P. HERD.

TRIPPING DEVICE REGULATOR FOR ELECTRICAL SWITCHES.

APPLICATION FILED SEPT. 4, 1909.

991,849.

Patented May 9, 1911.

2 SHEETS—SHEET 1.

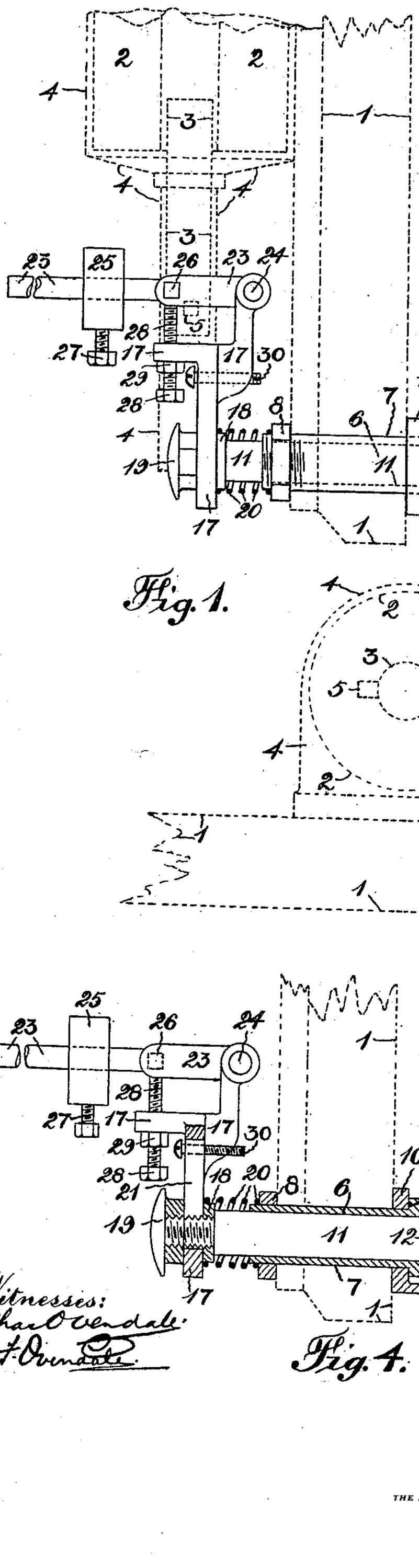

Fig. 1.

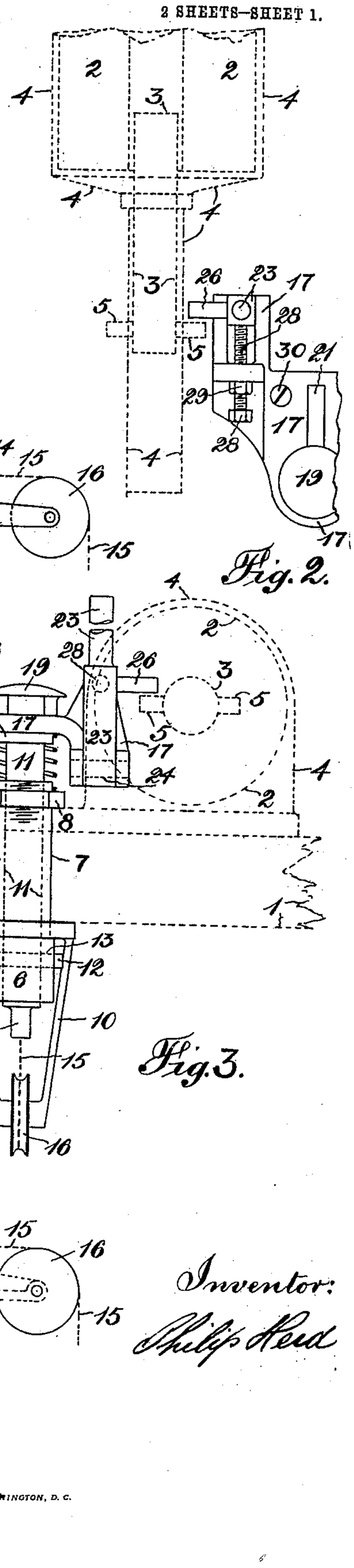

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses:
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2 SHEETS—SHEET 2.

