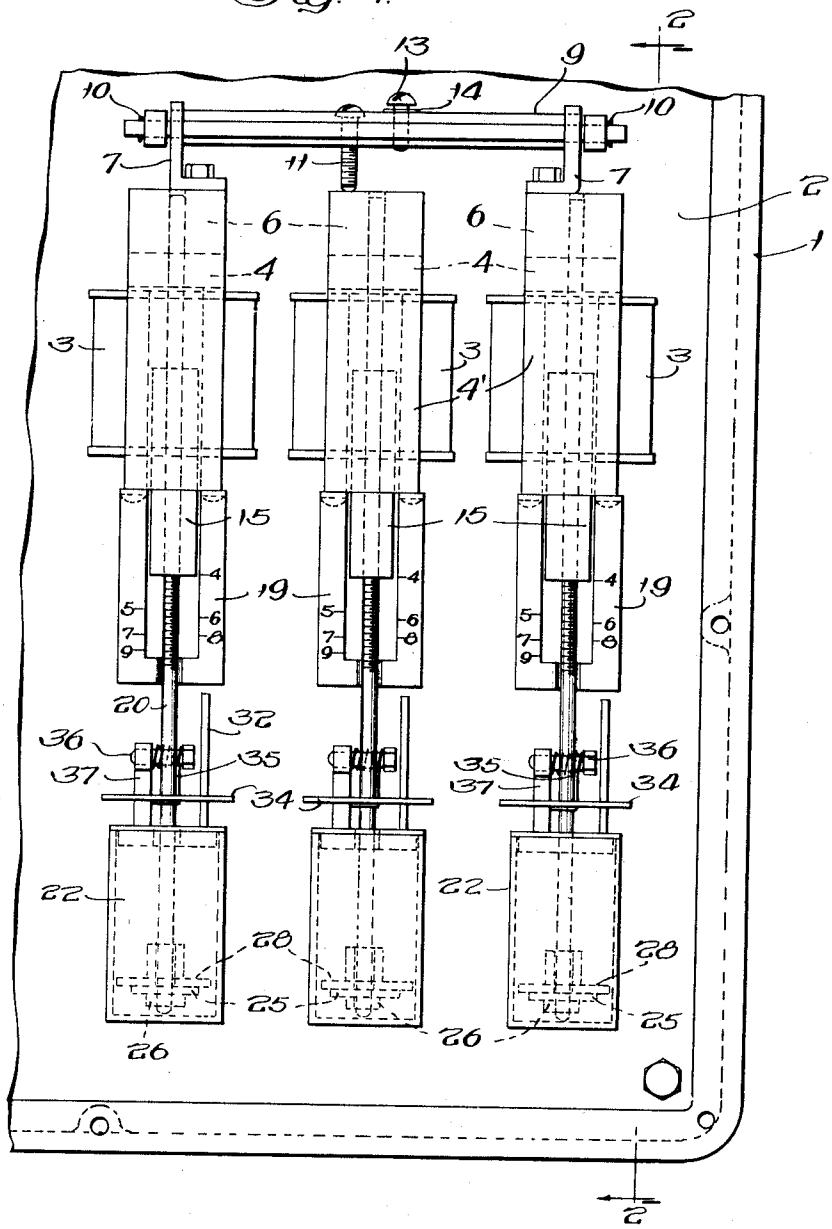
Feb. 20, 1934. J. H. STARR 1,947,810

DASHPOT

Original Filed Oct. 20, 1928 2 Sheets-Sheet 1

Fig. 1.



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DASHPOT

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Fig. 2.

