May 2, 1944. C. F. LEATHERS 2,347,695

RHEOSTAT

Filed Feb. 25, 1942 3 Sheets-Sheet 1

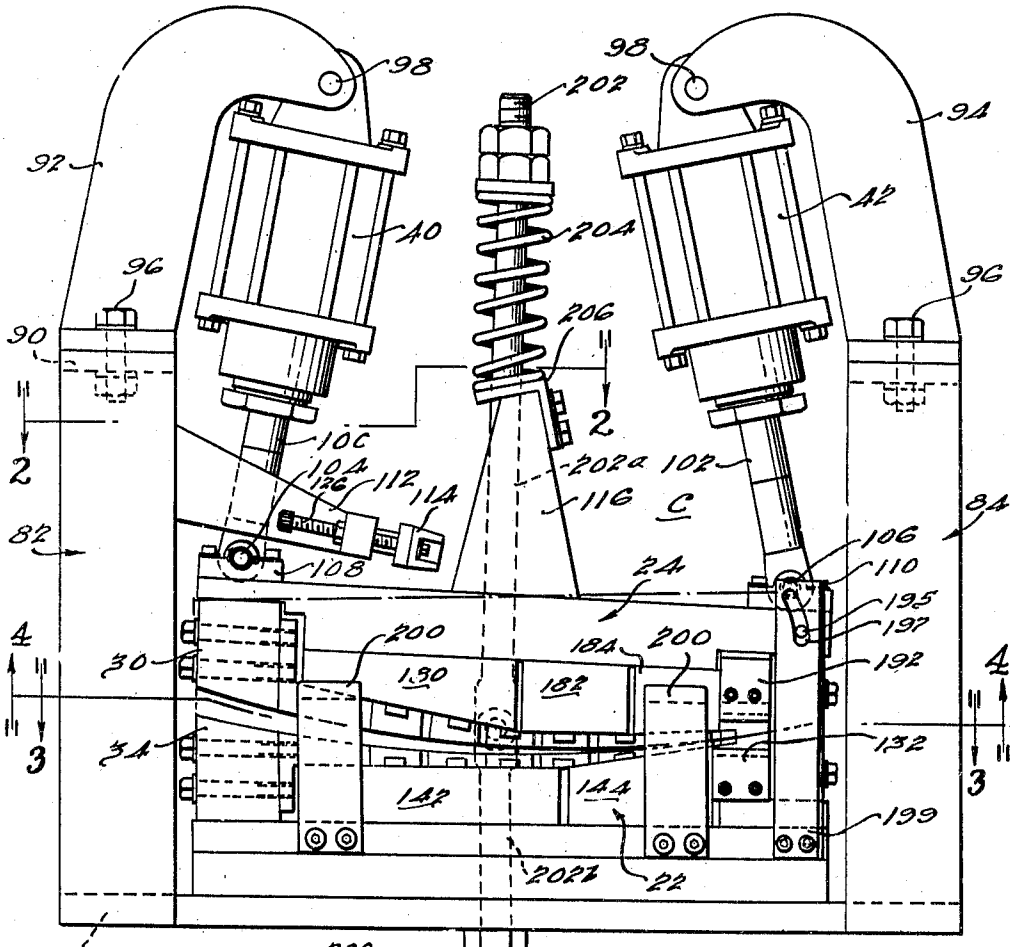


Fig. 1.

