Dec. 27, 1955 D. B. WHEELER 2,728,479

HONEYCOMB PAD

Filed Feb. 9, 1951 4 Sheets-Sheet 1

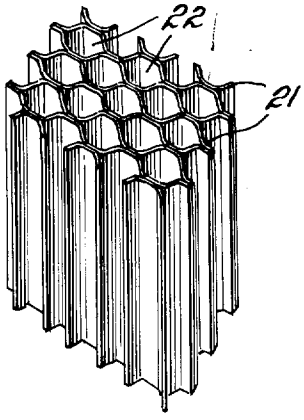


Fig. 1.

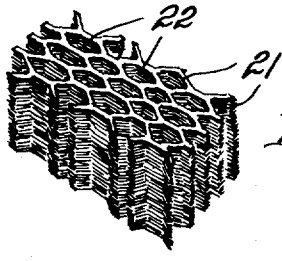


Fig. 2.

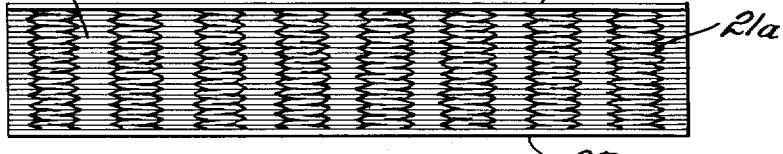


Fig. 3.

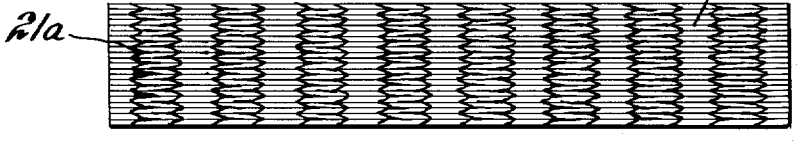


Fig. 4.

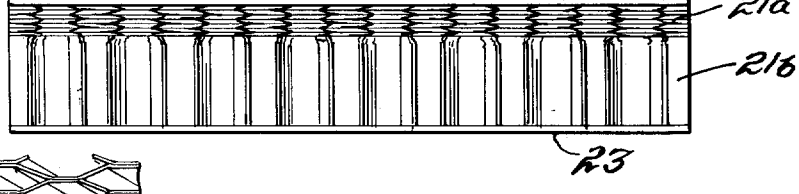


Fig. 5.

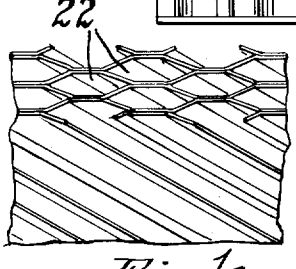


Fig. 1a.



Fig. 4a.

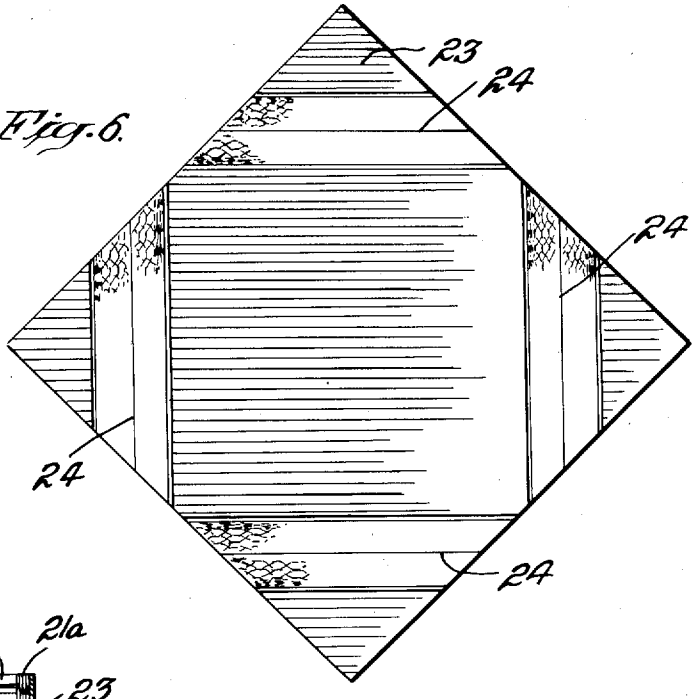
INVENTOR.
DONALD B. WHEELER
BY
Charles P. Bauer
ATTORNEY

Dec. 27, 1955 D. B. WHEELER 2,728,479

HONEYCOMB PAD

Filed Feb. 9, 1951 4 Sheets-Sheet 2

Fig. 6.



