

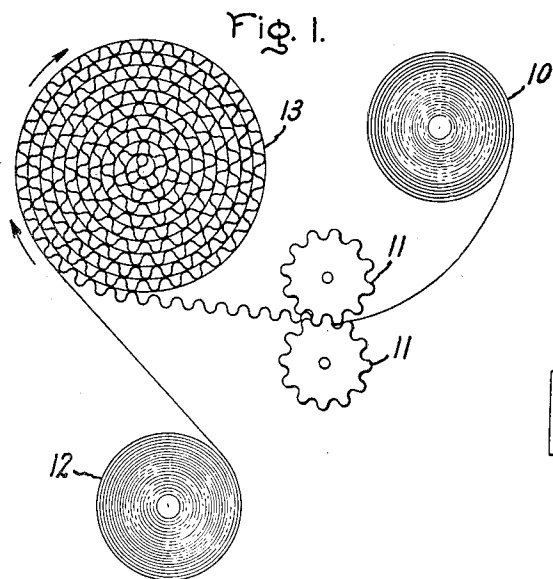
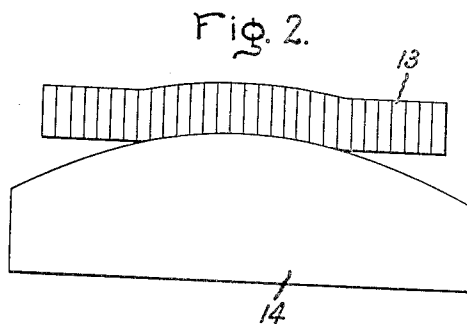
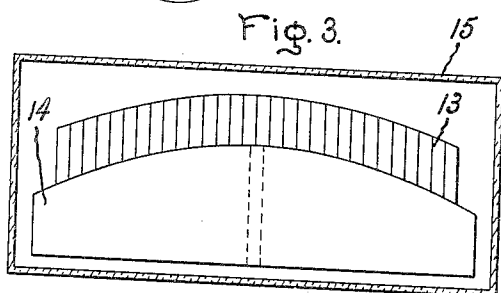
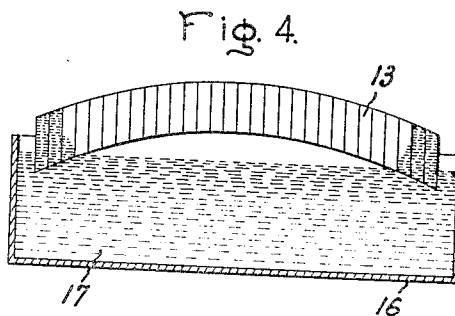
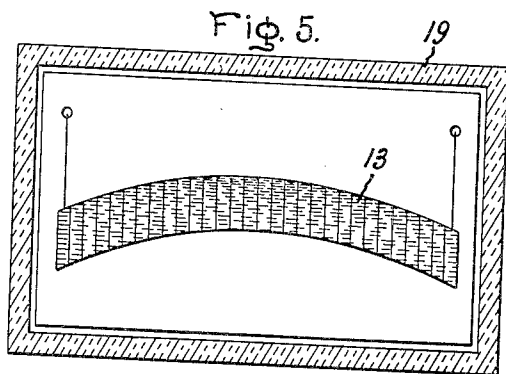
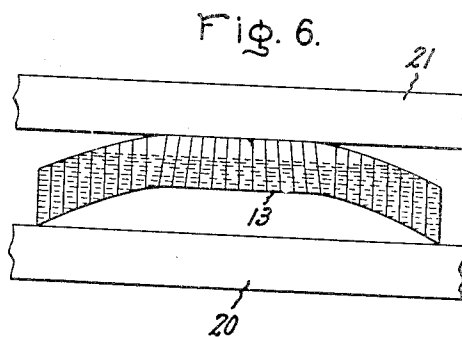
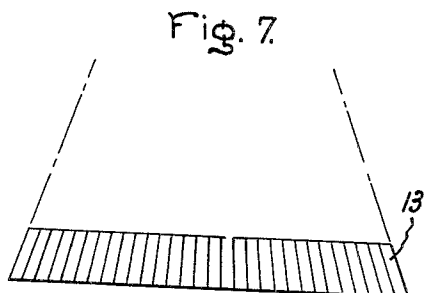
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METHOD OF MAKING A FOCUSED MULTICELL

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METHOD OF MAKING A FOCUSED MULTICELL

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8 Claims. (Cl. 29—423)

This invention relates to the method of making a focused multicell. More particularly, the invention relates to a method for preparing a multicell in which all of the cell units are so oriented that they are focused at a point a predetermined distance from the unit.

