March 6, 1951 H. L. DAVIS 2,544,491

SHOCK DAMPER FOR ELECTROMAGNETIC DEVICES

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Fig-1

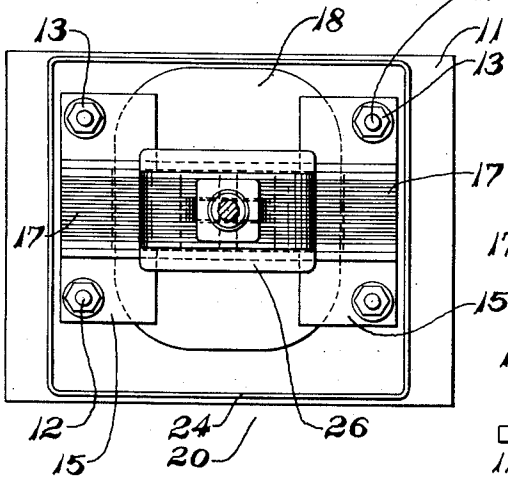



Fig-3

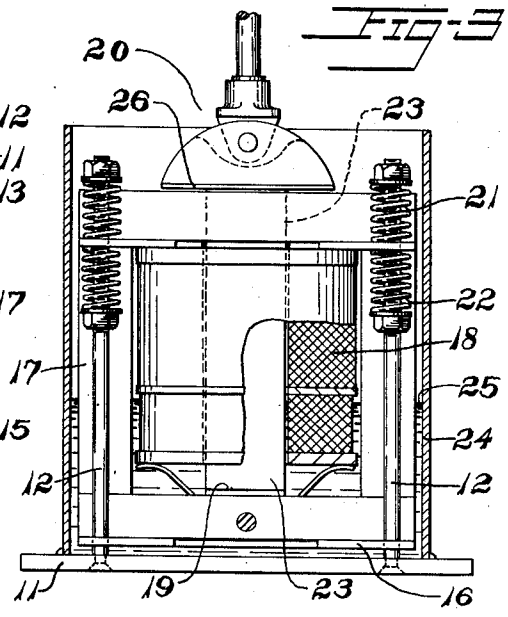



Fig-4

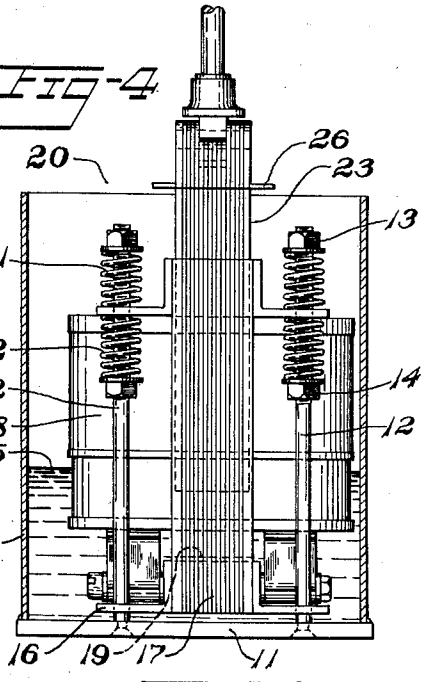
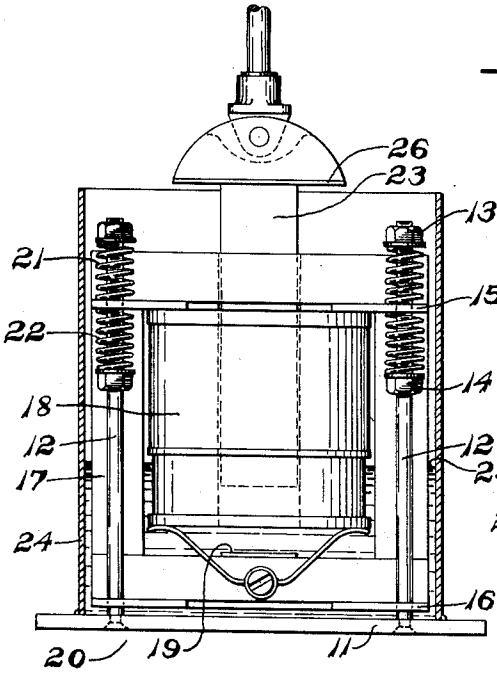



Fig-2

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## SHOCK DAMPER FOR ELECTROMAGNETIC DEVICES

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7 Claims. (Cl. 175—338)

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This invention relates to electromagnetic devices such as solenoids and particularly to electromagnetic switches having a damping means for the armature.

It is an object of this invention to increase the useful life of electromagnetic devices. Another object is to decrease the noise of operation of such devices. It is also an object to provide a means of reducing the shock of impact of the armature with the pole piece of an electromagnetic device. Other objects will be apparent from the description which follows.

It has been found that by employing a means for yieldably mounting the electromagnet and pole piece of an electromagnetic device and a means for damping the shock of the impact of the armature with the pole piece which results when the electromagnet is energized, it is possible to achieve the above objects.

One embodiment of the invention is shown in the drawing, in which

Fig. 1 is a plan view of an electromagnetic device embodying this invention;

Fig. 2 is a side elevation of the same device with fluid container in section;

Fig. 3 is the same as Fig. 2 except the armature is in the closed position and parts are broken away and in section; and

Fig. 4 is an end elevation with the container in section.

