

ELECTROMAGNETIC PLUNGER

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to improvements in or relating to an electromagnetic plunger wherein a fixed
5 iron core is fitted in an end portion of a center hole of a bobbin and held in position with one end thereof contacted with a stopper means in the center hole of the bobbin and with the other end thereof contacted with a yoke on which the electromagnetic plunger is mounted.

10 2) Description of the Prior Art

An exemplary one of conventional electromagnetic plungers is shown in FIGS. 4 and 5. Referring to FIGS. 4 and 5, the electromagnetic plunger shown includes a solenoid 3 mounted on a yoke 4 and including
15 a bobbin 1 and a coil 2 wound on an outer periphery of the bobbin 1. A fixed iron core 6 is fitted in an end portion of a center hole 5 of the bobbin 1, and a movable iron core 7 is inserted in the center hole 5 from the other end of the bobbin 1.

20 The yoke 4 is constituted from a first yoke member 4a having a substantially laid-down U-shape in side elevation, and a second yoke member 4b secured to

the first yoke member 4a in such a manner as to close the opening of the U-shape of the first yoke member 4a as particularly seen in FIG. 5. The fixed iron core 6 is securely mounted substantially at the center of the bottom of the U-shape of the first yoke member 4a. The bobbin 1 has, along a peripheral edge of the center hole 5 of the bobbin 1 on the other end side, a hub-like axial annular projection 8 which extends axially outwardly and is fitted in a fitting hole 9 perforated substantially at the center of the second yoke member 4b.

The movable iron core 7 is inserted into the center hole 5 of the bobbin 1 from the side of the fitting hole 9 of the second yoke member 4b and is normally biased outwardly of the solenoid 3 by a spring not shown. Thus, upon energization of the coil 2, the movable iron core 7 is drawn into the solenoid 3.

A pair of threaded holes 11 are perforated in one of a pair of sides of the U-shape of the first yoke member 4a, and a pair of fastening screws 13 are screwed into the threaded holes 11 through screw fitting holes 12 formed in a chassis 10 to fasten the electromagnetic plunger to the chassis 10.

Thus, in assembling the electromagnetic plunger described above, at first the fixed iron core 6 is

securely mounted onto the bottom portion of the U-shape of the first yoke member 4a by means of caulking or the like. Subsequently, the fixed iron core 6 is fitted into the center hole 5 of the solenoid 3. After then, 5 the second yoke member 4b is securely mounted on the opening side of the first yoke member 4a by means of caulking or the like, and the movable iron core 7 is inserted into the center hole 5, thereby completing the assembly of the electromagnetic plunger.

10 The electromagnetic plunger assembled in this manner is mounted on the chassis 10 by the fixing screws 13.

With the electromagnetic plunger of such a construction as described above, assembly is made by 15 securely mounting the iron core 6 on the yoke 4 by means of caulking or the like as described above. Therefore, it is disadvantageous in that the working efficiency in assembly is low and the cost is high accordingly.

SUMMARY OF THE INVENTION

20 Accordingly, it is an object of the present invention to provide an electromagnetic plunger which can be assembled in a high working efficiency at a low cost.

In order to attain the object, according to the

present invention, there is provided an electromagnetic plunger which comprises a yoke, a solenoid incorporated in the yoke and including a bobbin and a coil wound on the bobbin, the bobbin having a center hole formed therein, a fixed iron core fitted in a portion of the center hole of the bobbin adjacent one end of the bobbin, and a movable iron core inserted in another portion of the center hole of the bobbin adjacent the other end of the bobbin, the bobbin having adjacent the one end thereof a stopper means for contacting with the fixed iron core fitted in the center hole of the bobbin, the yoke cooperating with the stopper means to hold the fixed iron core in position therebetween in the center hole of the bobbin, said yoke being formed by bending part of a chassis on which said electromagnetic plunger is mounted and including a pair of support plates extending in parallel to each other such that said bobbin may be fitted between said support plates in a direction perpendicular to the direction of an axis of said bobbin, and said bobbin is made of a synthetic resin and has an engaging element formed on each of a pair of flanges thereof for resiliently engaging a corresponding engaging element provided on said yoke to hold said bobbin in position on said yoke, one of said support plates having a through hole coincident with the center hole of the bobbin for the insertion of said movable iron

core therethrough.

If the fixed iron core is inserted into the center hole of the bobbin until it is contacted with and stopped by the stopper means of the bobbin and then the bobbin is incorporated into the yoke, then the fixed iron core is pressed against the stopper means from outwardly by the yoke and held in position at the one end side of the bobbin. Accordingly, the electromagnetic plunger can be assembled in a high working efficiency at a low cost.