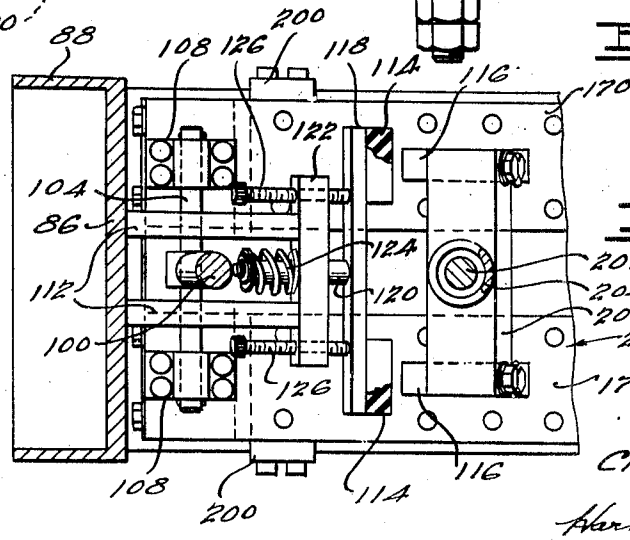


Fig. 2.

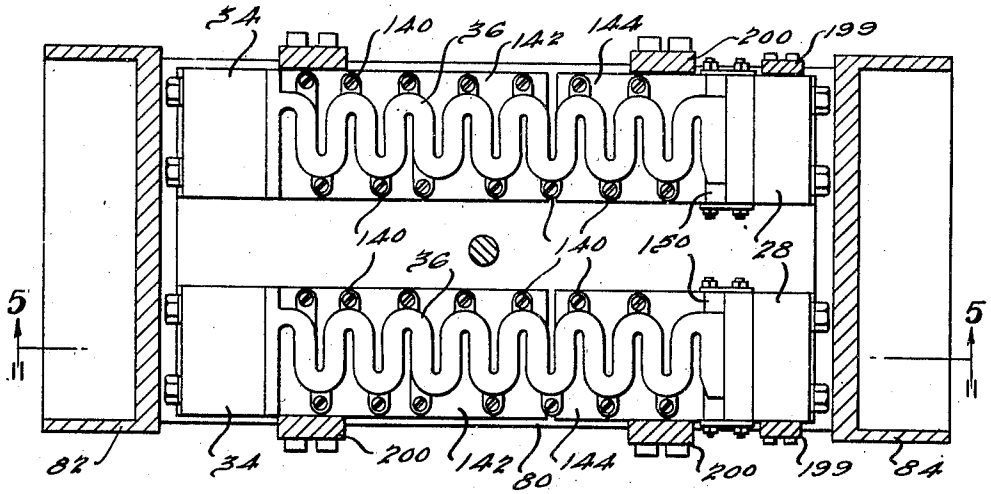
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FIG. 3.



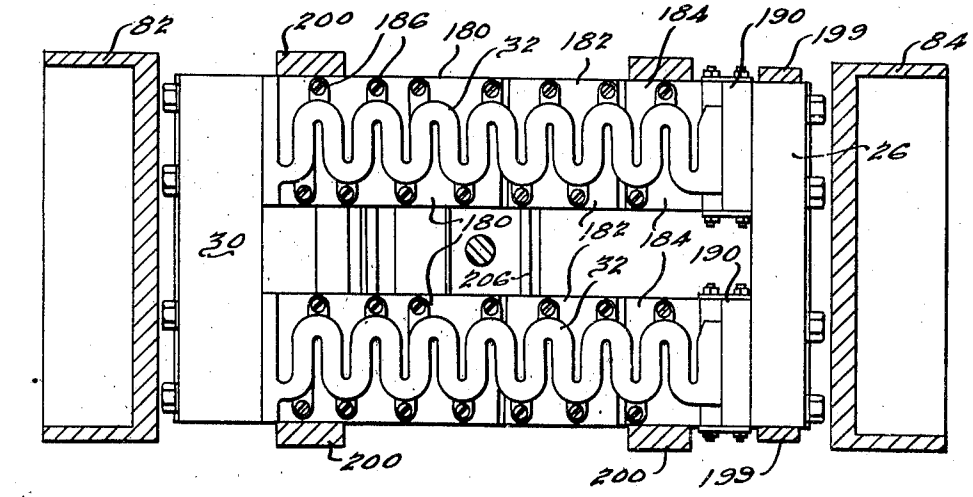


FIG. 4.

