

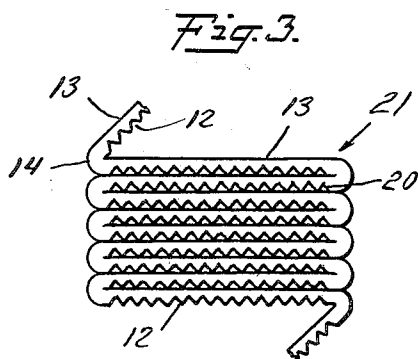
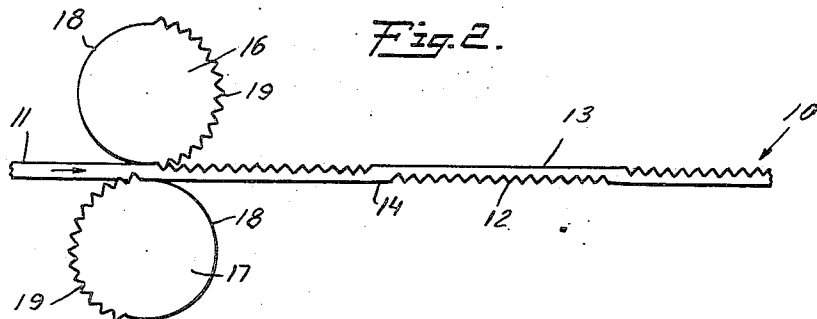
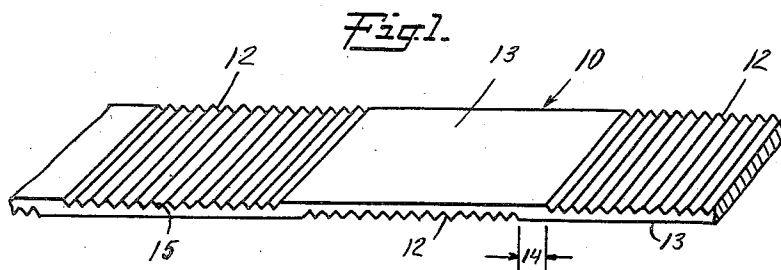
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SURFACE TENSION DIALYZER ELEMENT AND METHOD OF CONSTRUCTING SAME

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SURFACE TENSION DIALYZER ELEMENT
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2 Claims. (Cl. 210-169)

This invention relates to improvements in the manufacture of a dialyzer element which is particularly adapted for surface tension dialyzing liquid from commingled liquid, liquid from commingled sludges, suspensions and the like, as generally described in my copending application Serial No. 638,329 filed October 18, 1932.

The improved element structure, per se, is also adapted for other uses such as a permeable septum in filters.

In accordance with the invention, the element is preferably constructed of a continuous thin strip of metal such as copper or brass or the like, of substantially greater width than thickness. The flat surfaces of the thin metal strip are provided at equally spaced intervals, with a series of fine transverse grooves, the alternately spaced grooved and ungrooved areas on one flat surface of the strip being staggered with respect to the corresponding areas on the other flat surface thereof. Thus the grooved areas on one surface of the strip are oppositely disposed to the ungrooved area on the other surface thereof, etc. The ungrooved areas on each surface of the strip are also arranged so as to overlap. Hence a short length of the strip on either surface at regular intervals, is entirely ungrooved.

The grooving of the surface of the strip just described, may be conveniently effected by passing the strip between a pair of suitably spaced cylindrical knurling rolls. Each of the rolls is so constructed that a little less than one half of the periphery is uniformly knurled, and the remaining portion thereof is smooth. The rolls are so mounted that the knurled periphery of one of the rolls is displaced angularly approximately 180°, with respect to the knurled periphery of the other. Thus as the strip is fed between the rolls as they are rotatably driven, the strip will be grooved as explained above.

