

J. J. BERRIGAN.
 PROCESS OF AND APPARATUS FOR EXPRESSION.
 APPLICATION FILED AUG. 27, 1909.

994,495.

Patented June 6, 1911.

4 SHEETS—SHEET 1.

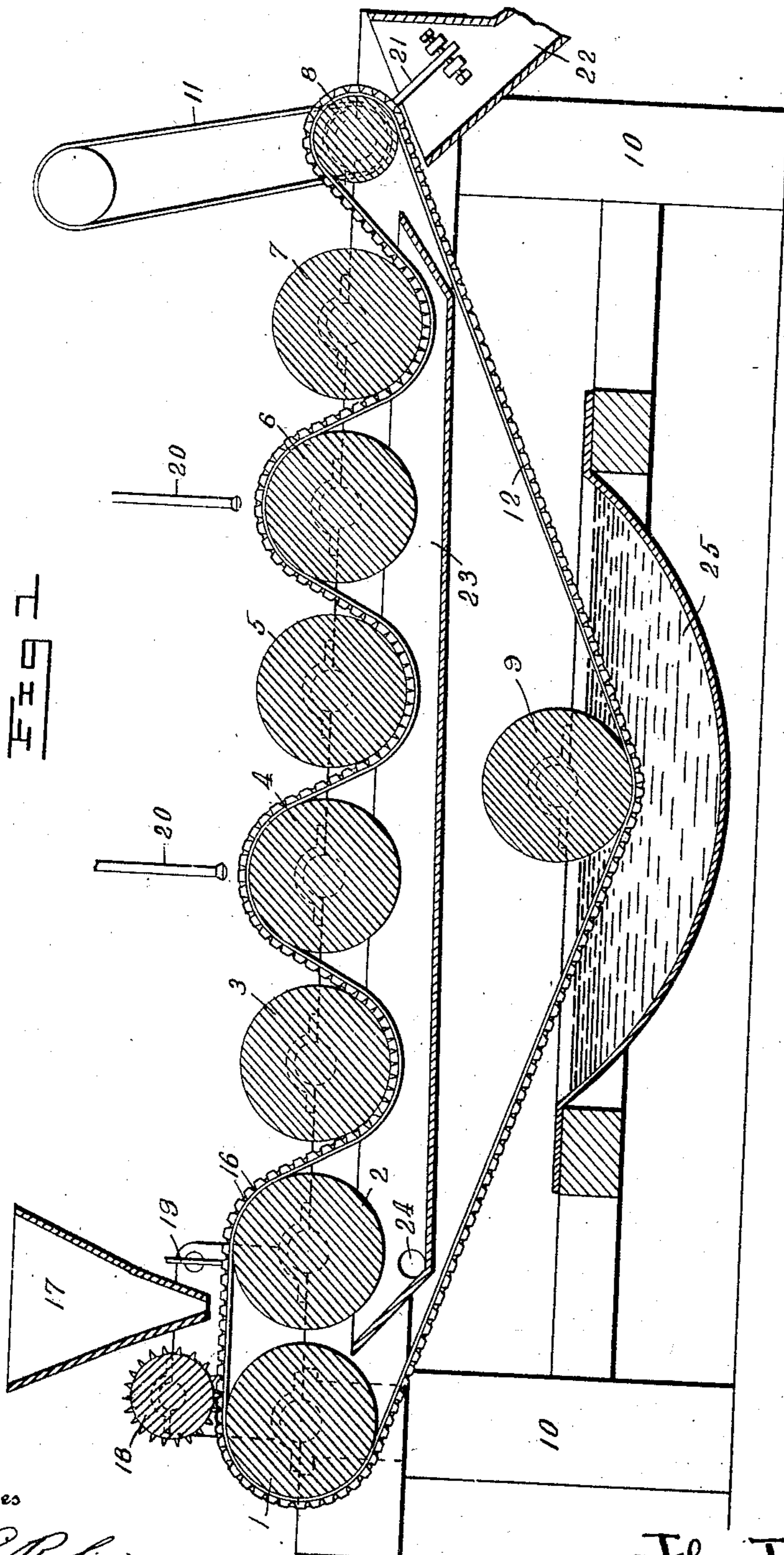


Fig 1

Witnesses
