

Nov. 13, 1945.

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2,388,951

SNAP-ACTING DEVICE

Filed Nov. 24, 1944

Fig. 1.

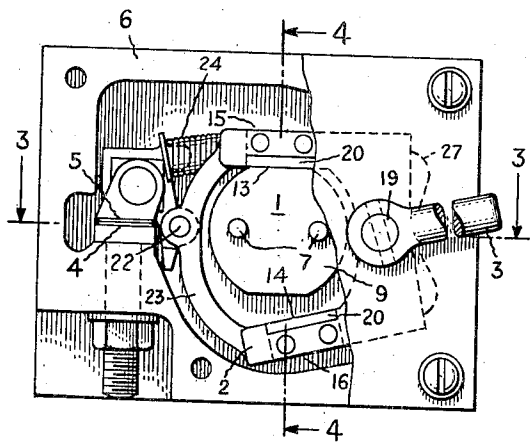


Fig. 2.

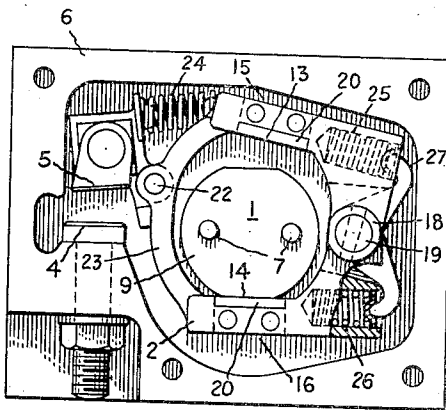


Fig. 3.

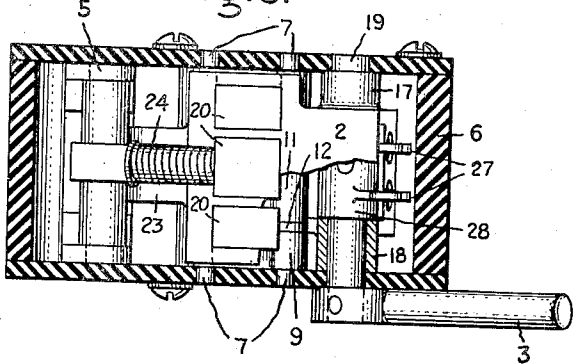
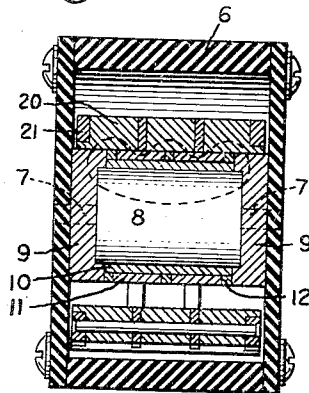


Fig. 4.



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UNITED STATES PATENT OFFICE

2,388,951

SNAP-ACTING DEVICE

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Application November 24, 1944, Serial No. 564,941

4 Claims. (Cl. 74-97)

My invention relates to double snap-acting devices of the magnetic type and is particularly suitable for application to manually or automatically operated snap-action electric switches.

It is a general object of my invention to provide a new and novel double snap-acting device of the magnetic type.

It is a particular object of my invention to provide a new and improved magnetic snap-action switch of simple and compact construction which is durable and reliable in operation.

Briefly, the invention comprises a bar type permanent magnet formed integrally with a segmented shunt structure and disposed between the legs of a pivotally mounted armature yoke. Each leg of the yoke carries a segmented armature for alternative engagement with the segmented shunt in staggered relation. The yoke is moved with a snap action by loading springs arranged to oppose the holding force of the magnet. It is one advantage of my arrangement that in either position of the yoke the magnetic circuit is closed through one of the armatures, thereby to prolong the life of the permanent magnet.

My invention will be more fully understood and its objects and advantages further appreciated by referring now to the following detailed specification taken in conjunction with the accompanying drawing in which Figs. 1 and 2 are side elevational views of a snap-action electric switch embodying my invention, showing the switch contacts in closed and opened circuit positions, respectively; Fig. 3 is a cross-sectional view taken along the line 3-3 of Fig. 1; and Fig. 4 is a cross-sectional view taken along the line 4-4 of Fig. 1.

Referring now to the drawing, I have shown a magnetic snap-acting electric switch comprising a permanent magnet assembly 1, a movable U-shaped armature yoke 2, an operating handle 3, and a pair of cooperating switch contacts 4 and 5. The switch is mounted in a casing 6 of insulating material suitably recessed to provide space for the operating parts of the mechanism.

