(No Model.) 2 Sheets—Sheet 1.

J. T. HUNT.

ELECTRIC SWITCH.

No. 564,283. Patented July 21, 1896.

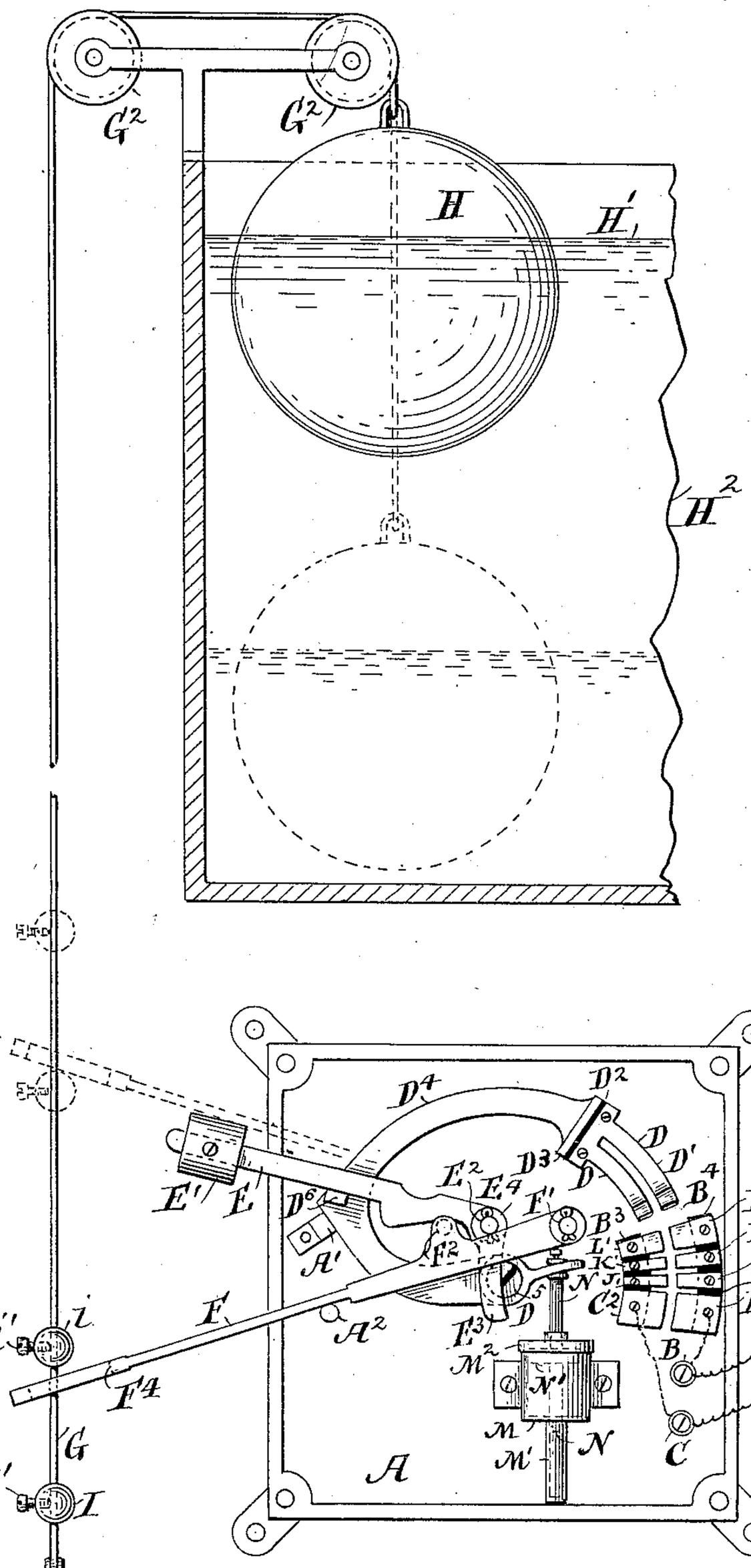

Fig. 1

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Fig. 2