The alternately grooved and ungrooved strip so produced is then bent in zig-zag form flatwise upon itself, the successive bends being made in opposite directions at the uniformly spaced ungrooved surface lengths, so that none of the grooves are deformed in the bending operation. In this way uniformly disposed and substantially identical foramina are formed between the contiguous grooved and ungrooved surfaces of the adjacent strips.

It will be understood that this method of construction readily lends itself to the production of an element structure essentially rectangular in shape. It may then be clamped or otherwise mechanically secured in any convenient manner

so as to permanently retain the contiguous layers in proper contact and to permanently maintain the completed element in rectangular form.

The completed structure may be generally described as a foraminous element having a substantial but uniform thickness, and wherein a myriad of uniform and substantially identical macroscopic (in contradistinction to microscopic) foramina provide a myriad of macroscopic continuous passages of substantially greater length than the greatest dimension of normal cross section thereof.

As to dimensions, the knurling rolls are preferably so constructed as to produce fine parallel grooves in the surfaces of the strip, which grooves in conjunction with the contiguous ungrooved (smooth) surfaces form the walls of foramina of the order of one hundredth (0.01) of an inch in their greatest dimension of cross section. The length of the foramina is largely determined by the width of the strip so that a width should be chosen of the order of four times, or more, the greatest dimension of cross section.

If the greatest dimension of cross section of the foramina normal to the length thereof, is selected as five thousandths (0.005) of an inch or less (as the result of grooves produced by appropriately constructed rolls), the width of the strip should be selected so as to provide a passage length of not less than of the order of seven times the greatest dimension of cross section normal to the length thereof.

If the element structure is to be employed for surface tension dialysis purposes, as generally described in my copending application Serial No. 638,329, filed October 18, 1932, the dimensions of the foramina should be predetermined so that the regulated pressure to be applied bears a definite relation both with respect to the surface tension of the liquid or liquids to be selectively recovered to the exclusion of others commingled therewith, and the dimensions as chosen.

If, however, the element is desired to be used, per se, as a permeable septum for a given filtering operation, the dimensions of the foramina may be predetermined without regard to the surface tension of the filtrate and may, therefore, be chosen so that they are of a suitable size to restrain solid particles of a given size. This use of the element, per se, as a permeable septum for filtering purposes, contemplates as usual in the case of filter septums, the accumulation of a shiny deposit on one surface of the element.

For a more complete understanding of the details of the element structure per se, and the

method of constructing it, reference may be had to the following description considered with the accompanying drawing, in which

Figure 1 illustrates in perspective a length of a grooved thin metal strip before bending;

Figure 2 illustrates the preferred manner of grooving both surfaces of the strip; and

Figure 3 illustrates a substantially completed foraminous element and the manner of bending the strip to form the element.

In the drawing, 10 designates the prepared strip from which the foraminous element of this invention is constructed. This strip is formed of flat strip stock, designated 11 in Figure 2, of soft metal such as copper, brass, or other suitable material, of a width equal to the required depth of the completed foraminous element, and of a thickness to permit of ready bending, but sufficient to provide the required cross-sectional dimensions of the foramina of the completed element.

Both flat surfaces of the strip 10 are provided with spaced alternate grooved areas 12 and ungrooved areas 13. The grooved areas 12 on one surface of the strip are displaced longitudinally with respect to the grooved areas 12 on the other surface thereof, so that the grooved areas 12 of opposite surfaces of the strip are staggered with respect to each other. In other words, an ungrooved area 13 on one surface of the strip lies immediately above a grooved area 12 on the other surface of the strip.

The ungrooved areas 13 on opposite surfaces of the strip overlap slightly so that short ungrooved lengths 14 on both surfaces of the strip are formed adjacent the ends of each grooved area 12.

The individual grooves 15 of the grooved areas 12 are of such depth and shape as to form foramina of the desired dimension of normal cross-section. To this end, the means which are used to form the grooves 15 are shaped appropriately.