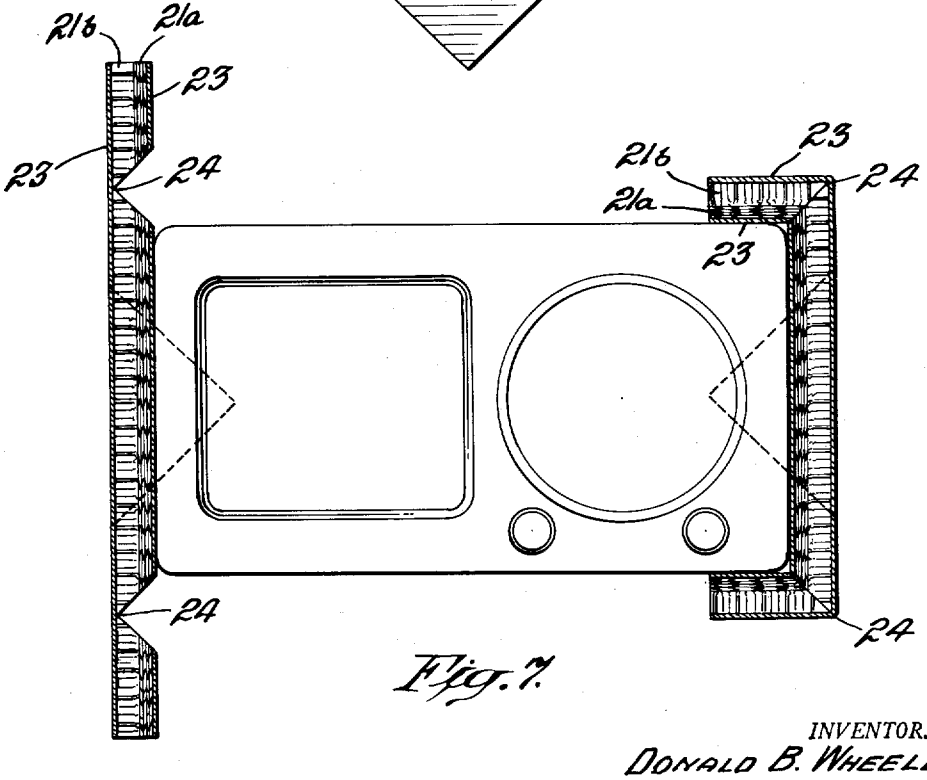


Fig. 7.

INVENTOR.
DONALD B. WHEELER
BY
Charles A. Bauer
ATTORNEY

Dec. 27, 1955 D. B. WHEELER 2,728,479

HONEYCOMB PAD

Filed Feb. 9, 1951 4 Sheets-Sheet 3

Fig. 8.

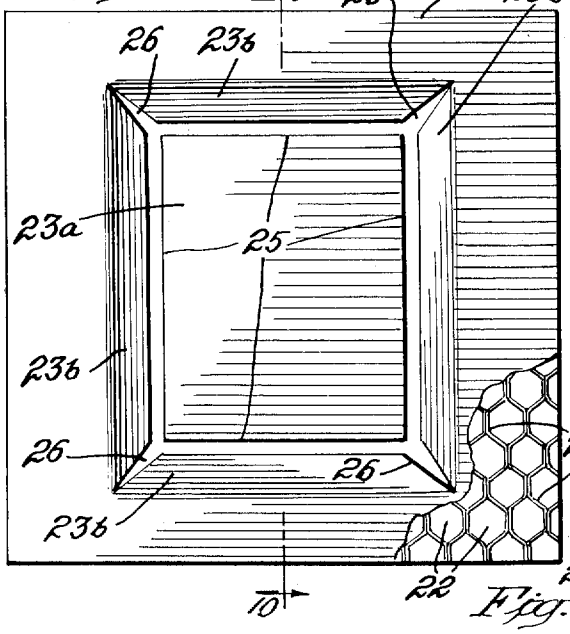


Fig. 9.

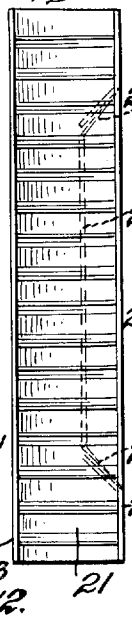


Fig. 10.

