

Dec. 18, 1934.

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1,984,384

LAMINATED DIE

Filed Feb. 14, 1933

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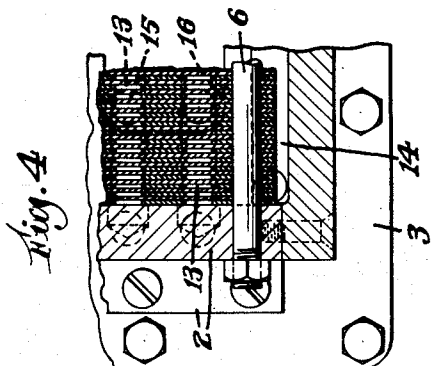
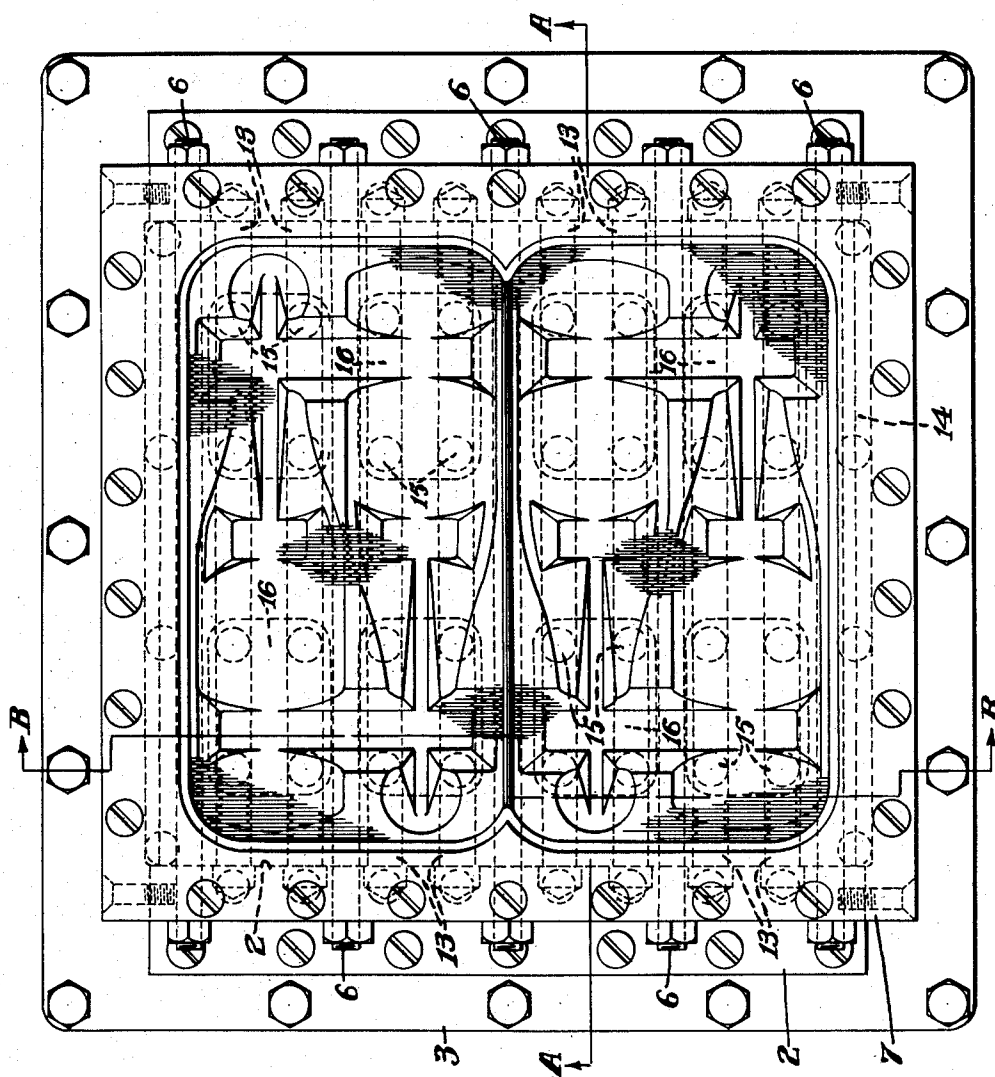


