April 17, 1934. E. X. SCHMIDT ET AL 1,955,565

MERCURY DASHPOT TIMING DEVICE

Filed March 30, 1931 2 Sheets-Sheet 1

Fig. 1

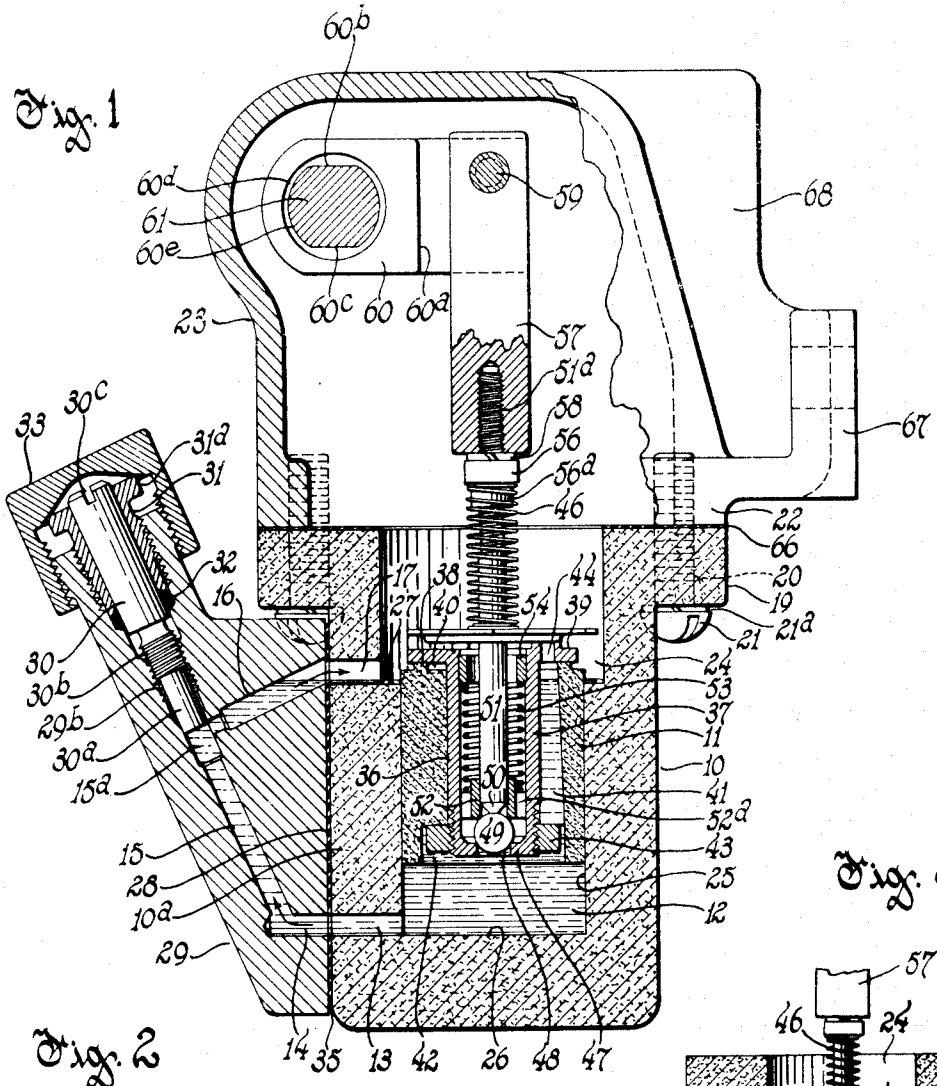


Fig. 2

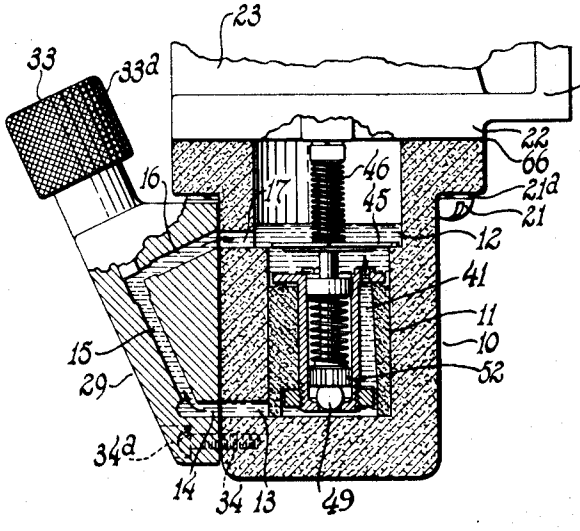
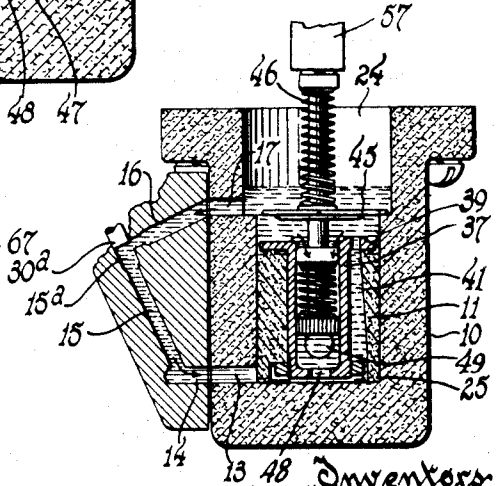


Fig. 3



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Fig. 4

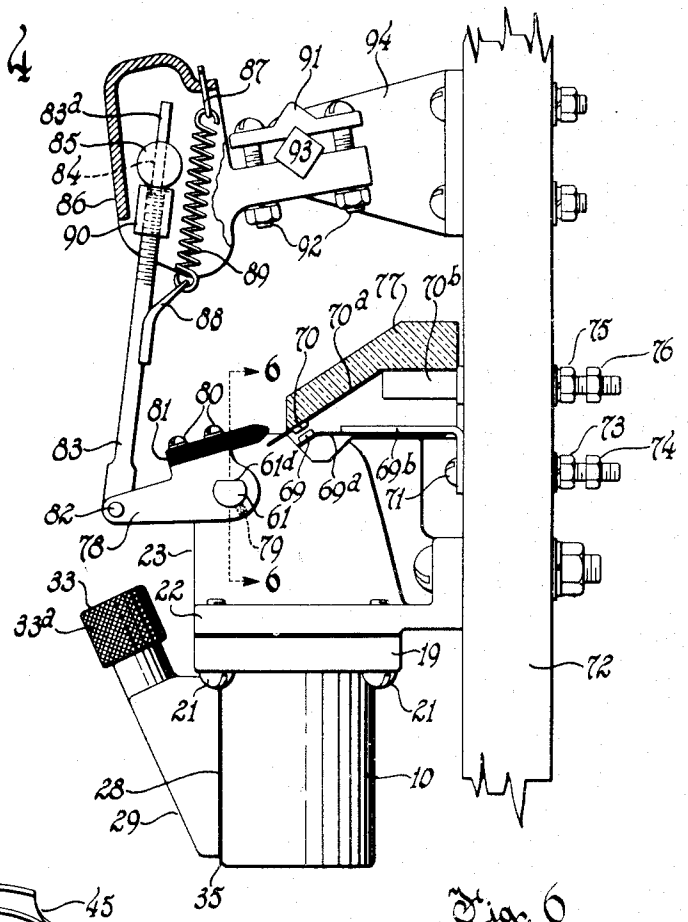


Fig. 5

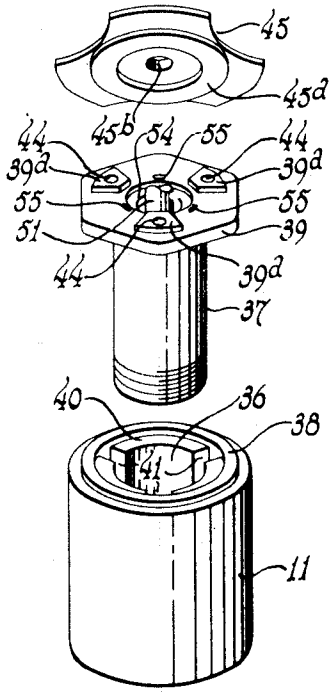
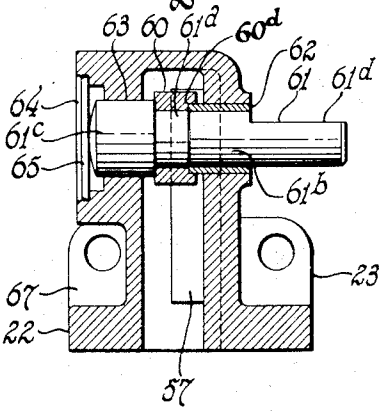


Fig. 6



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Patented Apr. 17, 1934 1,955,565

UNITED STATES PATENT OFFICE

1,955,565

MERCURY DASHPOT TIMING DEVICE

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Application March 30, 1931, Serial No. 526,444

14 Claims. (Cl. 188—97)

This invention relates to improvements in mercury dash-pot timing devices.

