No. 792,195. PATENTED JUNE 13, 1905.

A. F. CHRISTMAS.

ROTARY MERCURY CIRCUIT BREAKER.

APPLICATION FILED AUG. 15, 1904.

2 SHEETS—SHEET 1.

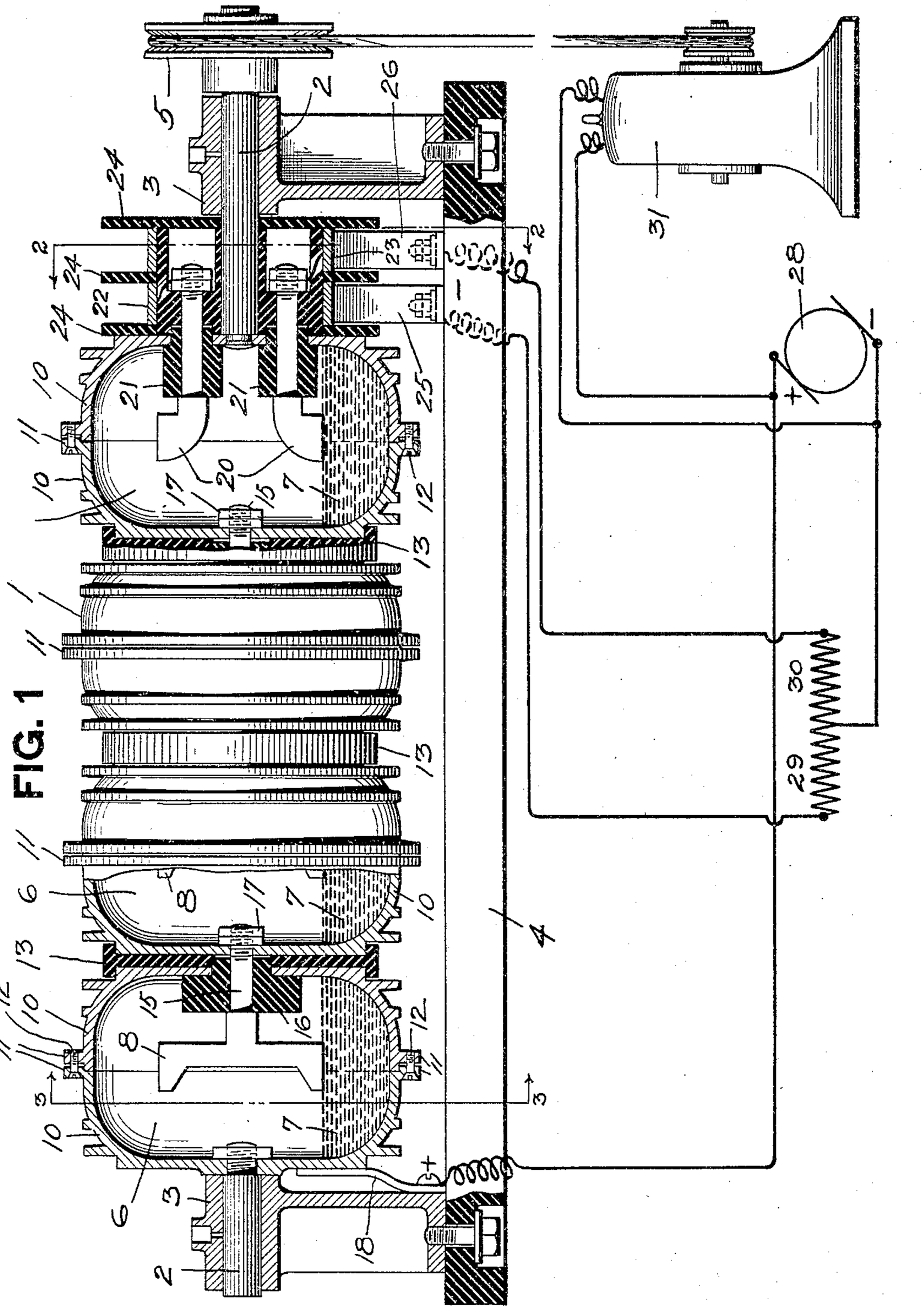

FIG. 1

WITNESSES.