Fig. 1

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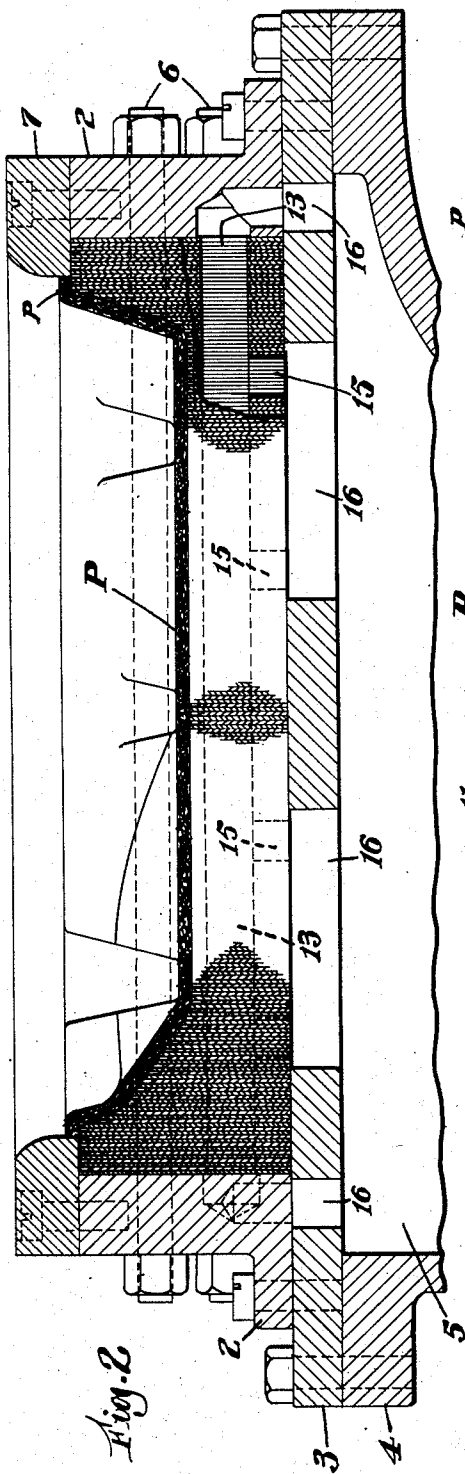