As shown in the drawing, base plate 11 supports the four parallel guide rods 12, 12 which are secured thereto at their lower ends. The rods 12, 12 are threaded and have screwed thereon spaced stop nuts 13, 13, 14, 14. Between these nuts 13, 13, 14, 14 and slidably engageable with rods 12, 12 is plate 15 and on either side of the plate 15 are springs 21, 21, 22, 22. Plates 15, 16 are attached to the laminated field piece 17 of the electromagnetic switch 20. Plate 15 is attached to the upper part of the laminated field piece and plate 16 to the lower part of the laminated field piece, and within the laminated field piece 17 is the magnetizing coil 18 and the pole piece 19. Thus the laminated field piece 17, the pole piece 19, and the magnetizing coil 18 are all yieldably mounted on the base plate 11. The springs 21, 21, 22, 22 are under compression and when no forces except the weight of the field piece and coil are exerted upon the upper plate 15, the springs are in the position shown in Fig. 2.

The movable armature 23 is normally in the open position shown in Fig. 2 and is surrounded at its lower end by the magnetizing coil 18.

The apparatus is surrounded on all sides by

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a thin wall 24 which in conjunction with base 11 makes a container which is partly filled with a light oil 25. Parts of coil 18, field piece 17, pole piece 19, and the stem of the armature 23 are submerged in oil. The T-head of the laminated armature 23 has a sheet metal splash shield 26 welded to it to prevent splashing of the oil 25 when the armature moves downward to that portion of the magnetizing coil's field having the greatest intensity.

When the magnetizing coil 18 is energized, armature 23 is pulled downwardly to the closed position shown in Fig. 3. As the armature moves downward the oil between the armature 23 and pole piece 19 is displaced, thus serving to dampen the movement of the armature and acting as a cushion between the pole piece and armature. When the oil is displaced and the armature strikes the pole piece, the latter, together with the field piece 17, coil 18 and plates 15, 16 move downward as a unit causing springs 22, 22 to compress further, and after the assembly recoils, springs 21, 21 and springs 22, 22, acting against each other bring the assembly to rest by damping the vibration.

When coil 18 is no longer energized the armature 23 is returned to the open position by any suitable means (not shown in the drawings).

The level of the oil or other liquid used to cushion the impact of the armature against the pole piece may vary from just above the top of the pole piece 19 to near the top of the wall 24. The splash shield 26 is needed the most when the fluid level is high in the container. When the oil level is low, the shield is not necessarily used.

By cushioning the shock of armature against pole piece it is possible to increase greatly the life of these laminated steel members which normally crack and break apart during use. By suspending the coil, field piece, and pole piece by a yieldable means such as coiled springs it is possible to lengthen the life of the unit because the springs will absorb most of the shock and vibrations to which these switches are subjected.

By combining the coiled spring shock mount and the oil bath shock-cushioning means in an electromagnetic device such as an electromagnetic switch the useful life has been greatly increased and in addition the noise of operation has been diminished to a great extent.

Other obvious variations and modifications may be effected without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. An electromagnetic device comprising a base plate, a plurality of parallel rods secured perpendicularly to said base plate, a coiled spring under compression between stops on each of said rods, an electromagnet supported from said springs and slidably mounted on said rods, said electromagnet including a pole piece attached to the lower end thereof, a movable armature normally held in an open position against the force of gravity and movable to engage said pole piece when said electromagnet is energized, a wall secured to said base plate around said electromagnet extending upwardly above the level of the face of said pole piece and forming with said base plate a liquid container, and a damping liquid disposed in said container to a level just above the face of said pole piece.

2. An electromagnetic device comprising a base plate, a plurality of parallel rods secured perpendicularly to said base plate, coiled springs under compression between stops on said rods, an electromagnet including a pole piece supported by a frame slidably mounted on said rods and restrained by said springs, a movable armature, container means associated with said base plate surrounding said pole piece and said armature and extending upwardly above the level of the face of said pole piece, and an oil bath disposed in said container to a level just above the face of said pole piece.

3. An electromagnetic device comprising a base plate, an electromagnet including a pole piece yieldably mounted on said base plate, a movable armature normally held in an open position and movable to engage said pole piece when said electromagnet is energized, container means attached to said base surrounding said pole piece and said armature and extending upwardly above the level of the face of said pole piece, and an oil bath disposed in said container to a level just above the face of said pole piece.

4. An electromagnetic device comprising a base plate, an electromagnet including a pole piece, an armature movable from an open position to a position in contact with said pole piece, said armature comprising a T-head and a stem, means for yieldably mounting said electromagnet and pole piece above said base plate, container means associated with said base plate and surrounding said pole piece and said armature and extending upwardly from said base plate above the level of the face of said pole piece, and within said container means a damping liquid which covers said pole piece and the stem only of said armature.

5. An electromagnetic device comprising a base plate, an electromagnet having a laminated pole piece and a coil of wire, a laminated armature movable through said coil and engageable with said pole piece, means for yieldably mounting said electromagnet above said base plate, container means associated with said base plate and surrounding said pole piece and said armature, and within said container means a damping liquid which covers said laminated pole piece and the pole piece engaging portion only of said laminated armature when said armature is in the closed position.



6. In an electromagnetic device, the combination of an electromagnet having a pole piece, a movable armature comprising a T-head and a stem which engages said pole piece, a means for reducing the shock of impact of the armature with said pole piece comprising a yieldable mount for said electromagnet, an oil bath which covers said pole piece and the stem of said armature when said armature is in the closed position, and container means for said oil bath associated with and surrounding said pole piece and extending above the level of the face of said pole piece.

7. In an electromagnetic device, the combination of an electromagnet including a pole piece, an armature disposed above and movable into engagement with said pole piece, and means for reducing the shock of the impact of said armature with said pole piece comprising a spring mounting for said electromagnet, container means surrounding said pole piece and said armature and extending above the face of said pole piece, and within said container means an oil bath which covers said pole piece and the pole piece engaging portion only of said armature when the armature is in the closed position.

HERBERT L. DAVIS.


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