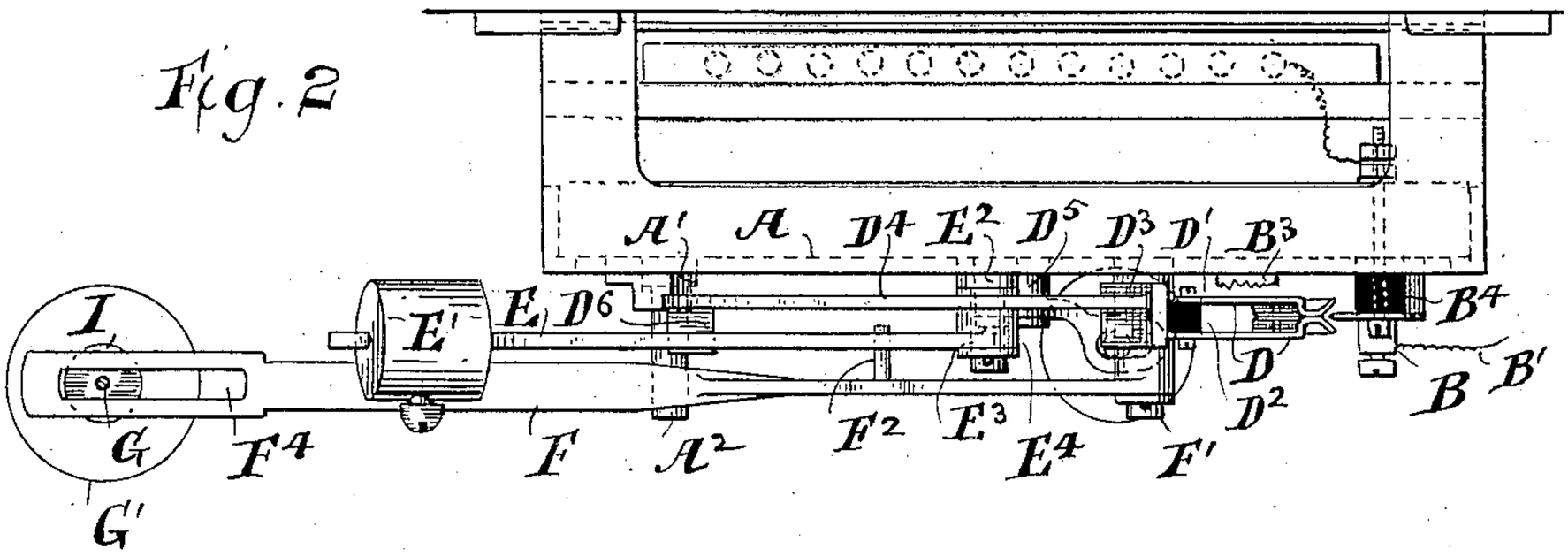


Fig. 3

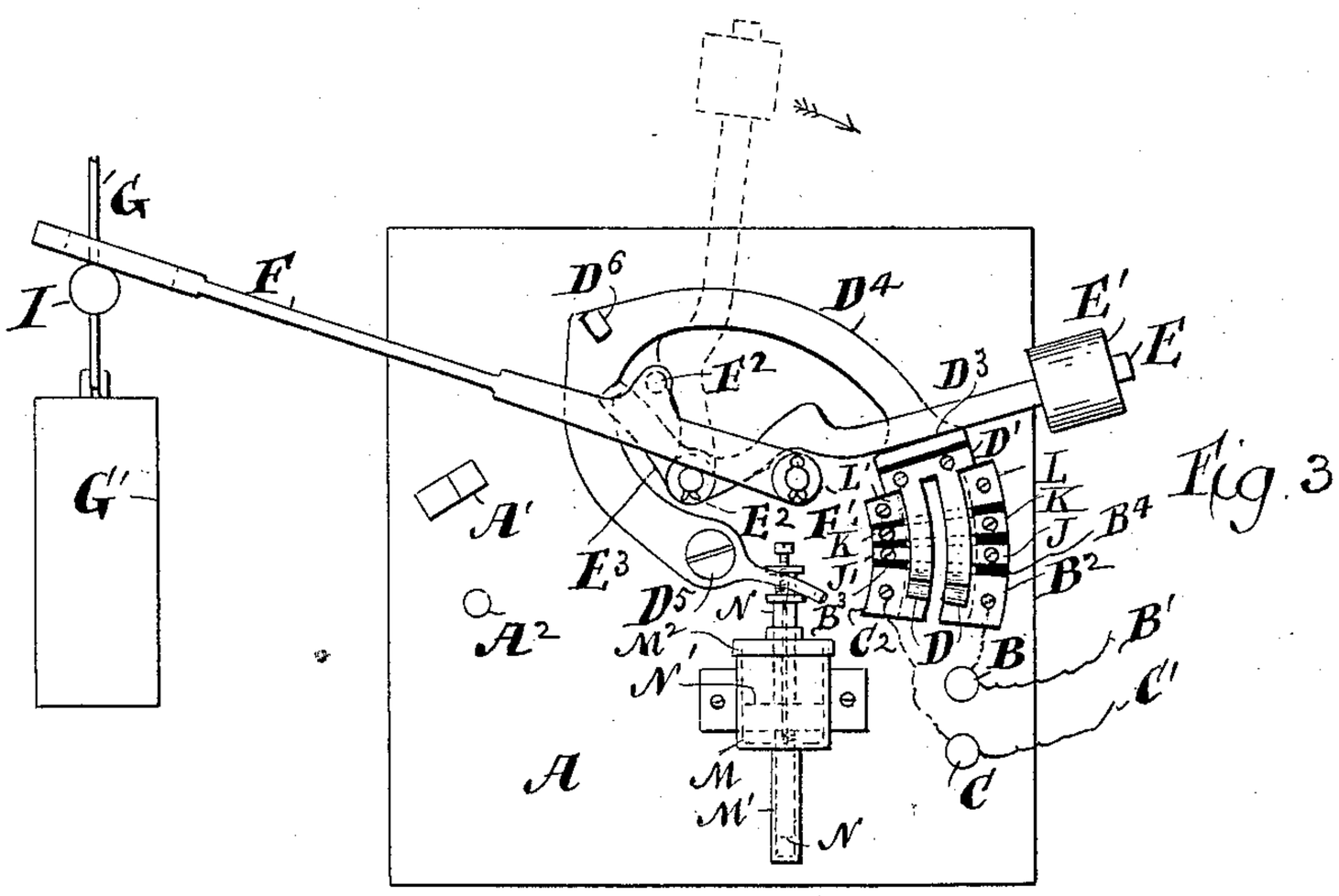
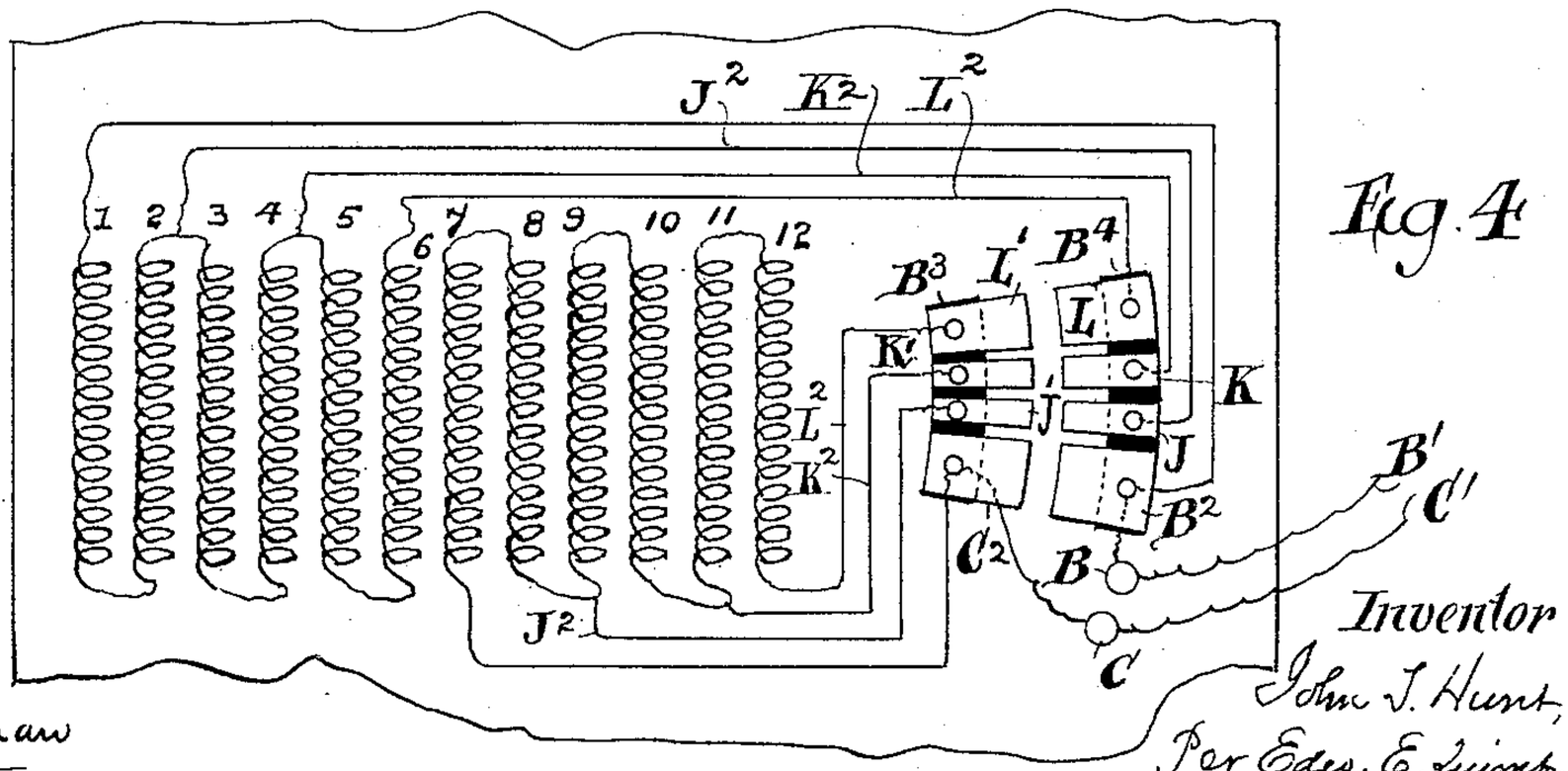