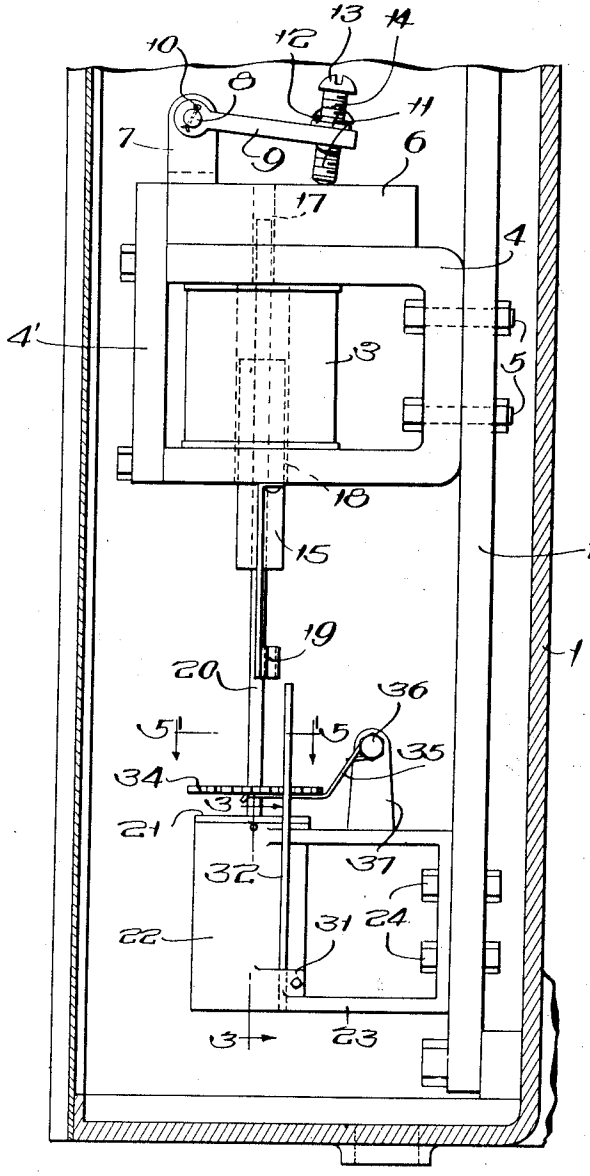


Fig. 3.

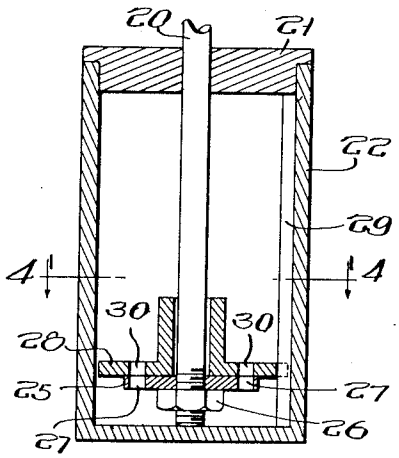


Fig. 4.

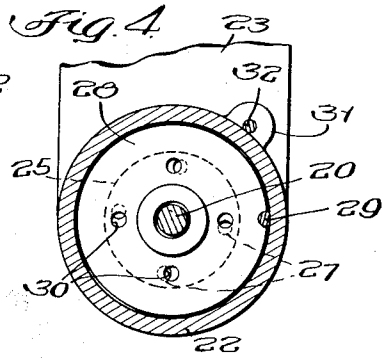
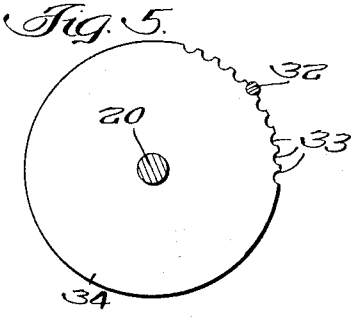


Fig. 5.



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UNITED STATES PATENT OFFICE

1,947,810

DASHPOT

James H. Starr, Oak Park, Ill., assignor to Electrical Engineers Equipment Company, Melrose Park, Ill., a corporation of Illinois

Original application October 20, 1928, Serial No. 313,729. Divided and this application January 24, 1930, Serial No. 423,101. Renewed July 14, 1933

10 Claims. (Cl. 188—96)

This invention relates to quick resetting dash pots and more particularly to dash pots adapted to be employed with electric oil switches of the character disclosed in my copending application Serial No. 313,729, filed October 20, 1928 for Oil switch, of which this application is a division.

