

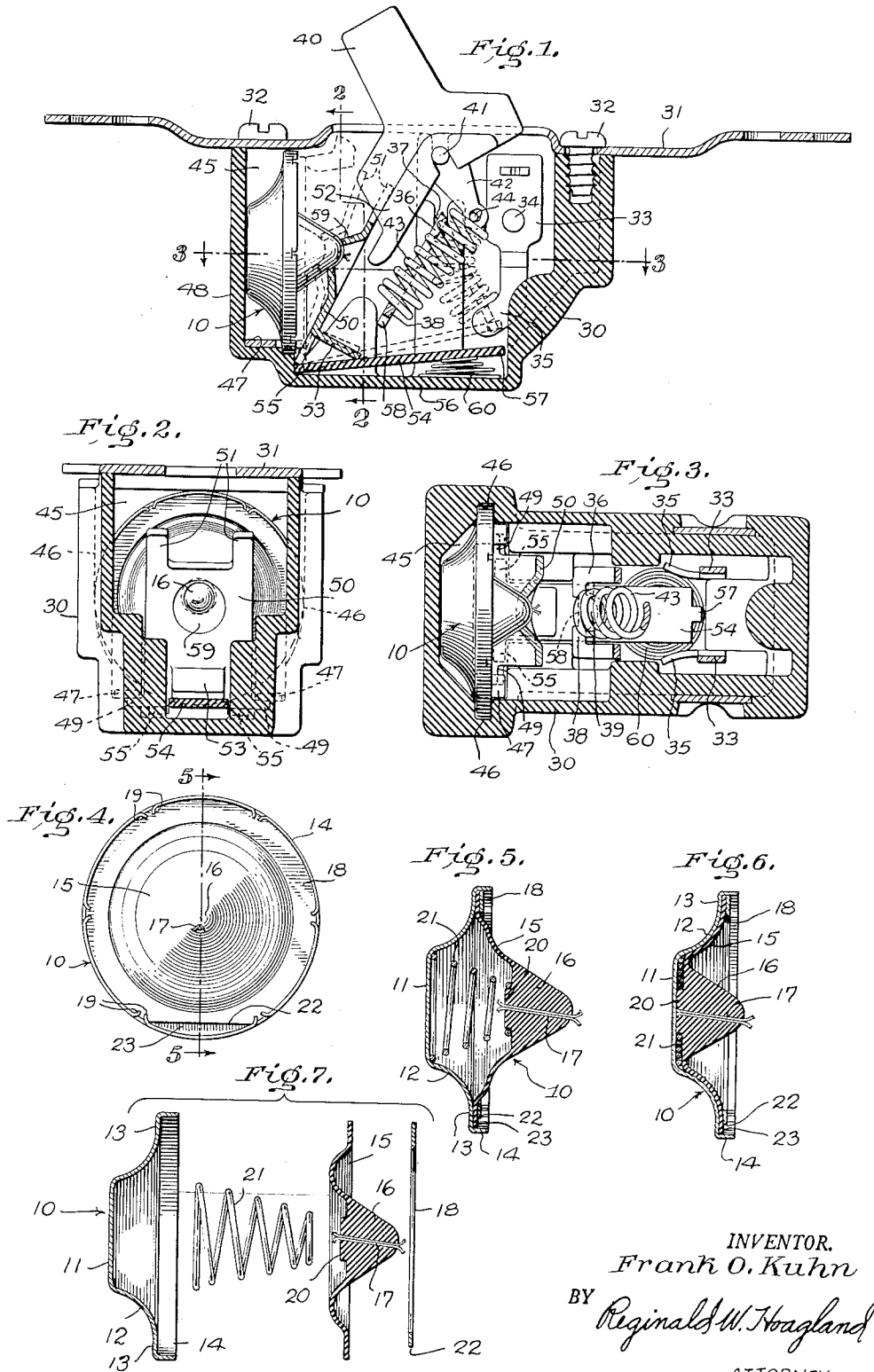
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TIME DELAY MECHANISM

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TIME DELAY MECHANISM

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9 Claims. (Cl. 267—1)

This invention relates to time delay devices that when set into operation actuate other devices after a predetermined interval of time has elapsed.