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 Attorney

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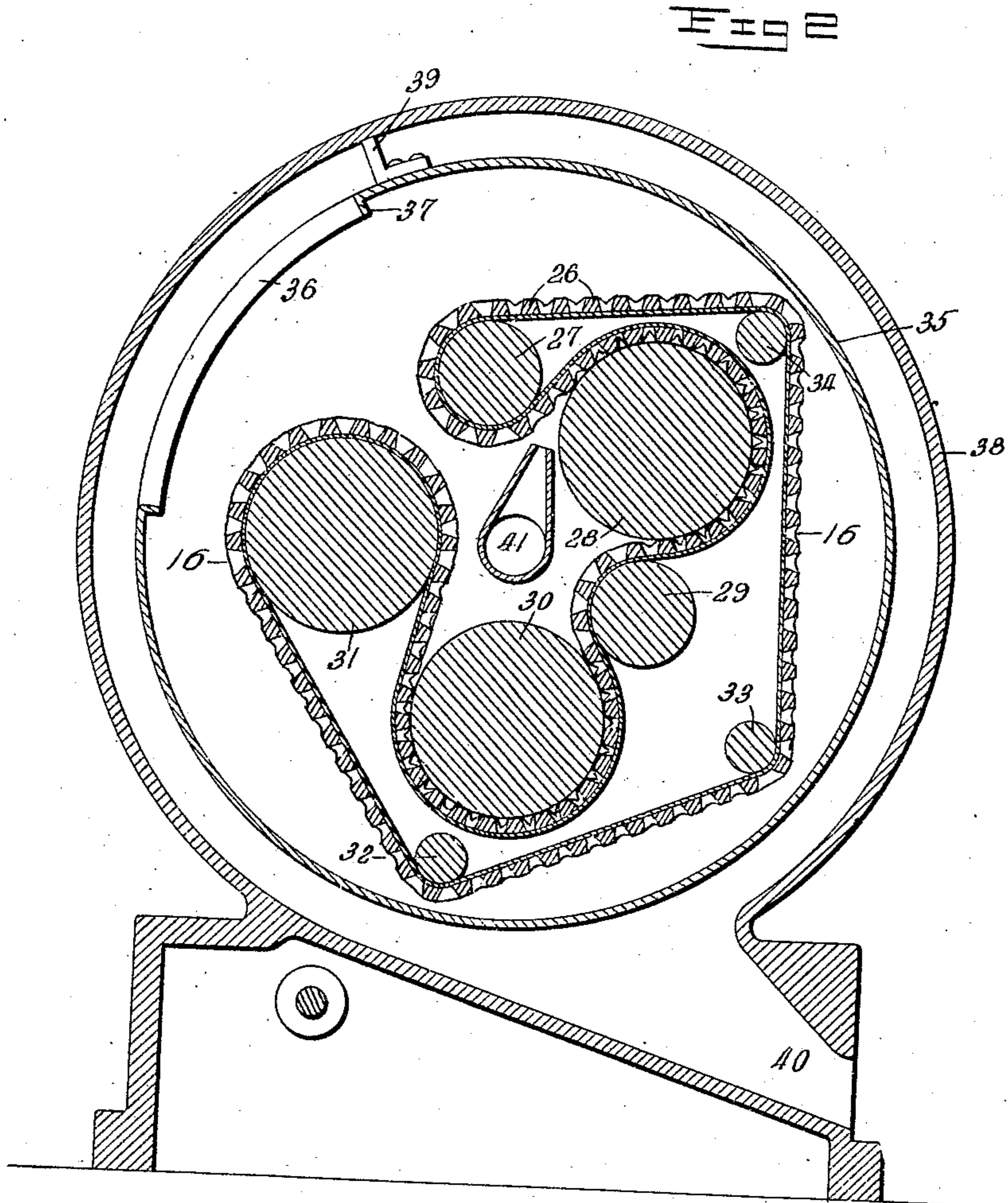
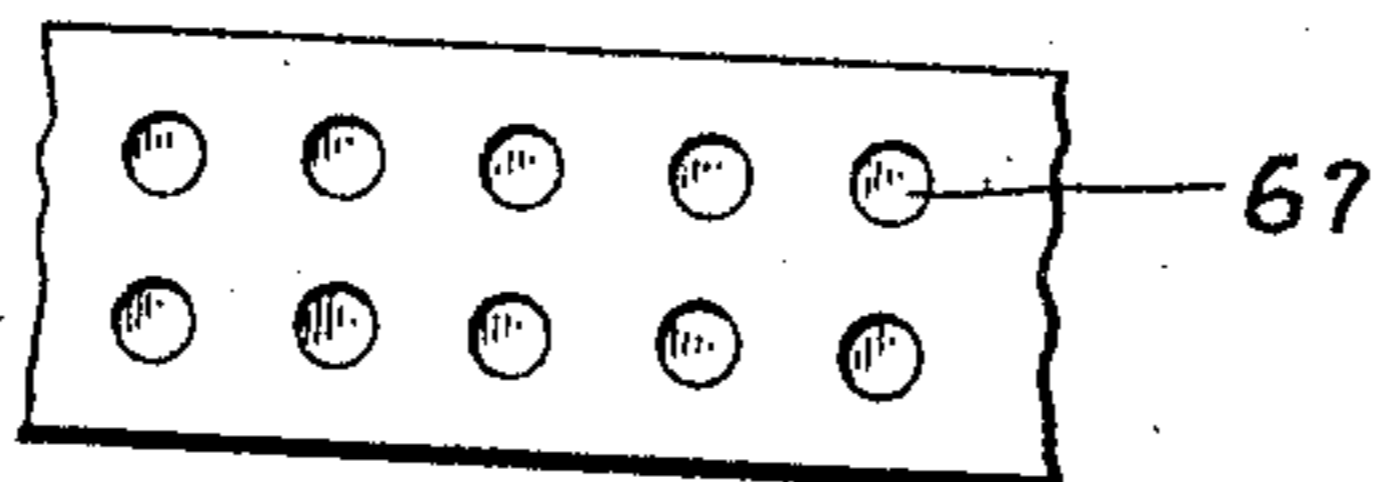