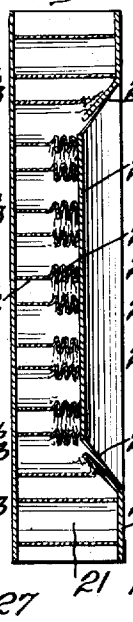


Fig. 11.

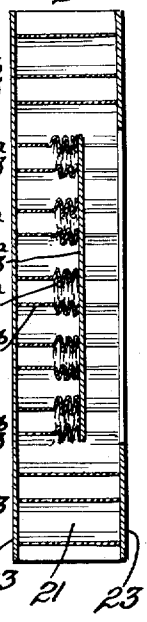


Fig. 12.

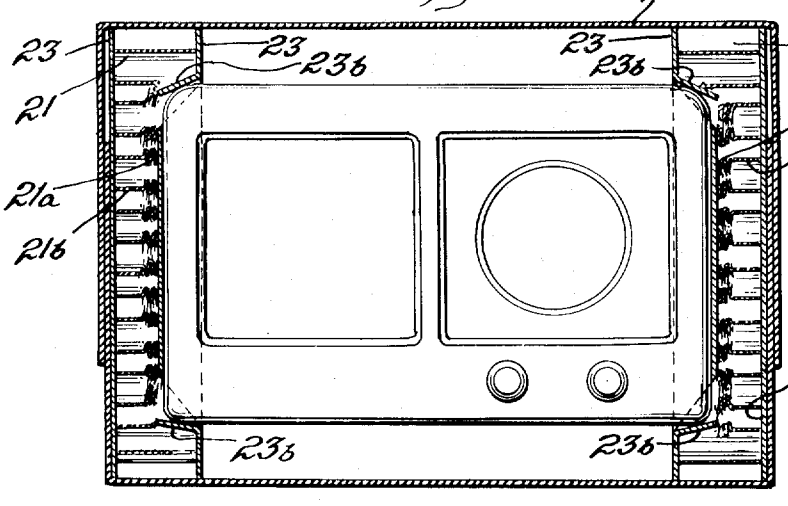
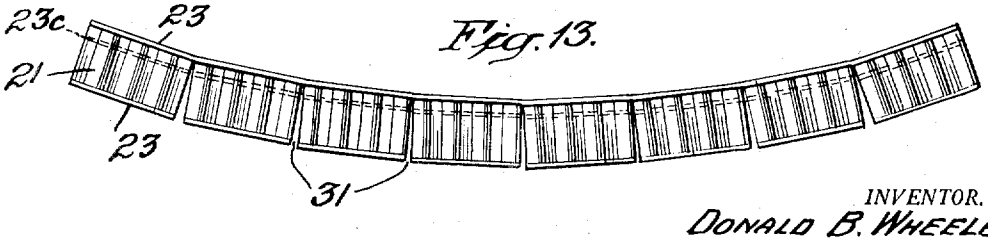


Fig. 13.

