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Kinsella

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[54] **ELECTROMAGNET WITH DETACHABLE CASTING AND NON-ROTATABLE ARMATURE**

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[52] **U.S. Cl.** **335/263,** 335/278, 137/66

[51] **Int. Cl.** **H01f 7/16**

[58] **Field of Search** 335/220, 263, 278; 137/66

[56] **References Cited**

UNITED STATES PATENTS

3,211,854	10/1965	Bengtsson	335/278 X
3,258,659	6/1966	Schaud et al.	335/220
3,259,811	7/1966	Dunn	137/66 X

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[57] **ABSTRACT**

A thermocouple-energized electromagnet having a casing comprising a metal base and a molded plastic cover detachably connected thereto and conveniently removable to permit cleaning of the armature and pole faces. A yoke and winding are fixed to the base and a non-circular armature is slidably mounted in the cover. A non-circular interior cover wall surface prevents rotation of the armature, and a recess in the cover wall receives an element fixed to the base to insure that the cover is always replaced in the same angular relation to the yoke.

6 Claims, 4 Drawing Figures

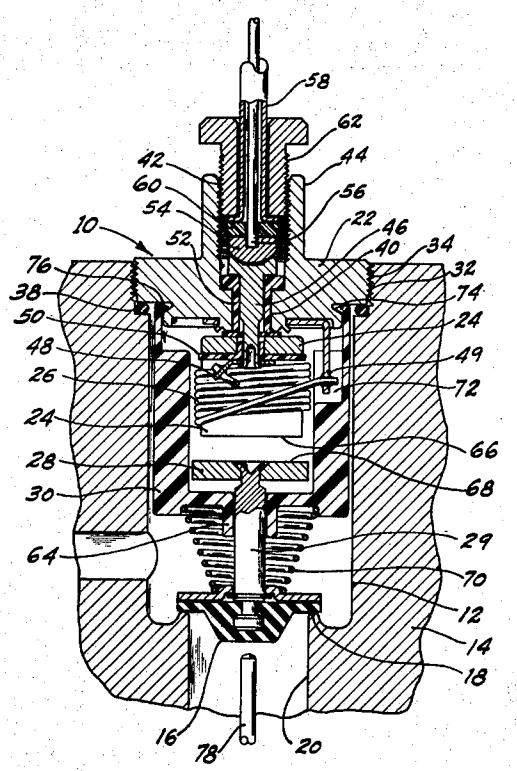

FIG. 1

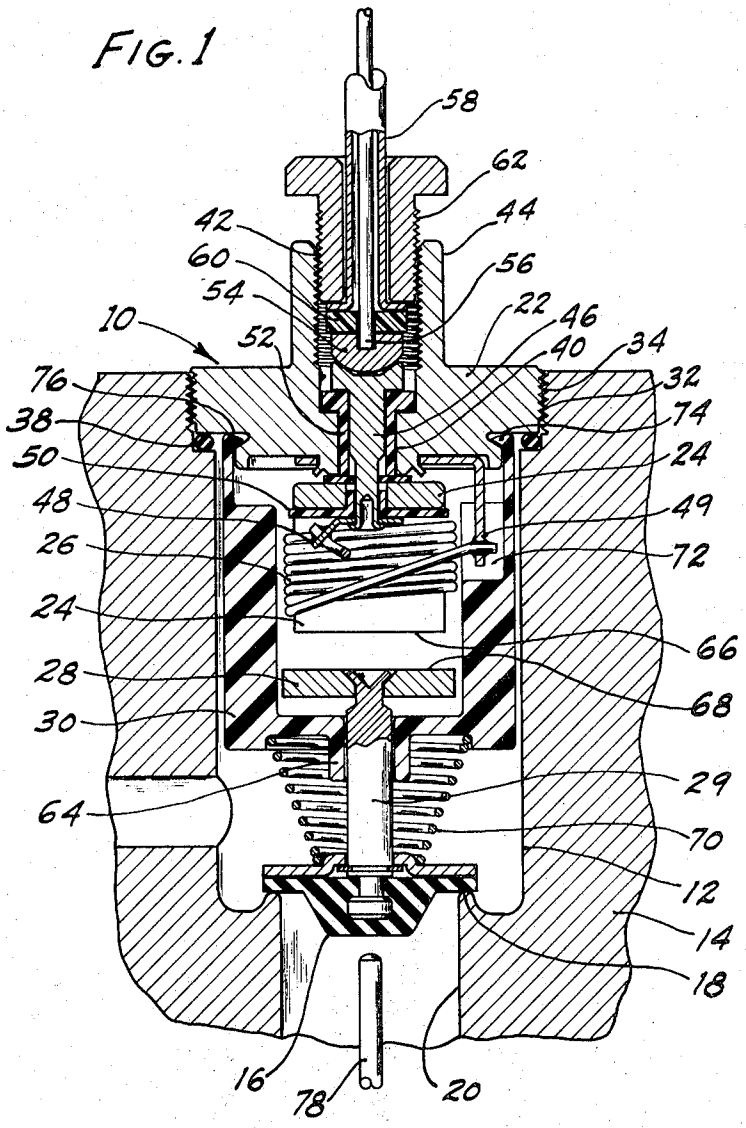
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FIG. 3

