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[54] **SOLENOID CONSTRUCTION MEANS OR THE LIKE**
20 Claims, 3 Drawing Figs.

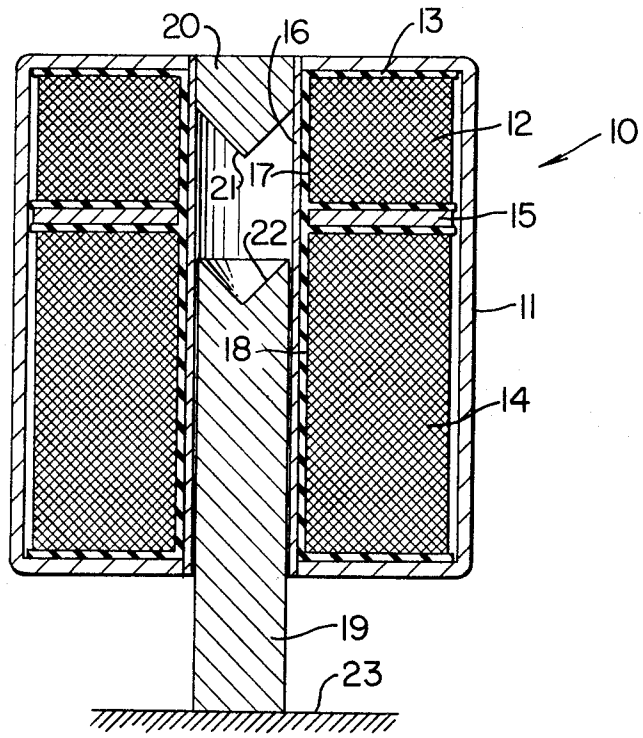
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[51] **Int. Cl.** **H01h 47/00**
[50] **Field of Search** 317/155.5; 335/266, 268, 256

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ABSTRACT: A solenoid construction wherein a pull coil means is only adapted to move a plunger means from its deenergized position to a position intermediate its deenergized position and its fully actuated position when the pull coil means is energized whereby the plunger means when disposed in its intermediate position is adapted to be influenced by a hold coil means so that when the hold coil means is also energized the same will move the plunger means from its intermediate position to its fully actuated position and hold the plunger in its fully actuated position regardless of whether or not the pull coil means remains energized.