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Adolph F. Christmas

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2 SHEETS—SHEET 2.

FIG. 3

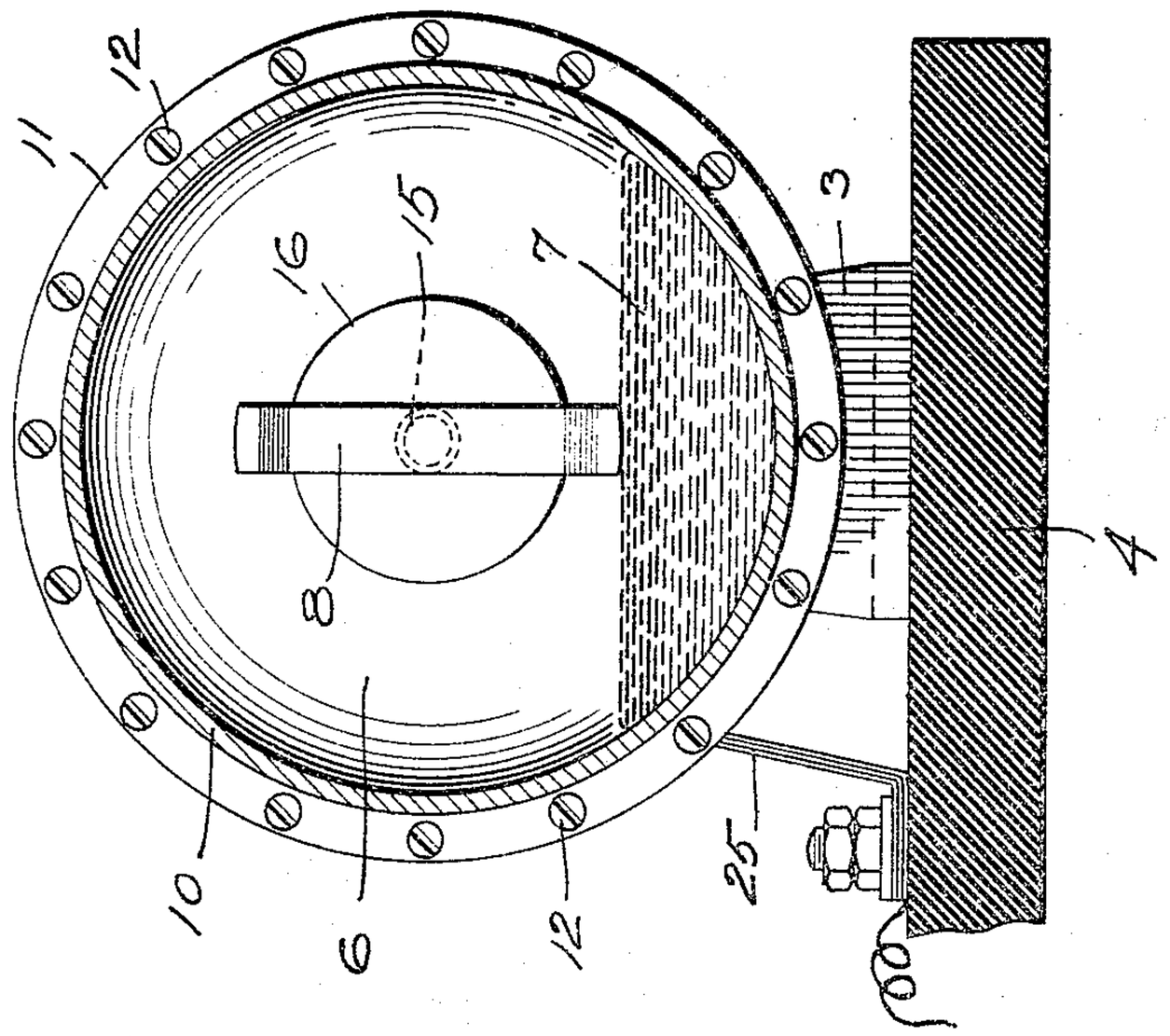
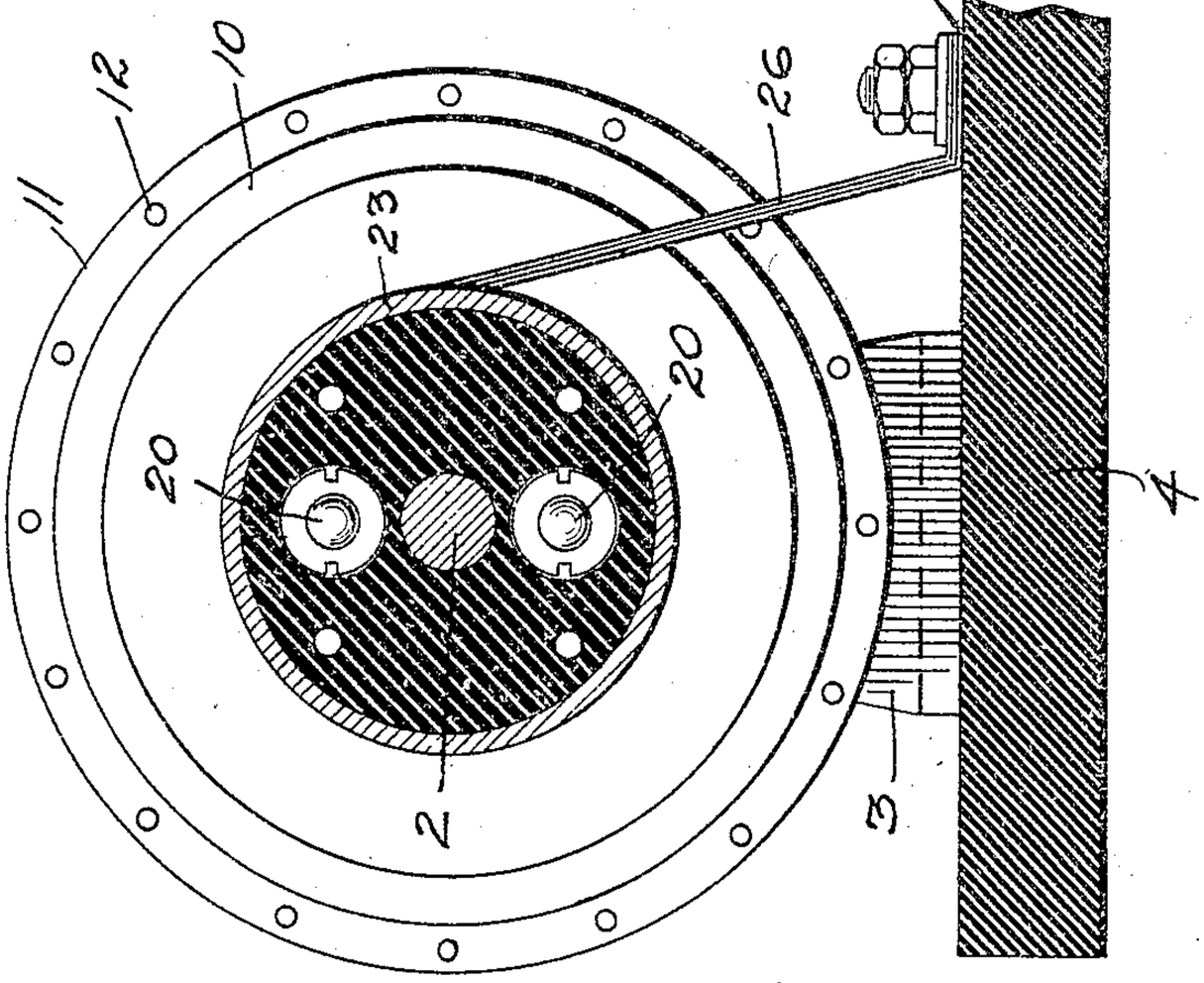