The permanent magnet assembly 1 is fixedly mounted in the casing 6 by means of a plurality of studs 7 and comprises a substantially cylindrical bar type permanent magnet 8 magnetized longitudinally to provide a pair of pole faces at opposite ends thereof. The magnet 8 is encased in an integrally formed shunt structure providing a pair of flux paths longitudinally of the magnet on opposite sides thereof. The shunt structure comprises a pair of end caps 9 of magnetizable material, such as soft iron, a sleeve 10 of non-

magnetizable material, such as brass, encasing the sides of the magnet 8, and a plurality of alternate bands of magnetizable and non-magnetizable material 11 and 12, respectively, encircling the sleeve 10. The bands or rings 12 of non-magnetizable material, such as brass, are preferably short relative to the magnetizable bands 11 in the direction of the principal axis of the magnet, and are so positioned that a non-magnetizable ring 12 lies immediately adjacent each end plate 9. The magnetic shunt structure is flattened on opposite sides, as at 13 and 14, to provide a pair of pole surfaces alternatively engageable with a pair of armatures 15 and 16, respectively, carried by opposite arms of the U-shaped yoke 2. The iron and brass rings 11 and 12 in the region of the flattened surfaces 13 and 14 constitute a pair of magnetic shunt paths adjacent the armatures 15 and 16.

The movable armature yoke or switch member is pivotally mounted substantially centrally of its bight on a pivotal axis parallel to the principal axis of the permanent magnet 8, and is so positioned that the arms carrying the armatures 15 and 16 embrace the sides of the magnet and shunt structure 1. As shown in the drawing, and particularly at Fig. 3, the bight end of the yoke 2 is open at its center and formed integrally with a pair of sleeve bearings 17 and 18. The yoke 2 is rotatably mounted upon a pivot pin 19 passing through the sleeves 17 and 18 and mounted in the casing 6. The pivot pin 19 is itself rotatably supported in the casing 6 and rigidly connected to the operating handle or lever 3.

The armature inserts 15 and 16 in the opposite legs of the yoke 2 are segmentally formed of a plurality of alternate sections 20 and 21 of magnetizable and non-magnetizable material, respectively. Preferably, the sections 20 of magnetizable material are longer in the direction of the principal axis of the magnet 8 than are the sections 21 of non-magnetizable material, and the sections are so positioned that, when either armature is in contact with the associated shunt face 13 or 14, the non-magnetizable sections 12 and 21 of the shunt and armature, respectively, are positioned in staggered relation, while the magnetizable sections 11 and 20 of the shunt and armature, respectively, overlap appreciably on both sides of each non-magnetic section. With this arrangement of shunt and armature, the magnetic flux path is forced to pass back and forth a plurality of times between the shunt and an engaging armature, thereby to effect a plurality of crossings of the air gap and appreciably

to enhance the attractive effect of the magnet upon its armature.

In constructing the permanent magnet 3, I prefer to employ magnetic materials which are characterized by a relatively high coercive force as compared, for example, to chrome steel. While it is not my intention that this invention shall be limited to the employment of a particular magnetic material, I have found that highly satisfactory results may be obtained by the use of permanent magnet alloys containing iron, nickel, and aluminum as the basic or essential ingredient. This magnet may be prepared in accordance with the teaching of United States Letters Patents 1,947,274 and 1,968,569 to William E. Ruder, and 2,027,994 to 2,028,000, inclusive, to Tokishichi Mishima, or, if desired, the magnet may be formed by a sintering process, as disclosed in United States Patent 2,192,743 to Goodwin H. Howe. Magnets composed of such alloys not only have a high coercive force, but they also exhibit a fairly high residual induction, with the result that they are capable of producing a maximum amount of magnetic energy with a minimum volume of magnetic material. They are also highly resistant de-magnetizing influences.

The switch contact 4 is fixedly mounted in the casing 6. The cooperating switch contact 5 is movable with the armature yoke 2 and is pivotally mounted at 22 upon an arcuate cross bar 23 connected between the remote ends of the legs of the yoke 2. A compression spring 24 interposed between the movable contact member 5 and the yoke 2 provides wipe for the contacts.

The movable armature yoke 2 is moved between alternative positions of armature engagement by a spring loading connection with the manually movable operating handle 3. This connection comprises two pairs of compression springs 25 and 26 mounted in recesses in the bight end of the yoke 2 on opposite sides of the pivot pin 19, and a pair of rocker arms 27 having opposite ends engaging the upper ends of the springs 25 and 26. The rocker arms 27 are formed integrally with a sleeve 28 surrounding and fixedly attached to the manually movable pivot pin 19.

