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C. E. BAZLEY

2,460,116

CONTROL DEVICE

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Fig. 1.

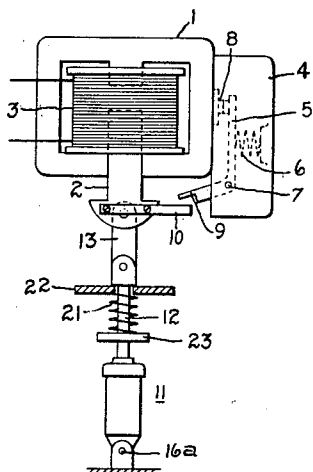


Fig. 2.

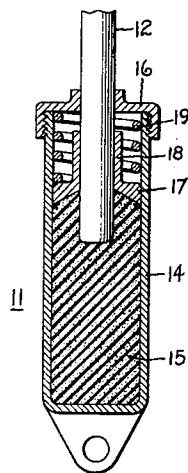


Fig. 3.

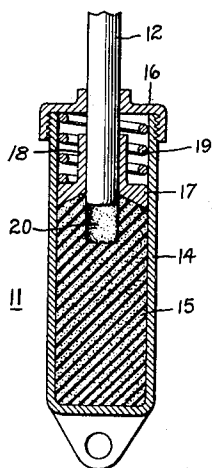
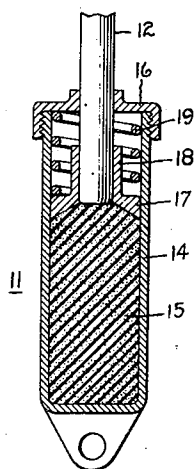


Fig. 4.



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UNITED STATES PATENT OFFICE

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CONTROL DEVICE

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6 Claims. (Cl. 267—1)

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My invention relates to control devices, more particularly to time delay devices applicable to various apparatus, such as electric switches, and has for its object a simple, reliable and inexpensive time delay means.

In carrying out my invention in one form, I utilize as a time delay medium a plastic material having a substantially uniform viscosity over wide ranges of temperature.

I arrange a quantity of this plastic material in a container, together with a plunger which for a time delay action moves into the plastic material so as to de-form it whereby the movement of the plunger is delayed. The plunger may be withdrawn quickly for return movement after which the plastic material is re-formed by suitable spring compression means.

For a more complete understanding of my invention reference should be had to the accompanying drawing Fig. 1 of which is a front elevational view of an electromagnetically operated electric switch or relay provided with time delay means embodying my invention; Fig. 2 is an enlarged sectional view of the time delay means shown in Fig. 1; while Figs. 3 and 4 are views similar to Fig. 2 showing different stages in the operation of the time delay device.

Referring to the drawing, I have shown my invention in one form as applied to an electromagnetically operated switch or relay comprising an electromagnet having a magnet core 1, a plunger armature 2, and an operating coil 3.

Secured to the magnet frame 4 made of magnet core iron is an enclosure 4 containing a switch arm 5 biased by a spring 6 to its pivot 7 to a closed circuit position in engagement with stationary contact 8. At its lower end the switch arm has a projection 9 in position to be engaged by a projection 10 on the plunger armature 2 when the plunger moves upward to its attracted position upon energization of the coil.

In accordance with my invention I provide a time delay device 11 having a plunger 12 whose upper end is connected by means of a link 13 to the armature 2. The plunger 12 as shown in Fig. 2 extends into a cylindrical container 14 containing a quantity of a suitable plastic material 15 having the property of substantially uniform viscosity over wide ranges of temperatures. The plunger 12 has a diameter which is only a fraction of the diameter of the container 14, the plunger being held in axial concentric relation with the container by means of a bushing 16 secured to the top of the container. As shown the container 14 is mounted at its lower end on a pivot 16a to provide if required a slight rocking motion.

When the armature 2 is in its lowermost position as shown in Fig. 1, the plunger 12 extends downward for a substantial distance into the plastic material as shown in Fig. 2, whereby the

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plastic material is displaced by the plunger and forced upward and around the plunger into the space between the plunger and the container 14.

For the purpose of re-forming the plastic material when the plunger is withdrawn by upward movement, I provide a piston 17 having a substantially close sliding fit in the bore of the container 14. This piston is provided with a central opening whose wall forms a close sliding fit with the plunger, this wall being extended by a guide flange 18 surrounding the plunger.

By means of a helical spring 19 in the chamber 14 having its upper end bearing against the bushing 16 and its lower end bearing on the piston 17, the plunger is biased downward with a predetermined force against the plastic material.

In the operation of the device, when the coil 3 is energized, the armature 2 and the plunger 12 are moved quickly upward until the armature reaches its attracted position. During this movement the plunger 12 is withdrawn from the plastic material, as indicated in Fig. 3, and the switch arm 5 is moved clockwise by the projection 10 to its open circuit position.

Upon withdrawal of the plunger 12 to the position indicated in Fig. 3, the pressure exerted by the spring 19 on the plastic material forces the material quickly into the space 20 left by the plunger, the piston 17 being forced downward by the spring. The parts quickly assume their relative positions shown in Fig. 4 with the plastic material completely re-formed and filled in below the lower end of the plunger 12.