Fig. 2

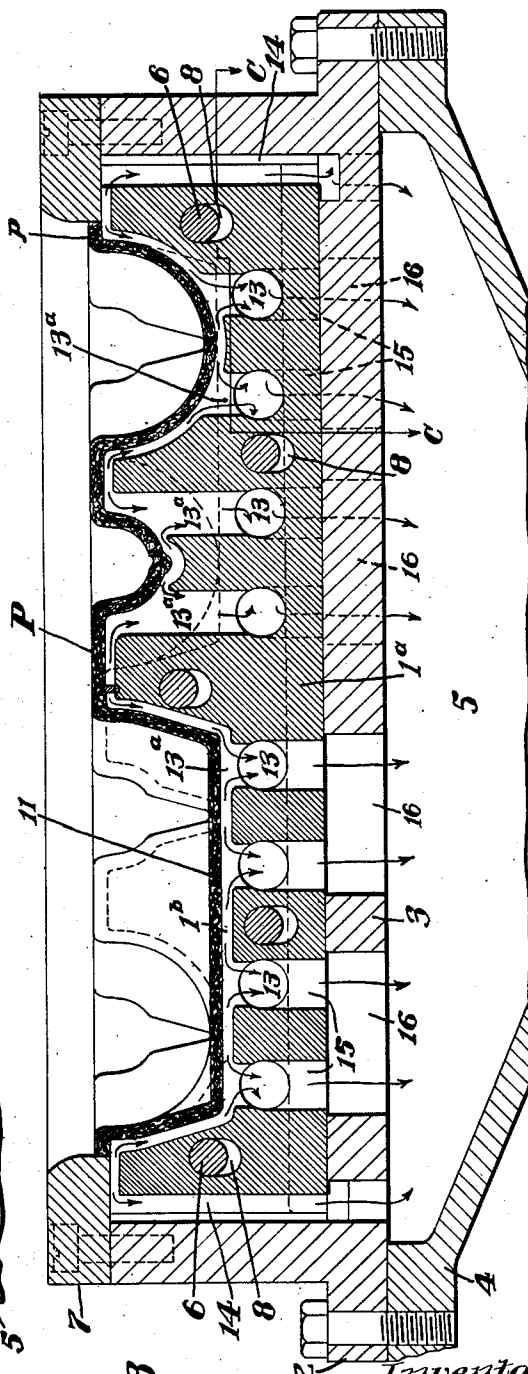


Fig. 3

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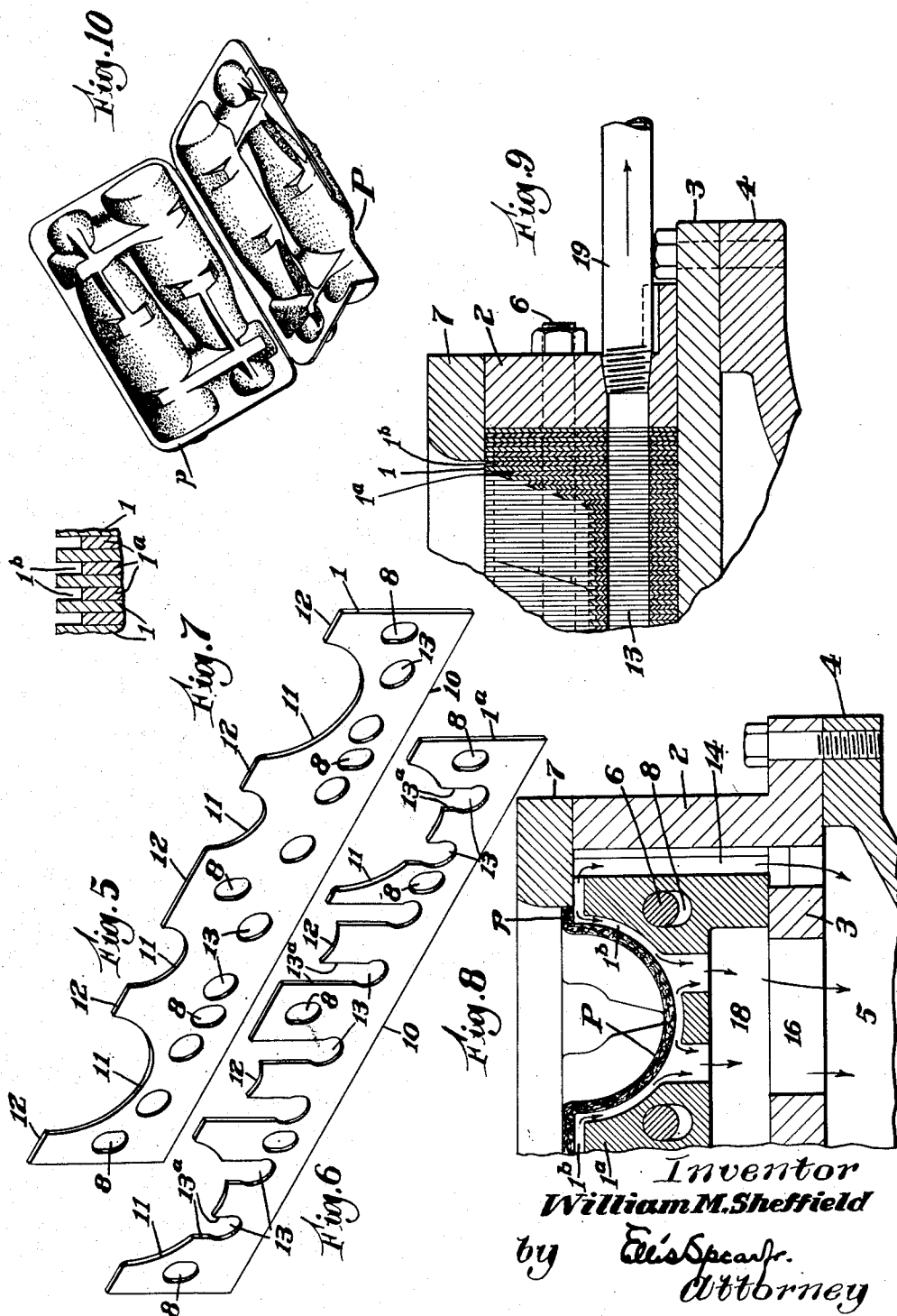
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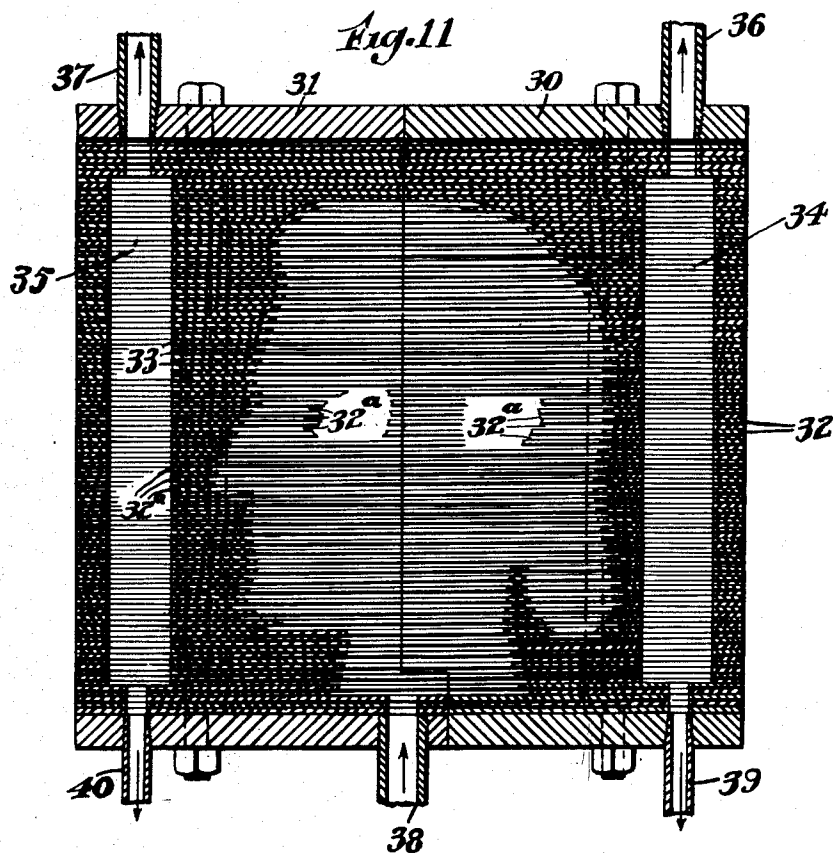
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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LAMINATED DIE