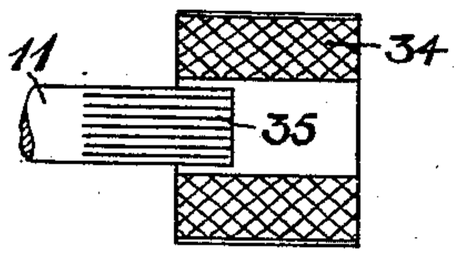


Fig. 7.

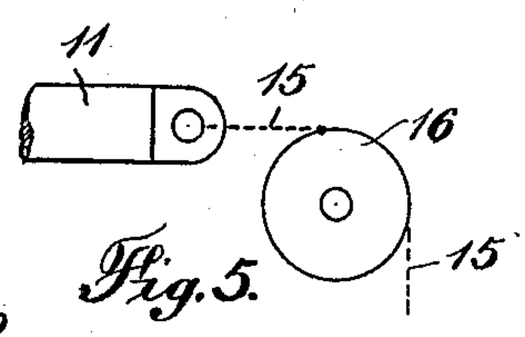


Fig. 5.

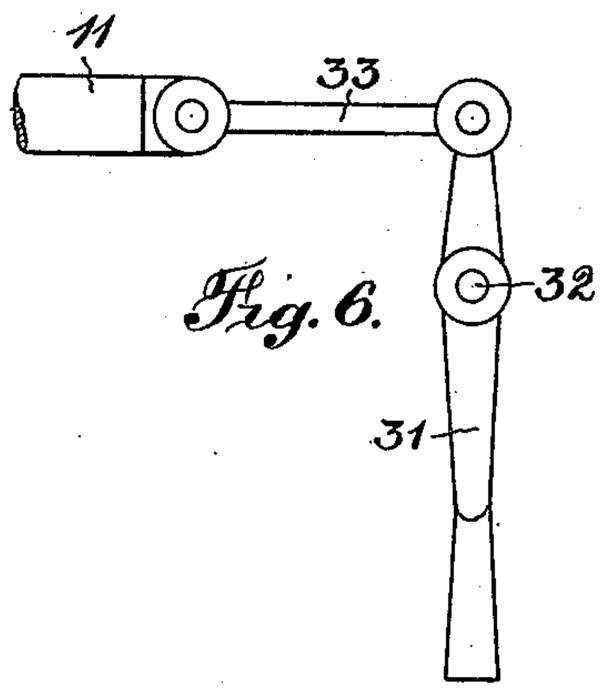


Fig. 6.

