

May 19, 1931.

W. H. MILLSPAUGH

1,805,780

COUNTERSUNK SUCTION ROLL SHELL

Filed Dec. 13, 1926

3 Sheets-Sheet 1

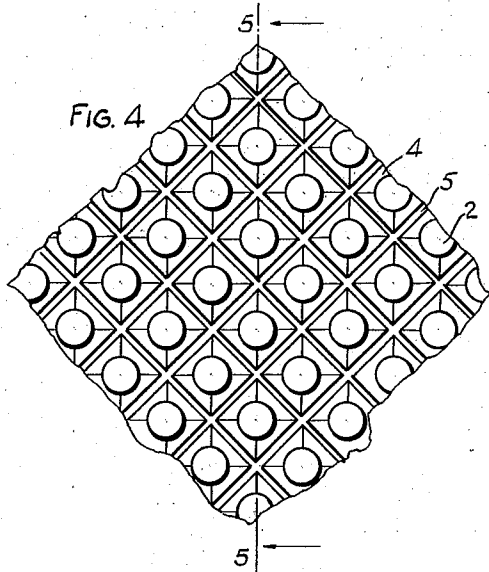
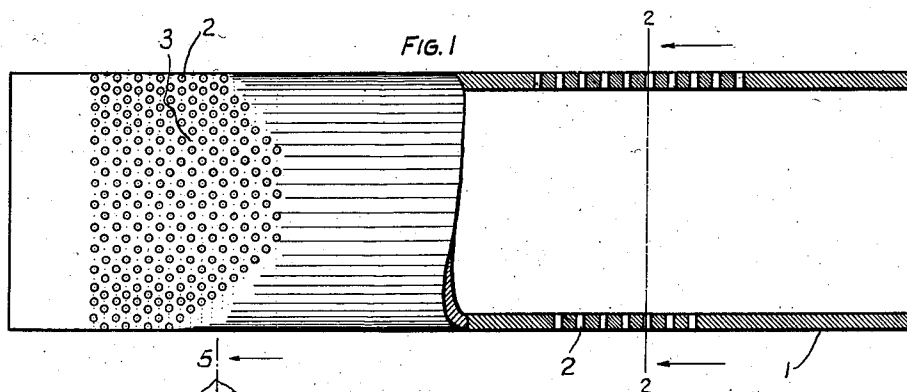


FIG. 1A



FIG. 3



FIG. 2

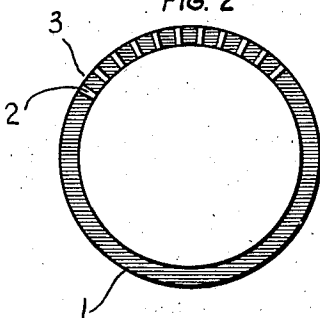
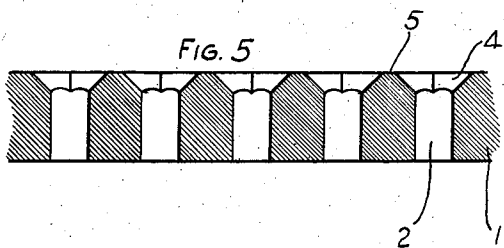