A specific embodiment of the present invention will now be described in detail by way of example with

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reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective view of an electromagnetic plunger showing a preferred embodiment
5 of the present invention;

FIG. 2 is a longitudinal sectional view, in an enlarged scale, of the electromagnetic plunger of FIG. 1;

FIG. 3 is a longitudinal sectional view of an
10 electromagnetic plunger showing a second preferred embodiment of the present invention;

FIG. 4 is a fragmentary perspective view of a conventional electromagnetic plunger; and

FIG. 5 is a longitudinal sectional view, in an
15 enlarged scaled, of the electromagnetic plunger of FIG. 4.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring first to FIGS. 1 and 2, an electromagnetic plunger according to a first preferred
20 embodiment of the present invention is shown. The electromagnetic plunger shown includes a yoke 25 which is constituted from a chassis 20 on which the electromagnetic plunger is mounted. In particular, the chassis 20 has a pair of substantially U-shaped slots 21

and 22 formed in a predetermined spaced relationship therein, and portions of the chassis 21 defined by the slots 21 and 22 are bent perpendicularly upwardly relative to the remaining portion of the chassis 21 in such a manner as to oppose in a parallel relationship to each other to form a pair of support plates 23 and 24, respectively. The yoke 25 is thus formed by the support plates 23 and 24 and an intermediate portion of the chassis 20 between the support plates 23 and 24. A solenoid 26 is fitted between and held by the support plates 23 and 24.

The opposite corners of the top of each of the support plates 23 and 24 are cut obliquely as seen in FIG. 1, and a pair of notches 27 and 28 are formed on the opposite side edges of each of the support plates 23 and 24. A depression 29 is formed substantially at the center of an inner wall of the support plate 23 opposing the support plate 24 while a central portion of the other support plate 24 is swollen outwardly away from the support plate 23 and a through-hole 31 is perforated at the center of the swollen portion 30 of the support plate 24.

The solenoid 26 is constituted from a bobbin 32 made of a synthetic resin, and a coil 33 wound on the bobbin 32. The bobbin 32 is in turn constituted from a

tubular member 34 on which the coil 33 is wound, and a pair of square flanges 35 and 36 formed in an integral relationship at the opposite ends of the tubular member 34. The opposite sides of each of the flanges 35 and 36 are extended outwardly in the opposite directions to form a pair of clamping elements 37 and 38 which can clamp the support piece 23 or 24 therebetween.

A pair of projections 39 and 40 of a triangular shape are formed on inner faces of the clamping elements 37 and 38 for engaging with the notches 28 and 27, respectively, of each of the support plates 23 and 24. The tubular member 34 of the bobbin 32 has a center hole 34a formed therein. The center hole 34a of the bobbin 32 is stepped at a location 41 thereof near an end of the tubular member 34 adjacent the support plate 23 and has a greater diameter at a portion 34b thereof between the step 41 and the end of the tubular member 34. A cylindrical fixed iron core 42 is fitted in the greater diameter portion 34b of the center hole 34a of the tubular member 34, and when the fixed iron core 42 is inserted into the greater diameter portion 34b of the center hole 34a of the tubular member 34 from outwardly of the end of the tubular member 34, it is contacted with and stopped by the step 41 of the center hole 34a. The step 41 thus serves as a stopper means element for

the fixed iron core 42. A movable iron core 43 is inserted in the center hole 34a from outwardly of the other end of the tubular member 34.

A pair of terminals 44 for connecting the coil 33 to an external electric circuit not shown are implanted at the top of the square flange 35 of the bobbin 32. Each of the square flanges 35 and 36 of the bobbin 32 has a pair of slits 46 formed along intermediate portions of the clamping elements 37 and 38 thereof in order that the intermediate portions of the clamping elements 37 and 38 may be readily deformed outwardly.

In assembling the electromagnetic plunger of the construction described above to the chassis 20, at first the fixed iron core 42 is inserted into the greater diameter portion 34b of the center hole 34a of the tubular member 34 of the bobbin 32. After then, the solenoid 26 is moved toward a position between the support plates 23 and 24 and is pushed down in the direction indicated by an arrow mark A in FIG. 1 in such a manner that the support plate 23 may be clamped between the clamping elements 37 and 38 of the square flange 35 and the other support plate 24 may be clamped between the clamping elements 37 and 38 of the other square flange 36 until the solenoid 26 is placed in position between the support pieces 23 and 24.

Thereupon, the projections 39 and 40 on the clamping elements 37 and 38 are first slidably contacted with and pushed by inclined edges at the corners of the top ends of the support plates 23 and 24 so that the clamping elements 37 and 38 are deformed outwardly due to their resiliency. Then, as the solenoid 26 further moves down, the projections 39 and 40 slidably move on the opposite side edges of the clamping elements 37 and 38 until they are finally resiliently snapped into the notches 27 and 28, respectively, of the support plates 23 and 24, thereby completing assembly of the solenoid 26 to the chassis 20. After then, the movable iron core 43 is inserted into the center hole 34a of the bobbin 32 from outwardly of the other end of the solenoid 26, thereby completing assembly of the electromagnetic plunger.

