United States Patent [19]

Studders

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[54] **PERMANENT MAGNETIC STRUCTURE**

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[52] **U.S. Cl.** **335/302;** 206/444

[51] **Int. Cl.** **H01f 7/02**

[58] **Field of Search** 206/444; 335/285, 295, 335/302, 303, 306

[56] **References Cited**

UNITED STATES PATENTS

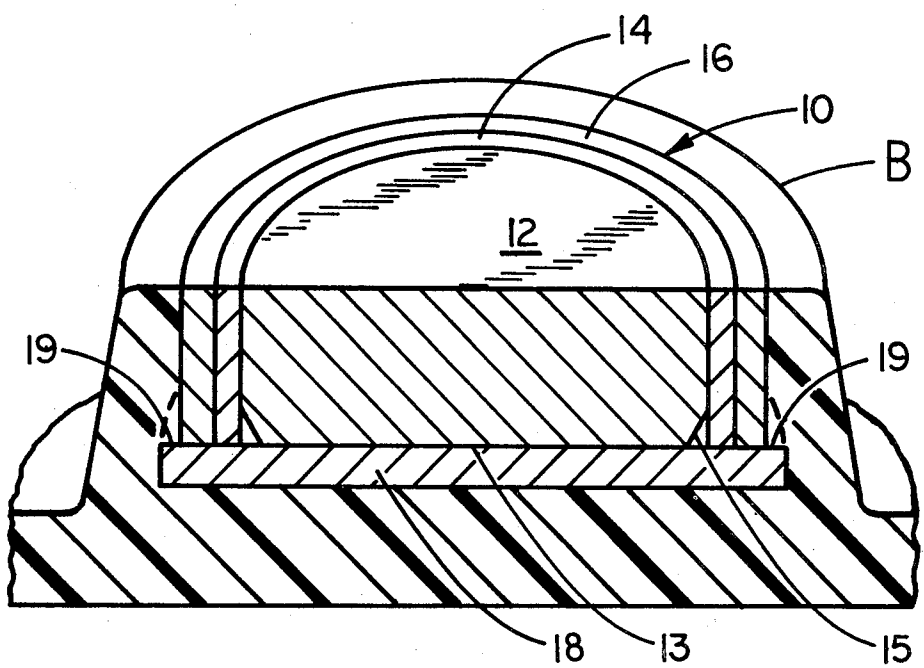
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Primary Examiner—G. Harris

[57] **ABSTRACT**

A cylindrical non-corrosive permanent magnet assembly having a permanent magnetic core pressed fit into a substantially non-magnetic stainless steel tube of the same length which is press fit into a second or outer magnetic stainless steel tube of the same length, with one axial pole magnetically holding a soft iron disk having a diameter slightly greater than the diameter of the outer magnetic stainless steel tube. This pole end of the core may be chamfered at its peripheral edge to aid in the press fitting of it into the non-magnetic tube. This assembly is embedded in a plastic base, except for its other exposed pole, and the outwardly extending edge of the disk helps anchor the assembly in the plastic.