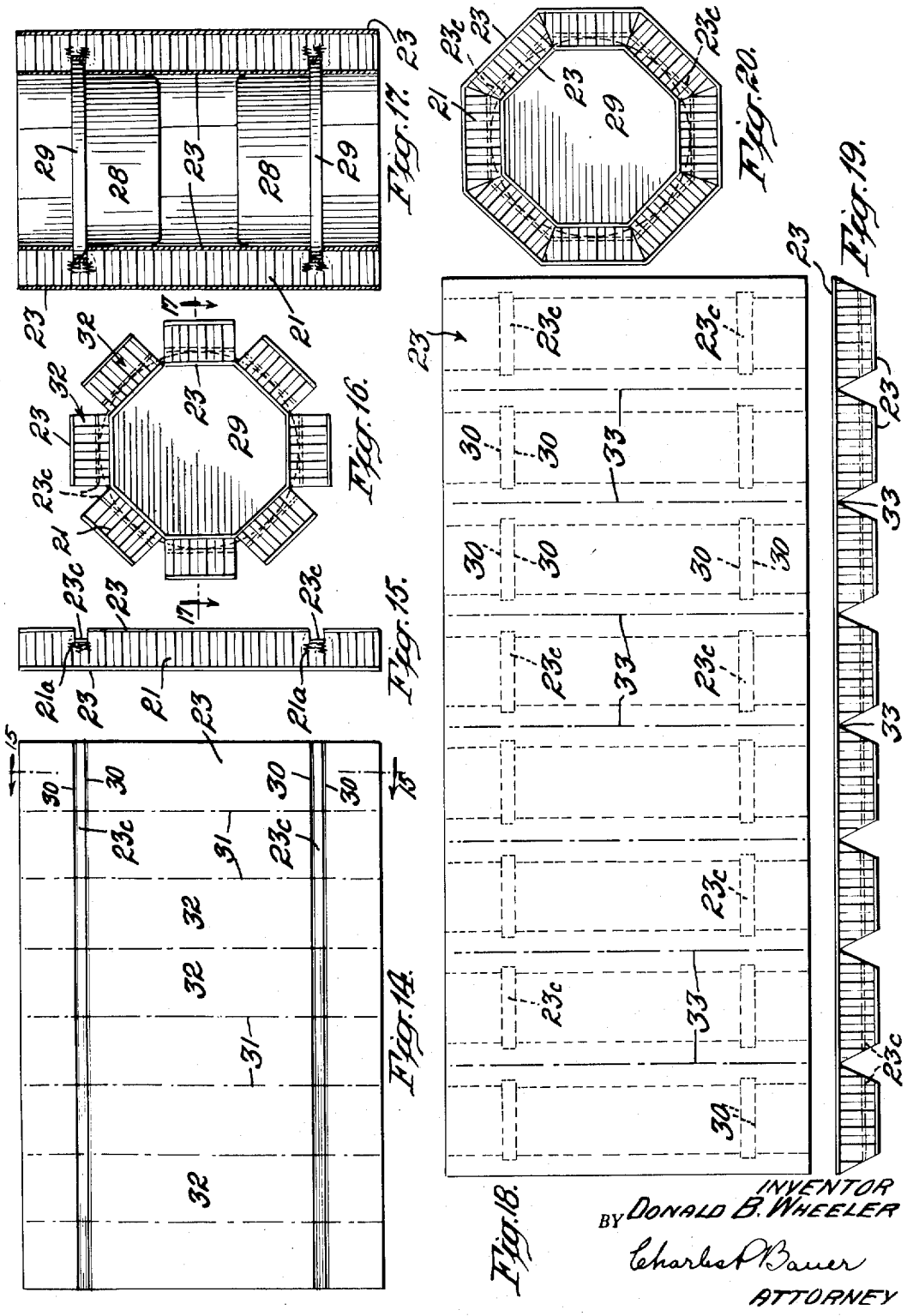


INVENTOR.
DONALD B. WHEELER
BY
Charles P. Bauer
ATTORNEY

Dec. 27, 1955 D. B. WHEELER 2,728,479

HONEYCOMB PAD

Filed Feb. 9, 1951 4 Sheets-Sheet 4



United States Patent Office

2,728,479

Patented Dec. 27, 1955

2,728,479

HONEYCOMB PAD

Donald B. Wheeler, Hudson Falls, N. Y., assignor to Union Bag & Paper Corporation, New York, N. Y., a corporation of New Jersey

Application February 9, 1951, Serial No. 210,128

18 Claims. (Cl. 217—35)

The present invention relates to improvements in honeycomb material. More particularly it pertains to a new and improved pad or cushion to be used to lessen jarring, impact, or shock.

A general object of the invention is to provide a pad which may combine resiliency, strength and rigidity and is so designed and constructed that it can be adapted for use in diversified fields where such qualities are necessary.

More specifically it is an object of the invention to provide a pad having a honeycomb structure, said honeycomb structure being compressed to form a resilient cushion over all or a portion of the said pad.

A further object is to provide a pad which is particularly useful in shipping fragile products such as radios, electric meters and objects of a similar nature.

A further object is to provide a pad which is not only compressed into a resilient cushion to protect the product being shipped but also is cut to form a recess for retaining such product in position.

A further object of the invention is to provide a pad which is easily cut, scored and shaped.

A further object is to provide a pad of the character stated which is simple in design, rugged in construction and inexpensive for the bulk which it occupies.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises an article of manufacture possessing the features, properties and the relation of elements which will be exemplified in the article hereinafter described and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a perspective view of a piece of honeycomb material with the sheets cut at a right angle across the adhesive lines;

Figure 1*a* is a perspective view of a piece of honeycomb material with the sheets cut at an oblique angle across the adhesive lines;

Figure 2 is a perspective view of the honeycomb material of Figure 1 after being compressed;

Figures 3 and 4 are side views of pads embodying the invention and made of the material of Figure 1, the pad of Figure 3 having facing sheets on top and bottom;

Figure 4*a* is a fragmentary side view of a pad embodying the invention and made of the material of Figure 1*a*;

