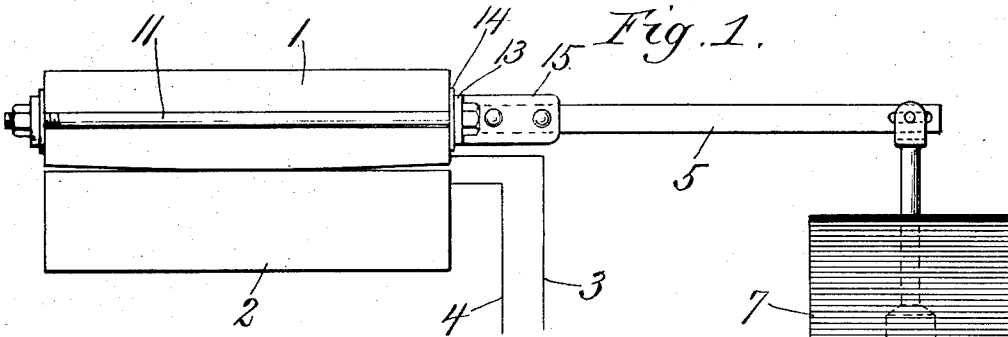
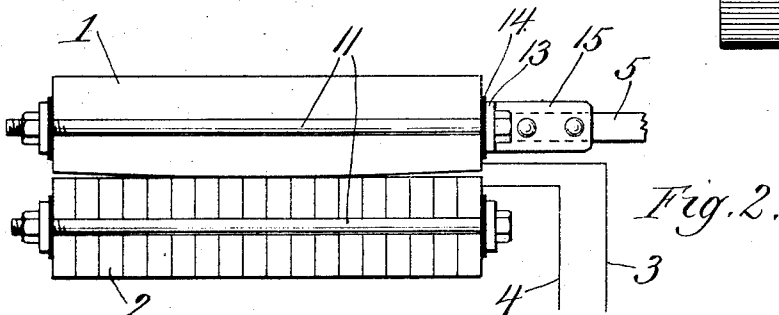
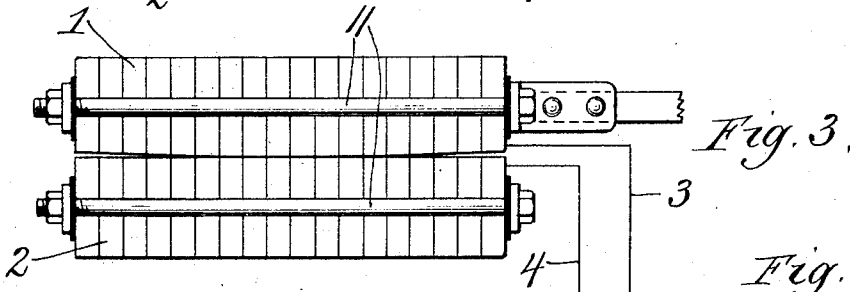
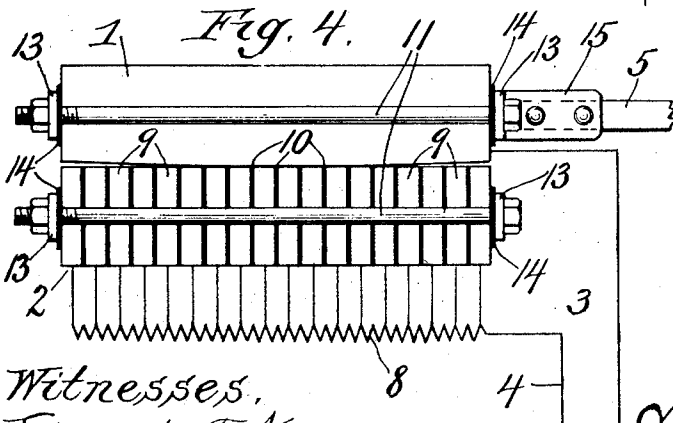
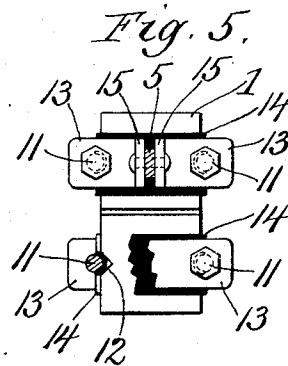


D. P. RUGER.
RHEOSTAT.
APPLICATION FILED JULY 22, 1910.

1,073,173.