The main object of the invention is to provide a novel and improved self-contained time delay unit which is simple and substantial in construction, dependable in operation, and which may be conveniently associated with operative parts of other mechanisms such as, for example, electric switches, for causing operation of said other mechanisms.

Another object of the invention is to provide, in a device of the character set forth, novel means for metering the passage of a gaseous fluid, such means forming a part of the invention.

Still another object of the invention is the provision, in a device of the character set forth, of a novel exhaust valve forming a part of the invention.

A further object of the invention is the provision, in a device of the character set forth, of a novel mounting for a diaphragm spring forming a part of the invention.

A still further object of the invention is the provision, in a device of the character set forth, of a novel unitary time delay unit which is simple in construction, inexpensive to manufacture and yet effective and efficient in use.

Other and further objects of the invention will become apparent from a reading of the following specification taken in construction with the drawing, in which:

Figure 1 is a vertical sectional view, partly in elevation, of an embodiment of the invention wherein the same forms a part of an electrical switch,

Figure 2 is a sectional view taken along line 2—2 of Figure 1,

Figure 3 is a sectional view taken along line 3—3 of Figure 1,

Figure 4 is an elevational view of a time delay unit constructed in accordance with the teachings of the present invention,

Figure 5 is a sectional view taken along line 5—5 and showing a diaphragm forming a part of the invention in expanded position,

Figure 6 is a view similar to Figure 5 but showing the diaphragm in depressed or retracted position, and

Figure 7 is an exploded sectional view, partly in elevation, of the device illustrated, for example, in Figures 4 to 6, inclusive.

Referring more particularly to the drawing, there is shown therein a time delay unit generally indicated at 10 and comprising a cup 11 having outwardly flaring sides 12 terminating in a radially extending peripheral portion 13 whose outer edge has integrally formed therewith a cylindrical flange 14. There is also provided as a part of the unit 10 a circular diaphragm 15 having an outwardly extending centrally disposed thickened portion 16 in which is centrally and longitudinally embedded one or more fibrous threads 17. The diaphragm 15 is composed of any suitable flexible material such as rubber, neoprene or the like and the threads 17 may be of any suitable

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fibrous material but I have found preferable for the purposes of this invention the use of nylon threads.

In practice, it has been found that the most practical and convenient manner of embedding the threads into the diaphragm has been to merely force a threaded needle through the thickened portion 16 of the diaphragm and then leave strands of the thread extending entirely through the diaphragm by severing the thread a short distance outwardly of opposite sides of the diaphragm thickened portion; however, it is to be understood that other methods may be employed for the installation of the threads.

A lock ring 18 of flat metal is positioned over the peripheral portion of the diaphragm 15 to maintain such peripheral portion against the radial portion 13 of the cup 11 and the ring 18 is locked in such position by splitting the flange 14 at circumferentially spaced points to form inwardly directed lugs 19. The inner face of the thickened portion 16 has integrally formed thereon a circular boss 20. A helical spring 21 is interposed between the cup 11 and diaphragm 15 in such manner that its larger end bears against the cup while the smaller end encircles the boss 20.

The ring 18 is chordally cut away, as indicated at 22, to thereby expose a sector 23 of the peripheral portion of the diaphragm 15 and to provide flexibility to an area of the ring between two sets of the locking lugs 19, such portion 23 thus becoming an outlet valve for the unit 10.

