Sept. 27, 1960 N. V. SUTHERLAND ET AL 2,954,140

MAGNETIC SHIELDING

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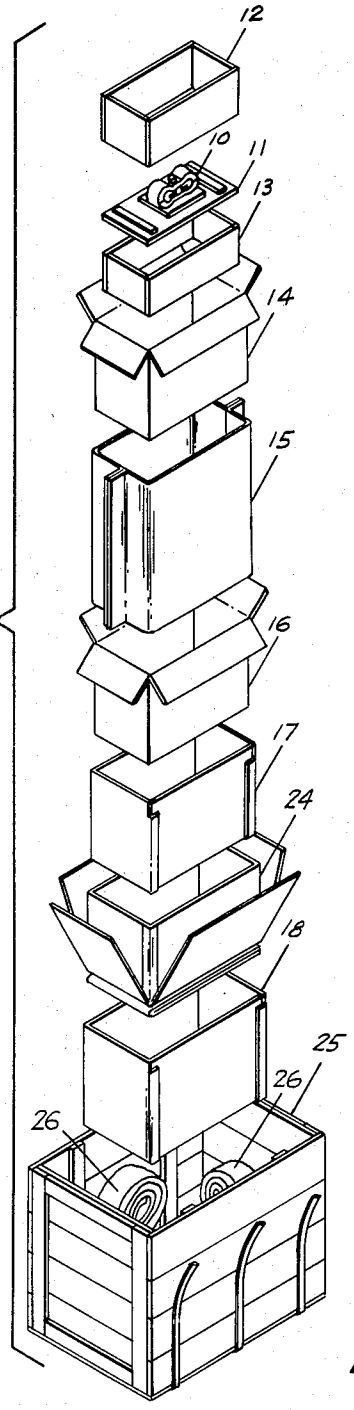


FIG 1

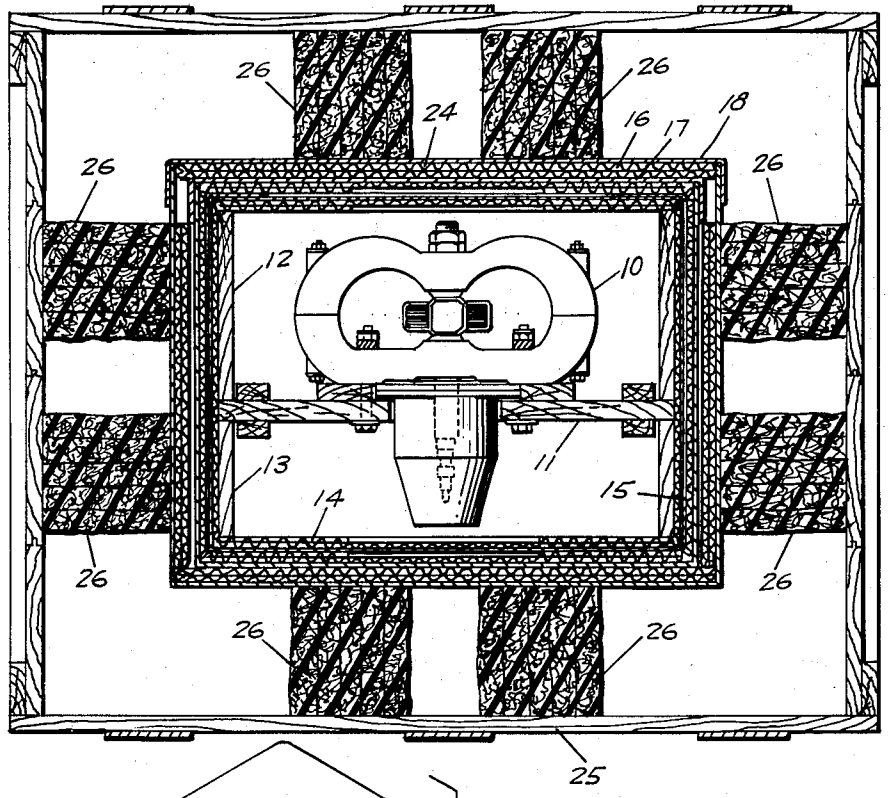
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FIG. 2



