Oct. 4, 1966 F. S. STICKNEY ETAL 3,277,230

SHIELDING GASKETS WITH FASTENING MEANS

Filed March 17, 1965 3 Sheets-Sheet 1

Fig. 1.

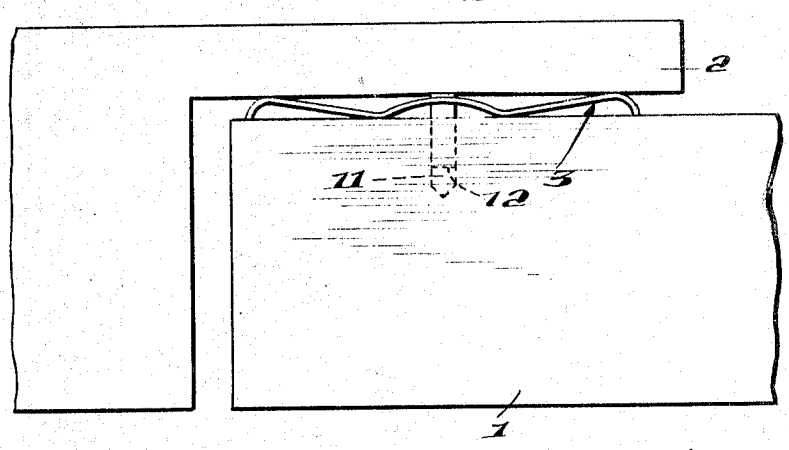


Fig. 2.

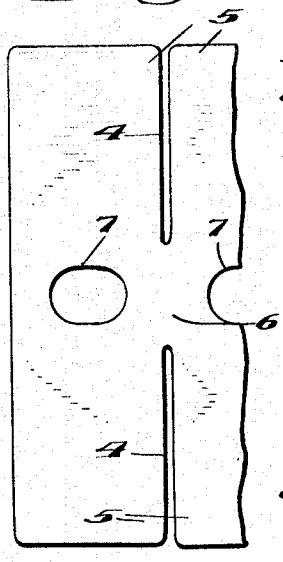


Fig. 3.



Fig. 4.

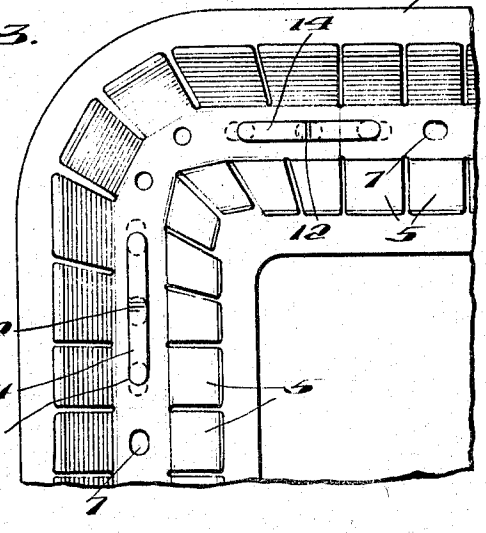


Fig. 5.

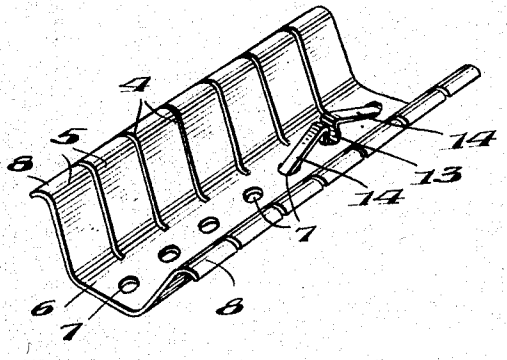
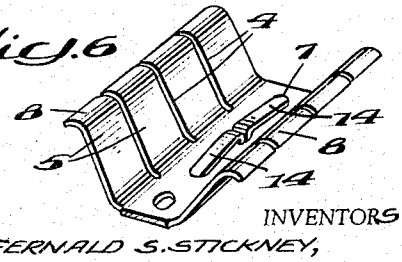


Fig. 6.