In the operation of this portion of the invention, it will be apparent that the diaphragm 15 may be quickly moved from its extended position as illustrated in Figure 5 to its collapsed condition as shown in Figure 6 by pressing inwardly upon the enlarged portion 16 against the action of the spring 21. During this inward movement of the diaphragm 15 air will be expelled through the outlet valve 23, it being apparent that the weakened portion of the ring caused by the cut-away will be flexed outwardly by air being compressed in the unit and since the sector 23 of the diaphragm is not confined by the ring 18, it together with said flexing action will allow air to quickly escape under such portion of the diaphragm but will prevent the return of air due to the fact that the flexed portion springs back to its normal position and any inward pressure upon the exposed sector 23 will tend to force the same against the radial portion 13 of the cup 11. When air has been thus exhausted from the interior of the unit 10 and inward pressure is released from the outer side of the diaphragm, the spring 21 will begin to urge the diaphragm again to its outward position shown in Figure 5. Such outward movement of the diaphragm would normally be impossible due to atmospheric pressure, it being understood that the spring 21 is of insufficient strength to overcome such atmospheric pressure. The provision of the thread or threads 17, however, makes it possible for air (or other gas) to pass from without the unit 10 through such thread or threads to the interior of the unit. Due to the minuteness of the diameter of the thread and the length thereof through which such air must pass, the reintroduction of air into the unit necessarily consumes a definite period of time. By selecting the number of such threads and the type of fiber of which such threads are composed, as well as the size of such individual threads and the length thereof, such time interval may be regulated in accordance with the needs of the particular unit. By "length of the thread" is meant that portion of the thread which is embedded in the thickened portion 16, it being understood that the thickness of this portion 16 may be varied likewise in accordance with the needs of the particular unit.

Referring now more particularly to Figures 1 to 3, inclusive of the drawing, there is shown therein a switch mechanism utilizing one of the units 10 above described. The switch mechanism shown in the present application

constitutes an improvement over my former Patent No. 2,190,842 dated February 20, 1940, and includes some of the mechanisms shown in such former patent. The switch of the present invention includes a casing 30 of Bakelite or other suitable dielectric material having an open outer end covered by a base plate 31 removably mounted thereon by means of screws 32 or the like. A pair of fixed contact members 33 is respectively fixed to opposite sides of the inner wall of the casing 30 and each is held in position by a terminal member 34. Each of the fixed contacts is provided at its lower end with a resilient finger portion 35. A U-shaped movable contact member 36 has the free end of each of its legs pivoted in a suitable groove 37, such grooves being formed on either side of the inner wall of the casing 30. Extending upwardly from the bight portion 38 of the member 36 is a lug 39.

A switch handle 40 is pivotally mounted upon a transverse shaft 41 extending across the upper portion of the interior of the casing 30 and has affixed thereto a dependent lever 42. A compression spring 43 is affixed at its upper end, as indicated at 44, to the lower end of the lever 42 and has its lower end positioned over the lug 39.

One end of the casing 30 is provided with a chamber 45 for vertically receiving the cup 11 and of communicating with a pair of vertical slots 46 for receiving slidably therein the flange 14 and allied parts of the unit 10. A U-shaped guard member 47 is positioned horizontally in the lower end of the chamber 45 with its bight portion adjacent the end wall 48 of the casing 30 and the free end portions of the legs of the member 47 overlie outstanding ears 49 of an actuator plate 50 of substantially rectangular shape and whose upper end is provided at either side thereof with an upwardly extending arm 51, such arms bearing against a dependent lip portion 52 formed integrally with the handle 40.

An outstanding tongue 53 is formed integrally with the lower end of the plate 50 and bears against the upper side of an elongated latch 54 which is generally rectangular in shape and formed of a dielectric material such as Bakelite. The latch 54 is provided at one end with outstanding ears 55 positioned in suitable grooves formed in the bottom 56 of the casing 30 whereby to provide a pivot for the same. The free end of the latch 54 has centrally extending therefrom an integrally formed lug 57 which is receivable in a notch 58 centrally formed in the upper side of the bight portion of the U-shaped member 36.

