Dec. 10, 1946. M. STALEY 2,412,304

ELECTROMAGNET

Filed Aug. 11, 1944

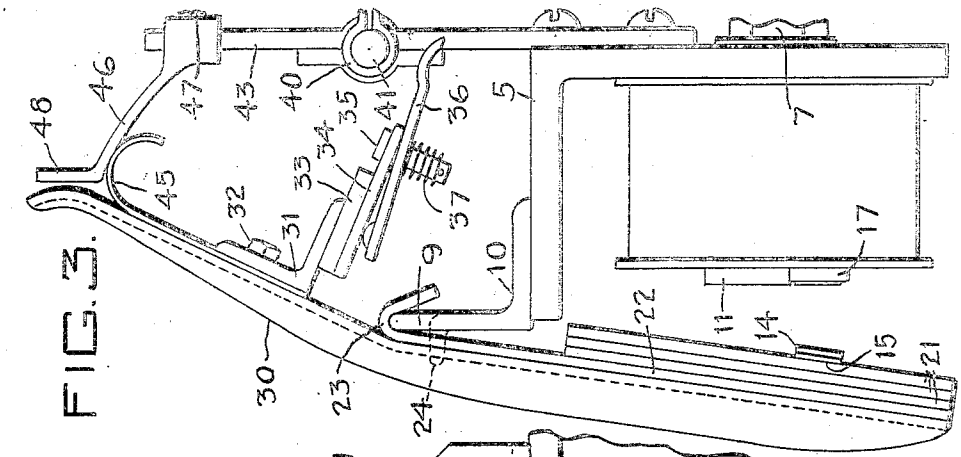


FIG. 3.

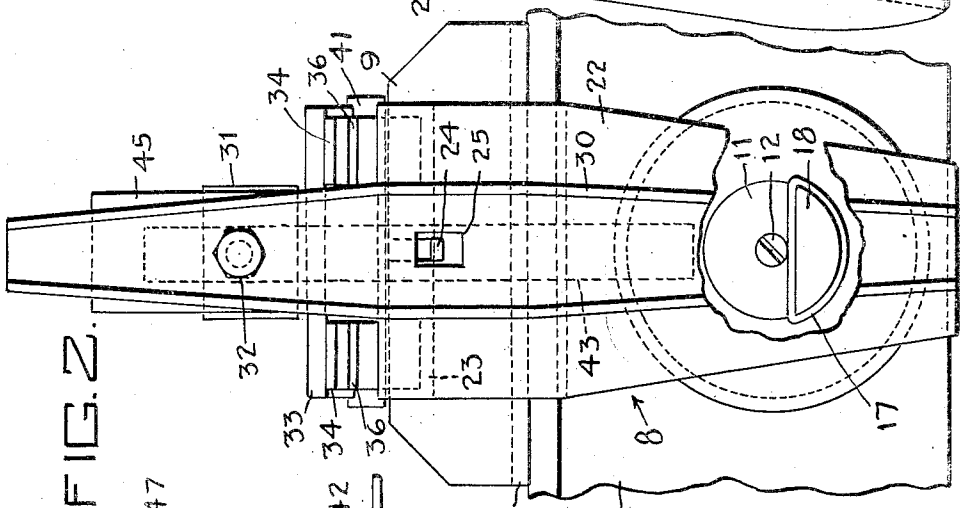


FIG. 2.

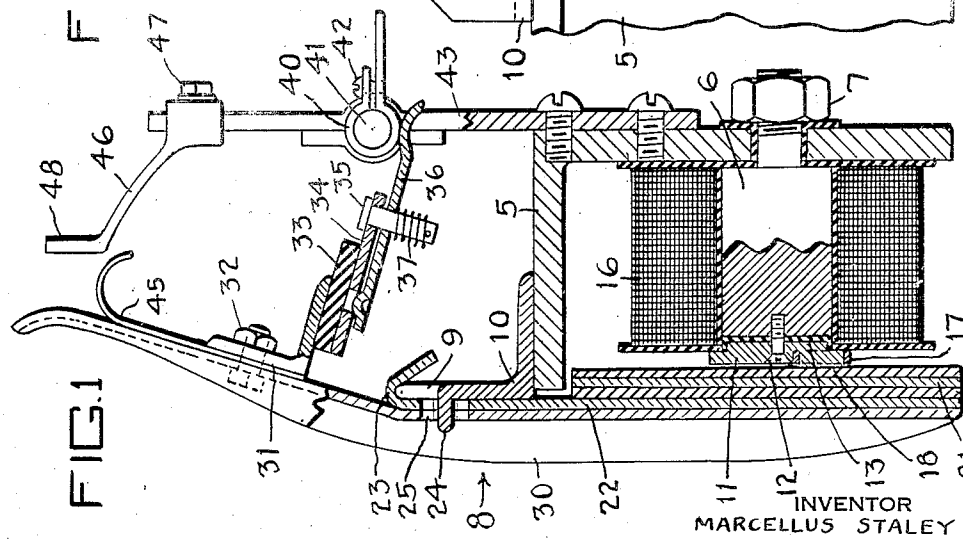


FIG. 1.