FIG. 2



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UNITED STATES PATENT OFFICE.

ADOLPH F. CHRISTMAS, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR OF TWO-THIRDS TO FRANK R. McFEATTERS, OF WILKINSBURG, PENNSYLVANIA.

ROTARY MERCURY CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 792,195, dated June 13, 1905.

Application filed August 15, 1904. Serial No. 220,823.

To all whom it may concern:

Be it known that I, ADOLPH F. CHRISTMAS, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Rotary Mercury Circuit-Breakers; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to circuit-interrupters, and more especially to devices of this character whereby heavy currents can be safely broken and made repeatedly.

The object of the invention is to construct circuit makers and breakers of this character, so that the evil effects which result from the arcs which are formed when a heavy current is broken are largely overcome.

With many translating devices—such, for instance, as reciprocating motors and the like—it is either necessary or desirable to break and make the circuit at rapid intervals. With heavy commercial currents this is difficult, because the arcs which are formed detrimentally affect the terminals of the circuit-breaker and soon destroy the same and make the interrupter useless. This difficulty has probably prevented the commercial use of translating devices which depend upon rapid interruptions of heavy commercial currents for their operation.

The object of the present invention is to provide a circuit-interrupter whereby the foregoing defects are overcome.

To these ends the invention consists, generally stated, in providing a plurality of pairs of terminals in series with each other, together with means for separating said several pairs of terminals substantially simultaneously, whereby the voltage of the current is divided by the number of pairs of terminals and the arcs which are formed at the separation of said terminals are proportionately decreased in size. Preferably one of each pair of terminals will be a body of mercury contained in a practically-sealed chamber, so that the arcs which are necessarily formed will expend themselves in volatilizing the mercury; but as the latter is contained in a closed chamber it will immediately condense and again join the body of mercury.

The invention also comprises certain details of arrangement, such as providing in connection with each body of mercury a pair of contacts, those of the last contacts of the series being independent and connected to different translating devices or to different windings of the same device and so arranged that the current will be alternately sent through the two translating devices or coils.

The invention also comprises certain details of construction, which will be hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a longitudinal section, partly in side view, of my improved circuit-interrupter, showing in diagram the circuits to which it is connected. Fig. 2 is a section on the line 2 2, Fig. 1; and Fig. 3 is a section on the line 3 3, Fig. 1.

My circuit-interrupter is constructed upon the principle that when an electric circuit is simultaneously broken at two or more points in series with each other the voltage of the current at each break will be the voltage of the original current divided by the number of such breaks. To this end the interrupter comprises a plurality of pairs of terminals in series with each other, together with means for simultaneously separating said several pairs, as a result of which the arcs formed at the several breaks will be very small compared to an arc which would be formed by breaking the same current at a single point. An interrupter constructed on this principle may be embodied in a large variety of forms. Preferably I employ mercury as one terminal of each pair and inclose the same in a chamber, so that the arcs which are formed will expend themselves in volatilizing the mercury, which will again condense. The separation of these mercury and their coacting metallic terminals may be brought about in any desired manner. Preferably, however, the interrupter will be of the rotary type, as thereby a more uniform movement can be imparted thereto and greater

uniformity in the succession of interruptions and making of the current obtained.

As shown in the drawings, the interrupter comprises a suitable body 1, mounted on trunnions 2 in bearings 3, secured to an insulating-base 4. This body can be rotated in any suitable way, such as connecting to one of the trunnions a belt-pulley 5 or other suitable means. The body 1 is provided with a series of chambers 6, four such chambers being shown; but the number thereof may be varied within wide limits, two or more embodying the principle of my invention. In each of these chambers is contained a body of mercury 7, which, however, only partially fills the same. Naturally in the rotation of the body the mercury will always remain in the lower portions of the several chambers. Also projecting into each chamber is a terminal or terminals 8, which in the rotation of the body come in contact with the mercury, thus establishing the electrical circuit. In order to facilitate construction, each of the chambers 6 is built up of a pair of metallic shells 10, united in any suitable manner, such as by the flanges 11 and screws 12. The shells of adjacent chambers are separated from each other by a disk of insulation 13, whereby electrical connection through the walls of said members is completely cut off. Each terminal 8 is provided with a stem 15, passing through a bushing of insulation 16, placed in the opening in the wall of the particular chamber in which said terminal is located, and the end of said stem has a metallic connection through nuts 17 with the walls of the adjacent chamber. Bearing against the outside of the first chamber 6 is a brush 18, which is connected with the positive pole of the source of electrical energy. As many terminals 8 will project into each chamber as the number of times it is desired to make and break the current at each rotation of the body. In the drawings said terminals are shown double, so as to close the circuit twice during each rotation of the body. Into the last chamber of the series also project as many terminals 20 as the number of times it is desired to make and break the circuit at each rotation of the body. Two such terminals are shown in the drawings, said terminals being independent of each other, so as to connect to two separate translating devices or to two coils of the same translating device. In case the translating device is only a single coil only one of such terminals may be used, or the two terminals would be connected together. These terminals 20 pass through bushings 21, of insulating material, set into the wall of the end chamber, and they are connected one to a metallic ring 22 and the other to a similar ring 23, which rings are suitably insulated from the body-bearings and from each other by disks of insulation 24. Bearing against the ring 22 is a brush 25 and bearing against the ring 23 is a similar brush 26, these brushes being connected to the two translating devices or to separate coils of the same translating device.