Figure 5 is a side view of a modified form of pad embodying the invention and made of the material of Figure 1, the cells of the honeycomb material being compressed vertically for only a portion of the thickness of the pad;

Figure 6 is a plan view of a further modified form of pad embodying the invention;

Figure 7 is a view of a radio with the pads of Figure 6 in cross-section to illustrate how they are placed at each end of the radio;

Figure 8 is a plan view, partly broken away, of a further modified form of pad embodying the invention;

Figure 9 is a side view of the pad of Figure 8;

Figure 10 is a cross-sectional view on the line **10—10** of Figure 8;

Figure 11 is a sectional view of a further modified form of pad embodying the invention;

Figure 12 is a view of a radio packed in a carton with the pads of Figure 8 in cross-section to illustrate how the radio is supported between the pads;

Figure 13 is a side view of a further modified form of pad embodying the invention;

Figure 14 is a plan view of the pad of Figure 13;

Figure 15 is a cross-sectional view on the line **15—15** of Figure 14;

Figure 16 is a side view of the pad of Figure 14, illustrating the pad rolled around an electric meter;

Figure 17 is a view of the pad of Figure 14 rolled around two electric meters, with the pad in cross-section on the line 17—17 of Figure 16 to illustrate how the meters are held in the pad;

Figure 18 is a plan view of a further modified form of pad embodying the invention;

Figure 19 is a side view of the pad of Figure 18;

Figure 20 is a side view of the pad of Figure 18, illustrating the pad rolled around an electric meter.

The "honeycomb structure" or "honeycomb material," referred to in the specification and claims and shown in the drawings, is made up of a plurality of open-ended cells which may be of any desired size and shape, for example, hexagonal, circular, oval, or rectangular. Such structure may be formed of any desired material, for example, paper, cloth, metal, or the like. However, since all or a portion of the structure must be compressed into accordion shape to act as a resilient cushion, it has been found preferable to construct the structure of paper or paperboard.

The paper honeycomb structure may be produced by superimposing sheets of paper upon each other until a thick stack is formed, each sheet of this stack being held to the one above it, by adhesive or other means, along spaced and generally parallel lines, with the lines on one side of each sheet between the lines on the other side of said sheet. It will be seen that the distance between such lines determines the cell size. By cutting this stack either at a right angle (Figure 1) or at an oblique angle (Figure 1*a*) across the lines holding the sheet together, pieces may be obtained of a length corresponding to the desired thickness of the honeycomb structure to be used for the pads shown in the various figures. The thickness of the pad may be varied and is dependent upon several factors, such as size, weight and the use to which it will be put. These pieces are then expanded into the shape and form shown in Figures 1 and 1*a*. It will be understood that the cell wall thickness depends on the weight of paper used. Since the honeycomb structure varies with both the cell wall thickness and cell size, these may be varied to meet practically any requirements. Where additional rigidity or strength is required or where the pad is used in places where it will be subjected to high humidity or moisture, which softens and weakens the paper, the paper may be impregnated or coated with resin, sulphur, metal or similar products. This may be done prior to the forming of the paper into the honeycomb structure or after. It has also been found that greater resiliency can be imparted to the compressed structure if the paper or honeycomb material is impregnated with resin before placing it under compression.

Where the honeycomb structure is to be made of other materials, for example, cloth or metal, other known methods may be used to construct the desired structure. It will be understood that the honeycomb material it-

self and the method of manufacturing it are well known and are therefore not specifically claimed herein.

Referring more particularly to the drawings there are shown in Figures 1 and 1*a* pieces of honeycomb material constructed as heretofore described. This material is made up of walls **21** which form a plurality of open ended cells **22**. Such material is placed in a press with the plates resting against each face of the material. The uniform application of pressure to the top plate causes the walls of the cells to assume an accordion shape, such shape occurring first at the top of the walls and moving gradually down the walls as long as the pressure is applied. It is possible merely by controlling the pressure to obtain the accordion shape for any depth desired. The depth of the accordion shaped cushion is dependent on the weight of paper used for the structure and also on the pressure applied. Figures 2 to 5, inclusive, illustrate the effects achieved by so compressing the honeycomb. Figure 2 shows the piece of honeycomb of Figure 1 after the walls have been compressed to their full depth. Figures 3 and 4 illustrate the same results on a full pad, the pad of Figure 3 having facing sheets **23**. While such facing sheet is not essential, it serves in some cases to hold the honeycomb in expanded form and give it additional rigidity and strength. Figure 4*a* illustrates a portion of a pad in which the honeycomb of Figure 1*a* has been so compressed. Figure 5 shows a pad similar to that of Figure 3 but with the walls compressed for only a portion of their depth, so that there remains beneath the accordion shaped honeycomb a portion of the honeycomb which is still in its original condition. The accordion shaped portion is designated as **21***a* and the portion under it still in its original condition as **21***b*.