An apertured protuberance 59 is formed substantially centrally in the plate 50 and extends toward the unit 10 to engage the outermost portion of the thickened portion 16 therein and a like helical spring 60 is interposed between the bottom 56 and the free end portion of the latch 54.

The operation of the switch just described is as follows: In Figure 1, it will be apparent that the switch is in its "off" position and that the various movable parts of the device are shown in full lines in such position. When it is desired to complete a circuit by the switch, the handle 40 is moved to the right as viewed in Figure 1, that is to say to the "on" position pivoting upon the shaft 41 at such time. This will act to move the lever 42 likewise in a clockwise position to thus move the upper end of the spring 43 to the left side of the plane of the U-shaped member 36, likewise as viewed in Figure 1 to thus force with a snap action the U-shaped member 36 to a position between the flexible fingers 35 and in full frictional contact therewith thus completing electrical circuit between the terminals 34. When this action occurs the latch 54 will be forced upwardly by the spring 60 so that the lug 57 will become positioned within the notch 58.

When, now, it is desired to again open the switch, the handle is again moved to its first position. This action will release the actuator plate 50 from inward pressure upon the diaphragm 15 of the unit 10 previously placed

thereon when the handle 40 was moved in the opposite direction due to the action of the lip 52 impinging against the plate 50 and the diaphragm will now be allowed to slowly expand in the manner above described thus slowly moving the arm 53 against the latch 54 and against the action of the light helical spring 60 to eventually disengage the lug 57 from the notch 58 to thus allow the spring 43 to reassume its first position. This latter action will, of course, cause the U-shaped member 36 to be moved to the left as viewed in Figure 1 to thus sever its interconnecting engagement with the spring arm portions 35 of the fixed contact members 33. Thus will be seen that the unit 10 acts to cause a definite delay in the opening of the switch when the handle 40 is moved to its "off" position. It will also be seen that the unit 10 may be replaced quickly and easily as a whole unit with respect to the remainder of the mechanisms forming the part of the switch.

In view of the foregoing description taken in conjunction with the accompanying drawings, it is believed that a clear understanding of the construction, operation, and advantages of the device will be quite apparent to those skilled in this art. A more detailed description is accordingly deemed unnecessary.

It is to be understood, however, that even though there is herein shown and described preferred embodiments of the invention, various changes may be made without departing from the spirit and full intentment of the invention.

What is claimed is:

1. A time delay mechanism comprising a cup having outwardly flaring side walls, said side walls having a radially extending peripheral portion, a cylindrical flange formed integrally with the outer edge of said radial portion, a compressible diaphragm positioned within said flange and engaging said radial portion of said cup to form a chamber between said diaphragm and said cup, a flat lock ring superposed over the peripheral portion of said diaphragm and likewise positioned within said flange, lock lugs formed in said flange and in engagement with said lock ring to normally maintain the entire peripheral portion of said diaphragm under pressure between said lock ring and radial portion of said cup, said lock ring being chordally cut away to form an outlet valve for said chamber of the exposed sector of said diaphragm in conjunction with the adjacent radial portion of the cup, and means for metering the entrance of gaseous fluid to said chamber.

2. A time delay mechanism comprising an expansible chamber composed of a circular rigid wall and a compressible diaphragm wall peripherally connected together and forming said chamber therebetween, spring means that urge the central portion of said diaphragm wall away from said rigid wall, an outlet valve to permit the escape of gaseous fluid from said chamber upon a build-up of pressure therein, and separate metering means for the entrance of gaseous fluid to said chamber, said metering means comprising a thin thread of fibrous material extending entirely through said diaphragm wall with one end exposed interiorly of said chamber and the opposite end exposed exteriorly of said chamber, said thread being of a diameter considerably less than the thickness of the wall portion of the diaphragm through which it extends.