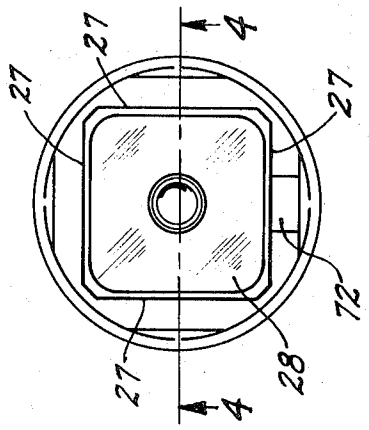


FIG. 4

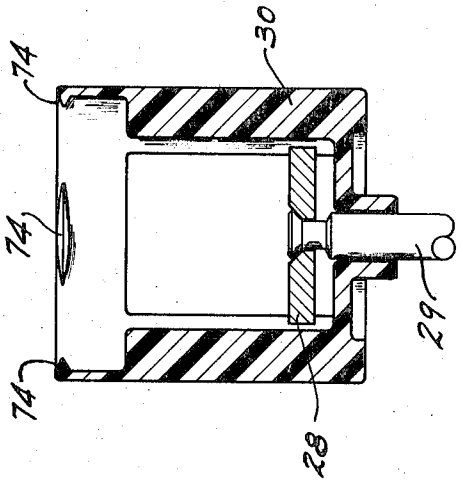
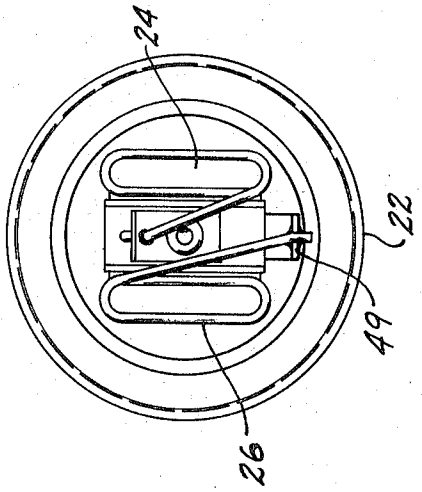


FIG. 2



ELECTROMAGNET WITH DETACHABLE CASTING AND NON-ROTATABLE ARMATURE

This invention relates to thermocouple-energized electromagnets adapted, but not limited, to use in holding open safety cutoff valves in gas burner control systems, and it particularly relates to casing means therefor which provide convenient access to the armature and pole faces for cleaning.

BACKGROUND OF INVENTION

A thermocouple-energized electromagnet is commonly employed to hold open a biased closed safety cutoff valve in a gas burner fuel supply conduit. The electromagnet is energized by a thermocouple heated by a pilot burner and therefore holds the cutoff valve open only so long as pilot flame exists. Usually, in the interest of economy and for other reasons, the pilot flame and thermocouple are of such size that a very limited amount of electrical energy is generated, insufficient to pull open the cutoff valve against its closing bias. The cutoff valve is therefore manually pushed open and the electromagnet armature which is connected to the valve is pushed against the pole faces, wherein the maximum holding force is attained.

It is well known to manufacturers of these devices that even minute particles of metal or other matter lodged between the armature and pole faces will significantly affect operation or even effect malfunctioning. The very limited electrical energy available and the critical relationship of magnet holding force and trip spring force require that the faces of the armature and poles be spotlessly clean and in contact over their entire meeting area to insure uniform holding force and reliable operation.

