the top of the structure, immediately below the cap or cover 3.

To electro-magnetically operate the circuit-breaker by swinging over the lever 11 to take the contact or brushes 19, 20, into contact with the fingers 21, 22, a no-volt coil 30, connected up in a shunt circuit is mounted outside the said lever and its core or plunger 31 is suitably connected with the short arm 14 in such a way that on the said coil being energized (which is effected by arranging for the first motion of the controller-barrel to close the said shunt circuit) the plunger is drawn in and rocks the lever 11 into its main-circuit closing position (as in Fig. 2) in opposition to the pull-off spring 15, while after the said main-circuit has been so closed, the shunt-coil 30 magnetically locks the said lever in its on position until the shunt circuit is again broken or interrupted, whereupon the said spring acts to swing back the lever and so break the main circuit automatically. The no-volt coil is mounted in a frame 32 carried by hangers 33 from the transverse web or bar 29 in the top of the structure.

In conjunction with the no-volt coil, there is arranged a reducing resistance 34, (Fig. 3), which is cut out of the shunt circuit by a contact 35 on the controller barrel, when the latter, (at starting), is moved into its preliminary position for first closing the said shunt circuit and energizing the no-volt coil. Thus, when the barrel is in this particular position, the shunt voltage in said coil is at its maximum value, which is sufficient to draw in the plunger 31 and pull over the switch lever 11 for closing the main circuit. Immediately the barrel moves past the aforesaid preliminary position, however, and commences to cut out the armature resistance 45, the reducing resistance 34 is placed in series with the no-volt coil and re-

mains in so long as the shunt and main circuits are closed, and it has the effect of cutting down the voltage on the no-volt coil 30.

The main controller-barrel 5 is mounted upon the operating shaft 4, below the main circuit-breaker, and it is furnished with any suitable arrangement of brushes 36 which, by the rotation of the said barrel away from its off position, are carried successively into contact with the corresponding fingers 24 on the finger-bar 23, and thereby progressively cut out the armature resistance 45 from the armature circuit, while after the armature resistance has been entirely cut out, the further movement of the shaft with the main barrel is utilized for controlling or altering the resistance in the shunt circuit and thereby increasing or decreasing the speed of the motor. To provide for this regulation, the main shaft is extended through its bearing in the lower cross web 10 of the casing and is there furnished with an arm 37 having a forked or slotted extremity adapted to engage with a stud or projection 38 upon the operating lever 39 of a shunt regulator device 40 which may be of any suitable type or construction that can be bolted or otherwise fixed onto the floor or bottom of the hollow base 2 of the pillar-casing. The said shunt-resistance lever is so arranged with respect to the controller barrel that it will move idly, without inserting any resistance, during the first part of the motion of the said main barrel when the starting resistances are being cut out, and will then commence to insert the additional speed-regulating resistances into the shunt circuit of the motor. The opposite sides of the shunt-regulator casing may as shown be furnished with external brackets 41 to carry the main or series circuit fuses. The elements comprising the armature resistance 45 are preferably contained within the pillar casing.

47 is a blow-out coil for preventing sparking at the contact fingers of both the controller barrel and the circuit breaker, same being carried upon a pivotally-mounted bar 48.

56 are the usual brushes or contacts provided upon the reversing barrel 7 to cooperate with the fingers 57 on the bar 53 for reversing the direction of flow of the main current through the motor armature.

69 is the push-button of a starting switch mounted upon the top of the pillar-casing and which must be held closed by hand during the operation of the main barrel until the "full-on" position is reached. The spring fingers of this button are adapted, when said button is depressed, to engage a pair of terminals 75 and 76 mounted within the casing and connected up in the shunt circuit, as shown in Fig. 3. This switch is adapted to close and break the shunt circuit in which the no-volt coil is situated and

it has to be closed by the operator depressing the button with one hand before the first motion is given to the starting handle; otherwise, the shunt circuit being open, the no-volt coil cannot be energized for putting on the main circuit closer, and should the operator's hand be removed at any time when the barrel is on any resistance step or before the armature current is full on, the shunt is automatically broken and the motor consequently stopped.