Dash-pots as heretofore proposed for use in timing the operation of electric switches and the like inherently possess certain undesirable characteristics which result in irregular timing, such irregularity being due primarily to changes in temperature, uncontrollable leakage past the piston, and the fact that foreign matter gets into the dash-pot.

An object of the invention is to provide a dash-pot wherein the difficulties aforementioned are overcome.

Another object is to provide a dash-pot having improved structural and operative characteristics whereby the novel results hereinafter described are attained.

Another and more specific object is to provide a mercury dash-pot utilizing a piston and cylinder each of which is molded from a compound comprising the phenol-formaldehyde condensation product sold under the trade-name of "Bakelite" the "Bakelite" being impregnated with or containing graphite.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that the invention is susceptible of embodiment in other forms without departing from the scope of the appended claims.

In the drawings, Figure 1 is an enlarged vertical sectional view of a mercury dash-pot timing device constructed in accordance with my invention,—showing the position of the parts at approximately the beginning of the timing stroke of the piston.

Fig. 2 is a similar fragmentary view, of normal size, showing the position of the parts at the end of the timing stroke of the piston.

Fig. 3 is a view similar to Figs. 1 and 2, showing the relation of the parts during the up-stroke of the piston for resetting of the timing mechanism.

Fig. 4 is a view, partly in side elevation and partly in vertical section, of certain parts of a switch mechanism having our improved timing device associated therewith.

Fig. 5 is a perspective view, in separated relation, of certain of the parts illustrated in Figs. 1, 2 and 3, and

Fig. 6 is a view partly in end elevation, and partly in vertical section on the line 6—6 of Fig. 4, showing the novel form of bearing for the actuating shaft of the timing device.

Referring to the drawings, the numeral 10 designates a cup or cylinder and 11 designates a piston slidable within said cup,—the cup and the piston each being molded from a composition of "Bakelite" and graphite of the character disclosed in Patent No. 1,182,258, dated May 9, 1916 to Frank Engel.

The numeral 12 designates a body or quantity of mercury the rate of flow of which from each end of the piston 11 to the other controls the rate of movement of said piston in opposite directions within cylinder 10.

By employment of a piston and a cylinder formed of molded "Bakelite" impregnated with graphite the clearance between said parts may be made extremely small. Therefore by using mercury in the dash-pot as the active material there will be no leakage past the piston even with relatively great differences in pressure between the top and bottom of the piston. Since no leakage occurs, the dash-pot will have no variation in the coefficient of discharge; such variation being a common defect in ordinary types of dash-pots, due to sidewise or lateral movement of the piston within the cylinder.

Thus the timing of a mercury dash-pot of the character herein disclosed depends primarily on the density of the mercury and is substantially independent of viscosity. The variation in timing due to temperature changes is therefore negligible, since the density of mercury changes only approximately two per cent from zero to one hundred degrees C., and the timing would vary only as the square root of such change.

In operation, mercury is forced from the lower end of piston 11 to the upper end thereof through a timing passage 13, 14, 15, 16 and 17 during the timing stroke. On resetting movement of the parts of the timing device the mercury may pass both through the timing passage 17, 16, 15, 14 and 13 and through the check valve opening 48, as indicated by the arrows in Fig. 3.

Referring more particularly to the cup or cylinder 10, the same is provided at the upper end thereof with an integral substantially rectangular flange 19, each of the four corners of said flange having a passage 20 therethrough to accommodate the shanks of screws 21 which respectively take into tapped openings provided in the integral flange 22 of a metal casting designated in general by the numeral 23. Cup 10 is provided at its upper end with a relatively large cylindrical bore 24 and has a relatively smaller cylindrical bore 25 opening to bore 24. Bore 25 is closed by the bottom wall 26 of cup 10,—the passage 13

being drilled through the side wall 10^a of cup 10 in a line substantially flush with said bottom wall 26. Passage 17 is likewise drilled through the wall of cup 10 in a line substantially flush with the shoulder 27 formed between bores 24 and 25.