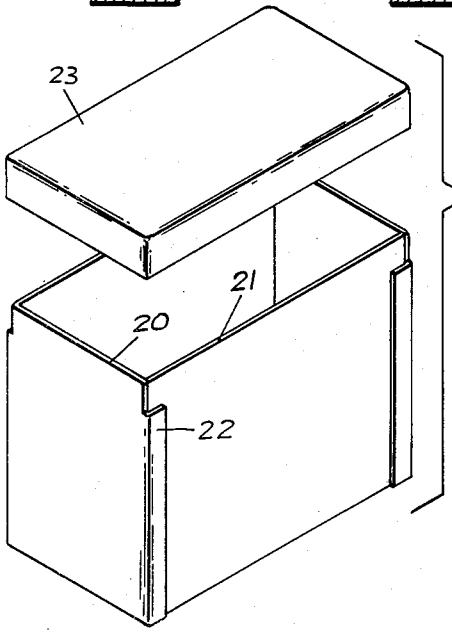


FIG. 3

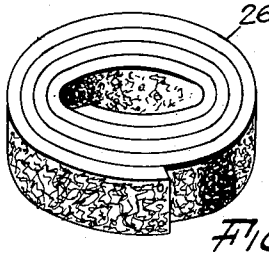


FIG. 4

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MAGNETIC SHIELDING

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3 Claims. (Cl. 217—53)

This invention relates to magnetically shielded shipping containers for devices comprising a permanent magnet.

Devices such as packaged magnetrons including permanent magnets of substantial strength when carried by air may adversely affect the accuracy of the plane's navigation instruments due to the leakage of a substantial portion of the magnetic field of the included magnet from the package. Therefore, in addition to the package protecting the device it must also confine its magnetic field. This has been done by wrapping therein sheet steel shielding repeatedly about a fibreboard or other unit package both lengthwise and crosswise. Usually two such shields separated by an air gap are required. Heretofore this gap has been obtained by the use of wood. The shielded package is then placed in a padded shipping crate. In a representative case a 50 pound magnetron when packaged weighed 277 pounds and occupied a volume of 35.3 cubic feet. The thin sheet shielding used in such a package is both heavy and fragile, thus presenting special problems in handling while it is being applied to the package. It has also presented a hazard to the packers in that the thin edges of the sheet cut their hands, but the sheet is so fragile that it cannot be handled efficiently with gloves thick enough to protect the hands. By the method heretofore used four men could package only four such magnetrons a day.

By the present invention the shielding is accomplished by the use of two ferrous metal boxes formed preferably of grain oriented sheet steel. This material is so effective in shielding that the same shielding effect can be obtained with lesser bulk and weight and the separation or air gap between the boxes can be reduced to the point where fibreboard sheets can be used to separate them rather than the bulkier and heavier wood. The cushioning pads holding the outer shielding box within the shipping crate are made of strips of a fibrous material such as hair encased in a resilient plastic material such as rubber coiled in a plane parallel to its associated side of the crate. As a result a package is obtained which is equally if not better shielded and protected from shock and other environmental hazards than the package heretofore used but which has a packaged weight of only 139 pounds and a bulk of 12 cubic feet for the 50 pound magnetron mentioned above. Furthermore, four men can pack 25 such magnetrons in such packages against 4 by the old method resulting together with other savings in a total saving of 60% in packing cost. This package gives an additional advantage in that the shielding boxes can be readily removed, the tube tested and replaced without damage to the shielding, which was not possible with the wrapped shielding previously used.