The interrupter described may be used in any electrical circuit, a suitable one being shown in Fig. 1, in which the dynamo or other generator is shown at 28, having its positive main connected to the brush 18 and having in its negative main two coils 29 and 30, which may represent independent translating devices or the two coils of a reciprocating motor, these coils being connected by suitable wires to the brushes 25 and 26, respectively.

The interrupter may be rotated by any suitable motor, and for this purpose I have shown a small electrical motor 31 belted to the pulley 5 on the interrupter. This, however, is not necessary, as the interrupter may be driven from any independent motor or from a counter-shaft in the factory or other convenient source.

In the operation of this interrupter the current coming from the generator will pass from the brush 18 to the body of mercury 7 in the first chamber. The mercury in the several chambers is always in contact with some portion of the annular metallic walls of said chambers. In the operation of the device when the body has been rotated so that the terminals 8 are in contact with the several bodies of mercury the current coming from the generator will pass from the brush 18 to the mercury in the first chamber, through the terminal 8 in that chamber and its stem to the metallic wall of the next chamber, thence to the body of mercury therein, thence through the terminal 8 in that chamber and its stem to the metallic wall of the next adjacent chamber, and so on continuously through the several chambers, and finally out of the interrupter through whichever one of the terminals 20 is in contact with the mercury in the last chamber, and thence to the translating device. As soon as the body has rotated sufficiently far to carry the terminals 8 out of contact with the bodies of mercury the current will be broken in each of the several chambers of the interrupter. As a consequence the voltage of the current at each break will be only such proportion of the entire voltage of the current as the number of interruptions bears to unity. The arcs formed at each break will be proportionately decreased, and as a consequence heavy commercial currents of high voltage can be safely broken and by a device of minimum size. Furthermore, the arcs will expend themselves in volatilizing the mercury; but as the latter is contained in closed chambers it will condense and again join the main body. It will be observed that the positive terminal in each chamber is the body of mercury, so that practically no detrimental effects whatsoever will be produced on the terminals 8, but the entire energy of the arc will be expended in volatilizing the mercury. The bodies of mercury only partially

fill the several chambers, and the terminals 8 merely sweep into contact therewith. As a result the circuit will be only momentarily closed and with the full strength of the current being interrupted during the greater portion of each revolution of the body 1. As a consequence the coil of the translating device is given a strong sudden energization; but the current will then cease, thus preventing the heating of the coil, as would be the case if the current continued to flow to the translating device for a longer period. The principle is analogous to that of the modern steam-engine, in which the steam is admitted to the cylinder for only a portion of the entire stroke of the piston. The terminals 8 are of small section in their arcuate paths, as shown in Fig. 3, so that the current will be maintained only a short interval of time. This interval may be increased or decreased by varying the arcuate width of said terminals, and in this manner the period of energization of the coil of the translating device can be regulated at will.

The details of construction of the circuit-interrupter may be varied within wide limits. If desired, the several chambers containing the mercury may be separated from each other by insulated walls having openings therethrough through which the mercury may flow and come into contact, thus forming the electrical connection between the several chambers of the series, as shown in my Patent No. 773,121, October 25, 1904, and described and claimed in my application, Serial No. 225,684, filed September 23, 1904.