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ELECTROMAGNET

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6 Claims. (Cl. 175—336)

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The invention relates to electromagnets or relays, particularly adaptable for operating circuit controlling devices, and the invention comprises various new and useful improvements in the magnetic structure and the core therefor, as well as in the mounting arrangement of both the stationary and movable parts of the operating electromagnet or relay.

Among the principal objects of the invention are to increase the power, efficiency and quietness of the operating electromagnet, especially for alternating current service, and to improve the construction of the operating electromagnet so as to render both manufacture and maintenance of the same relatively simple and inexpensive, particularly when a number of magnets of similar duty are to be assembled.

The electromagnet of the present invention is of the clapper type and one of its features is the improved method of mounting the armature thereof. The use of bolts and pins is eliminated and the complete armature may be instantly removed at any time to permit of easy inspection or repairs.

A further object is to provide an improved contact means which will greatly add to the efficiency and life thereof.

A still further object is to provide a simple means for gradually absorbing the momentum of the armature in its releasing movements, thereby preventing a rebound of the released armature, saving wear and tear on the parts, and eliminating noise when the magnet is being de-energized.

Another object of the invention is the provision of means to greatly reduce or practically eliminate residual magnetism. The electromagnet of the present invention is particularly adapted for use in controlling the various circuits in an automatic electric elevator system and the accurate timing of the making and breaking of these circuits is vital in connection with the successful and efficient operation of the system. Obviously the building up or development of residual magnetism will seriously interfere with the proper and safe operation of the system.

It will be understood that the foregoing general description and the following detailed description are exemplary and explanatory of the invention but are not restrictive thereof. In addition to the foregoing other objects and advantages will become apparent as this specification proceeds. Referring to the drawing forming a part thereof and in which one embodiment of the invention is illustrated:

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Fig. 1 is a sectional view, parts being in elevation, the armature of the magnet being in its attracted position and a circuit being closed.

Fig. 2 is a front elevation with parts broken away, and

Fig. 3 is a side elevation similar to Fig. 1, the armature being away from its coil.

Referring to the drawing the stationary magnet section preferably comprises an angle 5, to the vertical leg of which a core 6 is suitably secured at 7.

The movable section or armature 8 is hinged to a lip 9 which may be suitably formed on the horizontal leg of the stationary magnetic section or as illustrated may be a separate angle 10 secured to said magnetic section.

The angle section 5 and the lip 9 may be of any desired length so as to carry any suitable number of cores and armatures. The section 5 also lends itself to supporting any suitable number of fixed contacts which are engaged by movable contacts carried by the armatures as will be hereinafter described. Thus a unit arrangement is provided which is very advantageous as it results in considerable saving of space, material and labor, and permits of easy maintenance, which is essential, particularly in complicated control systems such as full automatic push button elevator control systems which have to be periodically inspected to assure continuous and safe operation. The electromagnet of the present invention is particularly applicable in a system such as illustrated in Patent No. 2,014,821, granted September 17, 1935. The stationary magnet section in addition to its magnetic function might be a structural member of a complete controller assembly such as is disclosed in the aforesaid mentioned patent.

In accordance with the invention a flanged disc 11 is attached to the tip of the core by a screw 12 made of non-magnetic material. The disc 11 is magnetically separated from the body of the core by a gap in a direction across the flow of the flux. This gap is occupied by a sheet 13 of non-magnet material and the disc is of the smallest physical permissible thickness.

All magnets, whether direct current or alternating current, retain a certain amount of magnetism, known as residual magnetism, when the magnet winding is open circuited. It is well known to provide gaps in stationary magnet sections to reduce the power of the retained magnetism. However, in the prior art the sections so divided are comparatively large and retain sufficient residual magnetism so that considerable

mechanical force is required to separate the movable and stationary magnetic sections when the coil is open circuited.

The thin flanged disc 11 separated from the core 6 by the sheet of non-magnetic material 13 provides a magnetic contact surface for the movable section 8, but retains only a light magnetic polarization on account of its small size, thus readily permitting the separation of both magnetic sections when the coil is deenergized.

