Jan. 16, 1968 J. C. PETERS 3,364,298

FERROMAGNETIC SHIELDING

Filed April 15, 1966

Fig. 1.

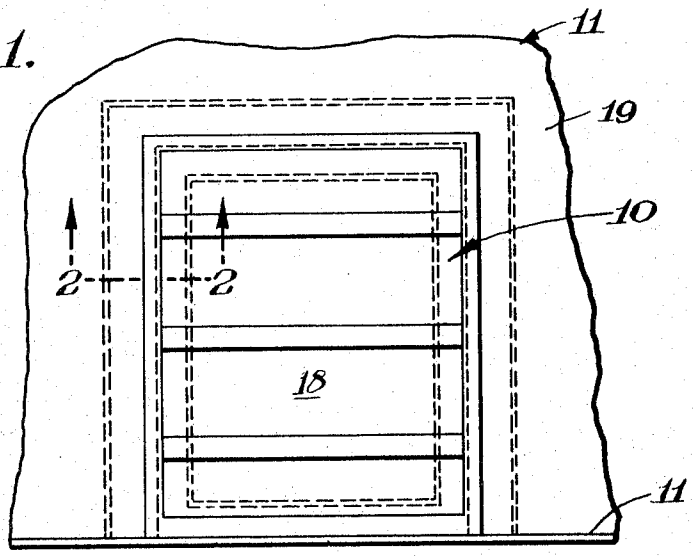


Fig. 2.

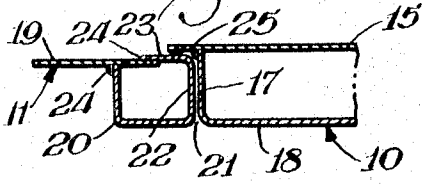
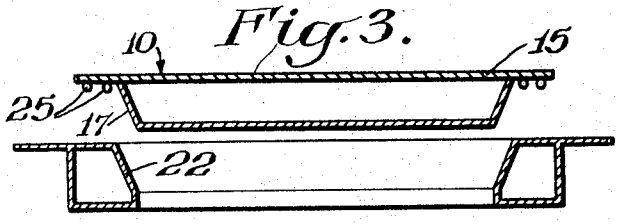


Fig. 3.



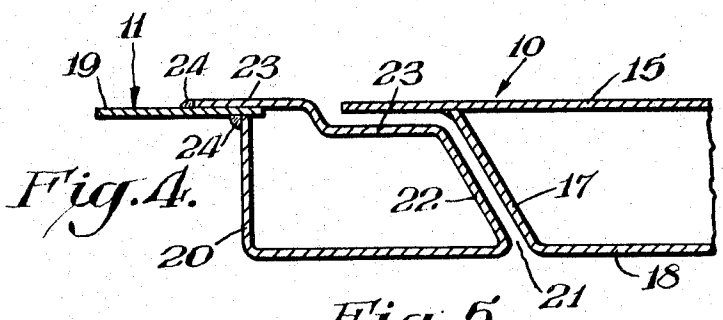
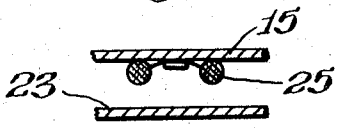


Fig. 4.

Fig. 5.



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FERROMAGNETIC SHIELDING

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5 Claims. (Cl. 174—35)

ABSTRACT OF THE DISCLOSURE

A closure for an opening in a shielded enclosure is provided with a flange member which provides a closed ferromagnetic loop. The closed flange on the closure member mates with a closed box-like jamb around the opening in the shielded enclosure to provide a gap reluctance that is substantially equal to the reluctance of the material employed.

This invention relates to a ferromagnetic shielded closure for an opening in a shielded enclosure, and more particularly to ferromagnetic shielding in the gap between the closure and the enclosure.