Patented Sept. 16, 1913.

2 SHEETS—SHEET 1.



Witnesses,
Edward F. Wray.
Edna K. Reynolds.

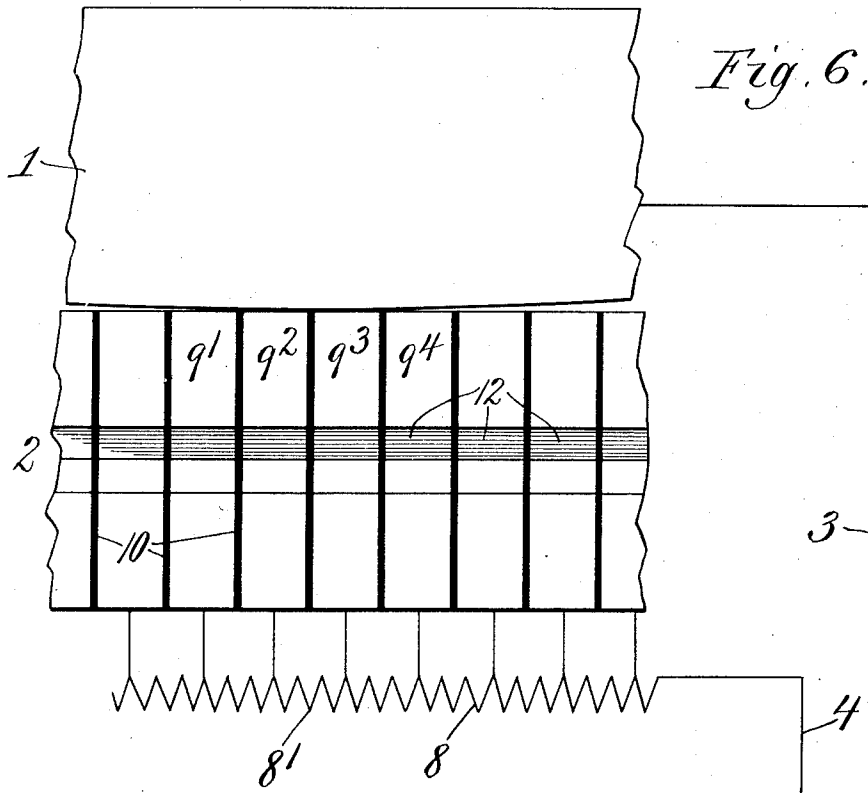
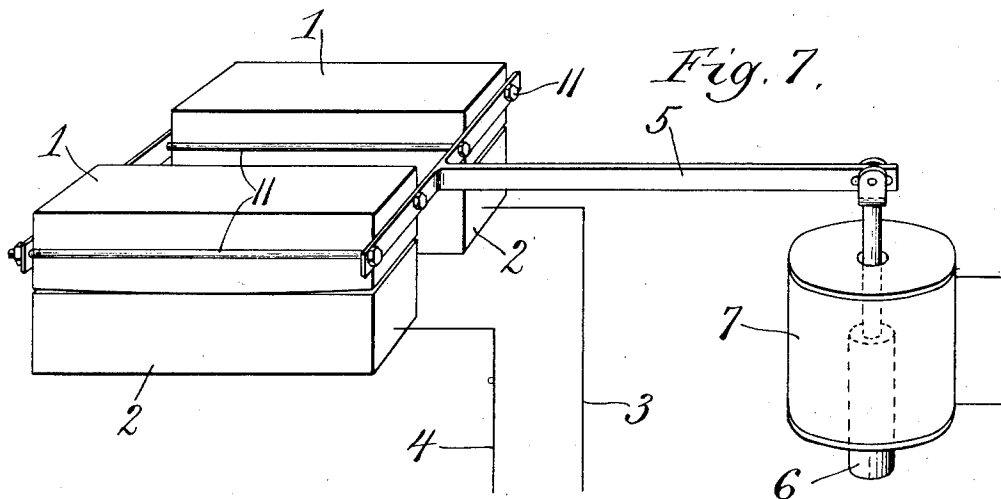
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2 SHEETS—SHEET 2.