A modification of this feature is illustrated in Fig. 3 in which a thin plate 14 is attached to the movable section of the magnet, the plate being magnetically separated by means of a gap in a direction at right angles to the flow of the flux. The gap space may be occupied with any non-magnetic metal 15, which, with the plate 14, may readily be secured to the surface of the movable section by resistance welding.

The flanged disc 11 also acts to simplify the mechanical structure of the electromagnet, the flange thereof functioning as a means to hold the conventional winding 16 on its core 6, thus dispensing with other means to hold the winding in place.

A shading coil 17 is set into the disc 11 as shown in Figs. 1 and 2. To increase the pull and obtain a quiet operating magnet it is desirable to permit only the disc area 18 surrounded by the shading coil to come in contact with the armature. For that purpose the area 18 as shown in Fig. 1 is a trifle higher than the balance of the surface area of the disc. As shown in Fig. 3 the end of the core or its disc may be flat in its entirety and the plate 14 suitably shaped to accomplish the same result.

The armature or movable section 8 may comprise a series of laminated plates 21. The outside plate 22 of the laminations extends upwardly and its uppermost section is bent over to form a hook-portion 23. This hook portion extends over and is suspended on the top of the lip 9, thus forming the hinge or pivot for the armature. An ear 24 bent outwardly from the lip 9 passes through a clearance slot 25 to prevent undue lateral movement of the armature in relation to its coil while not interfering with the normal movement of the armature toward and away from its coil.

A channel-shaped or ribbed reinforcing member 30 is secured to the armature and extends upward therefrom. This upward extension carries the movable contact means and also the means for absorbing the momentum of the armature when its coil is deenergized.

An angle 31 has one of its legs bolted at 32 to the upward extension of the member 30, and secured to the other leg of the angle 31 is a block of insulation 33. Mounted on the under side of the block of insulation 33 is a pair of fixed blades 34 in which headed studs 35 are mounted. These studs pass through clearance holes in movable contact members 36 which are urged toward the blades 34, as shown in Fig. 3, by springs 37 surrounding the studs 35.

With the parts in the position of Fig. 1 the coil is energized, the armature is attracted and the movable contact members 36 are spring pressed against fixed contact members 40. The fixed contact members 40 are secured to a pin 41 by screws 42, the pin being formed of insulating material and carried by an arm 43 suitably secured to the rear side of the vertical leg of the angle 5. When the annular parts of the fixed contact members 40 become worn or burnt at the

points where they engage the movable contact members 36 the screws 42 may be loosened, the contacts 40 turned to provide a new face on said fixed contact members 40 to engage the movable contact members 36.

As illustrated in Figure 1, when the coil is energized and contact is being made, springs 37 are tensioned. Upon the de-energization of the coil 6, the tensioned springs 37 will function together with the force of gravity stored in the armature to return the armature to its de-energized position, thereby separating the contact members. Usually a stop is provided to limit the movement of the armature after it has been released. However, considerable rebounding occurs on all known magnets. This is objectionable due to the noise and causes undue wear and tear on the parts. To insure a noiseless release and eliminate rebounding of the armature in its released position, and to prevent undue wear and tear, a simple means for gradually absorbing the release momentum of the armature is provided.

Secured between the upper extension of member 30 and angle 31 by the bolt 32 is a spring finger 45. This spring finger engages a radial shoe 46 which is adjustably mounted on the upper portion of arm 43 and held in position there by a screw 47. As it is apparent from Figures 1 and 3, the spring finger 45 will engage shoe 46 with increasing tension as the armature moves away from its coil due to its construction and method of support in relation to the member 30. The spring finger is so shaped that it will engage the radial shoe when the coil is de-energized and the armature starts to move away from the core. The spring finger 45 will thus engage its shoe 46 only after the contacts 36 and 40 have been separated and will bring the armature to a gradual and noiseless stop. When the coil is energized and the armature is pulled toward the stationary magnet section, spring finger 45 does not have the support of member 30 and it may readily flex and is therefore considerably weaker in its friction pressure against the shoe, and thereby permitting the armature to pull freely toward the stationary magnet section.

The position of the shoe 46 may be adjusted and a stop 48 is provided on the end of the shoe in case the spring finger weakens or gets out of adjustment.

Changes in details of construction and arrangement of parts such as would occur to one skilled in the art are to be considered as coming within the spirit of the invention as set forth in the appended claims.