A multicell is a group of cells oriented somewhat in the manner of the cells making up a honeycomb. The group of cells in a multicell may have their axes positioned in parallel alignment but this is not necessary. In certain optical apparatus, it is very desirable to have a multicell in which the axes of all of the individual cells are focused on a single point. In the past the preparation of a multicell made up of a great many very minute cells which have their axes focused on a single point has represented a very difficult problem.

It is an object of this invention to provide a method for producing a focusing multicell made of many very small individual cell units.

Another object of the invention is to produce a multicell heating element having a great deal of radiating surface area.

Another object of the invention is to provide a method for fabricating a focusing multicell wherein there is very little likelihood that any of the cells will buckle during fabrication.

Other objects of the invention will be apparent from a perusal of the following specification considered in conjunction with the attached drawings wherein:

Fig. 1 is a diagrammatic view of the initial step followed in producing a multicell;

Fig. 2 illustrates the forming step performed on the multicell;

Fig. 3 illustrates a sintering operation followed in fixing the cells in position;

Fig. 4 illustrates the step of filling the individual cells with liquid;

Fig. 5 illustrates a freezing process whereby the liquid in the cells is solidified;

Fig. 6 illustrates the step followed in focusing the individual cell units of the multicell; and

Fig. 7 shows the finished multicell with the plurality of cell units in position.

In accordance with my invention, a strip of corrugated material is cowound with a strip of flat material on a roll whereby the corrugations of the one strip form a plurality of axially aligned cells separated by the flat strip. Alternatively, the multicell may be formed by stacking a corrugated strip on top of a flat strip, a flat strip on top of the corrugated strip, and thus alternating flat and corrugated strips until the desired thickness is achieved. A roll produced as described above is loosely assembled with the individual cells slidable relative to one another and may easily be changed in shape by modeling on a form so as to have one end concave and the other convex. A sintering operation will then fix and bond the individual cells together so as to retain this concave-convex conformations. If the individual cells of the

multicell are thin-walled and fragile, they may be filled with liquid and the liquid frozen, thereby imparting to the walls of the individual cells a considerable resistance to buckling.

The ends of the roll may then be compressed to restore the initial flat configuration. This pressing operation realigns and reorients the axes of the individual cells so that they are focused on a central axial point.

Referring to the drawings, Fig. 1 shows a pair of rolls of flat strip material 10 and 12 which may be of a metal such as steel, nickel, or aluminum and may be of a thickness of the order of 0.001 inch or less. The strip 10 passes between the teeth of a pair of gears 11, an operation which imparts corrugations to the strip 10. The shape of the corrugations may be altered by altering the shape of the gear teeth from the conventional gear tooth cross section. Strips 10 and 12 are then cowound on a roll 13 where the corrugations of the strip 10 form a plurality of cells which are separated by the strip 12.

The size of the individual cells making up the multicell roll 13 depends upon the size of the teeth of the gears 11. As the gear pitch increases it is desirable to decrease the thickness of the metal strips in order to insure ease of fabrication. The diameter of the roll may be controlled very easily by stopping the winding process when the desired diameter has been reached.

When the multicell 13 has attained the desired diameter the strips 10 and 12 are cut and the loosely assembled roll placed upon a form 14 as shown in Fig. 2. The form 14 has a convex surface, the degree of convexity depending upon the focal length which it is desired to have in the final multicell. As the degree of convexity decreases, the focal length of the final multicell increases.

The multicell is now heated to a sintering temperature. For steel, this temperature is in the neighborhood of 1200° C. For materials having a lower melting point, the sintering temperature is correspondingly lower. As shown in Fig. 3, the multicell 13 is positioned on the support form 14 during the process of heating in an oven 15.

After the sintering step has fixed the numerous individual cells in position, the multicell 13 is withdrawn from the oven 15 and cooled. As shown in Fig. 4, the multicell 13 is then brought into contact with some liquid 17 (which may be water) in a tank 16. After immersing in water, capillarity holds the water in the individual cells after which it is frozen as shown in Fig. 5.

In Fig. 5, the multicell 13 is shown positioned in a freezer chest 19 which is maintained at a temperature of about -20° C. This step freezes the liquid in the individual cells in the multicell 13 thereby enabling the cell walls to offer considerable resistance to any stress which might tend to buckle them.