Witnesses.
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UNITED STATES PATENT OFFICE.

DURL P. RUGER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THOMAS MARSHALL, OF CHICAGO, ILLINOIS.

RHEOSTAT.

1,073,173.

Specification of Letters Patent.

Patented Sept. 16, 1913.

Application filed July 22, 1910. Serial No. 573,167.

To all whom it may concern:

Be it known that I, DURL P. RUGER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Rheostats, of which the following is a specification.

This invention relates to devices for varying the resistance in an electric circuit, and has for its object to provide a new and improved device of this description.

The invention is illustrated in the accompanying drawing, wherein—

Figure 1 is a side elevation of one form of device embodying the invention; Figs. 2 and 3 are similar views showing modified constructions wherein one or both elements are divided into a series of parts; Fig. 4 is a side elevation showing a further modification in which an external resistance is used; Fig. 5 is an end view of the device shown in Fig. 4; Fig. 6 is an enlarged side elevation of a portion of the device shown in Fig. 4; Fig. 7 is a perspective view showing a modified construction in which there are two sets of elements acting as a unit.

Like numerals refer to like parts throughout the several figures.

Referring to Fig. 1, I have shown two cooperating elements, 1 and 2, adapted to be connected in an electric circuit by the conductors 3 and 4. As shown in this figure the elements each consist of a single piece of conducting material, such as carbon or any other material which will conduct electricity, and which will cause resistance at the point or place of contact of the two elements. The electric current when the device is in use will flow through one conductor, say, the conductor 3, to the element 1, thence to the element 2, and thence through conductor 4. The elements 1 and 2 are arranged so that the area of contact between them is smaller than the entire area of their adjacent faces. This result may be secured by making one or both of the elements with a more or less curved surface, the amount of curvature depending, of course, upon the conditions presented and the results desired. By this construction it will be seen that the elements may be rocked, that is, rolled one upon the other, so as to vary the position of the area of contact be-

tween them. The parts may be rocked by hand or in any other desired manner. As illustrated in Fig. 1, the element 1 is provided with a projecting part 5, having connected therewith a core 6 of a solenoid 7, so that the relative position of the elements 1 and 2 may be controlled by means of this solenoid. When the core of the solenoid is in its lowest position, the position of the area of contact between elements 1 and 2 would be at the edge nearest the solenoid, so that a very small amount of the resistance of said elements is in circuit. As the core of solenoid 7 is raised the position of the area of contact between elements 1 and 2 will move along the surface of said elements away from said solenoid, until when the core is in its highest position the area of contact will be at the edge of the elements farthest away from the solenoid. During this operation the resistance of elements 1 and 2 has been gradually introduced into the circuit until at the last position all of the resistance is in circuit. It will thus be seen that any desired amount of the resistance of elements 1 and 2 may be inserted in the circuit, and that the entire variation of the resistance is secured by a very small movement of the projecting part and the core 6 of the solenoid. In this construction the position of the area of contact between the elements 1 and 2 moves back and forth without a corresponding movement of the elements. The parts may be so constructed that a very small or limited rocking or rolling of the elements with relation to each other will produce a large range of movement of this area of contact with relation to the surfaces of the elements, and that only a very small amount of power is necessary to secure this movement. The device may therefore be very easily and effectively operated.