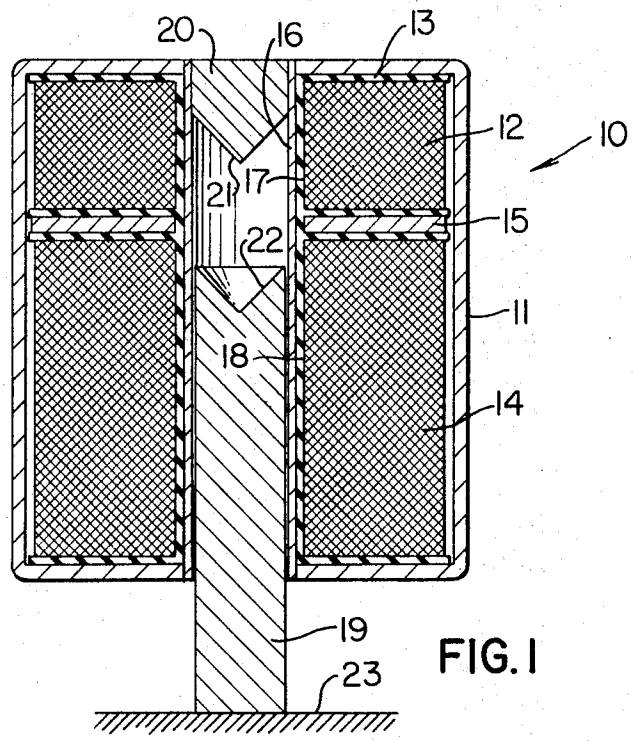


FIG. 1

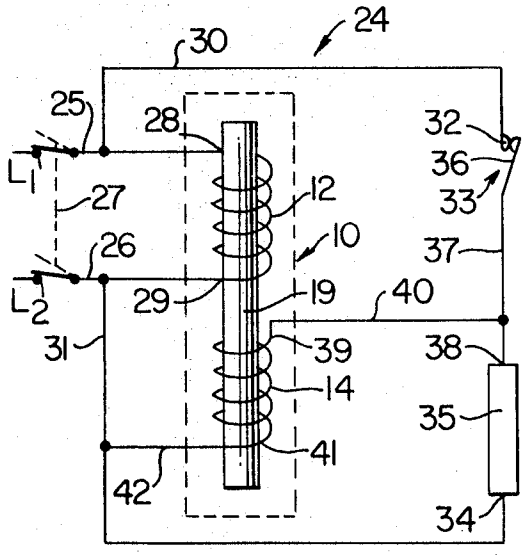


FIG. 2

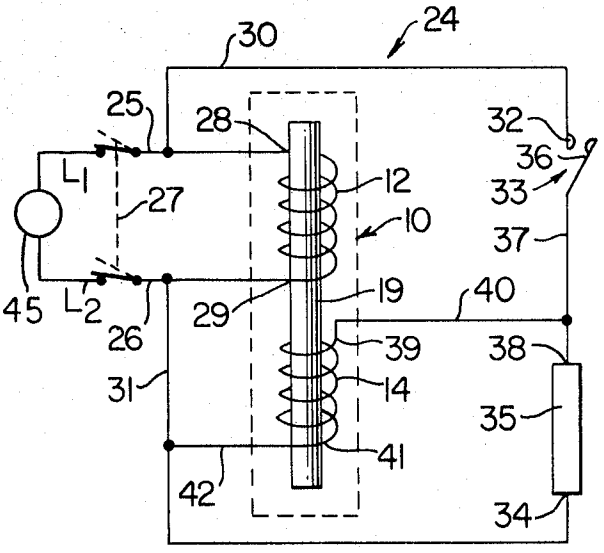


FIG. 3

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SOLENOID CONSTRUCTION MEANS OR THE LIKE

This invention relates to an improved solenoid coil construction as well as to an improved circuit for operating the same or the like.

It is well known that various pull-hold solenoids have been provided wherein a pull winding or coil is adapted to fully move an associated plunger member from its deenergized position to its fully actuated position, such prior known pull-hold solenoid constructions also having a hold winding or coil that will maintain the plunger in its fully actuated condition whereby the pull coil winding or coil is deenergized while the hold winding or coil remains energized to maintain the plunger in its fully actuated position.

However, according to the teachings of this invention, a solenoid construction is provided wherein both the pull coil and the hold coil must be energized to move the plunger means from its deenergized position to its fully actuated position, the solenoid construction of this invention thereafter permitting loading or unloading of the pull coil while the hold coil as fully energized without having adverse transformer action between the coils so as to minimize effects of loading which result in more uniform hold characteristics of the solenoid construction of this invention.

In particular, one embodiment of the solenoid construction of this invention comprises a pull coil and a hold coil disposed in stacked coaxial relation with a magnetic separator therebetween and being so constructed and arranged relative to the plunger that when the pull coil is energized, the same is only adapted to move the plunger from its deenergized position to an intermediate position intermediate the deenergized position and the fully actuated position of the plunger, such intermediate position of the plunger being within the influence of the hold coil so that the energized hold coil will move the plunger from such intermediate position to its fully actuated position and maintain the same in its fully actuated position even though the pull coil is subsequently loaded and unloaded in an alternating manner.

Accordingly, it is an object of this invention to provide an improved solenoid construction having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved solenoid circuit means, the circuit means having one or more of the novel features set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description, which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a cross-sectional view of the improved solenoid construction of this invention, the plunger thereof being in its deenergized position.

FIG. 2 is a schematic view illustrating the solenoid construction of FIG. 1 and the electrical circuit of this invention, the plunger means being in its fully actuated condition and the pull coil being fully loaded.

FIG. 3 is a view similar to FIG. 2 and illustrates the pull coil in its deenergized condition while the hold coil maintains the plunger in its fully actuated position.

While the various features of this invention are hereinafter described and illustrated as being particularly adaptable for providing a single operating solenoid construction means, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide other types of solenoid operated systems.