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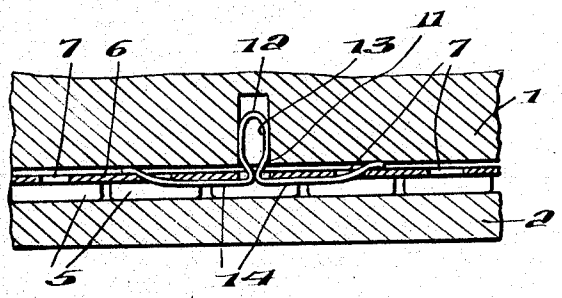


Fig. 7.

Fig. 8

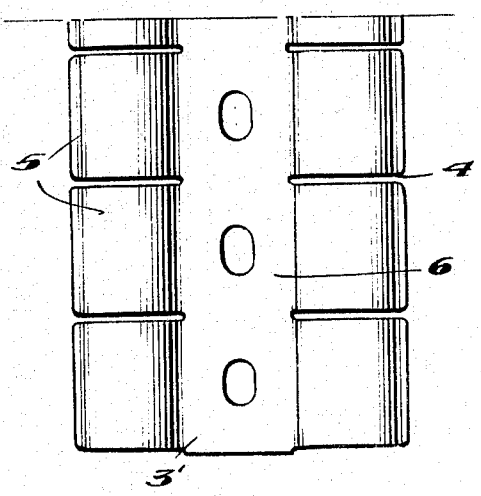


Fig. 9.

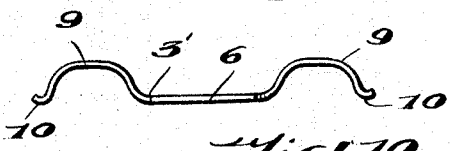


Fig. 10

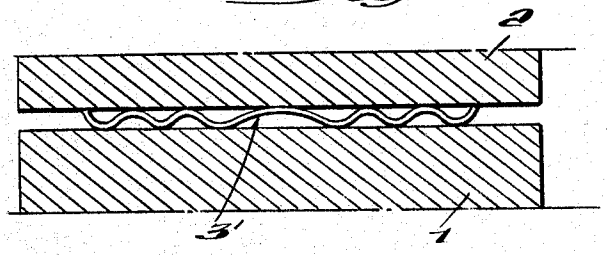


Fig. 11.

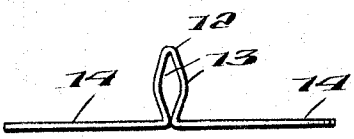
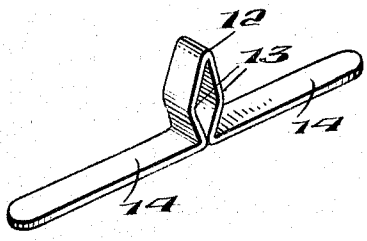


Fig. 12.



Fig. 13.



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Fig. 14.

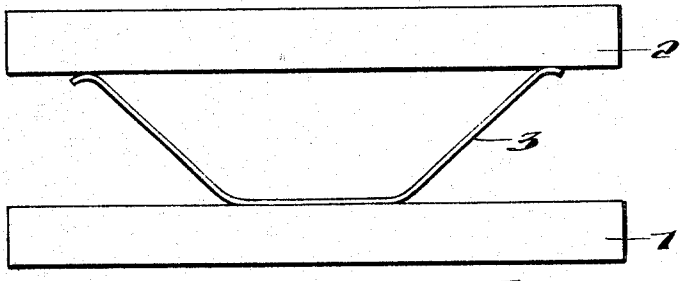


Fig. 15.

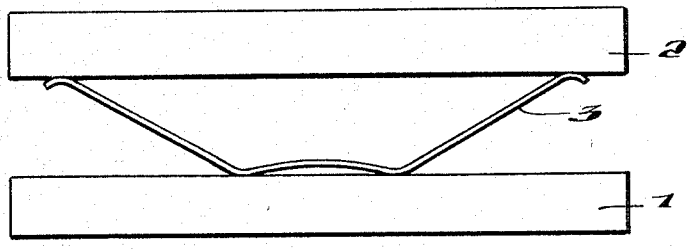


Fig. 16.