Fig. 4



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UNITED STATES PATENT OFFICE.

JOHN T. HUNT, OF NEW YORK, N. Y.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 564,283, dated July 21, 1896.

Application filed May 12, 1896. Serial No. 591,246. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. HUNT, of the city and State of New York, have invented certain Improvements in Electric Switches or Circuit Closers and Breakers, of which the following is a specification.

This invention consists of a vibratable contact-carrier having a rapid motion in one direction when breaking the electric circuit in connection with which it is employed, and having in the opposite direction a rapid motion of less range for closing a branch circuit of high resistance, followed by a slow motion in the said opposite direction while successively cutting out a series of resistances, and finally closing the main circuit. The said contact-carrier is so arranged as to be thrown from either one of its two extreme positions to the other by an appropriately-arranged trip-lever having its lower end mounted upon a pivot, and having its upper end provided with a weight whereby, whenever the said trip-lever is slightly out of its median position in either direction, gravity causes it to swing to the right or left, as the case may be, and during the latter portion of such swing to deliver a push against either one or the other, as the case may be, of two bearings upon said vibratable contact-carrier, intersecting the plane of movement of parts of said trip-lever. The vibration of the contact-carrier in the direction required to break the circuit is unobstructed, and hence the contact-carrier when actuated for the purpose of breaking the circuit is rapidly vibrated from one of its extreme positions to the other. The vibration of the contact-carrier in the opposite direction, after it has moved far enough to close the high-resistance branch circuit is retarded by an instrumentality (as, for example, a dash-pot) which compels it to complete its circuit-closing motion with prescribed slowness. The resistance-coils of a suitable rheostat are appropriately connected with pairs of stationary terminal strips arranged in concentric arcs in the path of a contact-maker mounted upon the contact-carrier, whereby during the slow circuit-closing movement of the contact-carrier the resistances are successively cut out.

An incidental feature of the invention consists in the employment upon the contact-carrier of a contact-maker composed of parallel metallic strips, the free ends of which spring toward each other, and at their extremities flare in opposite directions, whereby they are adapted to engage and embrace the stationary terminal strips and bear with elastic pressure upon the opposite sides thereof.

The invention further embraces an operating-arm, which is adapted to be automatically actuated and which swings in a plane parallel to the plane of motion of the trip-lever, and is adapted to push the trip-lever from either of its extreme positions upward and over to a point slightly beyond its median position and thus free the trip-lever to the action of gravity by which it is made to fall toward its nearer extreme position.