Here, if such a small projection 45 as seen in FIGS. 1 and 2, which is often left where a fixed iron core is produced by machining, is actually left at the center of a rear face of the fixed iron core 43, it will be fitted in the depression 29 formed in the inner wall of the support plate 23 so that the fixed iron core 42 can be closely contacted over the entire rear face thereof with the support piece 23. The depression 29 thus serves as a relief means for such a small

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projection.

After completion of assembly of the electromagnetic plunger, the movable iron core 43 may be connected to a desired operating member 47 which may, for example, be biased in the direction to project axially outwardly from the bobbin 32 by a spring 48. In the arrangement, energization of the coil 33 will pull the movable iron core 43 into the bobbin 43 thereby operating the operating member 47 and a mechanism connected to the operating member 47. The electromagnetic plunger thus serves as an actuator for actuating the mechanism including the operating member 47.

With the electromagnetic plunger of the embodiment described above, a fixing step such as caulking of the fixed iron core is not involved in the assembling process of the electromagnetic plunger. Accordingly, the assembling operation can be performed readily. Besides, since part of the chassis is utilized as the yoke, the number of parts is reduced and the necessity of a step of mounting the yoke on the chassis is eliminated. In addition, since the solenoid 26 can be assembled readily to the yoke 25 by a simple operation making use of the resiliency of synthetic resin, the assembling operation is facilitated

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accordingly.

Referring now to FIG. 3, there is shown an electromagnetic plunger according to another preferred embodiment of the present invention. The
5 electromagnetic plunger is similar in construction to the electromagnetic plunger of the preceding embodiment shown in FIGS. 1 and 2, and like parts or elements are denoted by like reference numerals to those of FIGS. 1 and 2. The electromagnetic plunger shown in FIG. 3 is
10 different from the electromagnetic plunger of FIGS. 1 and 2 only in that a cylindrical fixed iron core 50 has a flanged portion 51 of a greater diameter formed adjacent an outer end thereof adjacent a support plate 23, and a step 52 serving as a stopper means is formed
15 at a portion of a center hole 34a of a bobbin 32 substantially within a range of the thickness of a square flange 35, that is, near the support plate 23. When the fixed iron core 50 is inserted into the center hole 34a of the bobbin 32, the flanged portion 51
20 thereof is contacted with and stopped by the stopper means 52 of the bobbin 32 and is thus received in an annular recess or greater diameter portion 34b of the center hole 34a. Meanwhile, an outer end face of the fixed iron core 50 is held in contact with an inner wall
25 of the support plate 23 so that the support plate 23

prevents the fixed iron core 50 from being removed from the bobbin 32. The fixed iron core 50 is thus held in position by the support plate 23 and the stopper means 52 of the bobbin 32. With the construction described
5 just above, similar effects to those of the preceding embodiment can be anticipated.

It is to be noted that the present invention is not limited to the specific embodiments described above and many changes and modifications can be made to the
10 embodiments. For example, the fixed iron core 42 or 50 may be stopped by an outer face itself of the angular flange 35 of the bobbin 32.



CLAIMS:

1. An electromagnetic plunger comprising a yoke, a solenoid incorporated in the yoke and including a bobbin and a coil wound on said bobbin, said bobbin having a center hole formed therein, a fixed iron core fitted in a portion of said center hole of said bobbin adjacent one end of said bobbin, and a movable iron core inserted in another portion of said center hole of said bobbin adjacent the other end of said bobbin, said bobbin having adjacent the one end thereof a stopper means for contacting with said fixed iron core fitted in said center hole of the bobbin, the yoke cooperating with the stopper means to hold said fixed iron core in position therebetween in said center hole of said bobbin, said yoke being formed by bending part of a chassis on which said electromagnetic plunger is mounted and including a pair of support plates extending in parallel to each other such that said bobbin may be fitted between said support plates in a direction perpendicular to the direction of an axis of said bobbin, and said bobbin is made of a synthetic resin and has an engaging element formed on each of a pair of flanges thereof for resiliently engaging a corresponding engaging element provided on said yoke to hold said bobbin in position on said yoke, one of said support plates having a through hole coincident with the center hole of the bobbin for the insertion of said movable iron core therethrough.



2. An electromagnetic plunger as set forth in claim 1, wherein said stopper means is constituted from a step formed within the center hole of said bobbin.

3. An electromagnetic plunger as set forth in claim 2, wherein said stopper means contacts with an axial end face of said fixed iron core to position said fixed iron core in the axial direction of said bobbin.

4. An electromagnetic plunger as set forth in claim 2, wherein said fixed iron core has a flange formed at an axial end thereof for engaging with said stopper means to position said fixed iron core in the axial direction of said bobbin.

5. An electromagnetic plunger substantially as hereinbefore described with reference to, and as shown in, Figs. 1 and 2 or Fig. 3 of the accompanying drawings.