3. A time delay mechanism comprising an expansible chamber composed of a circular rigid wall and a compressible diaphragm wall peripherally connected together and forming said chamber therebetween, spring means that urge the central portion of said diaphragm wall away from said rigid wall, an outlet valve to permit the escape of gaseous fluid from said chamber upon a build-up of pressure therein, and separate metering means for the entrance of gaseous fluid to said chamber, said metering means consisting of a plurality of strands of thin thread of fibrous material in contact with one another and extending entirely through said diaphragm wall with the

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opposite ends thereof exposed at opposite sides of said diaphragm and the collective diameter of all strands being considerably less than the thickness of the wall portion of the diaphragm through which they extend.

4. A device in accordance with claim 2 wherein the material from which the diaphragm wall is constructed is materially increased in thickness at a location centrally of said diaphragm and wherein it is through such thickened wall portion that the thread extends.

5. A device in accordance with claim 3 wherein the diaphragm wall is materially increased in its thickness at a location centrally thereof and wherein it is through such thickened wall portion that the strands of thread extend.

6. A time delay mechanism comprising an expansible chamber composed of a circular rigid wall and a compressible diaphragm wall peripherally connected together and forming said chamber therebetween, an outlet valve to permit the escape of gaseous fluid from said chamber upon a build-up of pressure therein, separate metering means for the entrance of gaseous fluid to said chamber, a circular boss formed integrally with and centrally upon the inner face of said diaphragm wall, a coil spring having a larger end bearing against said rigid wall and a smaller end encompassing said boss for urging the central portion of said diaphragm wall away from said rigid wall, and metering means for the entrance of gaseous fluid to said chamber, said metering means comprising a thin thread of fibrous material extending entirely through the integral boss portion of said diaphragm wall with one end exposed interiorly of said chamber and inwardly of the coils of said helical spring and the opposite end exposed exteriorly of said chamber, said thread being of a diameter considerably less than the thickness of the boss portion of said diaphragm through which it extends.

7. A time delay mechanism comprising a cup having a bottom and outwardly flaring side walls extending from said bottom, said side walls having a radially extending peripheral portion, a cylindrical flange formed integrally with the outer edge of said radial portion, a compressible diaphragm positioned within said flange and bearing against said radial portion of said cup, a flat lock ring superposed over the peripheral portion of said diaphragm and likewise positioned within said flange, lock lugs formed in said flange to maintain said ring in position, a centrally disposed thickened portion arranged outwardly on said diaphragm, a circular boss formed integrally and

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centrally upon the inner face of said diaphragm, a thread of fibrous material extending entirely through said thickened portion and said boss and having its opposite ends protruding from said thickened portion and boss, a coil spring having a larger end confined within said flaring side wall and bearing against said bottom of said cup and having a smaller end encompassing said boss, whereby said boss engages the bottom of said cup and said spring occupies a minimum space in said chamber when the latter is fully compressed, and an outlet valve to permit the escape of gaseous pressure built up between said cup and said diaphragm.

8. A time delay mechanism comprising an expansible chamber composed of a circular rigid wall, a circular compressible diaphragm positioned to one side of said rigid wall, and a ring superposed over the peripheral portion of said diaphragm and held in place by said rigid wall, said ring normally maintaining the entire peripheral portion of said diaphragm under pressure and thereby forming said chamber between said rigid wall and said diaphragm wall, said ring being chordally cut away in its outer perimeter a short distance along its circumference and thereby permitting flexing of said ring at such area and a slight separation of a peripheral portion of said diaphragm from said rigid wall for the escape of gaseous fluid from said chamber upon a build-up of pressure in said chamber; a spring interposed between said rigid wall and diaphragm and adapted to urge the central portion of said diaphragm away from said rigid wall; and separate metering means for the entrance of gaseous fluid to said chamber.

9. A device in accordance with claim 8 wherein the ring is held by the rigid wall at spaced points around the circumference of the ring and wherein the chordally cut away portion of the ring is located between a pair of spaced holding points of said rigid wall.

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