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Application February 14, 1933, Serial No. 656,747

19 Claims. (Cl. 92—57)

In the molding of pulp articles on contoured dies it has been proposed to deposit the fibre by suction on a mold consisting of a compact assemblage of thin spaced bars through which the water was drawn. My prior Letters Patent Nos. 1,621,281 and 1,650,771 disclosed laminated dies made up of a compact assembly of laminae having their edges exposed on the mold face which was routed out to the desired contourings, alternate laminae being etched back to form fine shallow channels transversely of the die, through which channels the water was drawn by suction, leaving the fibre on the die surface as a contoured deposit.

My present invention while particularly applicable to that type of die involves certain improvements which give added strength and increased advantage in manufacture, as well as improved operation.

In accordance with my present invention I am able to make a laminated die of which the laminae may be entirely of metal if desired, so that the die will have a very considerable strength and be able to withstand the severe usage of machine production.

The laminae may be etched or otherwise cut to form the drainage channels, but in practice it is possible to rout out the edges of the laminae on the surface of the die to the desired contour and then drop alternate laminae slightly to form the fine channels across the face of the die. These channels drain all parts of the surface of the die but in accordance with my present invention I greatly increase the efficiency of the drainage and at the same time secure a better deposit of the fibre by a supplementary chambering as will be hereinafter described.

As illustrative of articles of this type but of course without intending to be limited to such articles, I cite so-called bottle packs and egg packs molded from pulp by deposit on such dies. These are articles of unusually steep section and well illustrate the difficulties of producing proper laminated dies for these articles and in effectively molding the articles on such dies. In dies of this character it is very important that the laminae be exceedingly thin and the protruding edges of alternate laminae as well as the combined edges in elevated portions of the die represent individual structures of considerable delicacy which individually are most difficult to tool and handle and which are apt to spread in use.