The exterior of side wall 10^a of cup 10 is preferably flat to accommodate the flat face 28 of a metal casting 29 in which the other portions 14, 15 and 16 of the timing passage are drilled in the manner illustrated. The upper end 15^a of portion 15 is preferably enlarged as illustrated to receive with a close fit the cylindrical lower end 30^a of a sort of needle-valve 30 whereby the adjacent end of portion 16 of the timing passage may be closed or opened to the desired degree to control the rate of flow of the mercury. For purposes of such adjustment valve 30 is provided with a threaded portion 30^b which cooperates with the tapped portion 29^b of casting 29,—the upper end of said valve being provided with a kerf 30^c to provide for adjustment thereof by means of a screw-driver.

Surrounding the upper end of valve 30 is an externally threaded bushing 31 which cooperatively engages a threaded portion of said casting 29,—the upper end of said bushing being preferably provided with a flange 31^a of polygonal contour to permit tightening thereof by means of a wrench,—and the inner end of said bushing being adapted to compress a suitable gland or packing ring 32 whereby leakage of mercury around valve 30 is prevented. An internally threaded cap 33 is provided for attachment to the upper end of casting 29, said cap being knurled or otherwise roughened as indicated at 33^a to facilitate manipulation thereof.

Casting 29 is rigidly attached to cup 10 in any suitable manner, as by means of a number of screws the shanks of which take into tapped recesses in the wall of cup 10, as indicated in dotted lines at 34 in Fig. 2. A relatively thin sheet of fiber 35 is preferably clamped between cup 10 and casting 29, said sheet having openings alined with the ends of portions 13, 14 and 17, 16 of the timing passage and having openings to accommodate the aforementioned attaching screws 34. Said sheet is also preferably coated on each side with "Bakelite" varnish or shellac whereby a liquid tight seal between cup 10 and casting 29 is provided upon assembly of said parts. The countersunk recesses 34^a (Fig. 2) which accommodate the heads of screws 34 are preferably filled with a suitable wax.

The molded "Bakelite"-graphite piston 11 is provided with a central cylindrical passage 36 within which a bushing 37 is adapted to fit closely. The upper end of piston 11 is provided with an annular upstanding flange or projection 38, and the horizontal flange 39 of bushing 37 fits against said flange 38 whereby an annular recess 40 is provided at the upper end of said piston. Extending upwardly along the walls of passage 36 and opening into recess 40 are a plurality of recesses 41 (preferably three in number) the lower ends of which open to a countersink or recess 42 at the lower end of piston 11.

The lower ends of recesses 41 are partially closed by the overlying corners of a nut 43 by which bushing 37 is rigidly attached to the piston. It will be noted, however, from Fig. 1, that the walls of recesses 41 diverge outwardly toward the lower ends thereof. The arrangement is preferably such that the cleared openings at the lower ends of recesses 41 are substantially equal in area to the three openings 44 which penetrate flange 39 in line with the annular recess 40 aforementioned,—said openings 44 extending through segmental projections 39^a which have smooth flat upper surfaces and against which the downwardly offset annulus 45^a of a valve member 45 is adapted to normally seat under the bias of a coiled compression spring 46.

After the bushing 37 has been secured to piston 10 by nut 43 the screw threads at the lower ends of said elements are preferably upset or distorted, as by means of a prick punch or the like to avoid any possibility of loosening thereof. The lower end of bushing 37 is provided with an inwardly extending annular flange 47 which leaves a circular opening 48 against the upper edge of which a steel ball valve 49 is adapted to seat. Ball 49 is preferably formed separately in a well known manner to insure concentricity of its surface, and the same is then attached, as by spot welding, to the lower end 50 of a valve stem 51. Slidable upon stem 51 and adapted to bear against ball 49 is a member 52 which may conveniently consist of a section of tubular gear stock of the required size,—the spaces 52^a between the teeth thereof forming suitable passages or clearance for the flow of mercury when ball 49 is displaced from its seat. The teeth are cut away for a portion of the length of member 52 whereby a cylindrical guide and a horizontal seat or abutment are provided for the lower end of a coiled compression spring 53.

Spring 53 is initially placed under the required degree of compression by a hollow metal collar or ferrule 54 which is seated upon a suitable horizontal shoulder provided upon the interior of bushing 37 (see Fig. 1), the horizontal flange 39 of said bushing being prick-punched at a plurality of points 55 as shown to rigidly and permanently secure said ferrule in position.