In my copending application, I have disclosed an oil switch of the kind which may be tripped either electro-magnetically or manually and which is re-closed manually and maintained in closed position mechanically. While the instant invention is particularly applicable to switches of this kind, especially high voltage switches, it is not limited to such use but may be employed wherever it is desired to employ a time-delay mechanism which is quickly resetting.

In large current transmission systems or in systems of transmission of currents at high voltage, it is the practice to provide electrical switches for interrupting the circuit under overload conditions such as may occur due to short-circuits, or other causes. Frequently overload conditions exist only for intervals of very short duration and such conditions are often self-correcting so that it is desirable to introduce a time-delay mechanism to prevent opening of the interrupter, thus eliminating unnecessary manipulation and operation thereof. At the same time, in the event that the interrupter is actuated, it is desirable to provide such a time-delay device as will quickly be automatically reset whereby the switch may be promptly closed after interruption without unnecessary delay. To this end, I have provided a dash pot of novel construction and operating in a novel manner.

In the switch disclosed in my above identified copending application, there is provided an interrupter which when re-closed is mechanically maintained in its closed position. The latter feature comprises a latch element which is adapted to be operated to releasing conditions by the action of one or more of a series of trip coils, the latch being so mounted as to be operable to releasing conditions by upward movement of the tripping armatures or plungers.

The force tending to raise the trip armature of each coil to release the latch is of course produced electro-magnetically. This force is to a certain degree within the control of the designer, the usual practice being a trip coil which takes from approximately 30 to 60 volt amperes at full load. Although this force is small in absolute value, it is nevertheless large compared to the weight of the moving parts of the trip coil. It will be evident therefore that the tripping action of the trip coils would be ordinarily instantaneous. As has been heretofore stated, it frequently occurs that overload conditions are of very short duration and self-correcting and under such conditions the interrupter might be actuated to open the switch unnecessarily. In accordance with my invention, I have mounted a dash pot in the interrupter housing in axial alignment with and below the armatures of each trip coil with the piston rod of each respectively connected to the armatures whereby the action of the electro-magnetic force tending to raise the armatures is retarded and thereby delay tripping of the latch.

Thus under instantaneous overload conditions, the dash pots serve to delay the effect of the electro-magnetic force, thereby eliminating unnecessary interruption except when overload conditions are relatively large or of long duration.

After the interrupter has been tripped by virtue of excessive overload conditions, it will be evident that the force tending to return the dash pot to its initial position is the weight of the moving parts. I have therefore provided a novel dash pot assembly wherein the checking or retarding action in raising or tripping direction is large while the retarding action is materially decreased on the return stroke as compared to the checking or retarding action on the tripping stroke.

This is accomplished by the provision of a fluid containing cylinder closed at the bottom and having a piston rod extending through the top thereof. At its inner end, that is the end within the cylinder, the rod is provided with a piston disc of appreciably smaller diameter than the inner diameter of the cylinder. This disc is rigidly secured to the rod and is provided with a series of holes or by-passes therethrough disposed in circumferential relation. A second disc provided with openings registrable with the by-passes in the first disc is slidably mounted upon the rod and is normally adapted to freely rest upon the upper face of the secured disc. The second disc is of a diameter substantially equal to the inside diameter of the cylinder except for mechanical clearance, and is nonrotatable retained in the cylinder and upon the piston rod by having a splined connection with a longitudinally extending rib projecting inwardly of the cylinder from the inner periphery thereof.