In Fig. 2 the element 1 consists of a single piece of material, but the element 2 is made up of a series of pieces of material making resistance contact with each other as well as with the element 1. The position of each of these pieces of element 2 is fixed with respect to the position of the adjacent pieces.

The construction shown in Fig. 3 is similar to that shown in Fig. 2, except that ele-

ment 1 is also divided up into a number of pieces, the pieces being of conducting material held against longitudinal movement with relation to each other, and making contact resistance with each other.

In Fig. 4 the element 2 is divided into a number of pieces of conducting material which are electrically connected to each other through an external resistance 8, the pieces 9 being separated from each other by the insulation 10. Each piece 9 is connected by a conductor to the proper point on the external resistance 8, as shown. The parts may be held together in any desired manner. As herein shown the pieces 9 are held in proper position by the rods 11, which engage grooves 12 in the sides thereof as shown in Fig. 5. These rods are passed through the end pieces 13, which are properly insulated from the pieces 9 by the insulating pieces 14. The element 1 may also be provided with similar rods 11 and end pieces 13 and insulating pieces 14. The projecting part 5 may be connected to the two projecting parts 15 on the end piece 13, as shown. The material of one of the elements 1 or 2 of Figs. 4 and 5 must be such that there will be substantial resistance between the two elements, non-metallic material such as carbon being the preferred material.

Fig. 6 shows a portion of the device illustrated in Figs. 4 and 5. The element 1 is shown in contact with the two adjacent pieces 9² and 9³ of the element 2. The current now flows from conductor 3 to element 1, thence through contact 9³ and then through resistance 8 to conductor 4. If, now, the element 1 is gradually rocked or rolled to the left, the pressure between element 1 and the piece 9³ will gradually decrease, and, since there is resistance between element 1 and the piece 9³, this decrease in pressure will increase the resistance between them, and this will continue until they are no longer in contact, whereupon the resistance between them will be such as to prevent the flow of current. As this change has been taking place the current flowing from element 1 to the piece 9³ has gradually been transferred to piece 9², due to the fact that the resistance between the piece 9² and element 1 has been decreasing while this change has been taking place. When the element 1 ceases to contact with the piece 9³, the current ceases to flow through said piece, and flows through the piece 9². The current now flows from conductor 3 to element 1, then through contact 2, thence through the external resistance 8 including the section 8¹ to conductor 4. The current is now compelled to pass through the additional section 8¹ of the external resistance 8, thus throwing more resistance into circuit. In the same way the various steps or portions of the external resistance 8 can be cut into

or out of circuit. By increasing the radius of curvature of the adjacent surfaces of elements 1 and 2, three or more conducting pieces of element 2 would be in contact with element 1 at one time, but the action of introducing the external resistance 8 in circuit would be similar to that herein described, except that the current would be divided among a greater number of paths.

The method of operation of the device as shown in Figs. 2 and 3 would be similar to that described with relation to Figs. 4, 5 and 6, except that the external resistance 8 of these latter figures would be replaced by the resistance between the conducting pieces. The device illustrated in Figs. 4, 5 and 6 is preferable where a greater resistance is desired than can be readily obtained through the resistance alone of the conducting pieces.

In Fig. 7 I have shown a construction where a plurality of elements, 1 and 2, are used. In this construction the conductors 3 and 4 may be connected to the stationary elements, and hence an electric connection to a moving element avoided. The current will then pass from conductor 3 to one element 2, thence to its opposed element 1, thence across to the other element 1, and thence to the opposed element 2, and thence to conductor 4.

It is, of course, evident that the form and construction of the two elements will depend upon the conditions presented, and the results desired, and that the form of resistance contact may of course be changed to meet the conditions presented.