The valve stem 51, which extends through an opening 45^b in valve member 45, is provided with a relatively long threaded portion 51^a at its upper end. Threaded onto said upper end is a nut 56 the reduced cylindrical lower end 56^a of which forms a guide and abutment for the upper end of spring 46. The end 51^a of stem 51 is then threaded into a tapped opening in the lower end of a lever 57,—a lock washer 58 being preferably interposed between nut 56 and said lever.

The upper end of lever 57 is pivoted by means of a pin 59 to a lever 60 at a point above the longitudinal center line of the latter, lever 60 being composed of relatively thick metal stock and being cut away from the line 60^a toward its outer end to provide adequate clearance for lever 57. As shown in Fig. 1, lever 60 is provided with an opening 60^e having flat sides 60^b and 60^c to receive with a drive fit the correspondingly shaped portion 61^a of an actuating shaft 61. As shown in Fig. 6 the portion 61^b of said shaft is adapted to bear within a ferrule or bushing 62 of stainless steel or other suitable hard metal,—said bushing 62 being shrunk within a suitable bearing opening in the casting 23. Bushing 62 projects inwardly an appreciable distance from the wall of casting 23 and the lever 60 is provided with an annular recess 60^d concentric with shaft 61, said recess being adapted to provide a close fit over the end of said bushing 62. A bearing is thus provided for the right-hand end of shaft 61 to effectually prevent leakage of mercury thereabout. Bushing 62 likewise cooperates with the

other parts illustrated to prevent endwise movement of shaft 61 toward the right.

As will be understood, shaft 61 is placed in position through a suitable opening 63 in the left-hand wall of casting 23, said opening likewise acting as a bearing for the relatively large end 61^c of said shaft. Casting 23 is provided with a countersink or recess 64 to receive a dished metal plug or disk 65 of well known form, said plug being flattened as illustrated to bite into the walls of recess 64 whereby a fluid-tight closure is provided, said plug also acting as an abutment to restrain shaft 61 against endwise movement toward the left.

As best illustrated in Fig. 1 a thin sheet of fiber 66 is interposed between the flanges 19 and 22 of cup 10 and casting 23, respectively, said sheet being coated on both sides thereof with "Bakelite" varnish or shellac to insure a fluid-tight connection between these parts when assembled. Lock washers 21^a are preferably associated with screws 21 to prevent accidental loosening of the latter.

It will be seen that by the construction and arrangement of parts as aforedescribed, the required volume of mercury may be placed within the timing device at the factory and all of the parts may be shipped in fully assembled relation since there is no possibility of the mercury escaping during transit or in handling of the device. This feature is of considerable importance from a commercial viewpoint, inasmuch as the device may be adjusted at the factory to provide a given timing function of the device and there is no possibility of any accidental variation of the adjustment such as might ensue if any of the parts were required to be disassembled prior to installation of the device.

The casting 23 is provided with a perforated bracket or projection such as 67 whereby the same may be attached to a suitable support,—a web or flange 68 being formed integrally with said bracket and the main body of the casting to strengthen the same.

In Fig. 4 we have illustrated an adaptation of our timing device to control the closing and reopening of a pair of normally open contacts 69 and 70. Contact 69 is carried by a flexible conductive strip 69^a which is attached to an L-shaped metal bracket 69^b,—the latter being in turn secured by a screw 71 to an insulating plate or panel 72, a nut 73 acting to clamp the aforementioned parts to said panel, and a nut 74 serving as means for attachment of a terminal wire.

Contact 70 is likewise carried by a conductive strip 70^a which is attached to member 70^b,—the latter having a threaded shank whereby the same may be clamped to panel 72 as by means of a nut 75,—the nut 76 serving as means for attachment of a terminal wire. The contact parts aforedescribed are preferably enclosed within or partially surrounded by the walls of a recessed insulating block 77, which is attached in any suitable manner to the member 70^b. One end of strip 70^a extends outwardly beyond the contact 70 and block 77.

The projecting end of shaft 61 is provided with a flat portion 61^d, and a lever 78 is non-rotatably fitted thereonto,—a set screw 79 or the like being employed to prevent movement of said lever endwise of the shaft. Secured to lever 78, as by means of screws 80 is a block or plate 81 of insulation the end of which is normally spaced from the projecting end of strip 70^a in an overlapping relation to the latter.