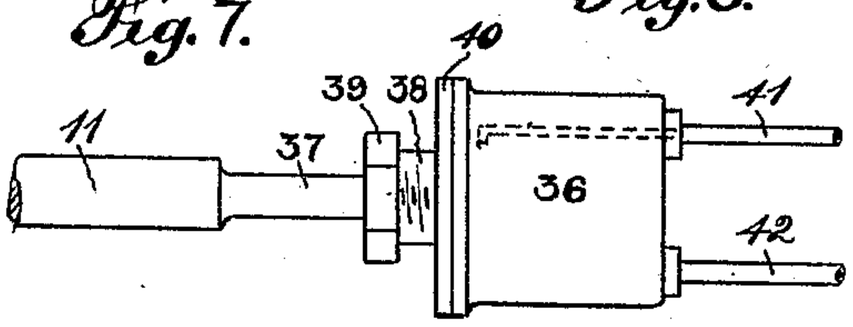
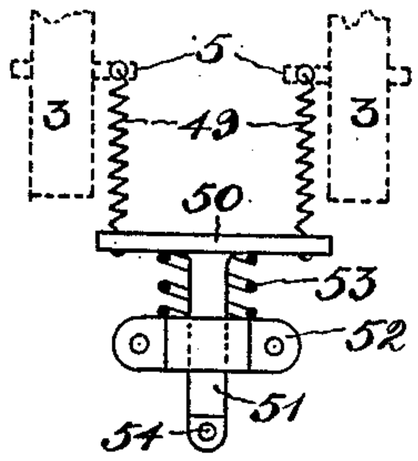
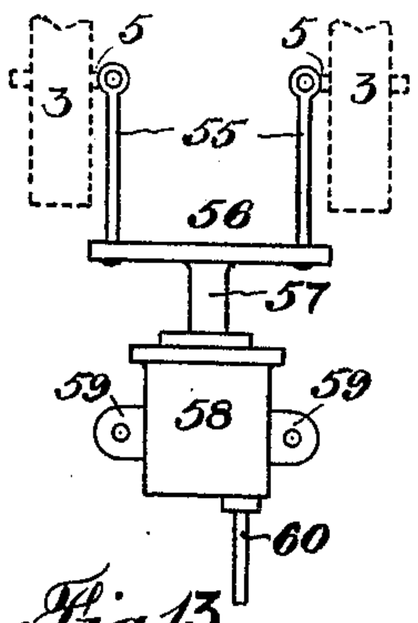


Fig. 8.





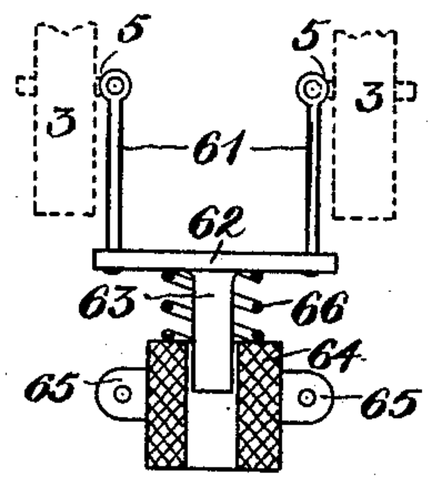


Fig. 12.

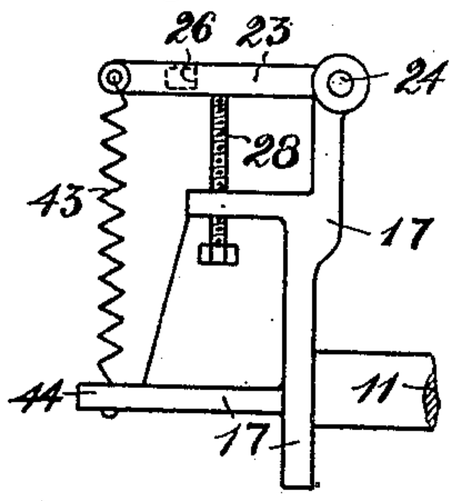


Fig. 9.

Fig. 13.

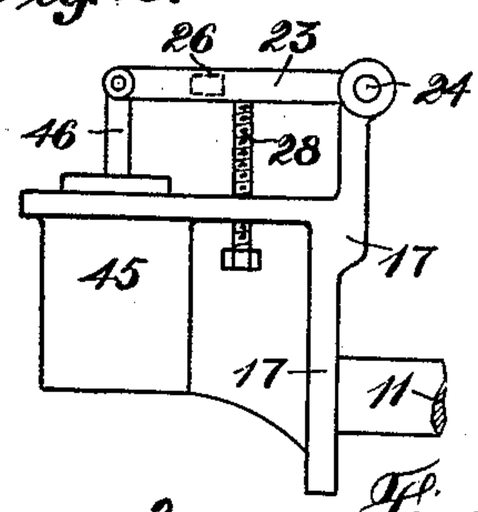


Fig. 10.