FIG. 5



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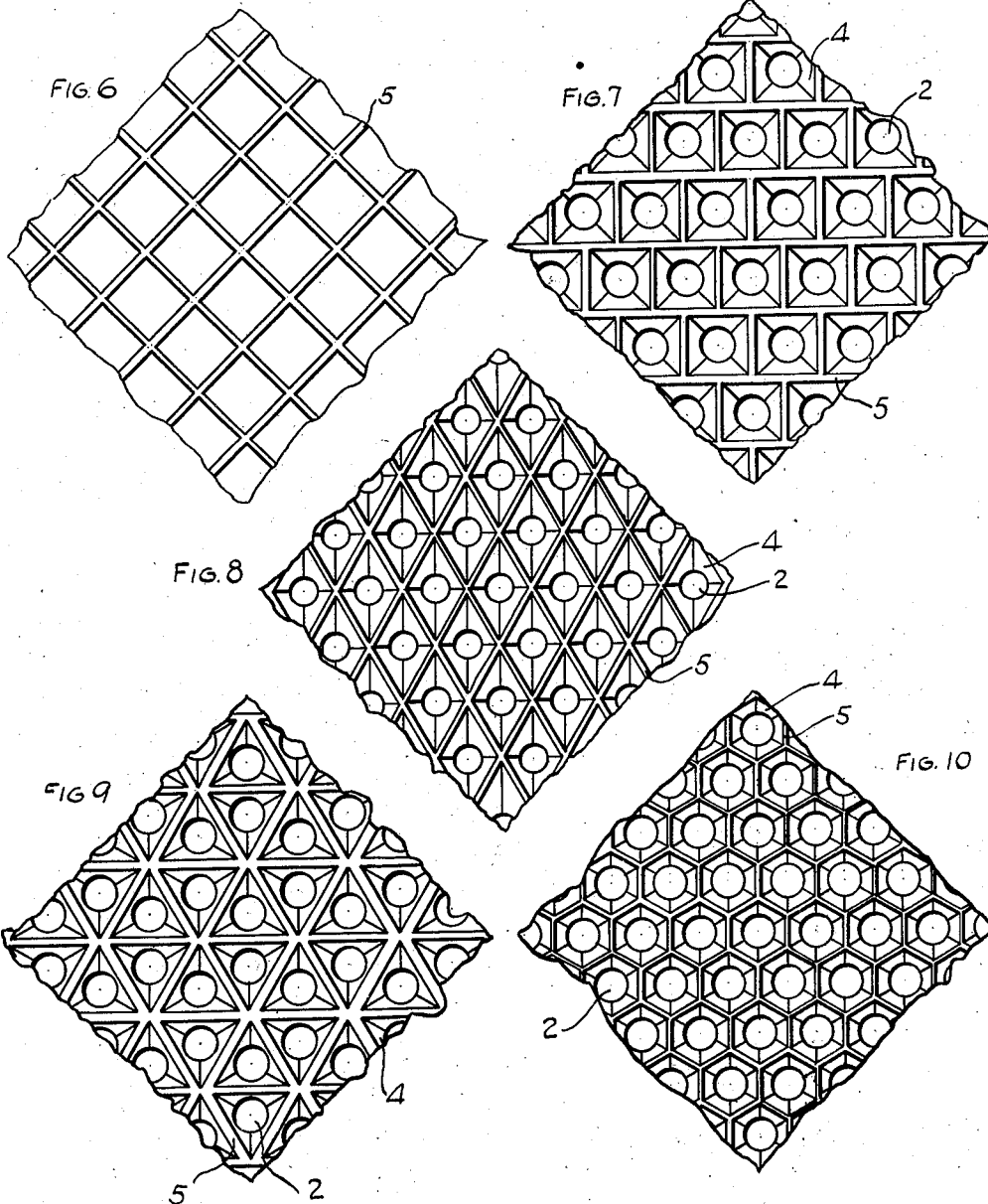
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COUNTERSUNK SUCTION ROLL SHEET

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3 Sheets-Sheet 2



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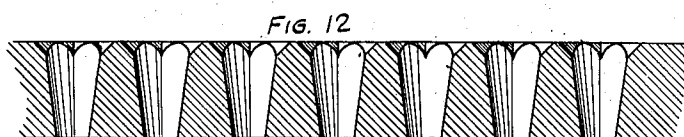
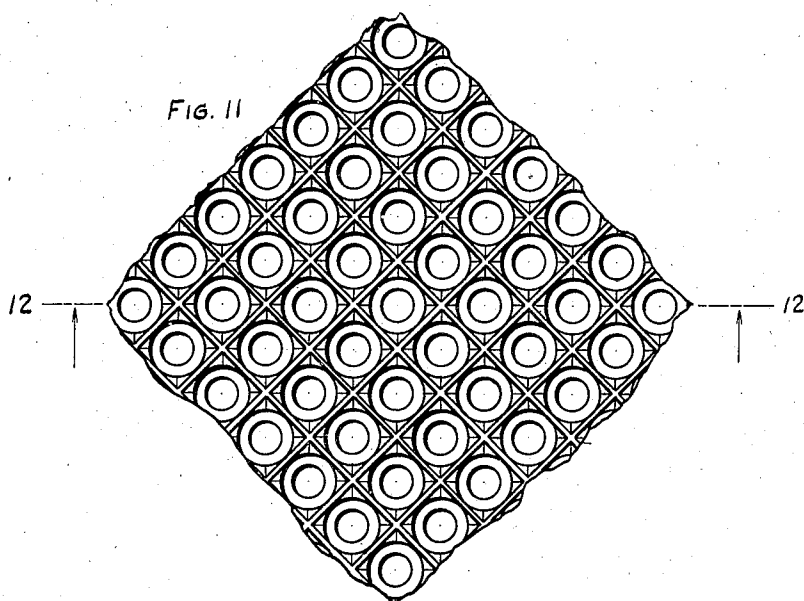
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COUNTERSUNK SUCTION ROLL SHELL