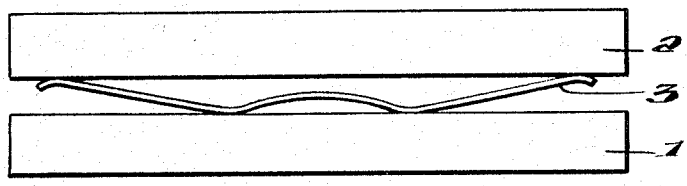


Fig. 17.

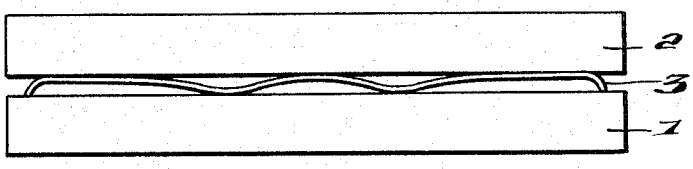
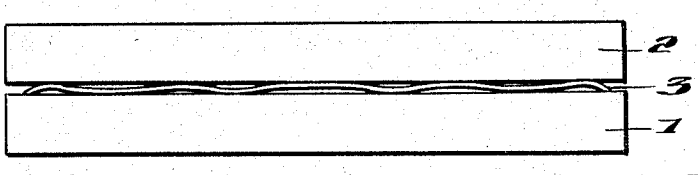


Fig. 18.



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United States Patent Office 3,277,230 Patented Oct. 4, 1966

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SHIELDING GASKETS WITH FASTENING MEANS

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Filed Mar. 17, 1965, Ser. No. 440,482
1 Claim. (Cl. 174—35)

This invention relates to improvements in shielding gaskets to be used in fixed or movable joints in shielded structures, such as test rooms and enclosures for radio transmitters, radio receivers, computers, and other equipment requiring electronic shielding.

Such structures usually are provided with movable joints which occur at doors, access panels, drawers and other non-fixed portions of the structures. Fixed joints may also involve permanent connections, attached panels and other connections which are not readily movable. It is desirable to seal these joints effectively with conductive surfaces that will permit of dissipation of electrical charges and so as to isolate the components contained therein.

Various attempts have been proposed heretofore for shielding such fixed and movable joints, but these have not been sufficiently secure so as to maintain the highest standards of attenuation with good electric contact between the opposed surfaces, especially in joints where the direction of closure is approximately perpendicular to the surfaces to which the gasket is attached.

One object of this invention is to improve the shielding effect obtained with gaskets that are employed in joints between fixed and non-fixed portions of structures.

Another object of the invention is to increase the effectiveness of the gasket as the latter is compressed to obtain a high dynamic range, long endurance life, good attenuation at light pressures and excellent attenuation when fully compressed.

Still another object of the invention is to improve the mounting of the gasket on one of the opposed surfaces so as to permit free motion of the gasket during compression and to provide for substantially full compression without interference between the fastener and the opposed surfaces to any appreciable extent.

These objects are accomplished, according to certain embodiments of the invention, by forming an elastic metallic gasket of a structure made of a linear strip of thin metal of good spring properties and good conductivity, having a symmetrical cross section consisting of integral formed fingers on each side of a perforated continuous center portion, the form of the fingers being such as to produce arching of the center portion when compressed between plane surfaces.

The fasteners are preferably made, respectively, from a thin metal strip having high spring properties of a width slightly less than the diameter of the hole used for fastening the gasket and having a double convex center portion for producing a frictional force when inserted in or through a fastening hole, said fastener having two coplanar ends approximately 180° from each other and approximately at 90° from the axis of the double convex center portion, the ends being long enough to be tucked under the gasket through holes adjacent the hole containing the double convex portion of the fastener.