Fig. 14.

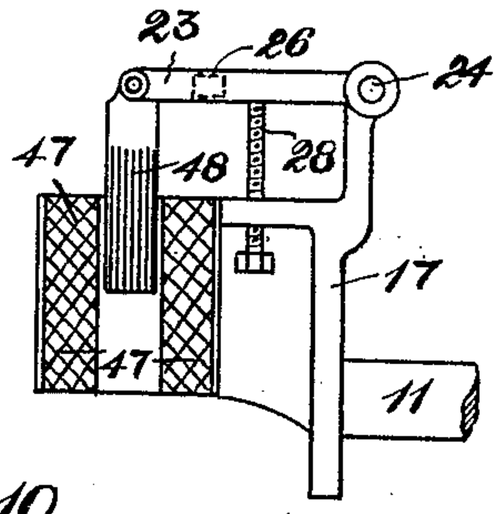


Fig. 11.

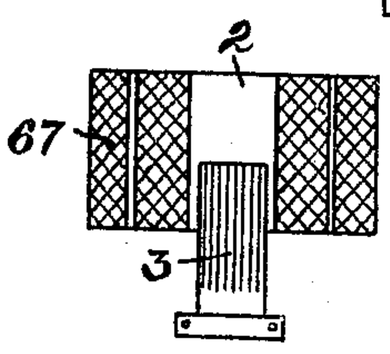


Fig. 15.

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UNITED STATES PATENT OFFICE.

PHILIP HERD, OF JOHANNESBURG, TRANSVAAL.

TRIPPING-DEVICE REGULATOR FOR ELECTRICAL SWITCHES.

991,849. Specification of Letters Patent. Patented May 9, 1911.

Application filed September 4, 1909. Serial No. 516,304.

To all whom it may concern:

Be it known that I, PHILIP HERD, a subject of the King of Great Britain, and resident of Johannesburg, Transvaal, have invented certain new and useful Improvements in Tripping-Device Regulators for Electrical Switches, of which the following is a specification.

This invention has reference to means for varying or regulating, as may be desired, the sensitiveness of the tripping or circuit opening device or devices employed in connection with automatically operated electrical switches. Although it is primarily intended for use with switches controlling electric motors, it may be adopted with switches employed for any other purpose to which it is or may be found applicable.

The invention consists of certain alternative methods of and means for increasing to any predetermined extent or degree, the tripping, or circuit opening, point of the overload release attachment of automatic electric switches or other auxiliary devices used in conjunction therewith, such as relays, without altering the original calibration or tripping point at which the overload release device operates under normal conditions, so that at the time of starting a motor, the extra normal current required shall not trip the switch, except under any such circumstances as would give a current in excess of the predetermined normal starting current.

The invention contemplates an arrangement which will permit the release of the apparatus directly the load or current is normal, reinstating the automatic features of the switch to their normal or running tripping capacity.

The desired end may be attained by retarding either directly or indirectly the action or operation of the armature actuating the tripping device or devices.

The invention may be carried into effect by increasing the weight of the tripping armature by means of weights; or by damping the action of said armature by or through the medium of springs, dashpots, bellows or their equivalent; by the pull of an auxiliary electro-magnet; or by weakening the pull of the tripping armature by passing an electric current through extra windings on the tripping coil of the switch or auxiliary device.

The retardation can be achieved by either attaching the aforesaid springs, dashpots, bellows or their equivalent directly to the armature of the main or auxiliary tripping device, or by mounting or arranging the springs, weights, dashpots or bellows on a separate attachment and causing the same to engage with the main or auxiliary tripping device by moving the same into engaging position by hand either directly or by means of cords, rods, levers, compressed air or other fluid or the pull of an auxiliary electro-magnet.

By the adoption of weights or springs as the retarding medium instantaneous application of the retarding effect can be obtained, whereas by the employment of the dashpot or bellows et cetera a gradual or timed application can be obtained.