This apparatus, which may be usefully employed for a variety of purposes, is of especial value for automatically governing the operation of an electrically-driven pump for keeping a water-tank supplied with a prescribed quantity of water. When thus employed, the apparatus will usually be arranged in a vertical position. The actuation of the operating-arm is governed by a float in the tank, which, when the water rises to a prescribed height, causes the operating-arm to be depressed, and to thereby push the trip-lever upward and over to a point beyond its median position, and thus cause it to fall in the direction required to effect the disengagement of the contact-maker from the poles of the electric circuit, and to thus break the circuit and cut off the supply of current to the electric motor which drives the pump. Conversely, when the water in the tank falls below a prescribed level, the float in falling down pulls the operating-arm upward and pushes the trip-lever in the contrary direction past its median position, causing it to fall in the direction required to enable it to throw the contact-maker into engagement with the poles of the electric circuit, and to thus close the circuit and renew the supply of current to the motor.

Owing to the rapidity with which the circuit is broken by this apparatus, there is no material sparking, while any danger from sparking when the circuit is closed is obviated by the employment of a rheostat, to the

introduction of which the organization readily lends itself. The employment of the rheostat is desirable in all those cases where it is necessary to avoid a sudden rush of current, as, for example, in cases where the circuit in connection with which the apparatus is employed, contains, in addition to a motor, electric lights which sudden extreme variations in the strength of the current would cause to flicker, or in cases where a motor is employed in connection with a safety-fuse which might be melted, if the full current were instantly turned on, before the static inertia of the motor could be overcome.

It will, of course, be understood that the apparatus may be employed for opening and closing a circuit by means of which any kind of work is performed, and also that the contact-carrier may have mounted upon it a multiplicity of independent contact-makers and thus be employed for opening or closing a multiplicity of electric circuits, severally having their terminal strips arranged in appropriate relation to the paths of motion of the several contact-makers mounted upon the carrier.

The accompanying drawings of an electric switch embodying the invention are as follows:

Figure 1 is a front elevation of the switch, showing the operative parts in solid lines in the positions which they occupy after the circuit has been opened, also affording a sectional view of a portion of an elevated tank containing a body of water, and illustrating the employment of the partially-counterbalanced float for actuating the operating-arm of the switch to open the circuit when the tank is full or to close the circuit when the water in the tank falls to a prescribed level. Fig. 2 is a top view of the switch, showing the parts in which they are represented in Fig. 1. Fig. 3 is a front elevation showing the operative parts in solid lines in the positions which they occupy when the circuit is closed, and showing the trip-lever in dotted lines in the position to which it has been elevated by the actuating-arm and from which it has fallen to effect the closing of the circuit. Fig. 4 is a diagrammatic representation of the branch circuits containing the resistance-coils, showing the manner in which they are connected to the stationary terminal strips.

For convenience of description it will be assumed that the switch is employed for the purpose of opening or closing a single main circuit, and it will be understood that the several vibrating parts move in parallel vertical planes.

The plate A is provided with two binding-posts B C, to which the ends of the line-wires B′ C′ are respectively connected. The binding-posts are electrically connected with the main-circuit terminal strips B^2 C^2, which are affixed to the insulating-blocks B^3 B^4, and are appropriately arranged to occupy the latter part of the path of vibration of the parallel fingers D D, composing the contact-maker D′, which is fastened to the insulating-block D^2, appropriately secured to the shoulder D^3 upon the free end of the vibratable contact-carrier D^4, which is pivotally connected to the plate A by the pivot D^5.

The circuit-opening movement of the contact-carrier D^4 is arrested by its collision with the stop A′, affixed to and projecting outwardly from the plate A. On its outer face the contact-carrier D^4 is provided with the lug D^6, which projects outwardly across the plane of movement of the trip-lever E, which near its upper end carries the weight E′.

When the circuit has been opened, the contact-carrier bears against the pin A′, and the trip-lever E bears against the lug D^6, as represented in Fig. 1. When the circuit is fully closed, the end of the contact-carrier carrying the contact-maker D′ bears against the insulating-blocks B^3 B^4, and the trip-lever E bears against the shoulder D^3, the parts then occupying the positions in which they are represented in Fig. 3.