These embodiments of the invention are illustrated in the accompanying drawings, in which:

FIG. 1 is an end view of a movable joint having a gasket in place therebetween;

FIG. 2 is a plan view of the forming strip for the gasket;

FIG. 3 is an edge view of one form of gasket as an embodiment of this invention;

FIG. 4 is a plan view of a corner gasket secured in place;

FIG. 5 is a perspective view of one form of gasket showing the fastening being inserted therein;

FIG. 6 is a similar view showing the second step in assembly of the fastening;

FIG. 7 is a longitudinal section through the gasket and opposed surfaces of the joint;

FIG. 8 is a plan view of another form of gasket;

FIG. 9 is an end elevation thereof;

FIG. 10 is a cross section therethrough, with the gasket in compressed shape;

FIG. 11 is a side elevation of the fastener;

FIG. 12 is a top plan view thereof;

FIG. 13 is a perspective view of the fastener; and

FIGS. 14 to 17 are elevations showing the form of gasket illustrated in FIGS. 1 to 6 in successive positions of compression between opposed surfaces of the joint.

The invention is illustrated as applied to a joint formed between opposed surfaces of a metallic enclosure between opposed parts, generally designated by the numerals **1** and **2**.

These parts **1** and **2** have opposed surfaces between which a gasket may be disposed for effecting an electronic shielding of the enclosure. One of the parts may be movable relative to the other as, for example, a door, access panel, drawer, etc. On the other hand, the parts may be fixed as in a permanent joint or one secured by adequate fastenings which may or may not be readily removable.

Mounted between the opposed surfaces of the parts **1** and **2** is a gasket **3** preferably formed of a linear strip of thin metal of good spring properties and good conductivity. It has been found that a beryllium copper alloy is satisfactory for this purpose. The gasket may extend in a straight line or be so shaped as to extend around a corner, the latter being illustrated as an example in FIG. 4.

The gasket **3** is formed initially from a flat strip of metal of the character described and of a width suitable for the surface to be shielded. The strip is notched at opposite edges, as indicated at **4**, to form a row of integral fingers **5** along each opposite edge of the strip and which project laterally in opposite directions from a continuous center portion **6** of the strip. This center portion **6** extends throughout the length of the strip. The center portion **6** has a hole **7** formed therein between the inner ends of a pair of oppositely directed fingers **5** and each of the holes **7** is preferably elongated so as to provide for adjustment of the position of the gasket to accommodate for irregularities in the mounting holes.

In the form shown in FIGS. 1 to 6, the outer ends of the fingers **5** are curved in cross section, as indicated at **8**, to permit a line of wiping contacts at the tips of the fingers against the opposed surface.

The blank is bent or formed in a channel shape, as illustrated in FIGS. 3 and 5, with the fingers **5** diverging from the center portion **6** and the rolled or curved edges **8** extending laterally in opposite directions at the ends of the fingers. The line of bending of each row of fingers **5** at the point of joining the center portion **6** is intermediate the length of the fingers so that the notches **4** slightly extend into the center portion. This shape and relationship of the fingers to the center portion tends to cause the median area of the center portion **6** to be bowed throughout its length, as illustrated in FIG. 1, when pressure is applied to the outer ends of the fingers as, for example, to the rolled edges **8** thereon. This is illustrated further in FIGS. 14 to 17.

If desired, the compression end portions of the fingers may be formed of other shapes, an example of which is illustrated in FIGS. 8 to 10. In that embodiment, the fingers which extend outwardly in diverging relation initi-

ally are turned over to form convex bearing surfaces **9** intermediate the length of the respective fingers and then back to the plane of the center section where rolled edges **10** are formed, abutting one of the opposed surfaces. This forms a total of four lines of wiping contact with each of the compressing plane surfaces initially, which is further increased under more extreme compressing action, as illustrated in FIG. 10. In other respects, the gasket shown in FIGS. 8 to 10 is made as described above and is designated generally at **3'**.

The supporting surface for the gasket, here illustrated at **1**, is formed with a series of holes therein, as indicated at **11** in FIGS. 1 and 7. A row of holes may be formed spaced apart according to the desired placement of the fastenings.

It is preferred to use a fastening which is not rigid and which will permit free motion of the gasket during compression. It is not desirable to use fastenings with heads for holding the gasket in place unless the compressing surface is relieved to clear these heads. Best shielding results are obtained when the fastenings permit arching of the center portion, which improves attenuation and endurance life of the gasket.

It is preferred to use fastenings of the character shown in FIGS. 4 to 7 and 11 to 13. Each fastening is made from a thin metal strip having high spring properties, its width being slightly less than the diameter of the hole **11** and likewise slightly less than the diameter of the hole **7**.