Moreover, in these electromagnets wherein the armature is arranged for reciprocation and spans the end faces of a yoke to complete a magnetic circuit, any rotation of the armature causing different face areas thereof to engage the pole faces frequently causes variations in the magnet holding force. This occurs because slight variations in the contiguity of the meeting faces frequently result when the armature is rotated. It is desirable, therefore, that the same areas of armature and pole faces are always brought into contact to insure uniform holding force.

Despite care to avoid it, foreign matter does find its way between the armature and pole faces during manufacture and during use in the field, even though these elements are enclosed in a casing. Heretofore, casings for electromagnets of this kind have generally included a metal base portion, on which a yoke and winding are mounted, and a cup-shaped metal cover having a bottom perforation slidably receiving a control actuating rod, to the inner end of which an armature is fixed. For reasons of economy, it has been the practice heretofore to spin over or swage the open end of the cup-shaped metal cover into an annular groove in the base member, thereby more or less permanently fixing it to the base and precluding access for the purpose of cleaning the armature and pole faces.

It is an object, therefore, of this invention to provide a generally new and improved casing means for a thermocouple-energized electromagnet constructed and arranged to provide convenient access to the armature and pole faces for cleaning.

A further object is to provide a thermocouple-energized electromagnet having a casing comprising two parts conveniently separable and connectable, a base part which supports a yoke and winding and a cover part which mounts an armature therein for slidable movement toward and away from the yoke but prevents rotational movement thereof.

A further object is to provide an electromagnet casing, as in the preceding paragraph, in which the cover part is constructed of a dielectric material, such as synthetic plastic.

A further object is to provide an electromagnet casing, as in the penultimate paragraph, in which the cover part can be assembled in only one angular position relative to the base, thereby to insure that the same areas of the armature and pole faces are aligned.

Further objects and advantages will appear from the following description when read in connection with the accompanying drawings.

In the drawings:

FIG. 1 is a longitudinal cross-sectional view of an electromagnet having a casing constructed in accordance with the present invention. The electromagnet is shown mounted in a cavity in the body of a gas burner control valve, shown fragmentarily, and is operatively connected to a biased closed safety cutoff valve;

FIG. 2 is a bottom plan view of the electromagnet with the cover part of the casing removed;

FIG. 3 is a open end plan view of the cover part of the casing with the non-circular armature shown assembled therein; and

FIG. 4 is a longitudinal cross-sectional view of the cover part of the casing taken along line 4—4 of FIG. 3.

Referring to the drawings in more detail, the electromagnet 10 is shown mounted in a cavity 12 in the body of a gas control valve shown fragmentarily at 14. A biased closed valve 16 cooperating with a seat 18 in the valve body controls the flow through a passage 20. The electromagnet 10 comprises a metal base member 22, a U-shaped yoke 24 of magnetic material, a winding 26, an armature disc 28, and a cup-shaped cover member 30 detachably connected to the base member 22 and constructed of a suitable dielectric material, such as synthetic plastic. The base member 22 is cylindrical in form and has screw threads 32 adapted to engage screw threads 34 in a counterbored outer portion of the valve body cavity 12. A gasket 38 between the base member and valve body seals the body cavity 12.

The base member 22 has a central bore 40 therethrough and a screw-threaded counterbore 42 extending through a central integral projecting boss 44. A headed conductive rivet 46 extending through bore 40 also extends through an aperture in the base of the U-shaped yoke 24 and rigidly connects the yoke to base 22. The winding 26 has one end connected to the rivet 46 via a terminal clip 48, the other end of winding 26 being connected to base 22 via terminal member 49, which terminal is riveted to base 22.

Insulators 50 and 52 insulate the terminal clip 48 from the yoke 24 and the yoke 24 from the base 22. A conductive head 54 soldered to the end of a lead 56 is seated in a cavity in the head of rivet 46. The lead 56 extends coaxially with a tubular lead 58 to a thermocouple junction (not shown). The end of tubular lead 58 is flared and an insulating block 60 separates the

flared end of tubular lead **58** from the head **54** on the end of lead **56.**

The tubular lead **58** extends through a hollow conductive metal nut **62** threadedly engaged in counterbore **42.** The nut **62** clamps the conductive head **54** against the conductive rivet **46** and clamps the flared end of tubular lead **58** between the end of the nut and insulating block **60.** One end of the winding **26** is therefore electrically connected to one side of a thermocouple junction through the terminal clip **48,** the rivet **46,** the head **54,** and lead **56.** The other end of winding **26** is connected to the other side of a thermocouple junction through the terminal member **49,** the base **22,** and tubular lead **58.** The terminal member **49** includes a downwardly extending leg portion to which one end of winding **26** is soldered.