I claim:

1. A resistance varying device comprising an element having a series of conducting pieces in proximity to each other so as to provide contact resistance to the passage of an electric current from one to the other at the surface of contact, and a cooperating element cooperating with said first element, the two elements having non-parallel faces when in contact arranged so that the position of the area of contact between the two elements is varied so as to vary the number of said conducting pieces in circuit to vary the resistance.

2. A resistance varying device comprising a resistance element provided with a series of conducting pieces fixed with relation to each other and making contact resistance with each other, and means for varying the number of said conducting pieces in circuit.

3. A resistance varying device comprising an element having a series of conducting pieces arranged in rows, the conducting pieces of each row making contact resistance with each other, a similar cooperating element having conducting pieces with resistance contact arranged in rows, said rows opposed to the said rows of the first element,

and means for rolling the two elements to vary the number of conducting pieces in circuit.

4. A resistance varying device comprising an element provided with a series of carbon strips placed upon end and arranged in rows, the carbon strips in each row making resistance contact with each other, the several rows connected in an electric circuit, a coöperating element adapted to make contact with a portion of said carbon strips, and means for varying the position of the area of contact between the two elements so as to vary the number of carbon strips in circuit.

5. A resistance varying device comprising an element having a series of carbon strips arranged in separate rows, the carbon strips in each row making electrical contact with each other, the several rows insulated from each other but connected in an electric circuit in series, a coöperating element connected in an electric circuit, the two elements having a small area of contact, and means for moving the position of the area of contact between the two elements back and forth across the face of said element so as to vary the resistance in the circuit.

6. A resistance varying device comprising two resistance coöperating elements having coacting surfaces of substantially the same length, and means for varying the position of the area of contact between said surfaces so as to change its location with relation to said elements.

7. A resistance device comprising two elements both made of material of poor electrical conductivity and located one above the other and having coacting surfaces of substantially the same length, said surfaces arranged so that only a portion is in contact at any given time, and means for moving the area of contact along said surfaces so as to change its location with relation to said elements.

8. A resistance varying device comprising two coöperating elements having coacting surfaces of substantially the same length, one of said elements made up of a series of conducting pieces fixed with relation to each other and having resistance contact with each other, and means for varying the position of the area of contact between the coacting surfaces of said two elements so as to change its location with relation to said elements to vary the number of conducting pieces in circuit.

9. A resistance device comprising two coöperating resistance elements having coacting surfaces, a comparatively small portion of said surfaces being in contact at a given time, and means for varying the position of the area of contact between said surfaces so as to change its location with relation to said elements by moving the adjacent ends of said elements toward and from each other.

10. A resistance varying device comprising two non-metallic resistance elements, each element having a face fixed with relation to said element, and coöperating with the other element, the fixed faces being non-parallel so that only a portion thereof can be in contact at one time.

11. A resistance varying device comprising a non-metallic resistance element, having a fixed contact face, a second resistance element having a coöperating contact face fixed with relation to said latter element, the coöperating face of one or both elements being curved so that only a portion of the coöperating surfaces can be in contact at a given time.

12. A resistance varying device comprising an element having a series of conducting pieces in proximity to each other, and electrically connected to each other through electrical resistance, and a coöperating element coöperating with said first element, the two elements having non-parallel faces when in contact, the material used in that portion of the two said elements where they come in contact being such that there will be resistance contact at the area of contact between them, these two elements being so arranged that the position of the area of contact between the two elements is varied so as to vary the amount of resistance in circuit.

13. The combination with an electric circuit of two coöperating elements of conducting material, one of which is made of resistance material, an external resistance connected at each end to one of said elements, and means for cutting said external resistance into or out of said electric circuit by breaking or making an electrical connection across the said two elements.

Signed at Chicago, Illinois, this 11th day of July, 1910.

DURL P. RUGER.

Witnesses:

DONALD M. CARTER,
EDNA K. REYNOLDS.