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3 Sheets-Sheet 3



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COUNTERSUNK SUCTION ROLL SHELL

Application filed December 13, 1926. Serial No. 154,363.

The present invention relates to suction devices, and more especially to means for increasing the operative area in suction roll shells and plates of the general type commonly used in the paper making industry.

Heretofore it has been common practice, especially in the making of suction roll shells or similar elements for use in paper making, to drill cylindrical holes through the wall thereof, of such size and number as to make of the shell, for instance, a cylindrical screen, the diameters of the holes or perforations varying according to the particular circumstances under which the shell or other element was to be used. In such shells, or the like, the practice, up to the present time, has been to maintain the same diameter throughout the length of each of the perforations, for press roll shells or the like, and to concentrically countersink the outer ends, circularly, for suction couch roll shells or the like. The remaining imperforate surface had a somewhat lace-like formation or appearance, the portions extending from one perforation to another and lying between them being regularly shaped, each with a plurality of curved notches or indentations between which extended necks or strips merging with and connecting adjacent similar portions. This regular or lace-like imperforate portion serves to support the wire or other pulp carrying medium which travels on the cylinders throughout the suction operation. With such rolls, the amount of supporting surface for the pulp carrying medium (imperforate portion) is unnecessarily large and the available suction or operative forming surface correspondingly reduced—a waste or excess of supporting surface and a loss or insufficiency of suction area.

The main objects of the present invention are to so construct a suction roll, plate, or like suction element or device, as to avoid to the greatest possible extent both of these objections and, while decreasing to the minimum the necessary bearing, supporting, or bar surface, at the same time increas-

ing to the maximum the effective suction or vacuum forming area. In this way, the total effective area of the countersunk perforations will approach as nearly as practicable the total area of that section of the pulp supporting medium lying or extending directly across the open or operative side of the suction box immediately underlying the adjacent perforate surface.

In order to more graphically disclose the construction and operation of the invention, comparative drawings are herewith presented showing similar fragmentary views of a common and well known construction and of the construction embodying this invention. For ready comparison, the drawings illustrate the old construction and the invention in but one of many uses—that of suction roll or cylinder for paper making machines. To more clearly understand the construction, operation, and use of the invention, reference is made to said drawings, forming part of the present application.

In the drawings:

Fig. 1 is a side elevation of a suction roll of the old construction, partly broken away;

Fig. 1a is a view similar to Fig. 3, with the first step of the countersink only—unpunched;

Fig. 2 is a cross section on line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is an enlarged plan view of a small fragment of a suction roll showing one of the portions between adjacent perforations;

Fig. 4 is an enlarged plan view of a fragment of a suction roll showing one preferred arrangement of the construction of this invention;

Fig. 5 is a cross section on line 5—5 Fig. 4, looking in the direction of the arrows;

Fig. 6 is a plan view of the rib construction between the countersinks of Fig. 4, with perforations and countersinks omitted;

Figs. 7—8—9 and 10 are views similar to Fig. 4, showing different designs of countersinks and several different arrangements of such different designs;

Fig. 11 is a view similar to Fig. 4, showing a modification with taper bore and

Fig. 12 is a cross section on line 12—12 of Fig. 11, looking in the direction of the arrows.

While the invention has been shown as applied to suction rolls or cylinders for paper making machines, it is obvious that it may be used effectively and operated in the same way, with flat or substantially flat plates, as in the rectangular suction chambers of the usual suction boxes of Fourdrinier machines; that it may be used in many other ways than that of paper making,—in filters for instance. It is of course not intended to limit the use of the invention by any statement herein made. It is intended to protect it in all uses to which it may be put, the single instance of a well known and general use being selected as one readily recognized and as merely illustration, in order to readily convey a clear and correct understanding of the invention.