Therefore, this invention is not to be limited to only the embodiments illustrated in the drawings because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIG. 1, the improved solenoid construction of this invention is generally indicated by the reference numeral 10 and comprises a housing means or external magnetic yoke means 11 carrying a hold winding or coil means 12 insulated therefrom by suitable insulating means 13 as well as from a pull winding or coil means 14 also carried by the housing means 11 and insulated therefrom by the insulating means 13.

The coil means 12 and 14 are disposed in stacked coaxial aligned relation in the housing means 11 and have a magnetic separating washer means 15 disposed therebetween for a purpose hereinafter described. A nonmagnetic tube or guide 16 is carried by the housing means 11 and passes through suitable opening means 17 and 18 of the coil means 12 and 14 while being spaced therefrom by the electrical insulating means 13 as illustrated so as to provide a guide path for axial movement of a cylindrical magnetic plunger means 19.

A magnetic stop member 20 is disposed in the guide tube 16 at the upper end thereof and has a conical lower end surface 21 to be engaged against a concave conical end surface 22 of the upper end of the plunger means 19 when the same is moved to its fully actuated position so as to limit the upward movement of the plunger means 19. When the coil means 12 and 14 are not energized, the plunger means 19 moves to and remains in the deactuated or deenergized position as illustrated in full lines in FIG. 1 wherein the lower end of the plunger means 19 will be disposed against suitable external stop means 23 or the like.

As previously stated, the coil means 12 and 14 and plunger means 19 are so constructed and arranged that when the plunger means 19 is in its deenergized position as illustrated in FIG. 1, energizing of just the hold coil means 12 will not cause movement of the plunger means 19 as the plunger means 19 in its deenergized position is substantially out of the magnetic influence of the thus energized hold coil means 12.

However, when just the pull coil means 14 is energized, the plunger means 19 is moved upwardly in FIG. 1 to a position intermediate the deenergized position illustrated in FIG. 1 and the fully actuated condition thereof wherein the end means 22 of the plunger means 19 will be disposed against the stop means 20, so that the energized pull coil means 14 cannot move the plunger means 19 from its fully deenergized position to its fully actuated position.

However, when the plunger means 19 is disposed in such intermediate position by the energized pull coil means 14, the plunger means 19 has been moved within the field of influence of the hold coil means 12 so that if the hold coil means 12 is also energized while the plunger means 19 is in its intermediate position, the hold coil means 12 is adapted to move the plunger means 19 from its intermediate position to its fully actuated position against the stop means 20 and to maintain the same against the stop means 20 even though the pull coil means 14 should be subsequently deenergized.

Therefore, it can be seen that the solenoid construction 10 of this invention requires that both coil means 12 and 14 must be energized to move the plunger means 19 from its deenergized position of FIG. 1 to its fully actuated position against the stop means 20. Because both coils 12 and 14 are required to move the plunger means 19 to its fully actuated position, the pull coil means 14 can be made smaller than in prior art solenoid constructions, which with a reduction in any transformer effect that might be caused between the coils 12 and 14 due to the use of common magnetic separator or flux shunting washer 15 allows a load to remain connected to the pull coil 14 without causing the pull coil 14 to be overheated and burn out.

While the solenoid construction 10 of this invention can be utilized in different manners, the solenoid construction 10 can be utilized in the circuit means of this invention, which is generally indicated by the reference numeral 24 in FIGS. 2 and 3 and now to be described.

As illustrated in FIG. 2, a pair of leads 25 and 26 are respectively adapted to be electrically interconnected to a pair of power source leads L^1 and L^2 provided from a suitable power source 45 (FIG. 3) when a switch means 27 is moved from its open position to its closed position as illustrated in FIG. 2, the leads 25 and 26 respectively being interconnected to opposed

sides 28 and 29 of the hold coil means 12. A pair of leads 30 and 31 are respectively interconnected to the leads 25 and 26 with the lead 30 being interconnected to a contact 32 of an electrical switch 33 and with the lead 31 being interconnected to one side 34 of a load 35.

The switch means 33 includes a switch blade 36 adapted to cooperate with the contact 32 and is interconnected by a lead 37 to the other side 38 of the load 35.