The apparatus may be constructed either as an integral part of the main switch and its attendant gear or as a separate device.

The invention will now be more fully described by aid of the accompanying drawings wherein—

Figure 1 represents a side elevation of the preferred form of the device. Fig. 2 is a front elevation of a part of Fig. 1. Fig. 3 is a plan of Fig. 1. Fig. 4 is a side part sectional elevation of Fig. 1. Fig. 5 is a detail view showing part of spindle 11, cord or flexible connection 15 and its guide pulley 16. Figs. 6 to 8 illustrate several alternative methods of operating the spindle 11 to place the tripping-point-increasing device in or out of operation. Figs. 9 to 11 depict various substitutes for the weight 25 on lever 23. Figs. 12 to 14 show several different modifications in which the desired result is obtained by means attached to the armature fingers or projections 5, and Fig. 15 represents a further modified form of the invention.

In the several figures of the drawings like parts are denoted by like numerals in so far as they apply.

In Figs. 1 to 5 I illustrate sufficient of the overload release attachment of an automatically operated electric switch to illustrate the application thereto of my invention. In these figures, 1 represents the ordinary panel on which is mounted the automatic switch. This panel 1 also serves in the arrangement shown for carrying the means or device for damping or decreasing the sensitiveness of the tripping or circuit opening device of the aforesaid attachment.

2 represent the ordinary coils for actuating the tripping armatures 3, and 4 the casings inclosing the magnetic tripping coils 2 and armatures 3. 5 represent the tripping fingers or projections formed upon or fixed to the armatures 3. The aforementioned parts may be fixed in any ordinary or suitable manner to the panel 1.

The damping apparatus, which is affixed to the panel 1 in the necessary position between the two tripping armatures 3,—see Fig. 3—comprises a tubular piece or member 6 which is projected through a hole 7 in the panel 1 and is provided with a screwthread for retaining nut 8. The other end of member 6 is constructed with a head or enlargement providing a shoulder 9 between which and the panel 1 is arranged and secured a bracket 10, whose function is hereinafter described.

11 is a spindle which is adapted to slide in member 6. Sliding spindle 11 is fitted with a pin 12 providing two lateral projections which move in slots 13 in the end of member 6—see Figs. 1 and 4. Pin 12 operates as a stop to limit the movement of spindle 11 in one direction. 14 is a hole in the end of spindle 11 for attaching a cord 15 or other suitable connection to operate the spindle. 16 is a grooved pulley (rotatably supported by bracket 10) for guiding cord or flexible connection 15. The other end of the spindle 11 is reduced and constructed with a screwthread and upon it is arranged a bracket or support 17 for carrying those parts of the device which cooperate with projections 5 of the armatures 3. 18 is a nut or washer on the threaded end of spindle 11 between bracket 17 and the shoulder formed by the inner end of said threaded end, and 19 is a nut screwed on to the threaded end of spindle 11 to retain bracket 17 in position thereupon, said nut being preferably constructed as shown to form a pressure button for moving in one direction spindle 11 in its tubular guiding member 6. 20 is a coiled spring placed around spindle 11 between nut 8 and bracket 17 to return the several parts of the attachment to their normal and inoperative position when the pull on cord 15 or its equivalent is released. The said parts are shown in said inoperative position in the several figures of the drawings. Bracket 17 is constructed with a slot 21—see Figs. 2 and 4—through which the screwthreaded end of spindle 11 projects to provide for any necessary vertical adjustment of the bracket and its attachments to accommodate the same to the varying positions of projection or finger 5 when the latter is raised or lowered for different calibrations or to decrease or increase the tripping point at which the device operates under normal conditions.

Bracket 17 is as shown constructed to carry the attachments for coöperating with the projections or fingers 5 of both of the tripping armatures 3. For each of the armatures 3 an arm or lever 23 is pivoted to the bracket at 24.