The piston disc and rod are adjustably retained for reciprocating movement by the coaction of a spring wire guide extending upwardly

above the upper end of the cylinder in parallel relation with the axis thereof with one of a series of peripheral notches in a disc rigidly attached to the piston rod immediately above the dash pot. Since the freely resting disc is held against rotation the piston rod with its piston disc may be rotated so that the holes in the freely movable disc and the holes or by-passes in the piston disc may be made to line up, to close one another, or to assume intermediate positions. By this adjustment, the resistance against upward movement of the piston assembly through the fluid may be varied. On the resetting stroke, which is accomplished by gravity, the resistance of the liquid tends to hold the upper freely movable disc while the piston disc drops more rapidly. Once the piston disc has separated from the other, the full passages defined by the holes in both discs are exposed and the freely movable disc follows the piston disc to the reset position with a minimum delay.

Thus, should the circuit breaker be opened due to excessive overload conditions, the armatures or plungers of the tripping coils are promptly reset so as to permit reclosing without delay. This is particularly desirable in interrupters which are automatically reclosed.

With the above in view it is the main object of this invention to provide a novel dash pot which provides a slow retarding action in checking direction and which is quickly resetting in non-retarding direction.

Another object is the provision of a dash pot in which the restriction of fluid flow in checking direction may be varied over a relatively wide range. This is accomplished by the provision of a multiplicity of holes in the piston disc and in the disc resting freely thereupon. By the retention of the free resting disc for slidable and non-rotatable movement within the cylinder and by the provision of means for the selective positioning of the piston disc relative thereto by rotation, the holes in both disc members may be made to line up, to close one another, or to assume intermediate positions. By this adjustment, the resistance of the retarding action of the piston moving through the fluid may be varied over a relatively wide range.

A further object is the provision of a dash pot in which the restriction of fluid flow may be varied by an easy and readily accessible adjustment on the outside of the cylinder. The spring wire guide which is adapted to take into any of the peripheral notches in the disc secured to the piston rod outside of the cylinder, is made of material sufficiently resisting rotary movements of the piston rod but at the same time permitting free sliding movement thereof.

To rotate the piston rod in order to adjust the by-passes or holes in the piston disc relative to the holes of the freely resting disc, it is only necessary to bend the wire rod or guide radially outwardly of the disc secured to the rod outside of the cylinder and to rotate the piston rod the desired amount and upon release of the spring wire guide it will take into another of the peripheral notches of its coacting disc and will retain this disc in the desired adjusted position until another change is to be made.

Another object is the provision of a dash pot the operation of which is simple and positive.

A further object is the provision of such a dash pot as may be cheaply manufactured comprising a minimum number of parts, and which is at the same time compact and durable.

Other and further objects will appear from the following detailed description of a preferred embodiment of my invention, illustrated in the accompanying drawings in which:

Figure 1 is a fragmentary side view of a portion of a switch interrupter operating mechanism showing trip coils with the armatures thereof operatively associated with dash pots in accordance with the instant invention, in elevation;

Figure 2 is a side view of the mechanism shown in Figure 1 the view being taken along the line 2—2 of Figure 1;

Figure 3 is a vertical section taken axially through one of the dash pots as viewed along the line 3—3 of Figure 2;

Figure 4 is a transverse section through the dash pot illustrated in Figure 3 and taken along the line 4—4 thereof; and

Figure 5 is a fragmentary detail of the adjusting means as viewed along the line 5—5 of Figure 2.

In order to simplify the disclosure of the instant invention, I have illustrated in Figure 1 only a fragmentary portion of the interrupter mechanism showing the automatic tripping mechanism for the latch maintaining the interrupter mechanism in reset condition. For a more specific disclosure of the cooperation of this portion of the mechanism with the interrupter mechanism, reference may be had to my copending application above identified.

The automatic tripping mechanism is mounted upon a supporting board 2 suitably supported in a casing 1 and is operated by the electromagnetic force of any one or all of three electromagnets 3, of usual construction, supported between the legs of U-shaped pole piece brackets 4 suitably secured to the supporting board 2 by means of bolts 5, the ends of the legs of these brackets being connected together by plates 4'. The upper leg of each of the U brackets 4 supports an insulating block 6, and the two outside blocks each support an angle bracket 7.