The free end of lever 78 has pivoted thereto at 82 a lever 83, the upper end 83^a of which extends through a perforation 84 in an endwise pivoted stud or block 85 carried by a lever 86, which is preferably cast to the form illustrated. Attached at one end to lever 86, as indicated at 87, and at its other end to a lug 88 attached to lever 83 is a coiled tension spring 89 whereby lever 83 is normally biased upwardly toward lever 86. The end 83^a of lever 83 is threaded and a nut 90 is adjustably carried thereon beneath the block 85 whereby the upward movement of lever 83 is limited as shown when lever 86 is in its normal or lower extreme position. Nut 90 thus provides simple means for adjustment of the initial spacing of insulating block 81 with respect to the end of strip 70^a.

Lever 86 is secured as by means of clamping plate 91 and screws 92 to the squared end 93 of an oscillatable shaft, said shaft being supported upon panel 72 as by means of suitable bearing brackets one of which is shown at 94. It may be assumed that shaft 93 is manually operable in a clockwise direction for directly or indirectly effecting closure of a plurality of contacts (not shown) to provide starting connections for an electric motor at will, whereas contacts 69 and 70 when closed are adapted to provide for completion of the running connections of the motor; said contacts 69 and 70 in practice being preferably adapted to control the energizing circuit of an accelerating relay of well known form (not shown), although if desired the same might be arranged to directly control completion of the running circuit.

Thus in operation the shaft 93 is moved in a clockwise direction to effect completion of a given electric circuit and such motion tends (through spring 89) to effect immediate upward movement of levers 83 and 78 with consequent closure of contacts 69 and 70. The dash-pot timing device aforedescribed, however, retards upward movement of lever 78, so that energy is stored in spring 89. Piston 11 therefore moves downwardly within cup 10 at a rate determined by the setting of needle-valve 30^a, and the arrangement is such that just prior to engagement of contact 70 with contact 69 the valve member 45 will strike against the annular shoulder 27 between bores 24 and 25 thus uncovering the openings 44 in the flange 39 of bushing 37 whereby the pressure of the mercury beneath the piston is additionally vented to accelerate the final movement of lever 78 to quickly close said contacts 69 and 70. Such rapid closure of the contacts as a final step in the timing operation is of great practical importance since it eliminates any tendency toward arcing or pitting of said contacts.

Resetting of the several parts to positions thereof shown or indicated in Fig. 4 may be effected quite rapidly, inasmuch as the ball valve 49 is then removed from its seat (see Fig. 3) and the mercury flows freely through the space between member 45 and the flange 39 of bushing 37 downwardly through the interior of the latter. A certain amount of the mercury may likewise flow in a reverse direction through portions 17, 16, 15, 14 and 13 of the timing passage, and during a portion of the upward movement of the piston the recesses or passages 41 will likewise be open.

As aforeindicated needle-valve 30^a may be accurately adjusted as desired to provide for variation of the timing period through a very wide range.

During manufacture of the timing device herein described the molded piston and the molded cup with which it is to be associated are tested, and the dimensions thereof changed if necessary, to insure a very accurate sliding fit of the former within the latter, with an allowance of, say, one and one-half thousandths of an inch minimum to two thousandths of an inch maximum clearance between the respective diameters. The piston is thereafter kept with the respective cup to which it has been fitted.

While we have described the cup and piston as being molded from a suitable composition of "Bakelite" and graphite, it is to be understood that under certain conditions the graphite may be omitted from the molding compound without sacrificing any of the novel results contemplated herein.

What we claim as new and desire to secure by Letters Patent is:

1. In a dash-pot timing device, in combination, a cup and a piston, the latter having a close sliding fit within the former, and said elements being composed of materials whereby the same have a relatively low coefficient of friction relatively to each other, a body of mercury interposed between said elements, and means providing a by-pass for venting said body of mercury and adapted to control the rate of movement of one of said elements with respect to the other.

2. In a mercury dash-pot timing device for electric switches, in combination, a cylinder and a piston, the former having a close sliding fit within the latter, said cylinder and piston each being molded from a composition comprising graphite and the material sold under the trade name of "Bakelite" whereby said parts have a relatively low coefficient of friction with respect to each other, a body of mercury interposed between said elements, means including an adjustable by-pass for venting said body of mercury and adapted to control the rate of movement of said piston with respect to said cylinder, a hollow cap having a mercury-tight connection with the open end of said cylinder, an actuating element penetrating said cap and having a mercury-tight bearing connection with the latter, and means providing an operative connection between said actuating element and said piston.