25 in Figs. 1 and 4 represent adjustable weights or their equivalent arranged upon the arms or levers 23. The arms or levers 23 are provided on the sides adjacent the tripping armatures 3 with fingers or projections 26 which are adapted to be brought into contact with the tops of the fingers or projections 5 on tripping armatures 3, when it is desired to increase the tripping or circuit opening point. The position of weights 25 on levers 23 determine the extent to which said tripping point is increased, and said weights are set to give any predetermined increase.

27 in Figs. 1 and 4 is a set screw for adjustably securing weight 25 in position on lever 23. 28 is a set screw (provided with lock nut 29) for adjusting the height or position of lever 23 to insure proper engagement of finger 5 with finger 26 when the damping device is operated. 30 is a screw screwed through the bracket 17 and adapted at its inner end to have contact with the escutcheon plate which is fixed to and stands out from the panel 1 in front of it, to limit the movement of the bracket 17 in the direction of the panel.

If desired, instead of employing the adjustable weight 25, as hereinbefore described, a weight of the necessary magnitude can be non-adjustably fixed to, or formed upon the arm or lever 23.

The operation of this form of the invention is as follows. Assuming that the weights 25 have been set or arranged upon the levers 23 to increase the tripping or circuit opening point to the predetermined extent, then prior to starting the motor the sliding member 6 is placed by means of button 19 or cord 15, in such a position that projection or finger 26 is immediately above and resting upon projection or finger 5. The motor is now started. As finger 5 now engages finger 26 the resistance offered to the tripping armatures 3 is increased to the predetermined extent, which insures that the extra normal current requisite at starting does not trip the switch. When the motor has attained its normal speed, and the current has also fallen to normal, then the button 19 or cord 15 is released, which allows the device to resume its inoperative position, whereupon the normal tripping point of the overload release device is reinstated.

In the alternative method of operating spindle 11, to place the circuit-opening-point-increasing device in or out of operation, illustrated in Fig. 6, a hand lever 31 is provided, fulcrumed at 32, and attached through the medium of a connecting rod or link 33

to the end of spindle 11. As will be understood lever 31 is moved in one direction to place spindle 11 and its attachments in position for finger or projection 26 to engage finger or projection 5, and released to allow spring 20 to disengage them, as previously described. In the method shown in Fig. 7, an electro magnet 34 is empolyed, and the end 35 of the spindle 11 is constructed and arranged to serve as the armature therefor. The electric circuit in which coil 34 is interposed is closed and opened by hand to operate spindle 11 as required.

In the further method represented in Fig. 8, 36 indicates a cylinder in which works a piston, the piston rod 37 of which is suitably attached to, or formed in one piece with and on the end of spindle 11. Piston rod 37 works through stuffing box 38 and gland nut 39 on the cylinder cover 40. 41 is a pipe communicating with one end of the cylinder 36, and 42 is another pipe communicating with the other end of said cylinder 36. This arrangement can be operated either by fluid under pressure or by vacuum, the controlling means being actuated by hand in any convenient manner. If the arrangement is operated by fluid under pressure then pipe 41 will be utilized for conveying the fluid into the end of the cylinder at one side of the piston, and the other pipe 42 will be open to the atmosphere. If the arrangement is operated by vacuum then pipe 41 can be used for admitting air to one side of the piston and the other pipe 42 as the outlet through which the air is exhausted from the other side of the piston so as to create a partial vacuum to move spindle 11. The return of the parts of this device to normal or inoperative position may be effected as before by the spring 20, or by creating a partial vacuum in the cylinder through pipe 41 and admitting air through pipe 42, or by admitting compressed fluid through 42 and opening 41 to the atmosphere.