A pivot rod 8 is journaled in the upstanding portions of the brackets 7 adjacent the upper ends thereof, the outer ends of the pivot rod 8 extending outwardly beyond the brackets 7. A U-shaped swinging member 9 is pivoted upon the pivot rod 8, the latter extending through the ends of the legs of said swinging member, this member being retained upon the rod by means of cotter pins 10. The intermediate portion of the swinging member 9 carries a set screw 11 threaded therethrough and locked in position by means of a lock nut 12. Set screw 11 is adapted to have its lower end abut the upper face of the block 6 of the middle electromagnet unit to limit the downward swinging movement of the member 9. The intermediate portion of swinging member 9 is also adapted to carry a set screw 13 threaded therethrough and adapted to be locked in position by means of a lock nut 14. The head of screw 13 is adapted upon upward swinging movement of the member 9 to engage the operating end of a latch member (not shown) which maintains the interrupter in reset condition.

Each of the electro-magnet units 3 has an armature or plunger 15 extending axially therein and adapted for movement therethrough, and each armature or plunger has threaded connection with an axial rod 20 extending both above the top and below the bottom of the armature. This rod 16 extends upwardly beyond the upper

end of the armature 15 and into a recess 17 in the upper leg of the U bracket 4 and block 6.

Armature 15 is adapted to extend through a recess 18 in the lower leg of the U-bracket 4 said recess 18 being in alignment with the axial recess of the electro-magnet 3. The lower leg of each U-bracket 4 has suitably secured thereto a downwardly depending indicator frame 19 having appropriate marking thereon for purposes of indicating the setting of the armature 15 whereby the armature may be set for automatic tripping of the latch of the interrupter for a desired load requirement.

The rod 20 also extends downwardly from the lower end of the armature 15 through the cover 21 of a dash pot cylinder 22 positioned in axial alignment with the armature 15.

Cylinder 22 has a mounting bracket 23 integrally associated therewith and suitably secured to the board 2 as by bolts 24. The automatic tripping mechanism are each shown in inoperative condition, and in such a condition the lower end of rod 20 of each unit is adapted to rest upon the upper face of the lower end of each cylinder 22.

The lower end of each rod 20 has secured thereto by threading thereon a disc 25 locked in position by means of a lock nut 26. This disc 25 is provided with a plurality of circumferentially disposed holes or by-passes 27 the purpose of which will be hereinafter described. Resting upon the disc 25 is a disc 28, the outside diameter of which is equal to, except for mechanical clearance, the inside diameter of the cylinder. It is thus apparent that the end of the rod 20 that extends into the cylinder constitutes a piston rod, and the disc 28 constitutes a piston disc or piston.

The disc 28 is free to move vertically on the rod 20 but is held against rotation about its vertical axis by a vertical rib or guide 29 extending inwardly from the inner periphery of the cylinder 22 and lengthwise thereof. The disc 28 is likewise provided with a plurality of holes 30 at the same distance from the center as the holes or by-passes 27 of the disc 25. Holes 30 and 27 may be made to line up, or to assume intermediate positions by rotating the rod 20 or the holes in each disc may be entirely closed by the other disc.

Each cylinder 22 is provided adjacent its lower end and extending outwardly from the outer periphery thereof with a lug 31 which supports a vertically extending spring wire guide 32. This guide is adapted to engage one of a multiplicity of peripheral notches 33 in a disc 34 suitably secured to the piston rod 20 above the upper end of the cylinder 22. Thus the rod 20 may be held in any desired rotated position by selective engagement of the guide 32 with any one of the notches 33 in the disc 34.

The dash pot cylinder 22 contains a suitable liquid which is of an approximately constant viscosity between the temperature limits anticipated. The discs 25 and 28 thus constitute in effect a piston having a leaky check valve which checks the passage of the cylinder fluid from the portion of the cylinder above the discs to the portion below the discs, but permits the free movement of fluid in the opposite direction. The leak in this check valve is adjustable for adjusting the extent of checking action when the piston moves upward.