What I claim is—

1. A circuit-interrupter comprising a plurality of pairs of terminals in series with each other, one terminal of each pair being mercury and the other being solid metal, and said terminals being so arranged that the current passes from the mercury to the solid metallic terminal of each pair, and means for separating said several pairs of terminals substantially simultaneously.

2. A circuit-interrupter comprising a plurality of pairs of terminals in series with each other, one terminal of each pair being a mobile conducting medium contained in a closed chamber, and means for separating said several pairs of terminals simultaneously.

3. A circuit-interrupter comprising a plurality of pairs of terminals in series with each other, one terminal of each pair being mercury contained in a closed chamber, and means for separating said several pairs substantially simultaneously.

4. A circuit-interrupter comprising a body having a plurality of chambers therein, a pair of terminals exposed in each chamber, one at least of said terminals being mercury, and constant electrical connections to the mercury in one end chamber, said body being movable to bring the other terminals into and out of contact with the mercury terminals.

5. In a circuit-interrupter, the combination of a body having a plurality of chambers, a body of mercury in each chamber but only partially filling the same, electrical connections to the mercury in the first chamber, terminals projecting into each chamber and having electrical connection to the mercury of the succeeding chamber, and electrical connections to the terminal projecting into the last chamber, said body being movable to bring the several terminals substantially simultaneously into and out of contact with the mercury bodies in said chambers.

6. A circuit-interrupter comprising a rotatable body provided with a plurality of chambers, a body of mercury in each chamber but only partially filling the same, permanent electrical connections to the mercury in the first chamber, terminals projecting into each chamber, permanent electrical connections to the terminal of the last chamber, and the terminals of each intermediate chamber being in permanent electrical connection with the mercury of the succeeding chamber.

7. A circuit-interrupter comprising a rotatable body having a plurality of chambers, a body of mercury in each chamber but only partially filling the same, and a pair of metallic terminals exposed in each chamber, the metallic terminals of the last chamber being independent and having separate electrical connections, and the terminals in each intermediate chamber being in electrical connection with the mercury in the succeeding chamber.

8. A circuit-interrupter comprising a rotatable body having a plurality of chambers with the walls formed in part of insulating material, a body of mercury in each chamber but only partially filling the same, annular metallic portions exposed in each chamber and with which the mercury is in constant contact, electrical connections to the annular metallic portions of the first chamber, another metallic contact portion or portions exposed in each chamber at a point or points entirely therein and arranged in the rotation of the body to come into contact at intervals with the mercury, electrical connections to the contact portion or portions of the last chamber, and electrical connections from such contact portion or portions of each intermediate chamber to the annular metallic contact portion of the succeeding chamber.

9. A circuit-interrupter comprising a rotatable body having a plurality of chambers, a body of mercury in each chamber but only partially filling the same, electrical connections to the mercury of the first chamber, metallic terminals of small section in their arcuate paths projecting into each chamber and having electrical connection with the mercury in the succeeding chamber, and electrical connections to the metallic contacts of the last chamber.

10. A circuit-interrupter comprising a body

composed of a plurality of chambers having metallic walls and insulated from each other, a body of mercury in each chamber but only partially filling the same, metallic contacts projecting into each chamber but insulated from the walls thereof and having metallic connection with the walls of the succeeding chamber, the metallic contact of the last chamber having an electrical connection thereto, and a brush bearing against the metallic wall of the first chamber.

11. A circuit-interrupter comprising a body composed of a plurality of chambers having metallic walls and insulated from each other, bearings in which said body is rotatably mounted, a body of mercury in each chamber but only partially filling the same, a brush bearing against the wall of the first chamber, a pair of independent terminals projecting into the last chamber and insulated therefrom, a pair of contact-rings to which said terminals are independently connected, and a pair of terminals projecting into each chamber but insulated from the walls thereof and having a metallic connection with the walls of the succeeding chamber.

In testimony whereof I, the said ADOLPH F. CHRISTMAS, have hereunto set my hand.

ADOLPH F. CHRISTMAS.

Witnesses:

ROBERT C. TOTTEN,

G. KREMER.