Other and further advantages of this invention will be apparent as the description thereof progresses, reference being had to the accompanying drawings wherein:

Fig. 1 is an isometric exploded view of a magnetron packaged according to the invention;

Fig. 2 is a vertical section through a completed magnetron package of Fig. 1;

Fig. 3 is an isometric view of one of the shielding boxes of the package of the invention; and

Fig. 4 is an isometric view of one of the resilient coiled pads used in the package of the invention.

In Fig. 1 the reference numeral **10** designates the magnetic device to be packaged according to the invention, here shown as a magnetron, by way of example. The magnetron or other device is supported in a frame **11** which may be of wood or light metal. The frame **11** is in turn supported on two wooden or light metal frames **12** and **13**. The magnetron and its supporting frames are then inserted in a fibreboard carton **14** which is in turn enclosed and sealed in a vapor barrier **15** of sheet plastic. The sealed package is then enclosed in a second fibreboard carton **16** which is inserted in the first of two shielding boxes **17** and **18** formed preferably of grain oriented sheet steel as described in "Electronics Buyers' Guide" for June 1949 at pages M16 and 17. The construction of these shielding boxes is best seen in Fig. 3 where it may be seen that the sides **20** and **21** are attached by folding over flaps **22** on the sides and welding. The attachment may also be made by an interlocking fold. The shielding boxes are closed at the top by telescoping the top **23** similarly formed of the same material. The shielding boxes **17** and **18** are separated by pads **24** of corrugated fibreboard so dimensioned as to maintain the air gap between the shielding boxes required for effective shielding. The shielding package is supported in the shipping crate **25** which may be made of wood or metal by means of resilient coils **26** formed of strips of a fibrous material coated with a resilient material such as rubber, the axis of each such coil being perpendicular to the contiguous faces of the shielding package and the shipping crate, as shown in the drawings. The tightness with which the coils are wound determines their stiffness, thus permitting the same basic material to be applied to different packaging problems. The coils **26** may be surrounded by more resilient padding material if desired.

The device may be supported between two pieces of plastic molded to accommodate it instead of supporting frames **11**, **12** and **13**.

It can readily be seen that with the package of the invention the device can readily be unpacked, tested or inspected, and repacked with a minimum loss of packaging material as contrasted with the total loss of the wrapped sheet shielding of the conventional shielded packaging.

This completes the description of the embodiment of the invention illustrated herein. However, many modifications and advantages thereof will be apparent to persons skilled in the art without departing from the spirit and scope of this invention. Accordingly, it is desired that this invention not be limited to the particular details of the embodiment disclosed herein except as defined by the appended claims.

What is claimed is:

1. A container for a magnetic device, comprising a support frame for such device, a first box of magnetic material completely enclosing said support frame, a second box of magnetic material completely enclosing said first box, non-magnetic spacing means between said first and second boxes, an outer case enclosing said second box, and a plurality of resilient support means between said outer case and said second box, each of said support means comprising a strip of fibrous material coated with a resilient substance and wound in a spiral coil the axis of which is perpendicular to the contiguous surfaces of said second box and said outer case.

2. A container for a magnetic device, comprising a

wooden support frame for such device, a first box of grain-oriented steel completely enclosing said support frame, a second box of grain-oriented steel completely enclosing said first box, non-magnetic spacing pads between said first and second boxes, an outer case enclosing said second box, and a plurality of resilient support means between said outer case and said second box, each of said support means comprising a strip of fibrous material coated with rubber and wound in a spiral coil the axis of which is perpendicular to the contiguous faces of said second box and said outer case.

3. A container for a magnetic device, comprising a light metal support frame for such device, a first box of grain-oriented steel completely enclosing said support frame, a second box of grain-oriented steel completely enclosing said first box, non-magnetic spacing pads between said first and second boxes, an outer case enclosing said second box, and a plurality of resilient support means between said outer case and said second box, each of said support means comprising a strip of fibrous material coated with rubber and wound in a spiral coil the axis of which is perpendicular to the contiguous faces of said second box and said outer case.

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