Since the compressed accordion shaped honeycomb (Figure 2) is resilient and springy and the honeycomb in its original condition (Figure 1) is strong and rigid, it will be seen that it is possible to form a pad which possesses the features and characteristics of both. In other words, where the demand is for only a cushion or cushion effect, the pad of Figures 3, 4 or 4*a* may be used, but where such cushion must be further protected and reinforced, the pad of Figure 5 will efficiently serve the purpose, as will be evident from the drawings and supporting description which follows.

Figures 6 and 7 show a pad, similar to that of Figure 5, which is ideally suited for shipping fragile products. This is made up of honeycomb material with the walls compressed for only a portion of their depth. In addition the pad has been scored across the corners along lines **24** with a V-shaped die, so that the corners can be turned in at right angles to the center portion of the pad. If such center portion conforms in size to a product being packaged, it will be seen that the turned in corners serve to protect such product not only on the end faces but also on the other sides. It is clearly shown in Figure 7 how a pair of these pads may be employed as a support for shipping a small radio. If the radio and end pads are slipped into a carton of proper size, the radio is firmly held in position away from all sides of the carton. This prevents it from moving in any direction and eliminates the necessity for the corrugated board members which are usually bent into various forms and placed around such products when they are shipped. In addition to the supporting effect the accordion shaped honeycomb acts as a cushion to absorb all shocks or knocks which the package may receive during shipment. Furthermore, the facing sheet **23**, which comes in contact with the radio or other product held between the pads, may be of sufficient softness so as not to mar or scratch the surface of the product.

Figure 8 shows a modification of the pad of Figure 6, which is likewise particularly adapted for shipping fragile products. This is made up of a honeycomb structure having walls 21, open ended cells 22 and a facing sheet 23. This sheet and the honeycomb structure beneath it are cut along the lines 25 to a depth approximately equal to half the thickness of the honeycomb. Such cuts define a rectangular shape corresponding generally to the end of the small radio shown in Figure 12. It will be understood that the cut-out portion may be of any shape necessary to receive any other type of product being shipped. In addition to the cuts 25 there are diagonal cuts 26 made in each corner of the rectangle. Thereafter a die having beveled corners is placed over the cut-out portion and pressure is applied, which results in the picture frame effect shown in Figure 8. Referring to Figures 9 and 10 it will be seen that the central portion 23*a* is uniformly depressed to the desired depth and that the flaps 23*b* slope in from the plane of the facing sheet 23 to the plane of the depressed portion 23*a*. This particular construction is particularly useful where the product to be shipped has a delicate finish which might be marred by coming in contact with the honeycomb material itself. It will be seen that the flaps 23*b* serve to protect the corners of the product, whereas the depressed portion 23*a* protects the flat side of the product.

Figure 11 shows a modified form of pad in which the cuts **25** are made as they were in the case of the pad of Figure 8, but the cuts **26** and flaps **23***b* are omitted. The die used in this instance has square corners instead of the beveled corners on the die used for the other pad. Therefore when pressure is applied the central portion **23***a* is depressed, exposing the honeycomb structure between the plane of the facing sheet and the plane of the depressed portion.

In the pads illustrated in Figures 8 to 11, inclusive, it will be noted that such depressed portion forms an ideal recess to receive the product being shipped. It has been found that the application of pressure to the cut-out portion **23***a* results in compressing the honeycomb structure so that the walls directly beneath the cut-out portion assume the accordion shape shown in Figures 10 and 11. As in the case of the pad of Figure 5, such accordion shape extends only for a portion (**21***a*) of the thickness of the pad so that there remains beneath such accordion shaped honeycomb a portion (**21***b*) which is still in its original condition. Thus the honeycomb structure beneath the cut-out portion retains in part not only the rigidity and strength characteristic of such material but also has the resiliency and springiness resulting from the accordion shaped cushion formed beneath the cut-out portion.