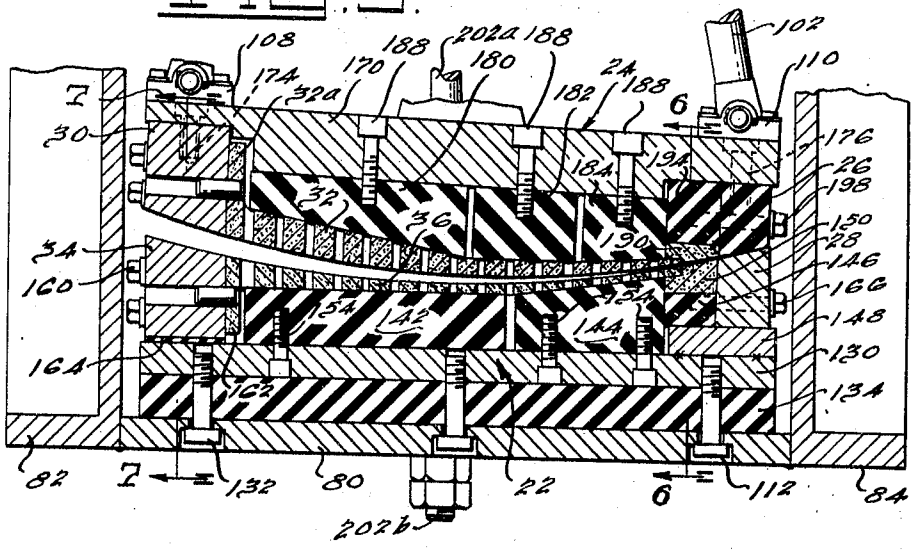
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FIG. 5.



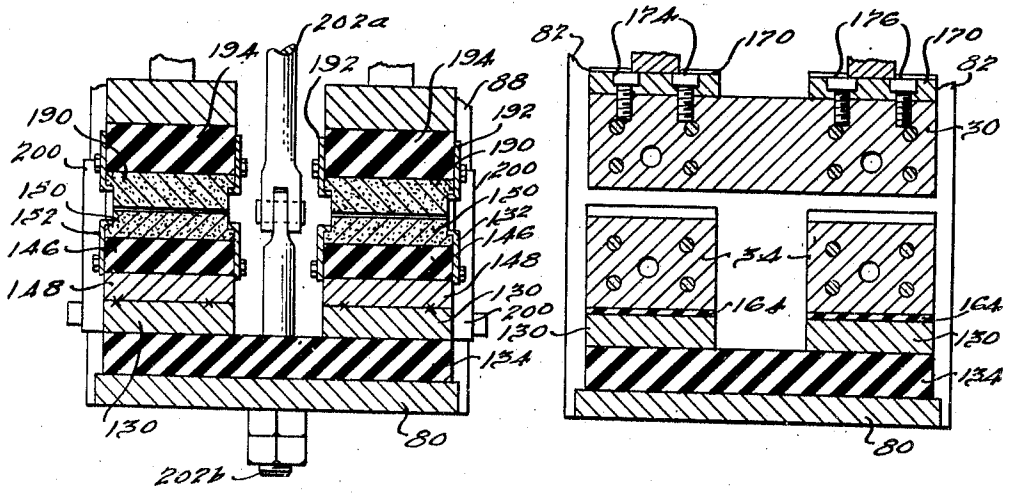


FIG. 6. FIG. 7.

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2,347,695

RHEOSTAT

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Application February 25, 1942, Serial No. 432,194

2 Claims. (Cl. 201—48)

The present invention relates to rheostats.