My present invention contemplates a chambering of the assembled laminae transversely of the laminal trend and preferably along lines as in one of the preferred forms shown which are parallel

with but below the concavities of the contourings but disposed adjacent thereto so that they may be vented or opened up to the minute channels or interstices between the exposed edges of alternate laminae.

In my present die, I materially reduce the thickness of the individual laminations so as to avoid the objectionable rough or shingle effect in steep sections of the article molded on such die.

I also obtain an interior drainage action which is substantially equal to the deposit rate of the pulp per unit length of slot throughout all parts of the die surface, thereby insuring a uniformity of thickness of the deposit in all areas of the molded article, regardless of variations in the steepness of the article in different sections. Such even deposit and drainage of the pulp over the entire surface of the die greatly reduces the tendency of the article to warp during drying as well as improving the appearance of the finished article.

As illustrative of my invention I have shown characteristic forms which indicate variants in structure which will be suggestive to those skilled in the art of many other modifications while at the same time constituting practical embodiments well adapted to commercial product of the dies so that such dies will be commercially operable in quantity production of molded articles from pulp or the like. The various principles involved and structural features will more fully appear from the discussion in the specification of the embodiments which are shown in the drawings.

In the drawings:—

Fig. 1 is a plan view of a characteristic die in accordance with my invention.

Fig. 2 a section on the line A—A of Fig. 1.

Fig. 3 a section on the line B—B of Fig. 1.

Fig. 4 a fragmentary section on the line C—C of Fig. 3.

Fig. 5 is a perspective view of an individual plate or lamina of the protruding or unvented type.

Fig. 6 is a similar view of a plate or lamina of the type forming the narrow channel bottom between the protruding plates.

Fig. 7 is an enlarged fragmentary section of an edge portion of the laminated die as shown in Fig. 2.

Fig. 8 shows a modified form of a portion of a die in cross section having an open bottom type suction chamber.

Fig. 9 shows a further modification in which

the suction is applied directly to the die assembly without suction chamber.

Fig. 10 is a view of a characteristic bottle pack so-called such as would be produced on the illustrative die shown, and

Fig. 11 is a section showing a further modification, the die or mold in such view being of two part construction and being particularly adapted for the molding of hollow articles.

Dies according to my invention are made up of a plurality of laminae assembled in edgewise compact relation and consisting of thin plates or strips 1 and 1a, the latter being of slightly less depth than the former so that when arranged alternately side by side a large number of small transverse channels 1b are formed. The bottom of these channels are formed by the contoured edges of the strip 1a and the sides by the projecting edges of the contourings of the intervening laminae 1.

The laminae 1 and 1a are assembled in a holding frame 2 having a bottom 3 carried for example by a head 4, as the die holder on the molding machine, and which head 4 usually has a suction chamber 5. The laminae have bolt holes 8 therein and are cross bolted and firmly clamped as at 6 through the side walls of the holder frame 2 at the top of which is secured the forming die ring 7 which slightly overlies the margin of the laminae assembly and defines the edge of the pulp deposit P as at p and seals off the lateral channels 14.

The laminae 1 and 1a are individually detailed in Figs. 5 and 6, respectively, and Fig. 7 shows the channels 1b on the face of the die formed by slightly dropping alternate laminae.

The lower edges of the laminae 1 and 1a are usually formed as straight edges or supporting bases 10 while the upper edges are contoured as at 11 according to the shape of the ultimate article to be molded. For illustrative purposes I have shown in Fig. 1 a face view of a mold adapted to form a bottle pack such as is shown in Fig. 10. The contourings 11 of such a mold constitute abruptly curved edges which together form the recesses or concavities of the article between which intervening portions such as 12 are left.

As in the illustrative form shown, many of these laminae are formed with such contourings 11 in rows or channels which may be parallel. As shown in Figs. 5 and 6, the elongated bolt holes 8 are disposed in the general vertical line of the projecting portions 12 and are thus generally intermediate of the recessed portions 11 of the laminae. Beneath the recessed portions I preferably form transverse apertures 13 which taken together constitute a series of drainage channels or passages directly across the die. These may be conveniently formed by drilling or routing out assembled laminae thus securing alignment of the apertures 13 in assembling the die.