The inner wall surface of the cup-shaped cover member **30** has four straight sides **27** forming a rectangle with rounded corners, and the armature disc **28** is of similar configuration, but somewhat smaller to provide suitable clearance, see FIG. **3.** The armature **28** is centrally perforated and is riveted to one end of a round control actuating rod, which is, in this illustration, a valve stem **29** to the other end of which the valve **16** is secured. The valve stem **29** is slidably guided in a short, central, tubular portion **64** formed integral with the bottom of the cup-shaped cover member **30.** The noncircular armature **28** is therefore mounted for reciprocation in the cover **30** and is prevented from rotating therein by the walls of the cover. The pole faces **66** at the ends of the legs of yoke **24** and the meeting face of armature **28** are ground and lapped to provide smooth flat meeting surfaces. A compression spring **70** between the bottom of cover **30** and valve **16** biases the valve on its seat and the armature away from the pole faces **66.**

There is a recess **72** in one of the flat interior wall surfaces of cover **30,** see FIG. **3,** which receives the downwardly extending leg portion of terminal member **49** and requires the cover **30** to be assembled to the base **22** in only one angular position. The rim of cover **30** at its open end is provided with relatively small, inwardly extending projections **74,** see FIG. **4,** which are snapped into an annular groove **76** in base member **22.** The number of such projections **74,** their depth of engagement in the groove **76,** and the resiliency of the cover wall adjacent the projections is such that the cover **30** is securely attached to base **22** when these projections are engaged and yet permits convenient removal of the cover without the use of tools and without distortion or damage.

When the cover is removed the armature may be pushed toward the open end of the cup to permit inspection or cleaning, but it is retained within the straight inner wall portions of the cover by the valve **16,** as illustrated. In other arrangements, wherein it is necessary to employ a longer actuating rod or valve stem, the outward movement of the armature may be limited by any suitable means, such as a C-washer snapped into an annular groove in the stem.

In operation of the device, armature **28** is pushed upward manually into contact with the pole faces **66** by any suitable means, as by a push rod **78** engaging the valve **16.** When sufficient energy is generated at a thermocouple junction, the device will remain in a set valve-open position. At any time thereafter when the energy source is lost or diminished a predetermined amount, the valve will close under the bias of spring **70.**

I claim:

1. In an electromagnet, a base member, a magnetic core member fixed to said base and having an outwardly facing pole face, a winding on said member, a cover member having an open end and a closed end and having its open end detachably connected to said base and completing a casing therewith, an operating rod extending through the closed end of said cover and slidably mounted therein, an armature in said casing mounted on the interior end of said rod for axial movement into and out of engagement with said pole face, said cover member having at least one flat axially extending interior wall surface, and said armature having at least one flat side contiguous with said flat wall surface whereby rotation of said armature is prevented.

2. The electromagnet claimed in claim **1** in which said cover member is constructed of dielectric material.

3. The electromagnet claimed in claim **1** in which said cover member is moved axially into detachable connection with said base member and in which a projection on one of said members enters an axially extending recess in the other of said members, thereby requiring said members to be assembled in a predetermined angular relationship.

4. The electromagnet claimed in claim **1** which includes stop means on the exterior extending portion of said operating rod limiting axial movement of said armature within the extent of said flat axially extending interior wall surface.

5. In an electromagnet, a circular metal base member, a U-shaped yoke fixed to said base member having outwardly extending legs and outwardly facing pole faces, a winding on said yoke, a cup-shaped cover member having an open end detachably connected to said base member and completing a closure therewith, an operating rod slidably mounted in the closed end of said cup-shaped cover member and extending interiorly and exteriorly thereof, an armature disc in said closure mounted on the interior end of said operating rod for axial movement into and out of engagement with said pole faces, said cover member having flat axially extending interior wall surfaces, and said armature having flat sides contiguous with said interior wall surfaces whereby its rotation is prevented.

6. The electromagnet claimed in claim **5** having radial projections at the open end of said cup member entered into recess means in said base member for detachable connection thereto, and said cup member having portions of sufficient resiliency to permit insertion and removal of said projections from said recess means.

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