3. In a dash-pot timing device for electric switches and the like, in combination, a cup and a piston each formed of a composition comprising "Bakelite" and graphite, said cup having a venting passage associated therewith, and a body of mercury within said cup and cooperating with said venting passage to control the rate of movement of said piston relatively to said cup.

4. In a dash-pot timing device for electric switches and the like, in combination, a cup and a piston each formed of a composition comprising "Bakelite" and graphite, said cup having a venting passage associated therewith, a body of mercury within said cup and cooperating with said venting passage to control the rate of movement of said piston relatively to said cup, and means for varying the size of said venting passage whereby the aforementioned rate of movement may be definitely varied at will.

5. In a dash-pot timing device for electric switches and the like, in combination, a cup and a piston therefor each being molded from a composition consisting of "Bakelite" and graphite, said cup having a venting passage associated therewith, a body of mercury within said cup and cooperating with said venting passage to initially control the rate of downward movement of said piston relatively to said cup, and valve means associated with said piston and said cup and operable automatically to additionally vent said body of mercury whereby a portion of the downward movement of said piston is accelerated.

6. In a dash-pot timing device, in combination, a cup, a piston slidably movable within said cup, said piston having a central passage therethrough, a ball valve at the lower end of said passge and spring-biased to normally effect closure of the latter, said piston having a plurality of passages extending therethrough and arranged around said first-mentioned passage, a valve member spring-biased to effect closure of said last-mentioned passages, a body of mercury within said cup, and means providing an adjustable venting passage independent of all of the passages aforementioned for initially controlling the rate of downward movement of said piston relatively to said cup, said valve member being operable automatically at a given point in the travel of said piston to open said second-mentioned passages whereby the rate of downward movement of said piston is accelerated.

7. A mercury dash-pot timing device for electric switches and the like, comprising a cup and a piston closely fitted within said cup and slidable with respect thereto, said piston having a plurality of passages extending from end to end thereof, spring-pressed valve members at the upper and lower ends of said piston for normally closing the respective passages, means directly connected with the lower valve member and operable to effect downward movement of said piston, a body of mercury within said cup beneath the piston to resist downward movement of the latter, means providing an adjustable by-pass for said body of mercury whereby the initial rate of downward movement of said piston may be definitely controlled, and a shoulder on said cup to be engaged by the upper valve member to open the latter at a given point in the downward movement of said piston, whereby such downward movement is accelerated.

8. A liquid dash-pot timing device for electric switches and the like, comprising a cup and a piston closely fitted within said cup and slidable with respect thereto, said piston having a plurality of passages extending from end to end thereof, spring-pressed valve members at the upper and lower ends of said piston for normally closing the respective passages, means directly connected with the lower valve member and operable to effect downward movement of said piston, a body of liquid within said cup beneath the piston to resist downward movement of the latter, means providing an adjustable by-pass for said body of liquid whereby the initial rate of downward movement of said piston may be definitely controlled, and a shoulder on said cup to be engaged by the upper valve member to open the latter at a given point in the downward movement of said piston, whereby such downward movement is accelerated.

9. In a dash-pot timing device for electric switches and the like, in combination, a molded composition cup and a molded composition piston closely fitted within said cup and slidable with respect thereto, a metal member secured to a side wall of said cup, said metal member having a venting passage extending therethrough and through said side wall of the cup at vertically spaced points in the latter, a body of mercury

within said cup and displaceable through said passage by downward movement of said piston, a valve member carried by said metal member and adjustable to vary the size of said venting passage whereby the rate of downward movement of said piston may be definitely controlled, a chambered metal cover member secured to the open end of said cup, a horizontally disposed shaft bearing within openings in opposed walls of said cover member and having an end portion projecting outwardly from the latter, means associated with said bearing openings to prevent leakage of mercury from said chamber, actuating means for said shaft, and a leverage connection between the latter and said piston.

10. In a device of the character described, in combination, a piston molded from a composition of "Bakelite" and graphite, said piston having a relatively large central passage extending longitudinally therethrough and a plurality of passages surrounding said central passage and opening thereinto, a hollow metal bushing having a body portion adapted to fit closely within said central passage to separate the second-mentioned passages therefrom, said body portion having an inwardly extending annular flange providing a valve opening at the lower end thereof, a valve member located within said body member and spring-biased into engagement with said valve opening, said bushing having a horizontal flange and said piston having an upstanding annular flange whereby an annular recess is provided between said parts, said second-mentioned passages being arranged to communicate with said recess, said horizontal flange having a plurality of openings therethrough, and a metal disk superimposed upon said horizontal flange and spring-biased into engagement with the latter to normally close said openings.