In paper making, the best results are obtained when the suction applied to the pulp layer is uniformly or evenly distributed over the entire surface exposed above the suction chamber, or as nearly so as possible. Clearly, the old construction was inadequate in this respect. On the other hand, the forming or supporting wire on which the paper sheet is made, must have adequate and even support on the surface through which the suction is effective. For best results, such support should be regular, even and uniform, relatively to the openings through which the suction takes effect. If the bar surface or area is not sufficient the pulp carrying or supporting medium, under the action of suction, will tend to collapse or sink below the surface at the points of insufficient support. Wherever it sinks in this manner, the effective suction area is correspondingly decreased, the corresponding portion of the supporting member is distorted; and a very destructive rubbing or friction action takes place, with resulting waste of power and wearing or cutting of the supporting medium. Also, of course, where the bar surface is insufficient, contact between it and the pulp supporting medium is inadequate and not uniform, causing corresponding leakage and loss of effective suction. On the other hand, any excess bar surface decreases the possible effective suction area without adding to essential support of the pulp supporting medium. Therefore, the most efficient construction is that having a maximum effective suction area combined with a minimum essential effective bar surface or area for adequately supporting the pulp carrying medium as it moves over the perforated surface during the action of the suction or vacuum. The present

invention has been designed, more particularly, to accomplish these results.

In describing the invention in detail, the form and arrangement disclosed in Figs. 1-6 inclusive, of the drawings will be dealt with, the other designs and arrangements being treated separately. Referring to Figs. 1-6, the operative wall 1 of the shell, plate, or like element, is drilled in any usual and well known manner to provide a plurality of spaced cylindrical suction holes or perforations 2 with the regular lace-like indented intervening portion 3 shown, on enlarged scale, in Fig. 3. The drilling may be done by any usual and well known machines and methods now so generally used in the art. The wall 1 may be either cylindrical, as in a roll, or flat as in a box, both constructions being well known in the paper making industry. The operations thus completed, produce the construction disclosed in Figs. 1-3 and well known prior to this invention. Of course, the holes may be drilled in various other positions, relatively to each other, than those illustrated. That is a mere matter of selection. Adjustment and regulation of the devices for operating the shell or plate, or of those for operating the feed of the drills, in one direction or the other, relatively to said shell or plate, during the drilling operations, will be greatly controlling factors in positioning of the perforations relatively to each other. There are many well known types of such regulating and controlling devices, many of them more or less automatic. It is not thought that illustration of any of them will add in any way to a clearer understanding of the present invention. Accordingly none of them is illustrated in the drawings.

When the holes have been drilled, they are then counterbored, circularly, in their outer ends, as in Fig. 1a, reducing considerably the imperforate area between perforations shown in Fig. 4 and providing an inclined or beveled countersunk wall 4 substantially concentric with the respective perforation or bore. The diameter of these counter bores is such that the material between the nearest points of the circumferences of adjacent counterbores is just sufficient to provide the necessary cross sectional width of the supporting bars which are completed by the next succeeding step. The preliminary circular countersink thus provided is then completed by re-shaping with a non-circular countersinking punch, stamp, or other suitable means of any desired construction. When a square is used, for instance, the width of the square will equal the greatest diameter of the circular countersink. On reference to Figs. 1a and 4 it will be seen that the circular counterbore is the most efficient way of removing most of the excess metal from the area of the final square

countersink, leaving only a small amount of metal to be punched back in each corner in forming the square. This final square countersink is then machined, polished, or otherwise smoothed to its final or finished condition. The same general idea is involved and the same general operations are used in each of the other forms of non-circular countersinks herein disclosed, as will be readily understood. A slight variation of the first step of countersinking could be resorted to in the original formation of the perforations. Instead of forming them as true cylindrical bores, they could be formed as frusto-conical, with the larger base at the end corresponding to that in which I have shown the circular countersink—the outer end. In that case, the larger end of the tapered bore should be of the same diameter as that of the circular countersink I have shown and the perforations should have the same relative positions as shown. In that case these larger ends would be punched in exactly the same way as described for punching of the square countersinks. The difference would be in the resulting inclined countersunk wall. In this instance, there would be only the four triangular inclined areas disposed equi-distant about the center of the perforation, whereas, in the form in which there is first a circular countersink, the final countersink is a continuous inclined surface of square outline with the hole of the perforation as its center. Such modified construction is illustrated in fragmentary plan view and in enlarged cross section in Figs. 11 and 12.