In operation, the switch member or yoke 2 is moved between alternative positions of armature engagement with a snap action, thereby to move the contact 5 between open and closed circuit positions, by rotating the handle 3 and connected rocker arms 27 to compress either the springs 25 or the springs 26, depending upon the desired direction of movement. For example, with the mechanism in the open circuit position shown at Fig. 2, the rocker arms 27 are rotated counterclockwise, as viewed at that figure, to compress the springs 25. The springs 25, when thus loaded, apply a spring force tending to rotate the yoke 2 counterclockwise, as viewed at Fig. 2, against the holding force of the magnet 3 and the armature 16. When the spring force is sufficient to overcome the holding force, the armature 16 snaps away from the magnet assembly and the armature 15 is brought into engagement with the flat shunt surface at the opposite side of the magnet assembly. Switch opening operation is effected in a similar manner by compressing the springs 26 when the switch mechanism is in the closed circuit position shown at Fig. 1.

While I have shown only a preferred embodiment of my invention by way of illustration, many modifications will occur to those skilled in the art and I, therefore, wish to have it understood that I intend in the appended claims to

cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A double snap-action device comprising a bar type permanent magnet having pole faces at opposite ends thereof, a pair of segmental magnetic shunt paths along opposite sides of said magnet comprising alternate sections of magnetizable and non-magnetizable material mounted upon said magnet between said pole faces, a substantially U-shaped armature member pivotally mounted upon an axis substantially parallel to the principal axis of said magnet and having legs embracing the sides of said magnet, each said leg including a segmental armature comprising alternate sections of magnetizable and non-magnetizable material, said armatures being alternatively engageable with said shunt sections with the non-magnetizable sections of said armature and shunt paths in staggered relation, and spring means for moving said armature members between alternative positions of armature engagement with a snap action.

2. A double snap-action device comprising a substantially cylindrical permanent magnet having pole faces at opposite ends thereof, a sleeve of non-magnetizable material encasing the sides of said magnet, a magnetic shunt comprising a plurality of alternate bands of magnetizable and non-magnetizable material encircling said sleeve, said shunt having a pair of flat pole surfaces at opposite sides of said magnet, a substantially U-shaped movable armature member pivotally mounted upon an axis substantially parallel to the longitudinal axis of said magnet and having a pair of legs embracing said magnet, a segmented armature carried by each said leg and comprising a plurality of alternate magnetizable and non-magnetizable sections, said armatures being disposed for alternative engagement with said flat surfaces with the non-magnetizable sections of said armatures and shunt in staggered relation, and manually operable means for applying a spring force to said armature member to move said member between alternative positions of armature engagement with a snap action.

3. A double snap-action device comprising a substantially cylindrical permanent magnet having pole faces at opposite ends thereof, a sleeve of non-magnetizable material encasing the sides of said magnet, a magnetic shunt comprising a plurality of alternate bands of magnetizable and non-magnetizable material encircling said sleeve, said shunt having a pair of flat pole surfaces at opposite sides of said magnet, a substantially U-shaped armature yoke pivotally mounted at its bight upon a fixed pivot substantially parallel to the principal axis of said magnet and having a pair of legs embracing said magnet, a segmented armature carried by each said leg and comprising a plurality of alternate magnetizable and non-magnetizable sections, said armatures being disposed for alternative engagement with said flat surfaces with the non-magnetizable sections of said shunt and armatures in staggered relation, a rocker arm pivotally mounted at its center upon said fixed pivot, a compression spring interposed between each end of said rocker arm and said yoke, and a manually operable handle connected to said rocker arm alternatively to compress said springs, thereby to move said yoke between alternative positions of armature engagement with a snap action.

4. A snap-action switch actuating mechanism comprising a substantially cylindrical permanent magnet having pole faces at opposite ends thereof, a sleeve of non-magnetizable material encasing the sides of said magnet, a magnetic shunt encasing said magnet and comprising a pair of magnetizable end caps and a plurality of alternate bands of magnetizable and non-magnetizable material surrounding said sleeve, said shunt having a pair of flat pole surfaces along opposite sides of said magnet, a substantially U-shaped movable switch member pivotally mounted at its bight upon a fixed pivot substantially parallel to the principal axis of said magnet and having a pair of legs embracing said magnet, said switch member being recessed at the bight end on opposite sides of said pivot to receive a pair of compression springs, a segmented armature carried by each said leg and comprising a plurality of alternate sections of magnetizable and non-magnetizable material disposed for alternative engagement with said pole surfaces with like sections of said armatures and shunt in staggered relation, a rocker arm pivotally mounted at its center upon said fixed pivot and extending across the bight of said switch member with its opposite ends in engagement with said compression springs, and a manually operable handle connected to said rocker arm alternatively to compress said springs and thereby to move said switch member between alternative positions of armature engagement with a snap action.

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