The contourings 11 of the plates 1a are connected up by a notch or cut out portion 13a with an adjacent underlying aperture 13 so that the channel of which this contoured edge constitutes the bottom drains at one or more points into the transverse drainage channels or chamberings formed by said apertures 13. Thus all danger of drainage water collecting between adjacent contourings 11 and 12 is avoided. Instead, the drainage water passes either to left or to right downwardly into an underlying coring 13, and then into the vacuum chamber 5 through holes 15 which connect said passages 13 at suitable intervals with said chamber (see Fig. 3).

The interlaminal grooves 1b also drain into the passages 13 through open slots 14 at the ends of the plates, so that the water of suspension is entirely drained by suction leaving the fibre as a pulp deposit P.

In the form shown in Fig. 3 the transverse chamberings 13, connected with each other as at 15, are connected directly to the vacuum chamber 5 by openings 16 in the bottom 3 of the frame 2.

In the modification of Fig. 8, the chambering may be formed by cut-outs 18 which extend across the drainage openings from the edge of the contouring of the interlaminal channels 1b. In this form sufficient stock is left between the chamberings 18 reasonably to support the plate on the bottom 3 of the die holder through which the chamberings 18 are freely drained directly into the vacuum chamber 5 as shown in Fig. 3.

As a further modification I have shown in Fig. 9 a construction in which transverse chamberings 13 are connected directly to a vacuum pipe or pipes 19 which may be connected up in any suitable way as through a manifold to the air exhausting system.

Referring to Fig. 11 I have illustrated a further modification particularly adapted for making hollow articles in which the mold or die consists of a pair of complementary mold sections 30, 31. Each die section includes an assembly of laminated plates 32 and 33 which are contoured to produce the desired fanciful figure or the like as shown in Fig. 11 and are so cut back and assembled as to afford drainage channels 32a which open into the vacuum chambers 34 and 35 behind the inner edges of such laminations. Each vacuum chamber is provided with a vacuum connection 36 and 37 whereby vacuum may be applied behind the laminations to cause the pulp admitted through the common inlet 38 to draw across and over the contoured edges of the laminations and thereby build up a deposit of pulp thereon which will follow the outline of such contoured edges. The mold sections are drained as indicated at 39 and 40.

In use the mold sections are brought together by any suitable mechanism to the position of Fig. 11, after which pulp is admitted through the inlet 38 and vacuum is applied behind the laminations as at 36 and 37 to the respective vacuum chambers 34 and 35 of the mold sections to effect deposit and drainage of the pulp.

When deposit and drainage is completed the mold sections are separated and the article bodily removed from the laminations.

Various other modifications in the construction and arrangement of the chamberings and the drainage apertures will readily occur to those skilled in the art without departing from the spirit of my invention. Such will be provided for according to the contouring of the particular die and the arrangement of its depressions and projections according to the nature of the articles to be made upon it.

What I therefore claim and desire to secure by Letters Patent is:—

1. A mold comprising a casing, a plurality of assembled laminae having contoured marginal surfaces for fibre deposit under suction, said assembly having collectively a chambering adjacent the marginal edges of the laminae disposed transversely to the laminal trend and in drainage and suction relation to the fibre receiving surfaces of the contourings to effect equalized distribution of the fibre and relief of the suspending fluid.

2. A mold comprising a casing, a plurality of assembled laminae having contoured marginal surfaces for fibre deposit under suction, said assembly having collectively transverse bores adjacent the marginal edges of the laminae disposed transversely to the laminal trend and in drainage and suction relation to the fibre receiving surfaces of the contourations to effect equalized distribution of the fibre and relief of the suspending fluid.

3. A mold comprising a casing, a plurality of assembled laminae having contoured marginal surfaces for fibre deposit under suction, said assembly having aligned apertures adjacent the marginal edges of the laminae disposed transversely to the laminal trend and in drainage and suction relation to the fibre receiving surfaces of the contourations to effect equalized distribution of the fibre and relief of the suspending fluid.

4. A mold comprising a casing, a plurality of laminae held therein having straight base edges and contoured face edges with transverse depressions and elevations, said assembly having interlaminal channels on its contoured face and having a series of transverse spaced channels passing through its members collectively below the contour depressions and transversely to the laminal trend and connected with the longitudinal interlaminal channels on the assembly face whereby equalized suction and drainage are maintained below the surface and transversely of the laminae.