After freezing, the ice filled multicell unit is placed on an arbor press between two flat plates as shown in Fig. 6 and slowly pressed, with a very light pressure being applied. As the ice at the surface melts, each individual cell bends in such a way that when the pressing is completed the axes of all of the units point toward a common focal point. The frozen liquid in each cell prevents local collapse, and as a result, the finished product is well focused and free of local collapse zones. The finished product is illustrated in Fig. 7.

While the strips 10 and 12 will normally be of the same material, it is not necessary that this be the case. For example, a heater element constructed in accordance with my invention employed a strip of resistance material as the corrugated strip 10 and glass cloth as the strip 12. The glass cloth then served as an insulating spacer. A heater element constructed in this fashion has excellent heat transfer characteristics. When placed in front of a 100 cu. ft. per minute blower, such an element raised

the temperature of a 300 cu. ft. room 10° F. in twenty minutes.

A multicell may be made up of very long cells (the width of the gears used for making the corrugated foil may be of practically any dimension), and the size of the gear tooth may be of any fineness down to 100 pitch or smaller. Such a multicell may be used very satisfactorily as a collimator for use in conjunction with X-rays. My method may be used to fabricate multicells of very soft metal, such as pure lead and cadmium, by folding a foil of this substance on either side of a thin foil of steel or aluminum. When passed through the corrugating rolls, the soft material becomes intimately formed in contact with the harder core, and as a result, it is easy to make a strong multicell having a softer metal effectively supported in space.

While I have described a specific method for the production of a multicell it is obvious that many variations are possible without departing from the spirit of my invention. Accordingly, it is not my intention to have my invention limited in scope other than as may be necessitated by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of preparing a multicell which comprises winding a corrugated strip along with a flat strip to form a roll having a plurality of cells in parallel axial alignment, deforming said roll to give it a concave configuration on one side and a convex configuration on the other, heating said roll to fix said roll in the concave-convex position, filling said cells with liquid, solidifying said liquid, and forcing said solidified liquid-filled roll to a flat-end configuration whereby the axes of said cells are brought to a substantially common focus.

2. The method of preparing a multicell which comprises winding a corrugated strip of metal coincidentally with a flat strip to form a roll having a plurality of cells in axial alignment with the axis of the roll, forming said roll to provide a concave surface at one end of the cells and a convex surface at the other, sintering said roll to fix said concave-convex configuration, filling said cells with liquid, solidifying said liquid, and deforming said roll while the liquid is melting to flatness at the ends of said cells whereby said cells are axially focused.

3. The method of preparing a multicell which comprises corrugating a strip of bendable material, winding the corrugated strip together with a smooth strip to form a roll of cellular construction, deforming said roll to break the cross-sectional planar alignment of the cells, sintering the roll to fix the changed planar alignment of the cells, filling the cells with liquid, solidifying the liquid, and applying stress to said solidified liquid-filled roll whereby said cells are restored to their original cross-sectional planar alignment and said cells are axially focused.

4. The method of preparing a multicell which comprises cowlinding a thin corrugated metal strip with a thin flat strip to form a roll containing a plurality of thin-walled cells in parallel axial alignment with the axis of said roll, displacing said cells longitudinally whereby the

side of said roll at one end of said cells has a concave configuration and the side of said roll at the other end of said cells has a convex configuration, heating said roll to fix said cells in the concave-convex configuration, filling said cells with water, freezing said water, and pressing said roll to flatness at the ends thereof while the frozen water is melting whereby the axes of said cells are focused upon a common point.

5. A method as claimed in claim 4 wherein the metal strips are of the order of 0.001 inch in thickness.

6. The method of making a focused multicell which comprises winding a corrugated strip along with a flat strip to form a roll having a plurality of cells in parallel relatively slidable axial alignment, deforming said roll to give a concave configuration on one side and a convex configuration on the other, heating said roll to bond the cells together in the concave-convex position, and forcing said bonded roll to a flattened configuration whereby the axes of said cells are reoriented to a substantially common focus.

7. The method of changing the relative axial orientation of the individual cells of a corrugated thin-walled multicell, which method comprises filling the cells with liquid, freezing the liquid to rigidify the multicell, and deforming the multicell by an axially applied force while the frozen liquid is melting.

8. The method of preparing an axially focused multicell from a flat cellular metal structure of the type having a plurality of open cells in relatively slidable parallel axial alignment, which method comprises applying an axial force upon said structure to deform said structure to a convex surface at one end of the cells and a concave surface at the other end, heating said structure to bond said cells in said concave-convex configuration, filling the cells with water, solidifying the water, and applying an axial force upon said structure while the solidified water is melting to deform said structure back to its original flat configuration whereby the individual cells of the structure are reoriented in axially focused alignment.

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