I claim:

1. An electromagnet comprising a stationary magnetic section embodying a core and a winding therefor, a thin disc non-magnetically secured to the top of said core, a sheet of non-magnetic material interposed between said disc and the body portion of said core, an upwardly extending lip formed at or near the edge of the horizontal leg of said stationary magnetic section, a movable magnetic section, a hook portion formed on said movable magnetic section, said hook portion extending over and suspended from said upwardly extending lip to permit free pivotal movement of said movable magnetic section in relation to said stationary magnetic section and permit of said movable magnetic section being lifted from said stationary magnetic section, means for preventing lateral movement of said movable magnetic section in relation to said stationary magnetic section, and means for gradually absorbing mo-

mentum of said movable magnetic section when the electromagnet is open circuited and said movable magnetic section is moving away from said stationary magnetic section, said means comprising a flexible spring carried by said movable magnetic section, and a radial shoe carried by said stationary magnetic section, said spring engaging said shoe when said movable magnetic section is moving away from said stationary magnetic section.

2. An electromagnet comprising a stationary magnetic section embodying a core and a winding therefor, a thin disc non-magnetically secured to the top of said core, a sheet of non-magnetic material interposed between said disc and the body portion of said core, a shading coil set into said disc, the area of the disc surrounded by said shading coil being a trifle higher than the area of the rest of said disc, an upwardly extending lip formed at or near the edge of the horizontal leg of said stationary magnetic section, a movable magnetic section, a hook portion formed on said movable magnetic section, said hook portion extending over and suspended from said upwardly extending lip to permit free pivotal movement of said movable magnetic section in relation to said stationary magnetic section and permit of said movable magnetic section being lifted from said stationary magnetic section, means for preventing lateral movement of said movable magnetic section in relation to said stationary magnetic section, and means for gradually absorbing momentum of said movable magnetic section when the electromagnet is open circuited and said movable magnetic section is moving away from said stationary magnetic section, said means comprising a flexible spring carried by said movable magnetic section, and a radial shoe carried by said stationary magnetic section, said spring engaging said shoe when said movable magnetic section is moving away from said stationary magnetic section.

3. An electromagnet comprising a stationary magnetic section embodying a core and a winding therefor, a thin disc non-magnetically secured to the top of said core, a sheet of non-magnetic material interposed between said disc and the body portion of said core, a movable magnetic section freely pivoted in relation to said stationary magnetic section, and means for gradually absorbing momentum of said movable magnetic section when the electromagnet is open circuited and said movable magnetic section is moving away from said stationary magnetic section, said means comprising a flexible spring carried by said movable magnetic section, and a radial shoe carried by said stationary magnetic section, said spring engaging said shoe when said movable magnetic section is moving away from said stationary magnetic section.

4. An electromagnet comprising a stationary magnetic section embodying a core and a winding therefor, a thin disc non-magnetically secured to the top of said core, a sheet of non-magnetic material interposed between said disc and the body portion of said core, a shading coil set into said disc, the area of said disc surrounded by said shading coil being a trifle higher than the area of the rest of said disc, a movable magnetic section freely pivoted in relation to said stationary magnetic section, and means for gradually absorbing momentum of said movable magnetic section when the electromagnet is open circuited and said movable magnetic section is moving away from said stationary magnetic section, said means comprising a flexible spring carried by said movable magnetic section, and a radial shoe carried by said stationary magnetic section, said spring engaging said shoe when said movable magnetic section is moving away from said stationary magnetic section.

5. An electromagnet comprising a movable magnetic section and a stationary magnetic section, an upwardly extending lip formed on said stationary magnetic section, a hook-portion formed on said movable magnetic section, said hook-portion extending over and suspended from said upwardly extending lip to permit free pivotal movement of said movable magnetic portion in relation to said stationary magnetic section and permit of said movable magnetic section being lifted from said stationary magnetic section, and means for gradually absorbing momentum of said movable magnetic section when the electromagnet is open circuited and said movable magnetic section is moving away from said stationary magnetic section, said means comprising a flexible spring carried by said movable magnetic section, and a radial shoe carried by said stationary magnetic section, said spring engaging said shoe when said movable magnetic section is moving away from said stationary magnetic section.

6. An electromagnet comprising a movable magnetic section and a stationary magnetic section, an upwardly extending lip formed on said stationary magnetic section, a hook portion formed on said movable magnetic section, said hook-portion extending over and suspended from said upwardly extending lip to permit free pivotal movement of said movable magnetic portion in relation to said stationary magnetic section and permit of said movable magnetic section being lifted from said stationary magnetic section, means for preventing lateral movement of said movable magnetic section in relation to said stationary magnetic section, and means for gradually absorbing momentum of said movable magnetic section when the electromagnet is open circuited and said movable magnetic section is moving away from said stationary magnetic section, said means comprising a flexible spring carried by said movable magnetic section, and a radial shoe carried by said stationary magnetic section, said spring engaging said shoe when said movable magnetic section is moving away from said stationary magnetic section.

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