5. A mold comprising a casing, a plurality of laminae held therein having straight base edges and contoured face edges with parallel transverse depressions and elevations, said assembly having interlaminal channels on its contoured face and having a series of parallel transverse spaced channels passing through its members collectively below the contour depressions and transversely to the laminal trend and connected with the longitudinal interlaminal channels on the assembly face whereby equalized suction and drainage are maintained below the mold surface and transversely of the laminae.

6. A mold comprising a casing having a vacuum chamber, a plurality of laminae held therein having straight base edges and contoured face edges with parallel transverse depressions and elevations, said assembly having interlaminal channels on its contoured face and having a series of parallel transverse spaced channels passing through its members collectively below the contour depressions and transversely to the laminal trend and connected with the longitudinal interlaminal channels on the assembly face and with the vacuum chamber at the assembly base whereby equalized suction and drainage are maintained below the mold surface and transversely of the laminae.

7. In a mold a casing having a vacuum chamber, a compact assembly of transversely rigid laminae within said casing and having contoured edges exposed as a mold face, the edges of alternate laminae being slightly lower than those adjacent to form with the adjacent projecting edges continuous parallel channelings over the entire surface of the contour, said laminae assembly being collectively transversely apertured below their contoured surfaces and the apertures thereof connecting with said channelings and with said vacuum chamber, and some of the alternate laminae being notched at intervals and said notches connecting with said transverse apertures.

8. In a mold a casing having a vacuum chamber, a compact assembly of transversely rigid laminae having contoured edges exposed as a mold face, the edges of alternate laminae being slightly lower than those adjacent to form with the adjacent projecting edges continuous parallel channelings over the entire surface of the contour, said laminae assembly being collectively chambered below their contoured surfaces and the apertures thereof connecting with said channelings and with said vacuum chamber, and some of the alternate laminae being notched at intervals and said notches connecting with said chambers.

9. In a mold, a contoured mold face comprising laminae having continuous parallel channelings over the entire surface of the contouring and having transverse chambering below said channelings disposed transversely to the laminal trend.

10. A laminated die, comprising a compact assembly of laminae contoured along their upper edges as an exposed mold face, alternate laminae being so disposed as to afford continuous drainage channels over substantially the entire face of the die, said laminae below said contoured edges being provided with registering openings which when the laminae are assembled together afford continuous drainage passages transversely of the laminal trend for the drainage therein to of the fluid draining through said interlaminal channels, and means whereby said last-named drainage passages may be placed under vacuum exhaustion.

11. A laminated die as claimed in claim 10, wherein the laminae are provided below said last-named drainage passages with holes which connect with the source of vacuum exhaustion.

12. A laminated die as claimed in claim 10, wherein said last-named drainage passages are connected by a manifold to the source of vacuum exhaustion.

13. A laminated die as claimed in claim 10, wherein vacuum exhaustion is applied through a vacuum chamber disposed beneath the lower edges of said laminae.

14. A lamina for use in a laminated die, consisting of a strip having its upper edge contoured and having beneath said contouring an opening which when said strip is assembled on edge in parallel relation with other strips affords a continuous drainage passage.

15. A lamina as claimed in claim 14, wherein said strip is also provided with a bolt hole which when the strip is assembled with other strips affords a continuous opening for a tie bolt.

16. A lamina for use in a laminated die, consisting of a strip having its upper edge contoured and having beneath said contouring and directly connected therewith an opening which when the strip is assembled on edge in parallel relation with other strips affords a continuous drainage passage.

17. For use in a laminated die, a pair of laminae adapted to be assembled on edge in parallel relation with each other and to afford at their upper edges an interlaminal drainage channel, both of said laminae having their upper edges contoured and both having below said contourings registering openings which extend transversely of the laminal trend and afford a continuous drainage passage for the drainage therein to of fluid from said interlaminal channel.

18. Laminae as claimed in claim 17, wherein one of said laminae also has its drainage opening

directly connected with its contoured upper edge.

19. In a laminated die, a pair of separable casing-forming members, each presenting top and bottom wall portions adapted to abut each other when the die is closed and a lateral portion connecting said top and bottom portions, an assemblage of laminae mounted in each casing-

forming member with their outer edges spaced away from said lateral wall portion of the member, the space between said outer edges and said lateral wall portion constituting a vacuum chamber, and an independent vacuum connection to each of said vacuum chamber spaces.

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