The trip-lever E rocks upon the pivot E^2, affixed to the plate A. An elbow E^3 projects laterally from the hub E^4 of the trip-lever. The operating-arm F is pivoted by the pivot F′ to the plate A, and at an appropriate distance from its axis is provided with the rearwardly-projecting pin F^2, adapted to engage the side of the trip-lever or the side of the elbow E^3, as the case may be.

The pin A^2, affixed to the plate A, serves as a stop to limit the range of downward movement of the operating-arm F. Near its free end the operating-arm F is provided with a slot F^4, through which extends the weighted cord G, having the weight G′ attached at its lower end. The cord G extends upward from the weight G′ and is led over suitable guide-rollers G^2 G^2, and is attached to the hollow globe H, which floats in the body of water H′, contained in the tank H^2.

Near its lower extremity the cord G is provided with the adjustable perforated tappets I *i*. The cord G extends through the tappets I *i*, which are secured in the desired positions by means of the set-screws I′ *i*′. When the prescribed quantity of water is contained in the tank, the hollow globe H floats in the position in which it is represented in solid lines in Fig. 1, and the operating-arm F, together with the tappets I *i*, occupy the positions in which they are represented in solid lines in Fig. 1. The tappets I *i* and the free end of the operating-arm F are represented in Fig. 1 in dotted lines in their highest positions, which they are made to occupy by the lowering of the water in the tank, and the consequent descent of the hollow globe H to the position in which it is represented in dotted lines.

The descent of the hollow globe or float H pulls the weight G′ upward to the position relatively to the switch in which it is represented in Fig. 3, in which, as will be seen, the

lower tappet I has raised the free end of the operating-arm F so far that it has swung the trip-lever E past its median position, as shown in dotted lines, so that the trip-lever E has commenced to fall toward the shoulder D^3, near the free end of the contact-carrier, by its collision with which the contact-carrier D^4 is rocked into the position in which it is shown in full lines in Fig. 3, in which, as will be seen, fingers D D of the contact-maker are in contact with the stationary strips B^2 C^2, thereby closing the main circuit. It is also to be observed that any means for automatically actuating the operating-arm is to be regarded as the equivalent of the float and weighted cord, in view of the fact that the operating-arm is employed to move the trip-lever from either one of its extreme positions slightly past its median position to such a point that the force acting upon the trip-lever becomes operative for rocking the trip-lever to its nearer extreme position, thereby enabling the trip-lever to administer to the contact-carrier the percussive blow by which the contact-carrier is rapidly thrown in the required direction.

The mode of employing the rheostat is diagrammatically illustrated in Figs. 2 and 4. The plate A, in addition to being provided with the two strips B^2 and C^2, which constitute the terminals of the main circuit, is also provided with the stationary strips J J′, K K′, and L L′, arranged in the same vertical plane and adjoining the strips B^2 and C^2. The strips J J′ constitute the terminals of the branch circuit J^2, the strips K K′ the terminals of the branch circuit K^2, and the strips L L′ the terminals of the branch circuit L^2. The fingers D D of the contact-maker are adapted to bear with elastic pressure upon the opposite sides of the terminal strips over which they move, as shown in Figs. 2 and 3.

When the contact-maker D′ closes the circuit L^2, the path of the current from the terminal strip L to the terminal strip B^2 includes the resistance-coils 1, 2, 3, 4, 5, and 6, while the path from the terminal strip L′ to the terminal strip C^2 includes the resistance-coils 7, 8, 9, 10, 11, and 12. Therefore the closed branch circuit L^2 includes twelve resistance-coils. When the contact-maker D′ in its further progress closes the branch circuit K^2 by connecting the terminal strips K and K′, the path from the terminal strip K to the terminal strip B^2 includes only the resistance-coils 1, 2, 3, and 4, while the path from the terminal strip K′ to the terminal strip C^2 includes only the resistance-coils 7, 8, 9, and 10, four resistance-coils being thus cut out. Similarly, when the contact-maker closes the branch circuit J^2, the path of the current from the terminal strip J to the terminal strip B^2 includes only the resistance-coils 1 and 2, while the path from the terminal strip J′ to the terminal strip C^2 includes only the resistance-coils 7 and 8, and thus four more resistance-coils are cut out. Finally, when the contact-maker makes contact with the terminal strips B^2 and C^2, the path of the current from the terminal strip B^2 to the terminal strip C^2 is through the electrically-connected fingers of the contact-maker, and thus all the resistance-coils, branch circuits, and pairs of terminal strips may be employed without departing from the invention, but for ordinary uses the described arrangement of resistances will suffice.