12 Claims, 3 Drawing Figures



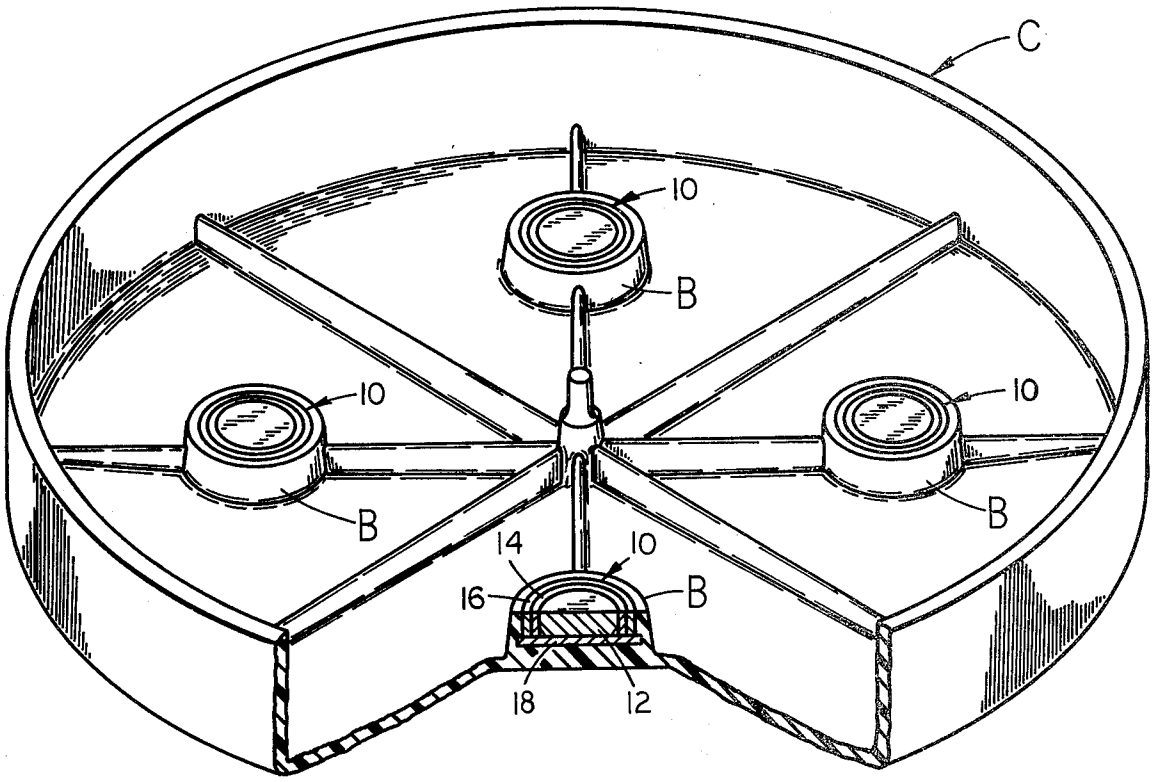


FIG. I

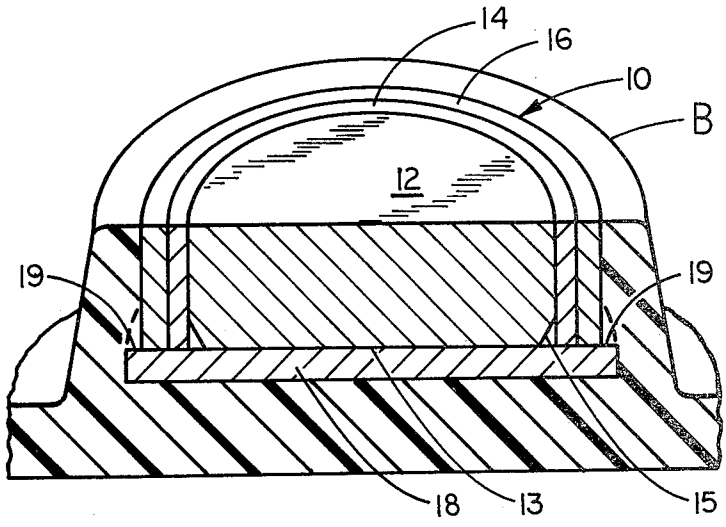


FIG. II

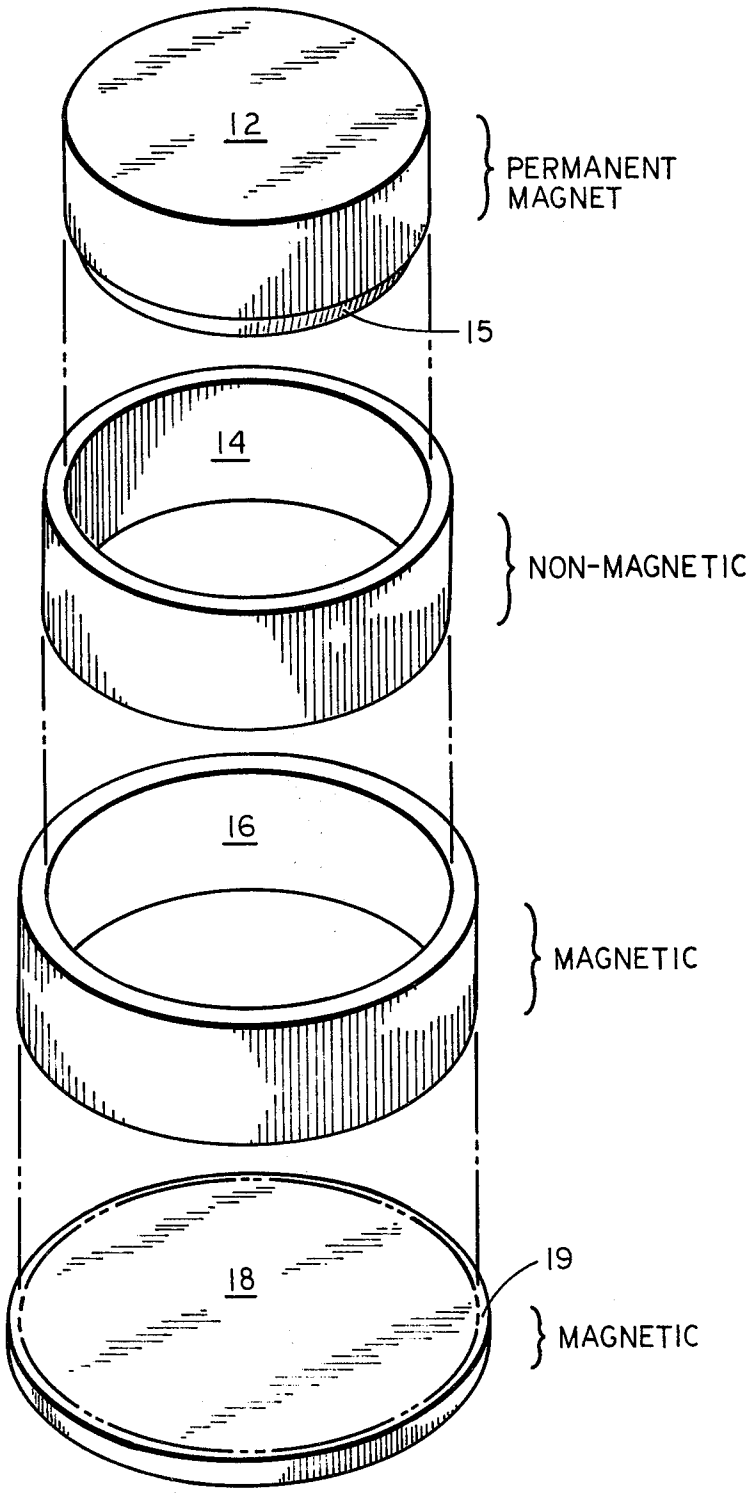

12
PERMANENT MAGNET
15
14
NON-MAGNETIC
16
MAGNETIC
18
19
MAGNETIC

FIG. III

PERMANENT MAGNETIC STRUCTURE

BACKGROUND OF THE INVENTION

A permanent magnet structure of this invention is primarily an improvement on the permanent magnets embedded in the plastic cover for the memory disk of a mini-computer, such as shown in Crouch et al. U.S. Pat. No. 3,635,608 issued Jan. 18, 1972, namely the permanent magnets 5 shown in FIGS. 1B and 2 therein.

Previously such permanent magnets have generally comprised magnetic cups into which a central cylindrical permanent magnet was seated equally spaced from the cylindrical sides of the cup by a non-magnetic material. The outsides of these cups were roughened, grooved, or notched to insure their anchorage in the plastic cover, and the outer exposed pole surfaces of these magnets at the open end of the cups were usually highly polished and then plated to prevent their corrosion. This plating often chipped off producing particles that caused errors when they got on the magnetic memory disks.

Accordingly, it is very important that the magnets used for these computer memory disk covers are non-corrosive and have a high strength so as to hold the cover on the package against the hub of the memory disk, in order to prevent all dirt and dust from entering the package during both use and storage of the memory disk. Since the pull of each of these permanent magnets is about 12 lbs., a leverage arrangement is connected to the handle 8 (see FIGS. 1A and 1B of said patent) for breaking the almost 50 lb. force of the four permanent magnets 5 that hold the cover on the package. Because of the precision required in making these cup-shaped holding magnets, that is the machining and fitting of their component parts, they are quite expensive.