A convenient means for grooving the strip 10 in the required fashion comprises a pair of rolls 16 and 17, shown in Figure 2. The axes of these rolls are parallel and the rolls are driven in opposite directions as the strip stock 11 is fed therebetween, as shown in Figure 2. The rolls are suitably spaced apart depending upon the thickness of the strip stock 11 when between their smooth cylindrical surfaces 18, so as to continuously feed the strip therethrough without appreciable rolling of the strip to a lesser thickness.

Projecting radially beyond the smooth cylindrical portions of each of the rolls 16 and 17 are knurling teeth 19 of suitable size and shape to produce the foramina-forming grooves 15 constituting the grooved areas 12 of the strip 10. These teeth extend parallel to the axes of the corresponding rolls and transversely of the strip stock 11 and occupy slightly less than 180° of the periphery of the respective rolls. Also, the toothed areas of the rolls are displaced angularly about 180° with respect to each other so as to alternately groove the strip stock 11 as it is fed between them, whereby the grooved areas 12 thereof are staggered with respect to each other.

Furthermore, because the grooved areas 19 of the rolls occupy less than 180° of the respective peripheries of the rolls, the short ungrooved length 14, on either surface, is formed adjacent the ends of each grooved area 12 of the strip 10. While the formation of the grooves by coating

rolls is a convenient and simple way of preparing the strip 10, it is described merely by way of illustration and it should be understood that any alternative method of grooving the strip may be employed.

The grooved strip 10 is then bent zig-zag fashion flatwise upon itself by bending it in opposite directions at successive ungrooved areas 14, as illustrated in Figure 3. In this way the ungrooved areas 13 either overlap or underlap the adjacent grooved areas 12, so that the flat surface of each ungrooved area 13 closes the grooves 15 of the grooved area 12 which it over-or-underlaps to form the foramina 20. Since the adjacent layers of grooved areas 12 and ungrooved areas 13 in the completed element 21 of Figure 3 are contiguous throughout, all of the foramina 20 thereof will be uniformly disposed and of substantially identical cross section.

Inasmuch as the folds in the strip 10 are made at the ungrooved areas 14 thereof, none of the grooves 15 are deformed. Furthermore, since the folds are made in the ungrooved areas 14, which are thicker than the grooved portions of the strip 10, the folds are strong and rigid and assist in maintaining the adjacent smooth and grooved layers of the element in proper contact. Also, if the grooves 15 are formed in the strip stock 11 by rolling in the manner described, the metal hardens to a certain extent, and if bent or folded at the thinned and hardened portions where the grooves are located, is likely to crack. However, the provision of the short ungrooved (smooth) lengths 14 in which the bends are made, avoids this tendency, since the lengths 14 are thicker and are substantially unaffected by the grooving process and are therefore stronger and more malleable than the grooved areas.

It will be seen that the alternate layers of the finished foraminous element 21, illustrated in Figure 3 are perfectly flat with respect to each other so that uniform contact is assured.

While the preferred form of element and the method of making it contemplate grooves to be knurled in the surfaces of the strip stock, any equivalent thereof may be employed. It will also be obvious that other changes may be made without departing from the scope of the invention as defined by the claims.

I claim:

1. A foraminous element comprising a continuous strip of material folded zigzag flatwise upon itself to form superimposed layers, one of the two contiguous surfaces between adjacent layers being grooved uniformly to form with the contiguous ungrooved flat surface a plurality of like foramina extending through the element.
2. A foraminous element comprising a continuous thin strip of metal of substantially greater width than thickness, each of the flat surfaces of the strip being provided at equally spaced intervals with a series of fine transverse grooves, the alternately spaced grooved and ungrooved areas of one flat surface being staggered with respect to the corresponding areas on the other flat surface thereof, and ungrooved areas on each flat surface at regular intervals, said strip being folded zigzag flatwise upon itself at the regularly spaced ungrooved intervals, the contiguous grooved and ungrooved surfaces forming a myriad of like foramina extending through the element.

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