In Fig. 9 I depict an alternative construction for the weight 25 on the lever 23. In this construction the bracket 17 is of a slightly different shape to that shown in Figs. 1 to 4. The spindle 11 may, as shown, be fashioned in one piece with said bracket 17, or be attached thereto as shown in Figs. 1 to 4, or in any other convenient manner. The lever 23 (which may be shorter than in Figs. 1 to 4) has attached to its outer extremity a suitably coiled tension spring 43, the other end of which is fixed to a projection 44 on the bracket 17. Lever 23, is, as before, fulcrumed at 24, and set screw 28 is provided for effecting vertical adjustment thereof. With this construction, and also with the constructions hereinafter described in connection with Figs. 10 and 11, the bracket 17 may be moved through the medium of spindle 11, by any of the means hereinbefore described, to place finger or projection 26 in engagement with finger or projection 5.

In Fig. 10 the bracket 17 is constructed to provide or support a cylinder 45 in which works a piston, the piston rod 46 of which is pivotally attached to the outer extremity of the lever 23. This arrangement may be worked either with fluid under pressure or vacuum. In the former case the compressed fluid would be admitted to the cylinder above the piston and the cylinder beneath the piston be placed in communication either with the atmosphere or a vacuum creating means; or the cylinder beneath the piston may be closed to the atmosphere and the cylinder above the piston be placed in communication with the atmosphere so that the upward movement of the piston would tend to create a vacuum in the cylinder beneath the piston; or the cylinder may be closed at both ends and the piston be arranged to take up a position at or in proximity to the bottom of the cylinder when the apparatus is in its inoperative position. When brought into operation the movement of the piston would then compress the fluid at the one side of the piston and tend to create a vacuum at the other side thereof.

In Fig. 11 the bracket 17 carries an electro magnet 47, the armature 48 of which is pivotally attached directly to the outer extremity of the lever 23. The influence exerted by the coil 47 on the armature 48 restrains the upward movement of the lever 23 sufficiently to retard the operation of the tripping armature 3 to the requisite extent.

In Fig. 12 I show a modification of the invention in which the means for damping or retarding the action of the tripping armatures 3 are attached directly to the fingers or projections 5. In this arrangement two suitable coiled tension springs 49 are attached at their upper extremities to the fingers 5 of the two adjacent tripping armatures 3. The other extremities of the springs 49 are connected with a member comprising the two connected parts 50, 51. 52 is a suitably disposed bracket which constitutes a sliding guide for the part 51. Beneath the part 50 and bracket 52 is arranged a suitable coiled spring 53 which serves for supporting the weight of the springs 49 and member 50, 51 when the device is at its normal tripping point. The lower end of member 51 is shown provided with a hole 54 for making attachment with the means for controlling the device which means may conveniently comprise cord 15 or lever 31.

In Fig. 13 I illustrate another arrangement in which the means for damping the tripping armatures are attached directly to the fingers or projections 5. In this construction two rods 55 are attached at one end

to fingers 5 of the tripping armatures 3 and at their lower ends to a crosshead or piece 56 connected with or fashioned on the end of a piston rod 57 working in cylinder 58. 59 represent perforated lugs for attaching cylinder 58 to its supporting means, and 60 represents a pipe fitted with a valve. The valve is either fully or partially closed when starting or when it is desired to retard the action of the tripping armatures 3, so that the upward movement of the piston or plunger (whose normal position is at the bottom of the cylinder 58) in cylinder 58 tends to create a vacuum within the cylinder. The valve on pipe 60 is opened when the normal tripping point of the overload release device is reinstated. Piston rod 57 may be connected directly to the tripping armatures 3, and rods 55 be dispensed with. In place of the vacuum the device may be operated by fluid pressure admitted to cylinder 58.