11. In a device of the character described, in combination, a piston molded from a composition of "Bakelite" and graphite, said piston having a relatively large central passage extending longitudinally therethrough and a plurality of passages surrounding said central passage and opening thereinto, a hollow metal bushing having a body portion adapted to fit closely within said central passage to separate the second-mentioned passages therefrom, said body portion having an inwardly extending annular flange providing a valve opening at the lower end thereof, a valve member located within said body member and spring-biased into engagement with said valve opening, said bushing having a horizontal flange and said piston having an upstanding annular flange whereby an annular recess is provided between said parts, said second-mentioned passages being arranged to communicate with said recess, said horizontal flange having a plurality of openings therethrough, and a metal disk superimposed upon said horizontal flange and spring-biased into engagement with the latter to normally close said openings, said ball-valve and said disk being movable independently of each other to effect opening of the respective passages controlled thereby.

12. In a dash-pot timing device for electric switches and the like, in combination, a molded composition cylinder having a closed lower end, a piston closely fitted within said cylinder and slidable with respect thereto, a cast metal member secured to one side of said cylinder, said member having a venting passage extending therethrough and communicating with the interior of said cylinder at vertically spaced points in the latter, a body of liquid within said cylinder and displaceable through said passage by downward movement of said piston, adjustable means carried by said member and associated with said venting passage for varying the size of the latter whereby the rate of downward movement of said piston may be controlled, a chambered metal cover member secured to the open end of said cylinder in liquid-tight relation thereto, said cover member having a pair of bearing openings formed in the opposed walls thereof, a horizontally disposed shaft insertable endwise into said bearing openings and having an end portion extending outwardly from said cover member, means comprising a pair of metal members respectively associated with said bearing openings and with said shaft to restrain the latter against endwise movement in either direction and to insure against leakage of liquid from said cover member, actuating means connected with the projecting end of said shaft, and a leverage connection between the latter and said piston.

13. In a device of the character described, in combination, a piston, said piston having a relatively large central passage extending longitudinally therethrough and having a plurality of passages surrounding said central passage and opening thereinto, a hollow bushing having a body portion adapted to fit closely within said central passage to separate the second-mentioned passages therefrom, said body portion having an inwardly extending annular flange providing a valve opening at the lower end thereof, a valve member located within said body member and spring-biased into engagement with said valve opening, said bushing having a horizontal flange and said piston having an upstanding annular flange whereby an annular recess is provided between said parts, said second-mentioned passages being arranged to communicate with said recess, said horizontal flange having a plurality of openings therethrough, a metal disk superimposed upon said horizontal flange and spring-biased into engagement with the latter to normally close said openings, a cylinder within which said piston is slidably mounted, a body of liquid interposed between the closed lower end of said cylinder and said piston, means additional to the passages aforementioned for controllably venting said liquid upon initial downward pressure on said piston, and means located in the path of said metal disk for displacing the latter at a given point in the downward movement of said piston, whereby said liquid is further vented to decrease the resistance to movement of said piston.

14. In a device of the character described, in combination, a piston, said piston having a relatively large central passage extending longitudinally therethrough and having a plurality of passages surrounding said central passage and opening thereinto, a hollow bushing having a body portion adapted to fit closely within said central passage to separate the second-mentioned passages therefrom, said body portion having an inwardly extending annular flange providing a valve opening at the lower end thereof, a valve member located within said body member and spring-biased into engagement with said valve opening, said bushing having a horizontal flange and said piston having an upstanding annular flange whereby an annular recess is provided between said parts, said second-mentioned passages being arranged to communicate with said recess, said horizontal flange having a

plurality of openings therethrough, a metal disk superimposed upon said horizontal flange and spring-biased into engagement with the latter to normally close said openings, a cylinder within which said piston is slidably mounted, a body of liquid interposed between the closed lower end of said cylinder and said piston, means additional to the passages aforementioned for controllably venting said liquid upon initial downward pressure on said piston, and means located in the path of said metal disk for displacing the latter at a given point in the downward movement of said piston whereby said liquid is further vented to decrease the resistance to movement of said piston, the means for actuating said piston including means for upwardly displacing said first mentioned valve member to provide a relatively large venting passage, whereby said piston may be quickly reset to its upper extreme position.

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