Principal objects of the present invention are to provide an improved electrical contactor arranged to open and close a circuit and further incorporating means to introduce resistance into the circuit at the beginning of each closing operation and to progressively decrease such resistance during the course of each closing operation; to provide such a contactor operable to progressively re-introduce said resistance into the circuit during the course of each opening movement; to provide such a contactor incorporating movable and stationary contact elements, resistance elements, and further arranged to provide a rolling contact between said elements; and to provide such a contactor which may be readily and economically manufactured and which is capable, though of relatively small size, to handle extremely large current values.

With the above as well as other objects in view, which appear in the following description and in the appended claims, a preferred but illustrative embodiment of the invention is shown in the accompanying drawings, throughout the several views of which corresponding reference characters are used to designate corresponding parts and in which:

Fig. 1 is a view in front elevation of a contactor embodying the invention;

Fig. 2 is a fragmentary view, taken along the line 2—2 of Fig. 1;

Fig. 3 is a view in horizontal section, taken along the line 3—3 of Fig. 1;

Fig. 4 is a view in horizontal section, taken along the line 4—4 of Fig. 1;

Fig. 5 is a view in vertical section, taken along the line 5—5 of Fig. 3;

Fig. 6 is a view in vertical section, taken along the line 6—6 of Fig. 5; and

Fig. 7 is a view in vertical section, taken along the line 7—7 of Fig. 5.

The illustrated contactor comprises a lower grid member 22 and an upper grid member 24, shown in Figs. 1, 3 and 4, which are superimposed upon each other and which are arranged to have relative rolling contact with each other. In the normal or off position of the contactor, shown in Fig. 1, the insulating block 26 of the upper grid member bears upon the corresponding insulating blocks 28 of the lower grid member and the conducting elements of the two grid members are out of contact with each other, so that the circuit through the contactor is interrupted.

The insulating block 26 is connected to a conducting bar 30 through a pair of similar resistance grids 32. The insulating blocks 28 are connected to corresponding conducting terminals 34 by means of resistance grids 36. When the contactor is in its fully closed position, the bar 30 bridges the terminals 34, to which the external circuit may be connected. For intermediate positions of the contactor, the grids 32 rest, with a rolling contact, upon the grids 36, thereby introducing into the associated circuit an amount of all of the grids 32 and 36 which is determined by the position of the contactor. For example, if the contactor is rocked counterclockwise from the open position of Fig. 1 to a position in which the points *a* of grids 32 rest upon points *b* of grids 36, the circuit through the contactor is as follows:

From one terminal 34, the corresponding grid 36 to the point *b* thereof, the co-operating upper grid 32 from the point *a* thereof to bar 30, the other grid 32 to the point *a* thereof, and the remaining grid 36 from point *b* thereof to the other terminal 34. As the contactor C is rocked further in a counterclockwise direction from the position of Fig. 1, the co-engaging points *a* and *b* of the grids 32 and 36 are advanced to the left, as viewed in Fig. 1, thereby progressively reducing the resistance in the circuit. When the fully closed position is reached, the bar 30 directly engages the terminals 34, short circuiting the grids. During an opening operation, the opposite effect is obtained, the initial rocking movement of the contactor serving to introduce a minimum amount of the resistance grids and further such rocking movement progressively increasing the amount of such resistance until such time as the circuit is opened by the seating of the insulating blocks 26 and 28 upon each other. It will be appreciated that widely varying amounts of resistance can be introduced into, and excluded from, the circuit in the above described manner.

In the illustrated embodiment, the movement of the upper grid member relative to the lower grid member is controlled by a closing ram 40 and an opening ram 42, the supply and exhaust lines whereof may be controlled in any suitable manner. It will be appreciated that in the off position of the contactor, ram 42 is connected to the supply source and ram 40 is connected to exhaust. In the opposite or on position of the contactor, ram 40 is connected to the supply source and ram 42 is connected to exhaust. The rams 40 and 42 are provided with conventional pistons, the piston rods whereof are coupled to

the upper grid member in such relation as to provide the aforesaid operating relationship.