In Fig. 14 I show a further arrangement similar to those shown in Figs. 12 and 13. In this arrangement two rods 61 are attached to the fingers 5 of the tripping armatures 3 at one end and to a crosshead or piece 62 at the other end. 63 is an armature formed in one piece with or attached to part 62, and 64 is an electro magnet for said armature 63. 65 are perforated lugs for fixing the electro magnet 64 in position, and 66 a coiled spring placed between part 62 and magnet 64 for returning the parts to their inoperative position. With this arrangement a current of a certain magnitude is passed through coil 64 so that it exerts a given pull on its armature 63. This pull is transmitted through part 62 and rods 61 to the tripping armatures 3 and is in the opposite direction to that of the main tripping coils.

In the further modified form of the invention illustrated in Fig. 15 the main tripping coil (or coils) is de-magnetized the desired extent to retard the action of the tripping armature 3. This as shown is accomplished by arranging around or in juxtaposition to the main tripping coil 2 a demagnetizing coil 67. The electric circuit in which coil 67 is interposed is closed and opened by hand by suitable means.

What I claim as my invention and desire to protect by Letters Patent is:—

1. In a device of the character described, in combination a tripping coil and a tripping armature, a loaded lever, means for varying the load on the lever, a part to which the loaded lever is pivoted, a projection on said lever which is adapted to be placed in engagement with the tripping armature, means for adjusting the lever vertically, and means for limiting the movement of the part to which the lever is pivoted, as set forth.

2. In a device of the character described, in combination, a tripping coil and a tripping armature, a weighted lever, means for altering the position of the weight acting on the lever, a part to which said weighted lever is pivoted, a projection on said lever which is adapted to be placed in engagement with the tripping armature, means for adjusting the lever vertically, and means for limiting the movement of the part to which the lever is pivoted, as set forth.

3. In a device of the character described, in combination a tripping coil and a tripping armature, a loaded lever, means for varying the load on the lever, a part to which the loaded lever is pivoted, a projection on said lever which is adapted to be placed in engagement with the tripping armature, means for adjusting the lever vertically, means for limiting the movement of the part to which the lever is pivoted, means for moving the part to which the lever is pivoted in one direction, and means for returning said part to its normal position when said last mentioned means are released, as set forth.

4. In a device of the character described, in combination a tripping coil and a tripping armature, a weighted lever, means for altering the position of the weight acting on the lever, a part to which said weighted lever is pivoted, a projection on said lever which is adapted to be placed in engagement with the tripping armature, means for adjusting the lever vertically, means for limiting the movement of the part to which the lever is pivoted, means for moving the part to which the lever is pivoted in one direction, and means for returning said part to its normal position when said last mentioned means are released, as set forth.

5. In a device of the character described, in combination, a tripping coil and a tripping armature, a loaded lever adapted to engage and retard said armature, means for varying the load of the lever, a bracket to which the loaded lever is pivoted, means for adjusting the lever relative to the armature, means for supporting the bracket so that it and the lever can be moved into a position in which the lever will engage the tripping armature, and means for limiting the movement of the bracket, as set forth.

6. In a device of the character described, in combination, a tripping coil and a tripping armature, a loaded lever adapted to engage and retard said armature, means for varying the load on the lever, a bracket to which the loaded lever is pivoted, means for adjusting the lever relative to the armature, means for supporting the bracket so that it and the lever can be moved into a position in which the lever will engage the tripping armature, means for limiting the movement of the bracket, means for moving the bracket

in one direction, and means for returning said bracket to its normal position when said last mentioned means are released, as set forth.

7. In a device of the character described, in combination, a tripping coil and a tripping armature, a weighted lever adapted to engage and retard said armature, a bracket to which the weighted lever is pivoted, means for adjusting the lever relative to the armature, means for supporting the bracket in such a way that it together with the lever can be moved to cause the lever to engage the tripping armature, means for limiting the movement of the bracket, means for moving the bracket comprising a sliding spindle to which the bracket is attached, a tubular member slidingly supporting said spindle, a spring for returning the spindle and its attachments to normal position when released, and means for moving the spindle against the spring to cause the lever to engage the tripping armature as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PHILIP HERD.

Witnesses:
CHAS. OVERDALE,
MAUD POPE.