To partially counterbalance the weight of the respective armatures 15, a spring wire 35 having a coil portion suitably supported upon a bolt 36 in turn suitably supported by an upstanding ear 37 formed integrally with the upper leg of the mounting bracket 23 has one end thereof in abutment with the ear 37 and its other end abutting the under face of the disc 34.

Each of the mechanisms or units operates as follows:

When the electro-magnet 3 is energized, its associated armature 15 is raised. As the armature moves upwardly, its movement is resisted by the movement of the discs 25 and 28 through the liquid in the cylinder 22. By adjusting the registry of the holes 27 and 30, the resistance against upward movement of the discs through the liquid may be varied. Should the magnets 3 or any one of them be energized for an appreciable length of time, the armature of the magnet affected will be slowly raised until the upper end of rod 16 abuts and raises the member 9, the head of the set screw 13 of which will then abut the operating end of the latch maintaining the interrupter in set condition thereby releasing said latch and permitting the interrupter to open the switch and thereby break the circuit. On the resetting stroke, which is accomplished by gravity, the returning force depending upon the weight of the moving parts, the resistance of the liquid in the cylinder tends to hold the disc 28 while the piston disc 25 drops more rapidly.

Once the piston disc 25 has separated from the disc 28, the passageways defined by the holes in the disc 28 are exposed to their full extent and this disc follows the piston disc to the reset position with a minimum delay.

When, however, one or all of the magnets 3 are only instantaneously energized, it will be apparent that the dash pot action is such as to be effective as a time-delay device so that unless overload conditions exist for a substantial period of time, the interrupter mechanism will not be released to open the switch.

Thus it will be seen that I have provided a novel quick resetting dash pot adapted to offer resistance in checking direction to a degree desired but which will be quickly reset regardless of the amount of resistive effect imposed thereby in retarding direction. I have also provided a novel external adjustment for such a dash pot whereby the resistive effect of the device may be quickly and easily adjusted to vary such resistive effect.

While I have disclosed the quick resetting dash pot mechanism as applied to an automatic tripping mechanism for interrupters, it will be apparent that its use is not limited thereto, but it may be used wherever it is desired to provide a retarding mechanism which is quick resetting.

Furthermore, while I have disclosed a preferred embodiment of my invention, I do not wish to be limited thereto. As will be understood by those skilled in the art certain changes may be made therein without departing from the essence of the invention or the spirit and scope of the appended claims.

What I claim and desire to secure by Letters Patent is:

1. A quick resetting dash-pot comprising a fluid containing cylinder, a piston including two discs having registrable by-passes therein, one of said discs being of a smaller diameter than the other disc, a piston rod secured to the smaller one of said discs, the other of said discs being slidably mounted on said piston rod and

resting freely upon said secured disc, said discs being adapted to move in unison in checking direction and adapted to be separated in resetting direction.

2. A quick resetting dash-pot comprising a fluid containing cylinder, a piston including a disc within the cylinder and of appreciably smaller diameter than the inside diameter of the cylinder, a non-rotatable movable plate resting freely upon the disc within the cylinder, said plate being of substantially the same diameter as the inside diameter of the cylinder, said disc and plate each having an opening therein, and adjustable means external to the cylinder for aligning the opening in the disc in any desired angular position with respect to the opening in the plate whereby the rate of movement of the piston is varied.

3. A quick resetting dash-pot comprising a fluid containing cylinder, a piston including a disc within the cylinder and of appreciably smaller diameter than the inside diameter of said cylinder, a non-rotatable movable plate resting freely upon the disc, said plate being of substantially the same diameter as the inside of the cylinder, said disc and plate each having an opening therein, said disc being rotatable for aligning the opening therein in any desired angular position with respect to the opening in the plate whereby the rate of movement of the piston is varied.