Every countersink 4 made by any of the above methods, radiates from the center of its respective bore 2. In this way, the effective suction area of each bore is increased by the difference between this greatest circular cross sectional area and the area within the outer edge of its enclosing countersink. Thus the adjacent countersinks extend the total effective suction area to include all otherwise waste space lying between the ends of the old cylindrical perforations, leaving only a fine continuous rib-like wall 5 between adjacent countersinks, as in Fig. 6, providing a complete network of bar surface for the uniform support of the pulp carrying medium. In this way the effective suction area is greatly enlarged—that of each perforation radiating to the full area of its respective surrounding countersink. The increased effective area distributes the operative effect of the vacuum much more uniformly because much more completely, leaving only the very small areas of the intervening ribs without vacuum effect. The narrow or thin rib-like walls 5 between the countersinks provide uniform and adequate support for the forming or pulp supporting medium, yet do not involve unnecessary waste of surface for that purpose. They

provide only the surface essential to an adequate and uniform support of the wire, or like medium, with the least possible decrease in effective suction area, while maintaining sufficient contact to prevent leakage or loss of suction and to avoid sagging of the surface.

In the preferred form, Figs. 4-6, a square countersink is shown, the squares being arranged diagonally, relatively to each other, in the same circumferential or perpendicular row or plane, i. e. corner-to-corner in such rows. Likewise, they are arranged side-to-side or parallel, relatively to each other in the rows running spirally of the roll or diagonally of the plate.

In Fig. 7 the square form of countersink is arranged so that those in alternate longitudinal rows are in the same circumferential plane, those of one longitudinal row falling opposite the spaces between those of the rows on either side—a staggered construction.

In Fig. 8 each countersink is of diamond shape.

In Fig. 9 the countersinks are equilateral triangles grouped to form hexagons, which, of course, may be grouped as the cells of a honeycomb;

In Fig. 10 hexagonal countersinks are shown.

In Fig. 11 is a view similar to Fig. 4, showing a modification with frusto-conical bore; and

Fig. 12 is a cross section on line 12—12 of Fig. 11.

It is obvious that many other forms of non-circular countersinks may be used and that each form may be variously arranged. The underlying ideas of this invention will be embodied in any non-circular countersinks which have three or more straight sides of equal length, however they may be formed, of whatever outline or shape they may be, and however they may be arranged, grouped, or disposed in the surface of the cylinder, plate, or other suction element or device; provided only, that such countersinks will be capable of completely occupying the entire operative or effective surface of the shell which is not occupied by either the cylindrical perforations or the net-like web or bar lying between the countersinks.

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

1. In a rigid cylindrical suction element, a wire supporting wall provided with a plurality of circular perforations throughout the greater part of its surface said perforations having surrounding outwardly inclined countersunk surfaces bounded at their outer edges by perimeters of angular configuration closely abutting one another on all sides and collectively presenting a net-

like wire supporting surface carried by said element and lying between and filling the spaces between the countersunk outer ends of all said perforations, the aforesaid
5 countersunk areas greatly increasing the effective suction area of said element without appreciably weakening the same.

2. In a rigid cylindrical suction element, a wire supporting wall provided with a plurality of circular perforations throughout
10 the greater part of its surface, each of said perforations having a surrounding enlargement at its outer end opening through the outer surface of said element and bounded
15 by perimeters of angular configuration, the said perforations and enlargements closely adjoining one another on all sides with adjacent boundary faces opening through the surface of the element to provide relatively
20 limited separating spaces on the outer surface of the suction element defined by parallel lines, whereby the effective area of said suction element is greatly increased without objectionably weakening the said element and a net-like wire supporting surface
25 is provided by the interconnected limited spaces lying between the outer enlarged ends of the said perforations.

In testimony whereof I have affixed my
30 signature.

WILLIAM H. MILLSPAUGH.

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