It will be seen from Figure 12 that a pair of the pads similar to the form shown in Figure 8 likewise make an ideal support for shipping a small radio. In this case the pads are placed over each end of the radio and the pads and radio are then slipped into a container or carton **27** of suitable size. The radio is thus firmly and securely held in position and is cushioned against any jars or shocks which may occur during shipping. It will be noted that the flaps **23***b* prevent the rounded corners of the radio from coming in contact with the honeycomb structure itself so that there is no danger of such honeycomb structure scratching or marring the finish of the radio.

One product which has been found most difficult to ship because of its fragile nature is the electric meter made up of a metal base and a glass shell, which houses a delicate mechanism. The general configuration of said meters is shown in Figure 17, the glass shell being designated as **28** and the metal base as **29**. Referring to Figures 13 to 17 inclusive it will be seen how the pad of the present invention may be adapted for packaging such product. A rectangular piece of honeycomb material provided with facing sheets **23**, shown in Figure 14, is cut along the lines **30** to a depth approximately half the thickness of the honeycomb structure. The narrow strips **23***c* of the facing sheet between these lines

30 and the honeycomb beneath such strips are depressed, as shown in Figure 15, to the proper depth to receive the base edge of the meter. Thereafter the opposite side of the honeycomb structure is cut along lines 31 to the full depth of the honeycomb structure without, however, cutting the top facing sheet 23. This results in a series of rectangular pads 32 which are hinged together merely by the top facing sheet, as shown in Figures 13 and 16. The depressed portion of this pad serves as a recess to receive the metal base of the electric meter so that a pair of electric meters can be rolled up face to face in this pad in the manner shown in Figures 16 and 17. This rolled up pad can then be placed in a container or be properly wrapped and tied or taped to complete the package. It has been found that electric meters so supported by a pad of the present invention can be dropped from a considerable height on a concrete floor without breaking or damaging them. Again, as in the case of the radio, the depressed portion serves as a recess to hold the meters in place while the accordion shaped honeycomb under such depressed portion acts as a resilient cushion to absorb any shocks imparted to the package.

A modified form of construction likewise for packaging such meters is shown in Figures 18, 19 and 20. In this case a pad, similar to that shown in Figure 14, is likewise cut along lines 30 and the strip 23c between such lines is depressed. Thereafter the pad is scored along lines 33 with a V-shaped die so that the pad assumes the configuration shown in Figure 19. By using a pad so scored it is possible to roll up a pair of meters into a package having a flat and smooth outside face, such as that shown in Figure 20. A corrugated sheet may be slipped into each end and it is then necessary only to tie or tape up the package without additional wrapping or container as called for in the construction shown in Figure 16.

The honeycomb structure illustrated in the drawings other than Figures 1a and 4a was made by cutting the stacked sheets at right angles across the spaced and parallel adhesive lines and then expanding the cut-off piece. Such structure with the faces disposed normal to the cells has great strength and rigidity. On the other hand Figure 1a shows the effect created when the stacked sheets are cut at an oblique angle across the adhesive lines. When this structure is compressed, as shown in Figure 4a, the same accordion shaped folds are obtained, but the folds overlap slightly. This tends toward a better cushioning effect and gives a larger exposed area on each face. It may be stated generally that as the angle of the cells from normal is increased, the strength and rigidity is decreased and the cushioning effect is increased. This allows a greater cushioning effect from the same weight of paper.

The pads and the particular products supported or packaged in such pads, illustrated in the drawings and heretofore described, may be taken as representative of the many variations and modifications which are possible within the principle of the invention. It will be seen that the honeycomb material may be compressed into accordion shape to form a pad having a resilient cushion over all or a portion of the pad, and may be compressed into accordion shape for any thickness to provide a completely resilient cushion or a resilient cushion backed by a rigid honeycomb structure; that the pad may be cut to any desired size and thickness; that the pad may be cut, scored and shaped to be fitted around a product being packaged; and such pad may be provided with a recess to receive a product, such recessed portion being cushioned.

Where a heavier product with a greater impact is being shipped, the pad compressed for a portion of the depth will usually be more suitable since it furnishes a cushion effect and a greater resistance effect. On the other hand the lighter more fragile product with less impact should in most cases be packed with a pad compressed for the full depth since this provides a greater cushion effect and a lesser resistance effect. In all cases the pad must be selected to satisfy the particular requirements for the product and the conditions under which it must be shipped. Although the pad of the present invention may be used in conjunction with a container, for example in packaging a product in the manner shown in Figure 12, it will be understood that in some instances the pad may be appropriately scored and folded so that no extra container is necessary, for example in packaging a product in the manner shown in Figure 20.