Shielded enclosures serve to protect an enclosed area from outside electromagnetic environment, or to contain and prevent emanation of undesirable radiation of electromagnetic energy from within an area. Apertures are a necessary part of a shielded enclosure and in turn necessitate closures. Shielding is required on the ceiling, walls and floor of the enclosure, and on the closure of any opening.

The shielding of the enclosing walls, ceiling and floor and the shielding on the closure are matched so that a uniform value is offered to the magnetic flux that the ferromagnetic shielding is intended to deal with. A major factor in this value is the reluctance offered to the electromagnetic energy. It is desirable that the reluctance be as uniform as possible. However, the closure for an aperture in the shielding, in the absence of elaborate designing, requires substantial clearances which interrupt this uniformity.

In the prior art the shielding closure, such as a door, is made up of a metal slab of shielding material. There is present, however, a space between the wall of the enclosure and the door which causes an interruption in the uniform reluctance of the wall and door.

It is an object of this invention to provide a shielded enclosure with a uniform value offered to the electromagnetic energy.

It is another object of this invention to provide means at the door of a shielded enclosure for matching the reluctance of the shielding.

It is still another object of this invention to eliminate the gap in the shielding values occurring at the door to a shielded enclosure.

These and other objects of this invention are more fully described in the following description taken together with the accompanying drawing, in which:

FIGURE 1 is a general elevational view of a shielded closure in a shielded enclosure according to this invention;

FIGURE 2 is a sectional view of the shielded enclosure at the shielded door taken on lines 2—2 of FIGURE 1 in the direction of the arrows;

FIGURE 3 is a sectional view partially disassembled of a modification of the shielding development of this invention;

FIGURE 4 is a further modification of this invention; and

FIGURE 5 is an enlarged broken-away section of a gasket for use in any of the embodiments of this invention.

In general this invention provides means in a shielded enclosure of matching the reluctance offered to the shielded energy so that a possible discontinuity in reluctance at openings in the enclosure is substantially eliminated, particularly at the door to the enclosure.

Specifically, a ferromagnetic metal flange, as of wrought iron, is welded to the shielding slab of the door at an angle thereto which matches the adjacent plane of the enclosure opening. The plane of the enclosure opening and the metal flange on the door are dimensioned so that the physical discontinuity resulting from the door does not result in a magnetic reluctance discontinuity. To achieve this, the total area of the adjacency of the flange and the enclosure opening provides a gap reluctance equal to the material reluctance.

In a preferred embodiment, a ferromagnetic mesh gasket is riveted to the inside of the portion of the door which overlies the wall of the enclosure in order to ensure electromagnetic conductivity therebetween.

In the drawing, FIGURE 1 shows a ferromagnetic shielding door **10** in a wall **11** of a shielded enclosure. The door **10** is provided with hinges on one side and latching means on the other. The hinges, the latching means and other hardware form no part of this invention and are not shown. However, it is noted that the thickness, or depth dimension, of the door is best accommodated by using double axis hinges, which are well known in the art.

FIGURE 2 shows ferromagnetic sheet **15** which forms the outer member of door **10**. Sheet **15** is provided with a ferromagnetic flange **17** completely around the door **10**. An inner ferromagnetic sheet cap **18** is in complete weldment contact with the flange **17** to provide a closed box-like structure for door **10**. Flange **17** and cap **18** may be fabricated from a single sheet, and thereafter secured in complete weldment to the inner side of sheet **15**.

Wall **11** is fabricated from ferromagnetic plate **19**, which is continuous or welded from individual plates. Wall **11** is provided with aperture **21** to permit access to the shielded enclosure. Aperture **21** is provided with a jamb **20** formed around the aperture so as to accommodate door **10**.

