IMPACT CUSHIONING SOLENOID YOKE AND FRAME MOUNTING

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ABSTRACT OF THE DISCLOSURE

The end laminations of a solenoid frame have outwardly turned flanges confined between cushion strips anchored to the base. Yoke means spans the frame and carries cushioning spaced therefrom to receive the returning impact of the armature head. The yoke means may be either continuous or made up of separate sections. In either case it has legs attached to a frame.

BACKGROUND OF INVENTION

There are numerous industrial applications for solenoids in which the armature is held in its retracted position by a relatively powerful spring, usually a part of the operated mechanism. Such an armature returns to its retracted position with considerable impace when the solenoid is deenergized. Both from a noise and vibration standpoint and for the protection of the apparatus, it is desirable to cushion this impact. There have been several attempts to accomplish this result, examples being shown in Patents 3,263,135 and 2,665,597.

DESCRIPTION OF THE INVENTION

The present invention seeks to provide what amounts to two-stage cushioning for solenoids or other magnets in that yoke means spanning the path of the returning armature carries a first cushioning means, residual shock being communicated to the solenoid frame. A second cushioning means is interposed between the solenoid frame and the base so that the residual shock is again cushioned before any remaining shock or vibration is communicated to the base.

The yoke may be in one piece or may comprise separate arms integral with legs attached to the opposite sides of the frame. Even if the arms are separate, the cushioning means need not necessarily comprise separate pads. One embodiment of the invention uses a single pad spanning the gaps between the separate arms.

Whether the yoke is made in one piece or more than one, its legs are desirably connected directly with the solenoid frame, the inertia of which is used to resist vibration.

In the drawings:

FIG. 1 is a view in perspective showing a device embodying the invention.

FIG. 2 is a view of the device in side elevation, and partially broken away.

FIG. 3 is a view similar to FIG. 1, showing a modified embodiment of the invention.

FIG. 4 is a view taken in section on the line 4-4 of FIG. 3.

A solenoid 6 has a frame 8 made up of magnetically permeable laminations confined between heavier terminal laminations 10 and 12 which have outwardly turned flanges 14 and 16 respectively. Each of these flanges is sandwiched between upper and lower cushioning strips 18 and 20 respectively, these being held by clips 22 anchored as by rivets 24 to the base 26. Thus the frame is cushioned both in an upward direction and in a downward direction of movement with respect to the base.

The solenoid frame becomes magnetized when the winding diagrammatically shown at 30 is energized. When the magnet frame is magnetized its polar portions 32 and 34 exert strong attraction drawing the head 36 of armature 38 toward the lower position to which it is also urged by gravity as shown in FIG. 4.

In normal practice the armature is held in an elevated position shown in dotted lines in FIG. 2, being supported by the bias of a spring acting on whatever part the armature actuates. For the purpose hereof such a part is diagrammatically illustrated as comprising a plunger 38 biased by spring 40.

When the winding 30 is deenergized the spring 40 tends to return the armature head 36 rather abruptly to its elevated or normally retracted position. A stop means is necessary and this may be impacted with considerable force and resulting shock and noise and vibration. It is customary to provide a yoke of some sort spanning the magnet frame 8 and serving as stop means to receive the impact of the returning armature, some sort of cushion being interposed between the armature head 36 and the yoke.

In the instant device I may use either a one piece yoke 42, as in FIG. 3, or I may use separate yoke arms 44 and 46 as in FIGS. 1 and 2. In the event a one piece yoke is used, it is preferably made of non-magnetic material. If separate yoke arms are used as in FIG. 1 and FIG. 2, the ends of these are preferably slightly spaced to reduce flux transfer. In either case, the yoke includes legs 48 and 50 which are attached to opposite sides of the magnet frame 8 so that the impact is absorbed in some degree by the inertia of the frame itself. The cushioning means may comprise separate cushions such as the separate rubber strips 52 and 54 of FIGS. 1 and 2 or the sheet of cushioning material 56 shown in FIGS. 3 and 4. It will be understood that the cushioning means may be continuous across the head of the armature or may be made up in multiple pieces, regardless of whether the yoke is made in one piece or is divided.

After the shock of the impact has been delivered into the solenoid frame 8 it is still desirable to damp or cushion transmission of the shock or vibration or the sound into the base 26. It is for this reason that I employ the cushioning means shown at 18 and 20 which embraces the flanges 14 and 16 both from above and from below to damp both upward and downward vibration. This very effectively minimizes the effect of vibration shock and noise on the base 26 and parts with which the base is connected.

I have shown a grommet or the like at 60 for guiding the rod 38 in its reciprocation through the base 26 but it will be understood that this feature is optional.

What is claimed is:

1. In combination, an electromagnet having a frame, an armature movable between advanced and retracted positions and having a bias toward its retracted position, a first cushion means connecting it with the magnet frame and disposed in the path of movement of the armature toward its retracted position, a base, and a second stage cushion means interposed between the magnet frame and the base for damping transmission of shock and vibration from the frame to the base, the second stage cushion means including damping elements resisting movement of the magnet frame with respect to the base both in the direction of movement of the armature toward its retracted position and in the direction of movement of the armature away from its retracted position.

2. A combination according to claim 1 in which the armature has a head and the first cushion comprises a pair of laterally spaced cushion elements engaged by
3,501,724

3. A combination according to claim 1 in which the magnet frame has lateral flanges spaced from the base, the second stage cushion means comprising cushion pads engaging said flanges from above and below and having clips confining them about said flanges and connecting them with said base.

4. A combination according to claim 1 in which a yoke supporting the first mentioned cushion means in the path of movement of the armature comprises legs connected with the sides of the magnet frame, the sides of the magnet frame comprising plates having outwardly turned flanges, the second stage cushioning means comprising cushion pads above and below the respective flanges, and means connecting said cushion pads to said base.

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