The center post on the fastener is designated generally at **12**, being formed of a double convex center portion bowed outwardly in opposite directions, as indicated at **13**, for producing a frictional force when inserted in or through the fastening hole **11**, being slidable into and out of the hole. The strip, after thus forming the center post **12**, has its end portions turned outwardly in opposite directions, forming two coplanar ends approximately at 180° from each other and approximately at 90° from the axis of the double convex center portion forming the post **12**. These end portions **14** are long enough so that when the post **12** is inserted in one of the holes **7** in the gasket, the end portions **14** can be tucked through and under the next adjacent holes **7** in the gasket to underlie the center section **6** of the latter in the manner that is apparent from FIGS. 4 to 7.

These fastenings may be assembled initially on the gaskets before the latter are applied to the closures or joints. The spring post **12** is inserted into one hole **7** of the gasket, while the end portions **14** are tucked into the next adjacent holes on opposite sides thereof in the manner illustrated in FIG. 5. Then, the center post **12** is pushed through the gasket, with the fingers or the butt end of a pencil or other suitable means, as illustrated in FIG. 6. Lengths of the gasket can thus be preassembled with the fastenings in place thereon and will be retained during handling. Thereafter, in applying the gasket to the mounting portion of the joint, the preassembled fasteners are pushed into mounting holes **11** with a gentle rocking motion, again using the fingers, the butt end of a pencil or other means.

The fastener may be formed of thin flat metal, so that the height of its head is substantially negligible, permitting the gasket to be compressed solid without difficulty. It will withstand a great many repeated compressions of the gasket without fatigue failure. Under compression, the fastener permits arching of the center portion of the gasket producing two or more lines of wiping contact with the mounting surface. It will achieve better attenuation, better dynamic range and longer endurance life than conventional screws, rivets or soldering.

The gasket may be formed in various shapes as found desirable. For example, it is illustrated in FIG. 4 as a

90° corner gasket, being otherwise of the shape and having the characteristics described in connection with FIGS. 1 to 3, 5, 8 and 9.

The gaskets may be assembled in strips which either abut each other at the ends or having ends that overlap the width of one pair of fingers **5**. A fastener may then be inserted through the overlapped ends of the gasket and will attach these ends jointly to a supporting surface of the shielded structure.

The gasket has a symmetrical cross section which produces little or no shearing force on its fastenings; permits arching of its center portion under compression which, in turn, provides two or more desirable wiping contacts with the mounting surface when lightly compressed; produces wiping contact between all of the fingers and the compressing surface; and produces additional contacts between the fingers and the mounting surface when fully compressed.

The compressing action is illustrated in FIGS. 14 to 18. In FIG. 14, where there is little or no compression, three lines of contact occur, in the center of the strip and along the rolled edges of the fingers. As compression is increased according to the illustration in FIG. 15, the center portion **6** begins to arch, thus increasing the lines of contact to four between the compression surfaces. This compression is further increased according to the illustration in FIG. 16, which illustrates the wiping contact with the mounting surface. Upon further reduction in the gap between the surfaces, as in FIG. 17, the tips of the fingers are in contact with the mounting surface and the center arch is in contact with the closing surface, thus making a total of seven lines of contact, which may be further increased, as illustrated in FIG. 18, when the gasket is fully compressed.

The loose mounting of the gasket by the fastenings permits of the arching of the center section, as stated above, and which arching is illustrated in FIGS. 15 to 18, although the fastenings are not there shown.

While the invention has been illustrated and described in certain embodiments, it is recognized that other variations and changes may be made therein without departing from the invention set forth in the claim.

We claim:

An electronic shielding gasket comprising a linear metallic strip having a center portion extending lengthwise thereof with holes therealong, a fastening including a post portion extending through a hole and outturned end portions extending over the center portion and through the next adjacent holes, for attaching the gasket to a supporting surface, and fingers extending in rows along opposite edges of the center portion and with the fingers in each row spaced apart, said fingers at opposite edges being in diverging relation to each other with bearing faces thereon spaced outwardly from the center portion and in positions to cause arching of the center portion by deflection of the fingers under compression.

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