SUMMARY OF THE INVENTION

Generally speaking, the structure of the permanent magnet of this invention comprises a non-corrosive central magnetic core surrounded by two snuggly concentric standard size stainless steel tubes, the inner one non-magnetic and the outer one magnetic, and a magnetic disk pole piece at one end of the assembly whose periphery extends beyond that of the outer tube. One end edge of the central permanent magnetic core may be chamfered or bevelled to aid its force fitting inside of the inner tube. Both of the tubes are of the same length with their ends aligned in parallel planes. The pole piece or disk which is held magnetically and axially of the core against one end of of the core and tubes has a circumference slightly larger than the circumference of the outer tube to prevent the assembly from pulling from the plastic base or mass into which it is cast, embedded or molded. For the specific use of this button type permanent magnet assembly as explained above, namely as a holder for the cover for the memory disk of a mini-computer, the other and exposed polar end of the embedded assembly is ground and polished flush with the other adjacent embedded magnets in the cover so as to form a smooth, intimate and direct contact with the magnetic hub of the memory disk.

By employing a return magnetic path for the flux from the end of the central core magnet through the bottom polar plate and the outer tubular sleeve, an increase pull of about 15% is obtained, over that obtained by the central core magnet alone.

Preferably the core, the surrounding tubes, and the pole plate are all cylindrical. The permanent magnetic core may be cut from a standard size bar of an alloy containing aluminum, nickel, cobalt, titanium, copper, and iron, such as Alnico 6 or 8. The inner sleeve may be cut from a standard size austenitic steel tube, such as of stainless steel No. 304, and the other sleeve may be cut from a larger standard size martensitic steel tube such as of stainless steel No. 410.

OBJECTS AND ADVANTAGES

Accordingly, it is an object of this invention to produce an efficient, effective, simple, economical, strong, clean, and non-corrosive permanent magnet structure of assembly for embedding or molding into a plastic supporting base.

Another object is to produce such a magnet from lengths cut from standard stainless steel tubes and bar stock, and a soft iron plate, thereby avoiding as much machining of the parts as possible.

BRIEF DESCRIPTION OF THE VIEWS

The above mentioned and other features, objects and advantages, and the manner of obtaining them are described more specifically below by reference to an embodiment of this invention shown in the accompanying drawings wherein:

FIG. I is a perspective view of the inside of a cover for the memory disk of a mini-computer showing four button shaped permanent magnets molded therein, with part of one of the magnets and adjacent cover being broken away;

FIG. II is an enlarged vertical sectional view of one of the magnets shown in FIG. I; and

FIG. III is an enlarged perspective exploded view of the parts of the magnet shown in FIG. II.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In FIG. I there is shown, for example, a plastic cover C for a mini-computer memory disk package, such as that shown in the above mentioned Crouch et al. patent, having four equally spaced permanent magnet assemblies **10** with all but one polar end of each magnetic assembly embedded in the plastic of the cover C. The plastic cover C is provided with supporting projections or bases B for surrounding the sides of the permanent magnet assemblies **10.** The cast plastic material of the cover C, preferably is very durable and non-magnetic, such as a polycarbonate organic plastic like "Lexan".

Referring now to FIG. II, the assembled permanent magnet **10** comprises a central core or permanent magnet **12** surrounded by a press fit non-magnetic inner sleeve **14** and then by an outer magnetic sleeve **16.** The one pole end or surface **13** of the core **12** may have its outer peripheral edge or corner bevelled at **15** so that it may be pressed fit more easily into the inner sleeve or ring **14** as also is shown in the exploded view of FIG. III. This inner non-magnetic ring **14** is also pressed fit inside the magnetic sleeve or ring **16,** and all of their end surfaces are parallel and co-planar with the pole ends of the core **12.**

Magnetically held by the permanent core magnet **12** is a soft iron pole plate or disk **18** which has an outer periphery or diameter slightly larger than the outer periphery or diameter of the outer sleeve **16,** so as to form an anchoring flange **19** as shown in FIG. II when

molded in the plastic base or support B. Because of the strong magnetic pull of the permanent magnet piece **12,** it is not necessary to otherwise physically anchor the assembly **10** into the plastic base B, and because this pole plate **18** is completely embedded it does not have to be made of an expensive non-corrosive material or a stainless steel, but may be made of soft iron.