A time interval or time delay is now obtained in the movement of the switch arm 5 to its closed circuit position when the coil 3 is deenergized. Upon the deenergization of the coil, the armature 2 and the plunger 12 are moved downward by a predetermined force consisting of the weight of the moving parts and the downward force applied by a helical biasing spring 21 surrounding the plunger 12. As shown, the upper end of the spring 21 rests against a stationary member 22 having an aperture whose walls form a guide for the plunger 12, while its lower end engages a flange 23 on the plunger 12. The combined weight of the armature and other parts and the biasing force of the spring 21 are so related to the viscosity of the plastic material as to give a desired time interval.

As the plunger 12 moves into the plastic material it displaces the plastic material which is caused to flow upward around the plunger, thereby raising the piston 17 against the force of the spring 19. Finally, the plunger reaches its lowermost position shown in Figs. 1 and 2 with the head of the plunger 12 resting on the member 22. At some time during this downward movement of the plunger when the plunger reaches a predetermined position, the switch arm 5 engages

the stationary contact 8 a predetermined time interval after the deenergization of the coil 3.

As a plastic material 15 having a substantially uniform viscosity over wide ranges of temperature, I use a kneadable cold-flowing composition having a high degree of bounce, i. e., being elastic under impulsive force, said composition comprising a heat reaction product of a dimethyl silicone oil and a minor proportion of a boron compound containing both boron and oxygen and, if desired, a filler and a hydrophilic material or a hydrophobic material, or both. Such a material is described and claimed in a copending application, Serial No. 569,647, filed on December 23, 1944, by James G. E. Wright, for Composition of matter, which application is assigned to the same assignee as the present application.

A preferred formula for the plastic material 15 for general purposes is as follows: A mixture of 500 parts of dimethyl silicone, 35 parts pyroboric acid made by heating boric acid to 150 degrees C. for 2 hours and grinding the product, and 5 parts ferric chloride hexahydrate is heated to 150 degrees with constant stirring. At the end of about six hours the mixture becomes stiff. It may then be placed in an oven and heated for an additional 18 hours. With a powerful stirrer which scrapes well the interior surface of the reacting vessel, the whole operation may be completed in the original vessel and in a shorter time. Different size batches may require different treatments depending upon the size of the vessel, the shape, whether shallow or deep, and the rate and manner of stirring. Small variations in the properties may be compensated for by using varying amounts of oleic acid and glycerine. Usually, both are desirable for an accurate adjustment of the properties. About 15 per cent of a filler, such as lithopone gives a final product strongly resembling ordinary window putty in appearance. The softer grades of the compositions will tolerate as much as 50 per cent of filler without substantial alteration of their elastic and plastic properties.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a container, a quantity of cold flowing solid plastic material having a high degree of bounce in said container, a member mounted for movement into said plastic material whereby said material is deformed and the movement of said member is delayed by reason of the viscosity of said material, and means for applying a pressure to said material to re-form it after said member is moved out of said material.

2. A time delay device comprising a container, a quantity of a plastic material in said container, said plastic material comprising a heat reaction product of dimethyl silicone oil and a boron compound, a plunger mounted for movement into said plastic material whereby said material is deformed and the movement of said member is delayed by reason of the viscosity of said material, and means applying a pressure to said material to re-form it upon withdrawal of said plunger.

3. A time delay device comprising a container, a quantity of cold flowing solid plastic material

in said container, said plastic material flowing under pressure and being elastic under impulsive force, a plunger mounted for movement into said plastic material whereby said material is deformed and the movement of said member is delayed by reason of the viscosity of said material, means for applying a predetermined force to said plunger thereby to move said plunger into said material to a predetermined position in a predetermined time, and means applying a pressure to said material to re-form it quickly upon withdrawal of said plunger.

4. A time delay device comprising a container, a quantity of cold flowing solid plastic material in said container, said plastic material flowing under pressure and being elastic under impulsive force, a plunger extending into said container movable into said plastic material, said plunger having a diameter smaller than said container to provide for the flow of said plastic material into the space between said plunger and said container when said plunger is forced into said material whereby said material is deformed and the movement of said plunger delayed by the viscosity of said material, a piston in said container, and a spring in said container applying a force holding said piston against said plastic material thereby to re-form quickly said plastic material when said plunger is withdrawn.

5. A time delay device comprising a cylindrical container, a quantity of cold flowing solid plastic material in said container, said plastic material flowing under pressure and being elastic under impulsive force, a plunger extending into said container, said plunger having a diameter much smaller than said container to provide for the flow of said plastic material into the space between said plunger and said container when said plunger is forced into said material whereby the said material is deformed, a piston in said container provided with a central aperture through which said plunger extends, and a spring in said container applying a force to move said piston against said plastic material thereby to re-form quickly said plastic material when said plunger is withdrawn.

6. In combination, a container, a quantity of cold flowing solid plastic material in said container, said plastic material flowing under pressure and being elastic under impulsive force, a plunger having a cross sectional area smaller than the internal cross sectional area of said container, means mounting said plunger for movement into said plastic material, said movement causing said material to flow around said plunger and assume an abnormal shape, and spring means for deforming said plastic material.

CARL E. BAZLEY.

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