The velocity of the circuit-closing movement of the contact-carrier after the contact-maker has closed the branch circuit L^2 is diminished in a slight degree by the frictional bearing of the fingers D D of the contact-maker upon the stationary terminal strips, but to a greater degree and mainly by means of an ordinary dash-pot M, the valve-stem N of which is seated in the guide-tube M′, projecting downward from the lower end of the dash-pot, and extends therefrom, through and above the head M^2 of the dash-pot, and near its upper end is loosely connected with a part of the contact-carrier.

The valve-stem N is entirely free to move upward, but its downward movement is retarded in the usual way by the slow escape of the air from the space within the dash-pot beneath the plunger N′. Hence the connection of the valve-stem N with the contact-carrier does not interfere with any part of the circuit-breaking motion of the contact-carrier, but does lead to the retardation of the circuit-closing motions of the contact-carrier.

The loose connection of the contact-carrier with the valve-stem N permits of a certain amount of lost motion after the contact-carrier has begun to make its circuit-closing movement, so that the dash-pot is not brought into effective action as a retarder until the contact-maker has engaged the terminal strips L L′ of the branch circuit L^2.

What I claim as my invention is—

1. In an electric switch, a carrier for carrying a contact-maker, a weighted trip-lever and an operating-arm, all mounted upon a supporting-plate and adapted to be vibrated in parallel planes, and severally differing in their ranges of vibration; means for communicating vibratory motion from said operating-arm to said trip-lever for pushing said trip-lever upward and over from either of its extreme positions to a point beyond its median position and thereby freeing it to the influence of gravity; means for communicating vibratory movement to said carrier from said trip-lever during a part of the time while said trip-lever, under the influence of gravity, is falling in either direction, and means for swaying said operating-arm upon its axis, in combination with a plurality of pairs of stationary terminal strips arranged in the plane of motion of said contact-maker and electrically connected with the terminals of a main circuit and with branches thereof of prescribed resistances and means for slowing the circuit-closing motion of said contact-maker over said terminal strips.

2. In an electric switch, a plurality of pairs of stationary terminal strips electrically connected with the terminals of a main circuit and branches thereof of prescribed resistances; a carrier vibratable within prescribed limits; a contact-maker mounted upon said carrier and adapted to embrace and bear with elastic pressure upon the opposite sides of said pairs of terminal strips; a weighted trip-lever for driving said movable contact-carrier into or out of contact with said pairs of stationary terminal strips, and means for automatically pushing said trip-lever from either of its extreme positions upward and over to a point slightly past its median position and thus freeing it to the action of gravity, as and for the purposes set forth.

3. In an electric switch, a vibratable contact-carrier; a weighted trip-lever swaying in a vertical plane parallel with the plane of vibration of said contact-carrier; an operating-arm for pushing said trip-lever from either of its lowest positions upward and over to a point slightly past its median or vertical position, and thus freeing it to the action of gravity; lugs or shoulders connected with said vibratable carrier and intersecting the path of motion of parts of said trip-lever for the purpose of compelling said contact-carrier to partake of the concluding parts of the motions of the said trip-lever in either direction; stops for limiting the range of vibratory movements of said contact-carrier and said trip-lever, and a dash-pot suitably connected with said contact-carrier for retarding a part of the contact-closing motion of said carrier, while leaving said contact-carrier free to move rapidly during the whole of its circuit-breaking motion.

4. In an electric switch for automatically opening or closing an electric circuit supplying a current for the performance of work; a vibratable carrier; a contact-maker mounted upon said carrier; a series of pairs of terminal contact-strips arranged in a part of the plane of motion of said contact-maker; a vibratable weighted trip-lever for imparting to said vibratable carrier prescribed ranges of vibratory movements in opposite directions; a vibratable operating-arm for pushing said weighted trip-lever upward and over from either of its extreme positions to a point slightly past its median position; an elevated tank for containing a liquid; a float for floating in said liquid, and connections between said float and said operating-arm for communicating motion from said float to said operating-arm, as and for the purpose set forth.

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