Fig 12



Inventor

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By

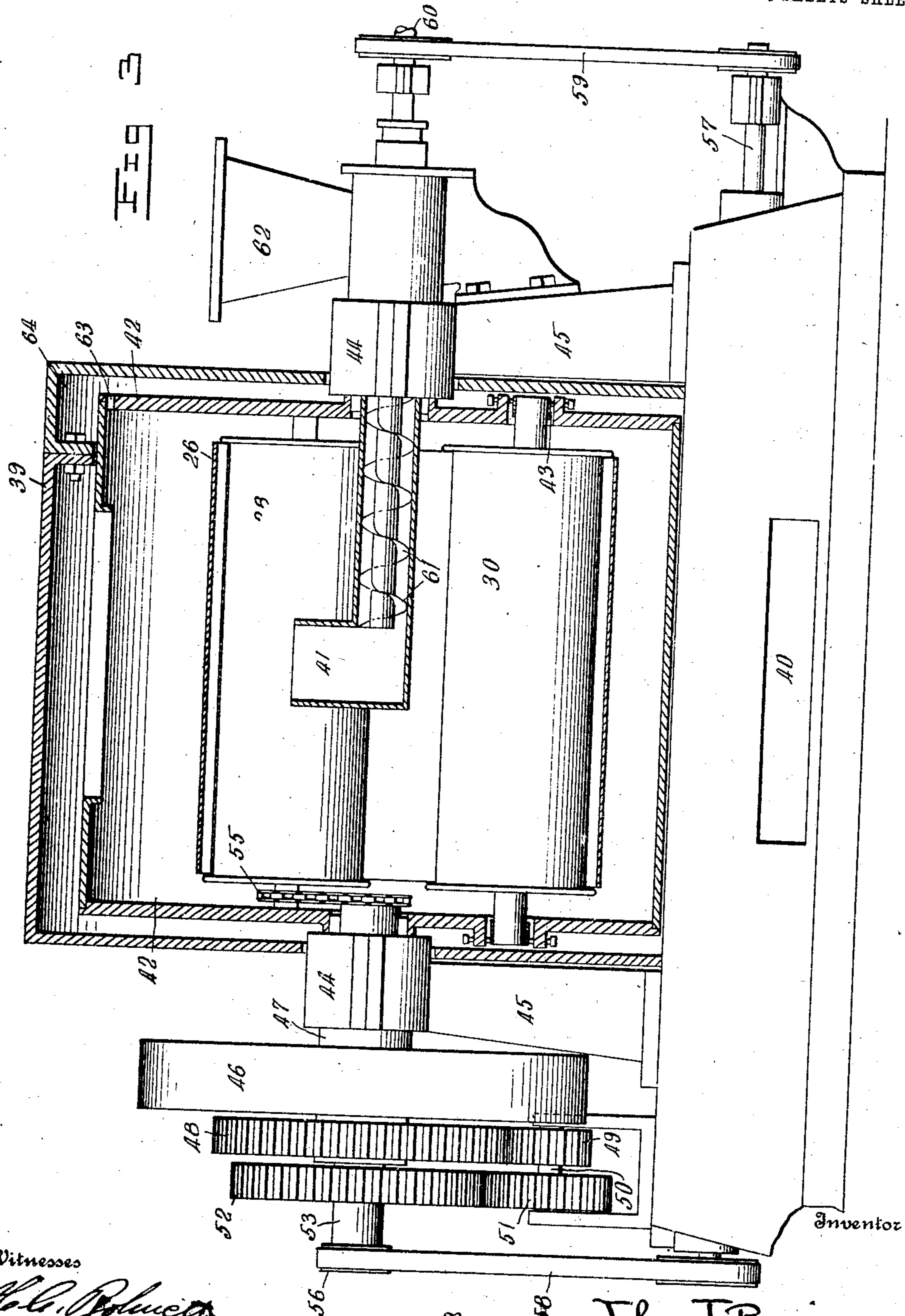
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4 SHEETS-SHEET 3.