The illustrated construction comprises a rectangular plate-like base member **80** and upwardly extending end members **82** and **84**. The end members may be and preferably are welded to the base member **80**. The end members **82** and **84** are similarly formed and each comprises a base portion **86** having outwardly extending flange portions **88** and **90** at the sides, top, and bottom thereof. The upper flat surfaces of the end members **82** and **84** form seats to which the yokes **92** and **94** are secured, as by means of bolts **96**. The upper ends of the yokes **92** and **94** are inwardly turned, and provide clevises within which the rams **40** and **42** are pivotally secured by means of pins **98**. The piston rods **100** and **102** of the rams **40** and **42**, respectively, are pivotally connected by means of pins **104** and **106** to pairs of laterally spaced bearing blocks **108** and **110**, which are secured to the upper grid member **24** at the opposite ends thereof.

The end member **82** also carries a pair of laterally spaced inwardly projecting bracket arms **112** which are provided with two spaced resilient bumpers **114** which are disposed to co-operate with the arm members **116** which are secured to and project upwardly from the upper grid **24**. The bumpers **114** and the arms **116** co-operate as hereinafter described to cushion the final closing movements of the contactor.

More particularly, the bumpers **114** are secured at opposite ends of a bar **118**, which is secured to a pin **120**. The pin **120** projects loosely through an opening in a co-operating bar **122**, and a spring **124** is provided to continuously urge the bar **118** towards the bar **122**, which movement is limited by the adjusting screws **126**, which are threadably received in the bar **122** and bear against the bar **118**. The spring **124** thus acts to withdraw the bar **118** to whatever position of adjustment is determined by the screws **126**. The bar **122** is rigidly secured to the previously-mentioned, spaced, forwardly projecting bracket members **112**.

The lower grid member **22** comprises a pair of similar laterally spaced base members **130**, which are secured to the previously-mentioned base **80** by a plurality of studs such as **132**, the heads whereof are loosely received in counterbored openings provided therefor in the base **80**, and which studs are tightened down sufficiently to compress a bumper pad **134**, formed of rubber or the like. The bumper pad is directly interposed between the base members **80** and **130**, and, as will be evident, serves to cushion loads applied to the lower grid member **22** by means of the upper grid member **24**.

The previously-mentioned lower grids **36** are of usual serpentine form and, like grids **32**, may be formed of any of the usual relatively highly resistant material such as cast iron. The individual convolutions of the grids **36** are provided with mounting tabs **140** by which the grids are rigidly secured to a pair of supporting blocks **142** and **144**, one pair of such blocks being individual to each grid **36**. The right-hand end of each base member **130** has a supplemental base member **148** rigidly secured to it as by welding, and these members **148** carry additional blocks **146**, which carry carbon contact elements **150**. The carbon contact elements are held in place on the blocks **146** by clamps **152**. The several pairs of blocks **142**, **144** and **146** may be formed of any suitable insulating material such as hard fiber. Blocks **142** and **144** are rigidly secured to the corresponding base members **130** by studs such as **154**.

The previously-mentioned conducting terminals **34** are secured by studs **160** to downwardly projecting portions **162** at the left-hand ends of the corresponding grid elements **36**, and rest upon insulating plates **164**, which, in turn, rest upon the corresponding base members **130**. It will be noticed, accordingly, that the terminals **34** are connected to the base members **130** through the grid elements **36** and the fiber blocks **142** and **144**.

The previously-mentioned insulating members **28** are connected, by means of studs **166**, to the corresponding fiber blocks **146**. It will be recalled that the blocks **146** are rigidly connected to the carbon contacts **150**, and contacts **150**, in turn, are rigidly connected to the grids **36**. The assemblies comprising the blocks **28** and **146** and the carbon contacts **150** are, consequently, secured to the base **130** through the grids **36** and the blocks **142** and **144**.