The flange **22** of jamb **20** extends normal to the major dimension of wall **11**. Weldment **24** intimately secures the entire periphery of portion **23** of jamb **20** to the plate **19**. The jamb **20** is attached to the inside of the plate **19** by another complete weldment **24**. The door **10** fits into aperture **21** in the wall **11** with sheet **15** overlapping plate **19** at the periphery of the aperture. An optional gasket strip **25** of suitable material, such as a woven ferromagnetic mesh, is fastened or adhered to the inner surface of sheet **15** immediately adjacent aperture **21**, and encircling the aperture **21** abuts the portion **23** of the jamb **20**. The sheet **15** is held against the jamb portion **23** with the door **10** secured in the closed position by a suitable latch (not shown). The flanges **17** welded to the inner side of sheet **15** are spaced from the outer edge of the sheet **15** and project into the aperture **21** when the door **10** is in the closed position as illustrated in FIGURE 2.

In the preferred embodiment the flanges **17** are wrought iron welded to wrought iron sheet **15** and capped with wrought iron sheet **18**, all welded together so as to be structurally and magnetically integral. The teachings of this invention are best practised when the materials are all of the same magnetic shield, i.e. wrought iron should not be mixed with other magnetic shield materials.

The inwardly extending flange **22** of jamb **20** and the inwardly extending flanges **17** both normal to the major

dimension are slightly spaced apart to provide a nominal gap which allows the door to move free in the aperture 21 with comfortable tolerances. The magnetic shielding sheet 15 and plate 19 of a ferromagnetic material present a desired magnetic reluctance to undesirable electromagnetic energy. The wrought iron flanges 17 and 22 are dimensioned so that the spacing between them produces a gap reluctance which is equal or less than the material reluctance of 15 and 19. Thus the structure of this invention provides a uniform reluctance across the door.

FIGURES 3 and 4 show modifications of the arrangement of the flanges 22 and 17 according to this invention. These modifications permit easier swing of the door, and FIGURE 4 provides a substantially flush outer wall of the enclosure. In both modifications the same essential relationships exist: the jamb 20 and the door 10 are both completely closed box-like structures that regardless of cross-section are best described as tubular structures; the flanges 17 and 22 are substantially parallel and substantially of equal depth.

Superior results are obtained by providing the faying surfaces of the door and aperture with a suitable protective and conductive finish. A preferred result is obtained by flame spraying pure nickel onto the flanges 17 and 22 and the adjacent members of the door and wall. It has been found that flame spraying provides nickel in intimate molecular contact with wrought iron.

What is claimed is:

1. In a shielding unit having sheet ferromagnetic shielding and generally parallel therewith a sheet ferromagnetic closure of an aperture in said shielding,

the combination of a member of ferromagnetic material extending completely around the periphery of the aperture and connected to the sheet ferromagnetic shielding,

at least a portion of said member extending at an angle to the major dimension of the shielding and forming with said shielding a closed tubular box-like structure,

a ferromagnetic sheet forming said closure, a section of said sheet closure overlying and slightly spaced from the shielding,

a transverse flange member of ferromagnetic material extending completely around said sheet closure extending generally at the same angle to the major dimension of said sheet closure as said portion of the peripheral member and a ferromagnetic sheet cap joined completely around the inner end of said flange and forming with said flange and said sheet closure a closed tubular box-like structure positionable in close juxtaposition and spaced from said portion in the closed position of said closure,

whereby the magnetic reluctance of the member portion and the transverse member and the dimension of the space between the portion and the member and the overlying section and the shielding and the dimension of the space between the overlying section and the shielding provide a magnetic reluctance at the space having a value no greater than the ferromagnetic shielding and closure.

2. The shielding unit of claim 1 in which said sheet ferromagnetic shielding and said closure are wrought iron.

3. The shielding unit of claim 1 in which the peripheral member is a jamb having a portion substantially parallel to the major dimension and integral with the ferromagnetic shielding.

4. In a shielding unit as claimed in claim 1, a ferromagnetic shielding gasket material in the spacing between the overlying section of said sheet closure and the shielding.

5. The shielding unit of claim 1 wherein said portion of said ferromagnetic member and said flange member are of substantially equal depth.

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DARRELL L. CLAY, *Primary Examiner.*