It has been further found that pads of the type shown in Figures 3, 4 and 4a possess sufficient resiliency and strength that they be used in place of or as a supplement to the springs in upholstered chairs, automobile seats and the like. In any cases where it is necessary to minimize or reduce shock or jarring, the pads of the present invention will prove most useful.

Since certain changes may be made in the above product and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

2. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells having a multiplicity of irregular transverse corrugations throughout their full depth forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

3. A cushion material for use in shipping a product comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations, the said pad being scored along lines defining an area conforming to a part of the product and portions beyond such area whereby such portions may be turned up on the score lines around the product to protect and hold the same during shipment.

4. A cushion material for use in shipping a product comprising a series of hinged sections, each section comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells having a multiplicity of erregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations, whereby such hinged sections may be wrapped around the product.

5. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially axially of said cells.

6. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells having a multplicity of irregular transverse corrugations throughout their full depth forming an accordion shaped structure compressible substantially axially of said cells.

7. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, walls of the

cells having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially obliquely to the axes of the cells.

8. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, all walls of the cells having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

9. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells in a portion of the pad having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations at such portion.

10. A cushion material comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells for a portion of their depth having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

11. A cushion material for use in shipping a product comprising a pad of paper honeycomb having a multiplicity of cells with a depressed portion to receive a product or a part thereof, walls of the cells at such depressed portion having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations at such portion.

12. A cushion material for use in shipping a product comprising a pad of paper honeycomb having a multiplicity of cells and a facing sheet with a portion of said sheet depressed below the plane of the sheet to form a recess to receive the product or a part thereof, walls of the cells beneath such depressed portion having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations at such portion.

13. A cushion material for use in shipping a product comprising a pad of paper honeycomb having a multiplicity of cells, the said pad being scored along lines defining an area conforming to a part of the product, the portions beyond such area being adapted to be turned up on such score lines around the product to protect and hold the same during shipment, walls of the cells at such area having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations at such area.

14. A cushion material for use in shipping a product comprising a series of hinged sections adapted to be wrapped around the product, each section comprising a pad of paper honeycomb having a multiplicity of cells with a depressed portion to receive a part of the product, walls of the cells at such depressed portion having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations at such portion.

15. A cushion material for use in shipping a product comprising a series of hinged sections adapted to be wrapped around the product, each section comprising a pad of paper honeycomb having a multiplicity of cells, walls of the cells for a portion of their depth having a multiplicity of irregular transverse corrugations forming an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

16. A method of making a cushion material which comprises providing a pad of paper honeycomb having a multiplicity of cells with ends terminating along a face of the pad, placing such pad with its faces between pressure plates, applying pressure against one face to the ends of the walls of the cells and forming a multiplicity of irregular transverse corrugations in said walls, and continuing the application of pressure until such corrugations extend to any desired depth of the walls, whereby said walls assume an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

17. A method of making a cushion material which comprises providing a pad of paper honeycomb having a multiplicity of cells with ends terminating along a face of the pad, placing such pad with its faces between pressure plates, applying pressure against one face to the ends of the walls of the cells and forming a multiplicity of irregular transverse corrugations in said walls, and continuing the application of pressure until such corrugations extend throughout the full depth of the walls, whereby said walls assume an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

18. A method of making a cushion material for use in shipping a product which comprises providing a pad of paper honeycomb having a multiplicity of cells with ends terminating along a face of the pad, defining an area on the pad conforming to a part of the product, cutting the pad for a portion of its depth along the lines around such area, applying pressure against the face within the defined area to the ends of the walls of the cells and forming a multiplicity of irregular transverse corrugations in said walls, and continuing the application of pressure until such corrugations extend to any desired depth of the walls, whereby said walls assume within such area an accordion shaped structure compressible substantially perpendicularly to the transverse corrugations.

References Cited in the file of this patent

UNITED STATES PATENTS

1,002,132	Brown	Aug. 29, 1911
1,116,695	Hahn	Nov. 10, 1914
1,444,397	Seigle	Feb. 6, 1923
1,568,834	Hauge et al.	Jan. 5, 1926
1,850,714	Gaylord	Mar. 22, 1932
1,992,950	Horner et al.	Mar. 5, 1935
2,160,221	Masters et al.	May 30, 1939
2,469,156	Cargill	May 3, 1949
2,501,180	Kunz	Mar. 21, 1950
2,611,531	Conkle	Sept. 23, 1952

OTHER REFERENCES

"Honeycomb," Modern Plastics, July 1951, pages 84–87.