In connection with the main circuit-breaker, is a spring-controlled emergency switch 77 which can be used both to break the interlocking circuit and mechanically push off the circuit-breaker lever 11. When pressed inward the shunt circuit is broken at 80, 81, so as to reenergize the no-volt coil and at the same time the circuit-breaker lever 11 is positively forced to the off position. An electrical interlock for the doors of the casing is also obtained by the aid of the emergency switch 77, for which purpose the sliding stem 78 of said switch is furnished with an additional collar 82, while the hinge sides of the two doors 8, 8, are both furnished with levering extensions 83, 84, provided with catch pieces 85, 86, which engage with the said slide collar 82 so that when either of the doors is subsequently opened, its lever extension will act, through the catch-piece, upon the collar and so give an inward movement to the slide, and thereby separate the contacts 80, 81, of the emergency switch.

87 is an overload release device acting to break the shunt circuit and remove the magnetic lock on the main switch 11. The winding of this is in series with the mains, and the contact piece on the end of its plunger is normally engaged with contact terminals 92, 93, situated in the no-volt shunt circuit, as shown diagrammatically in Fig. 3. Referring to the diagram in Fig. 3, when the main switch is closed the contacts 19, 20, bridge the pairs of fingers 21 and 22 and the current flows from the positive terminal through contact 19, overload coil 87, and the top pair of the right-hand contacts 56 on the reversing barrel 7 to the motor, thence to the bottom pair of contacts 56 on said barrel, and through blow-out coil 47. From there the current flows through the armature resistance 45, and through contact 20 to the negative terminal. When the controller barrel is rotated, the armature resistance 45 is cut in or out as required by the lower contacts 36 on the barrel, in the known manner. On an overload occurring, the coil 87 raises its plunger, which carries a contact piece at its outer end, so as to break contact between the terminals 92, 93, in the shunt circuit in which the no-volt coil 30 is situ-

ated. When this happens, the main switch is released, as previously described. In the preliminary position of the barrel this shunt current passes from the coil 30 through contact 35 to top finger 22, and thus to the negative terminal, the shunt voltage being at its maximum value, which is sufficient to close the main switch, but when the barrel is moved past this preliminary position the reducing resistance 34 is put in circuit, the current passing thence through terminal 76, press-button 69, terminal 75, through the barrel contacts 36 to fingers 24. The motor field shunt circuit is from the top finger 56 of the reversing barrel 7, through the field winding to the shunt regulator 40, leaving by the arm 39, and thence joining the main circuit. As previously described, during the movement of the barrel the arm 39 does not put any resistance into the shunt circuit until all the armature resistance 45 is cut out, but then gradually introduces resistance to vary the speed of the motor. Also, after the armature resistance has been cut out the push-button 69 is short-circuited by a contact on the barrel. When the reversing barrel is rotated the left-hand set of contacts engage with the fingers 57 and cause the current to pass through the motor in the opposite direction.

Having fully described our invention, what we desire to claim and secure by Letters Patent is:—

A combination appliance for controlling and regulating electric motors comprising a casing, a horizontal partition disposed within the lower portion of said casing for dividing the interior thereof into separate main and base chambers, said partition being provided with a bearing, a member disposed in the upper portion of the main chamber and provided with a bearing in line with the first-named bearing, a barrel type controller and a main electro-magnetic switch disposed within said main chamber, said controller including a vertical shaft which is journaled at its opposite ends in said bearings and projects at its lower end into said base chamber, a handle for rotating said shaft, a shunt regulator disposed within said base chamber and including an operating lever, and an arm connecting the projecting end of said shaft with said lever, whereby said shunt regulator will be operated during the rotation of said shaft.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

JOSEPH RICHARDSON GARNER.
MAX RICHARD HUGO MUELLER.

Witnesses:

HENRY NORTON SKERRETT,
WILLIAM STATTES SKERRETT.