4. A quick resetting dash-pot comprising a fluid containing cylinder, a piston including a disc within the cylinder and of appreciably smaller diameter than the inside diameter of said cylinder, a non-rotatable movable plate resting freely upon the disc, said plate being of substantially the same diameter as the inside of the cylinder said disc and plate each having an opening therein, said disc being rotatable for aligning the opening therein in any desired angular position with respect to the opening in the plate whereby the rate of movement of the piston is varied and adjustable means external to the cylinder for retaining said disc in adjusted position.

5. A quick resetting dash-pot comprising a fluid containing cylinder, a piston rod extending into said cylinder, a disc secured to the inner end of said rod and of appreciably smaller diameter than the inside diameter of said cylinder, and a non-rotatable plate resting freely upon said disc and freely slidable along said rod, said plate being of substantially the same diameter as the inside of the cylinder, said disc and plate each having an opening therein, said disc being rotatable for aligning the opening therein in any desired angular position with respect to the opening in the plate whereby the rate of movement of the piston rod is varied.

6. A quick resetting dash-pot comprising a fluid containing cylinder, a piston rod extending into said cylinder, a disc secured to the inner end of said rod and of appreciable smaller diameter than the inside diameter of said cylinder, a non-rotatable plate resting freely upon said disc and freely slidable along said rod, said plate being of substantially the same diameter as the inside of the cylinder, said disc and plate each having an opening therein, said disc being rotatable for aligning the opening therein in any desired angular position with respect to the opening in the plate whereby the rate of movement of the piston rod is varied and adjustable means external to the cylinder for retaining said disc in adjusted position.

7. A quick resetting dash-pot comprising a fluid containing cylinder, a piston rod extending into said cylinder, a disc secured to the inner end of said rod and of appreciably smaller diameter than the inside diameter of said cylinder, a non-rotatable plate resting freely upon said disc and freely slidable along said rod, said plate being of substantially the same diameter as the inside of the cylinder, said disc and plate each having an opening therein, said disc being rotatable for aligning the opening therein in any desired angular position with respect to the opening in the plate whereby the rate of movement of the piston rod is varied, a plate on said rod external to the cylinder, and means cooperating with said plate for retaining said disc in adjusted position.

8. A quick resetting dash-pot comprising a fluid containing cylinder, a piston rod extending into said cylinder, a disc secured to the inner end of said rod and of appreciably smaller diameter than the inside diameter of said cylinder, a non-rotatable plate resting freely upon said disc and freely slidable along said rod, said plate being of substantially the same diameter as the inside of the cylinder, said disc and plate each having an opening therein, said disc being rotatable for aligning the opening therein in any desired angular position with respect to the opening in the plate whereby the rate of movement of the piston rod is varied, a second plate having peripheral notches therein on said rod external to the cylinder, and a spring wire guide adapted to be selectively positioned in said notches for retaining said disc in adjusted position.

9. A quick resetting dash pot including a cylinder, a piston rod extending into the cylinder, a piston disc slidably mounted on the piston rod and drawn with the piston rod when the rod is moved in one direction, thereby impeding the motion of the rod in that direction, said rod sliding through the piston disc upon movement in the reverse direction, whereby its motion in the reverse direction is unimpeded, an externally adjustable bypass for bypassing fluid from one side of the piston disc to the other side thereof as the piston rod is moved in the first mentioned direction, thereby regulating the rate of movement of the piston rod in said first mentioned direction.

10. A delayed action, quick resetting, dash pot including a cylinder, a piston rod extending into the cylinder and having a piston at the end thereof, said piston comprising a pair of disc members one of which is slidable on the piston rod and rests freely upon the other disc, said other disc being mounted on the piston rod, said two discs controlling a communicating passageway through the piston, thereby controlling the rate of movement of the piston in one direction, means external of the cylinder for turning one disc with respect to the other to adjust the size of the passageway, said two discs separating from one another upon reverse movement of the piston thereby permitting free reverse movement of the piston rod.

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