The parts **12, 14,** and **16** are assembled in the manner shown in FIG. III; one part being pressed fit inside the other, and the pole plate **18** being held on one end by the magnetic force of the permanent magnetic core **12.** Once this assembly is embedded in its non-magnetic plastic base or support B, and/or cover C, its other and outer pole surface is polished flat so as to be in same plane with the other outer pole surfaces of the other permanent magnets **10** embedded in the other supports B of the memory disk cover C.

It is to be understood that although the present embodiment of the permanent magnetic assembly **10** is shown to be of circular cross-section, that other shaped prismatic structures can be employed embodying the features of this invention without departing therefrom.

While there is described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of this invention.

I claim:

1. A permanent magnet structure for casting in a non-magnetic plastic support, said structure comprising:

A. a central non-corrosive permanent magnetic core of outside uniform cross-section with opposite parallel pole surfaces on the opposite axial ends thereof,

B. a non-magnetic non-corrosive inner sleeve intimately surrounding said core extending between and to said parallel pole surfaces,

C. a magnetic non-corrosive outer sleeve intimately surrounding said inner sleeve and also extending between and to said parallel pole surfaces, and

D. a magnetic pole plate slightly larger in outer circumference than the outer circumference of said outer sleeve and magnetically held against one of said pole surfaces,

said structure being cast into a non-magnetic plastic support so that only the other said pole surface is exposed.

2. Is a structure according to claim **1** wherein said core and sleeves are cylindrical.

3. Is a structure according to claim **1** wherein said core has one end edge thereof bevelled for easier force fitting into said inner sleeve.

4. Is a structure according to claim **1** wherein said core and two concentric sleeves are forced fit together.

5. Is a structure according to claim **1** wherein said plastic support comprises a cover for a memory disk package for a mini-computer.

6. A permanent magnet structure for molding in a plastic support, said structure comprising:

A. a central solid cylindrical permanent magnet axially polarized,

B. a first stainless austenitic steel cylindrical sleeve around said magnet,

C. a second stainless martensitic cylindrical sleeve around said first sleeve,

said magnet and said sleeves all having the same axial length, and

D. a soft iron pole piece slightly larger in diameter than the outside diameter of said second sleeve held co-axially against one polar end of said magnet and sleeves,

said assembly and disk being cast into a non-magnetic support so that only the other polar end of said assembly is exposed.

7. A structure according to claim **6** wherein said permanent magnet is an alloy of aluminum, nickel, cobalt, copper, titanium and iron.

8. A structure according to claim **6** wherein said magnet and sleeves are forced fit together.

9. A non-corrosive permanent magnet assembly for casting in a non-magnetic plastic base with one pole exposed, said assembly comprising:

A. a central stainless steel permanent magnetic solid cylindrical core having its other axial pole end edge chamfered for force fit into

b. a first stainless steel substantially non-magnetic sleeve of the same axial length as said magnetic core which is forced fit into

C. a second stainless steel magnetic sleeve of the same axial length as said core in first sleeve, and

D. a soft iron pole disk having an outside diameter slightly larger than the outside diameter of said second sleeve for magnetic attachment to said other pole end of said assembly.

10. An assembly according to claim **9** wherein said first stainless steel sleeve is made of austenitic steel.

11. An assembly according to claim **9** wherein said second stainless steel sleeve is made of martensitic steel.

12. An assembly according to claim **9** wherein said core is an alloy of aluminum, copper, nickel, cobalt, titanium, and iron.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,899,762 Dated August 12, 1975

Inventor(s) Robert J. STUDDERS

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 15 "of" should be - - or - -.

Signed and Sealed this

fourth Day of *November 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

PO-1050
(5/69)

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