The pull coil means 14 of the coil construction 10 of this invention has one side 39 thereof interconnected by a lead 40 to the lead 37 intermediate the load 35 and the switch means 33 while the other side 41 of the coil means 14 is interconnected by a lead 42 to the lead 31.

The operation of the system 24 will now be described.

When it is initially desired to pull the plunger means 19 from its deactuated or deenergized position of FIG. 1 to its fully actuated condition illustrated in FIG. 2, the switch blade 36 must be disposed against the contact 32 as illustrated in FIG. 2 and when the switch means 27 is moved to its closed position to interconnect the leads 25 and 26 to the power source leads L^1 and L^2, it can be seen that the coil means 12 and 14 are respectively placed in parallel across the power source leads L^1 and L^2 so that the plunger means 19 can be moved to its fully actuated position in the manner previously described, the load 35 also being placed in parallel relation with the coil means 12 and 14 across the power source leads L^1 and L^2.

Thereafter, as long as the hold coil means 12 remains energized, subsequent opening and closing of the switch blade 36 of the switch means 33 as illustrated in FIG. 3 will not affect the plunger means 19 as the same will remain in its actuated position and the pull coil means 14 and 35 can be subsequently connected and disconnected from the power source leads L^1 and L^2 by the switch 33, the magnetic separator or flux shunting washer 15 of the solenoid construction 10 preventing the energized hold coil means 12 from producing a transformer effect on the pull coil 14 whereby the pull coil 14 can be completely disconnected from the power source leads L^1 and L^2 by the switch means 33 or can remain loaded by the switch blade 36 being disposed beneath the contact 32 without having the pull coil 14 being overheated and burning out.

Therefore, it can be seen that this invention not only provides an improved solenoid construction, but also this invention provides an improved electrical circuit means for such a solenoid construction or the like.

I claim:

1. A solenoid construction comprising housing means, a pull coil means carried by said housing means, a hold coil means carried by said housing means, and a plunger means carried by said housing means and being movable relative thereto between a deenergized position of said plunger means and a fully actuated position thereof, said pull coil means when energized being adapted only to move said plunger means from its deenergized position to a position intermediate its said deenergized position and its said fully actuated position whereby said coil means are required to be both energized before said plunger means can be moved thereby to said fully actuated position thereof.

2. A solenoid construction as set forth in claim 1 wherein said energized hold coil means is sufficient to maintain said plunger means in its fully actuated position after said plunger means has been moved to its fully actuated position by both energized coil means regardless of subsequent deenergizing and energizing of said pull coil means.

3. A solenoid construction comprising housing means, a pull coil means carried by said housing means, a hold coil means carried by said housing means, and a plunger means carried by said housing means and being movable relative thereto between a deenergized position of said plunger means and a fully actuated position thereof, said coil means being so constructed and arranged in relation to said plunger means that both coil means are required to be energized before said plunger means can be moved thereby to said fully actuated position thereof, said plunger means being substantially out of magnetic influence of said hold coil means when said plunger means is in its deenergized position.

4. A solenoid construction as set forth in claim 3 wherein said pull coil means when energized is adapted only to move said plunger means from its deenergized position to a position intermediate its said deenergized position and its said fully actuated position.

5. A solenoid construction as set forth in claim 4 wherein said plunger means when in said intermediate position thereof is within the magnetic influence of said energized hold coil means so that said energized hold coil means can move said plunger means from said intermediate position thereof to its fully actuated position.

6. A solenoid construction as set forth in claim 1 wherein said coil means are disposed in stacked relation in said housing means.

7. A solenoid construction as set forth in claim 6 wherein a magnetic separator is disposed between said stacked coil means.

8. A solenoid construction as set forth in claim 6 wherein said coil means are coaxially aligned and have aligned opening means passing therethrough for receiving said plunger means.

9. A solenoid construction as set forth in claim 8 wherein a stop means is carried by said housing means at one end of said opening means of said hold coil means and against which said plunger means engages when said plunger means is in its fully actuated position.