The upper grid member **24** is provided with a pair of laterally spaced base members **170** to which the previously-mentioned conducting terminal **30** and the insulating bar **26** are secured by means of studs **174** and **176**. The upper grids **32** are also of serpentine form with the central convolutions therein arranged in vertical registry with the central convolutions in the lower grids **32**. The upper grids are secured to a corresponding series of insulating blocks **180**, **182** and **184**, by means of screws **186**, and these blocks, in turn, are secured to the base members **170** by means of studs **188**. The left-hand ends of the upper grids **32** are provided with upwardly turned flanges **32***a*, by which these grids are rigidly connected to the conducting terminal **30**. The right-hand ends of the grids **32** are seated in and secured to corresponding carbon contacts **190**, which are complemental to the previously-mentioned carbon contacts **150**. The carbon contacts **190** are secured, by means of clips **192**, to fiber blocks **194**, which, in turn, are rigidly secured to the insulating member **26** by studs **198**.

The main base member **80** is provided with two pairs of side plates **200** which project upwardly therefrom and define a cradle within which the upper grid member **24** is received. These plates, as will be understood, prevent movement of the upper grid member **24** laterally of the lower grid member **22**. Corresponding guiding to keep the upper and lower grid members properly aligned with each other lengthwise thereof is afforded in part by the rams **40** and **42**, and in part by an articulated spring plunger **202**, having an upper section **202***a* and a lower section **202***b* pivoted thereto. The spring arm **202** passes downwardly between the laterally spaced halves of the upper and lower grid members and is provided with a compression spring **204** which acts between the arm **202** and a seat provided by an angle bracket **206** which extends between and is connected to the previously-mentioned upwardly projecting arms **116**. It will be noticed that the spring **202** continuously urges the upper grid member to an intermediate position in which the upper and lower grids **32** and **36** engage each other at the longitudinally central points thereof, which biasing effect is, however, overcome by the forces applied to the upper grid member by means of the rams **40** and **42**. It is preferred to supplement this aligning action by providing the upper grid member **24** with outwardly projecting pins **195** which ride in arcuate slots **197** formed in brackets **199** which are secured to the lower grid member

22. It will be understood that the slot 197 is shaped to define the free path followed by pins 195 during the rocking movements of the contactor.

It will be noticed that the upper surfaces of the lower grids 36, the terminals 34, the carbon blocks 150, and the insulating blocks 28 are formed as arcs of circles of equal radius and that the same is true of the under surfaces of the corresponding elements of the upper grid member 24. However, the radius of curvature of the upper grid member is somewhat smaller than the radius of curvature of the lower grid member, enabling the upper grid member to have rolling contact with the lower grid member in moving from the "off" position to the "on" position and vice versa.

It will be recalled from previous description that when the contactor is in the initial "on" position, the circuit extends through all of the upper and lower grids in series relation with each other, and it will be noticed also that each upper grid 36 and the corresponding lower grid 32 together form a pair of grids. The present structure utilizes two such pairs of grids, but it will be understood that additional such pairs may be used, if desired. By the addition of further pairs of grids 32—36 and co-operating contact elements, consequently, the number of grids available to the circuit may be increased at will.

Although only a single specific embodiment of the invention has been described in detail, it will be appreciated, as aforesaid, that various changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a contactor mechanism, the combination of a relatively fixed contact member having arcuately arranged portions, respectively, of low resistance, high resistance, and of insulating character, a relatively movable contact member having corresponding portions arranged on an arc of smaller radius, and means for rocking said relatively movable contact member from a position in which said insulating portions are in engagement through a position in which said high resistance portions are in engagement to a position in which said low resistance portions are in engagement.

2. In a contactor mechanism, the combination of a relatively fixed contact member having successively arranged portions, respectively, of low resistance, high resistance, and of insulating character, a relatively movable contact member having successively arranged corresponding portions, and means for moving said movable contact member from a position in which said insulating portions are in engagement through a position in which said high resistance portions are in engagement to a position in which said low resistance portions are in engagement.

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