10. A solenoid construction comprising housing means, a pull coil means carried by said housing means, a hold coil means carried by said housing means, a plunger means carried by said housing means and being movable relative thereto between a deenergized position of said plunger means and a fully actuated position thereof, said coil means being so constructed and arranged in relation to said plunger means that both coil means are required to be energized before said plunger means can be moved thereby to said fully actuated position thereof, said coil means being disposed in stacked relation in said housing means, said coil being coaxially aligned and having aligned opening means passing therethrough for receiving said plunger means, and a stop means being carried by said housing means at one end of said opening means of said hold coil means and against which said plunger means engages when said plunger means is in its fully actuated position, said housing means and said stop means being formed of magnetic material.

11. In combination, an electrical power source, a pull coil means, a hold coil means, plunger means operatively associated with said coil means to be moved thereby from a deenergized position thereof to a fully actuated position thereof, and means for electrically interconnecting said power source to said coil means, said pull coil means when interconnected to said power source by said interconnecting means being adapted to only move said plunger means from its deenergized position to a position intermediate its said deenergized position and its fully actuated position whereby said coil means must be simultaneously interconnected to said power source by said interconnecting means before said plunger means can be moved from its said deactuated position to its said fully actuated position.

12. In combination, an electrical power source, a pull coil means, a hold coil means, plunger means operatively associated with said coil means to be moved thereby from a deenergized position thereof to a fully actuated position thereof, and means for electrically interconnecting said power source to said coil means, said coil means being so constructed and arranged in relation to said plunger means that both coil means must be simultaneously interconnected to said power source by said interconnecting means before said plunger means can be moved from its said deactuated position to its said fully actuated position because when only said pull coil means is interconnected to said power source said pull coil

means is adapted to only move said plunger means from its deenergized position to a position intermediate its said deenergized position and its fully actuated position, said hold coil means being sufficient to maintain said plunger means in its fully actuated position as long as said interconnecting means is interconnecting said power source to said hold coil means and after said plunger means has been moved to its fully actuated position by said interconnecting means interconnecting both coil means to said power source regardless of subsequent disconnecting and interconnecting of said pull coil means to said power source by said interconnecting means.

13. In combination, an electrical power source, a pull coil means, a hold coil means, plunger means operatively associated with said coil means to be moved thereby from a deenergized position thereof to a fully actuated position thereof, and means for electrically interconnecting said power source to said coil means, said coil means being so constructed and arranged in relation to said plunger means that both coil means must be simultaneously interconnected to said power source by said interconnecting means before said plunger means can be moved from its said deactuated position to its said fully actuated position, said plunger means being substantially disposed out of magnetic influence of said hold coil means when said plunger means is in its deenergized position and said interconnecting means is only interconnecting said hold coil means to said power source.

14. A combination as set forth in claim **13** wherein said pull coil means when interconnected to said power source by said interconnecting means is only adapted to move said plunger means from its deenergized position to a position intermediate its said deenergized position and its fully actuated position.

15. A combination as set forth in claim **14** wherein said plunger means when in said intermediate position thereof is within the magnetic influence of said hold coil means so that when said hold coil means is interconnected to said power source by said interconnecting means and thus energized hold coil means can move said plunger means from said intermediate position thereof to its fully actuated position.

16. In combination, an electrical power source, a pull coil means, a hold coil means, plunger means operatively associated with said coil means to be moved thereby from a deenergized position thereof to a fully actuated position thereof, and means for electrically interconnecting said power source to said coil means, said coil means being so constructed and arranged in relation to said plunger means that both coil means must be simultaneously interconnected to said power source by said interconnecting means before said plunger means can be moved from its said deactuated position to its said fully actuated position, said interconnecting means having means for placing said coil means in parallel across said power source to energize both of said coil means.

17. A combination as set forth in claim **16** wherein said interconnecting means has means for placing a load in parallel relation with said pull coil means across said power source.

18. A combination as set forth in claim **17** wherein said interconnecting means has means for disconnecting said load and said pull coil means from said power source while maintaining said hold coil means across said power source.

19. A combination as set forth in claim **11** wherein said coil means are disposed in stacked relation in a housing means.

20. A combination as set forth in claim **19** wherein a magnetic separator is disposed between said stacked coil means, said coil means being coaxially aligned and having aligned opening means passing therethrough and receiving said plunger means.