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4 SHEETS—SHEET 4.

Fig 4

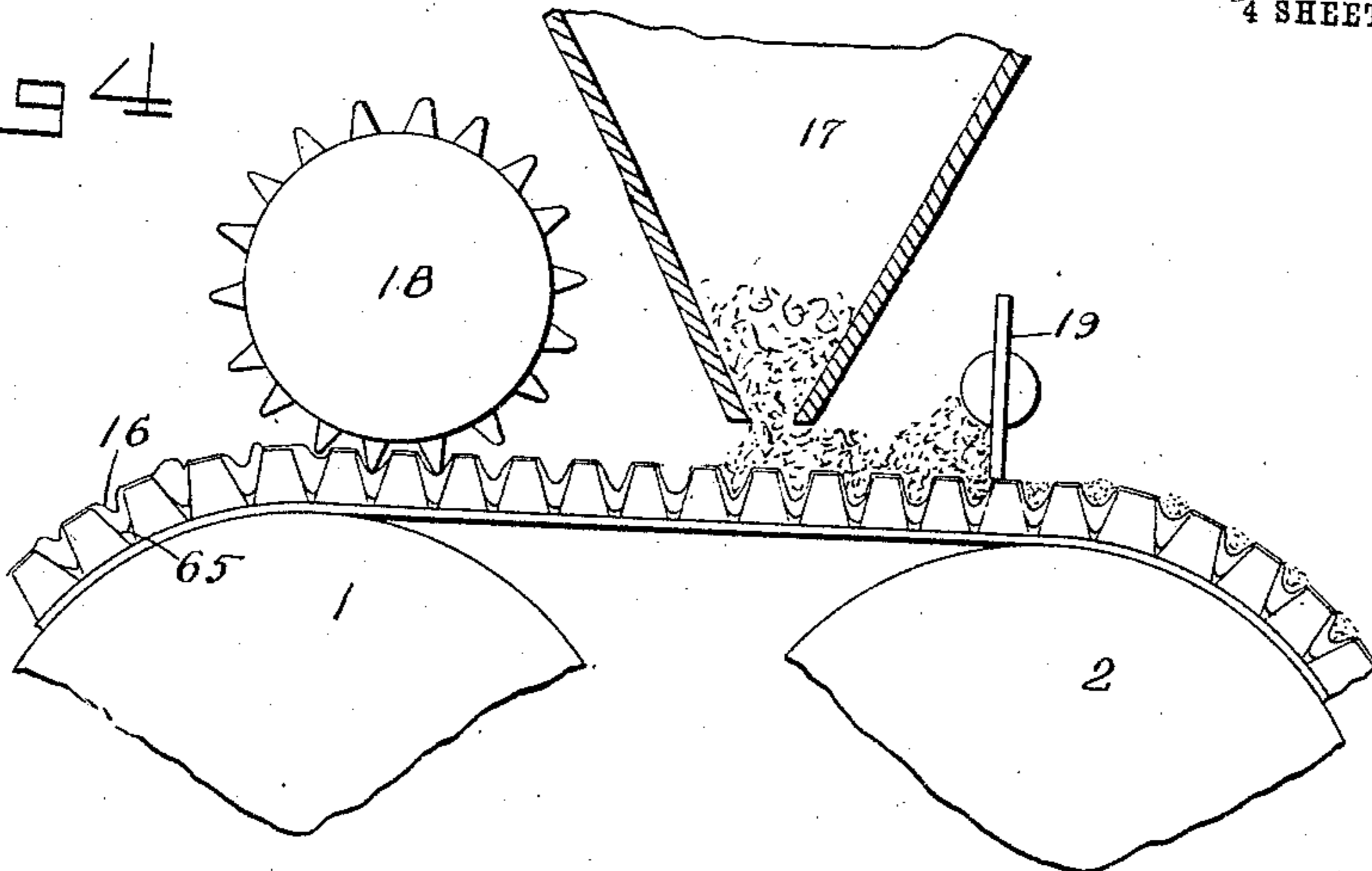


Fig 5

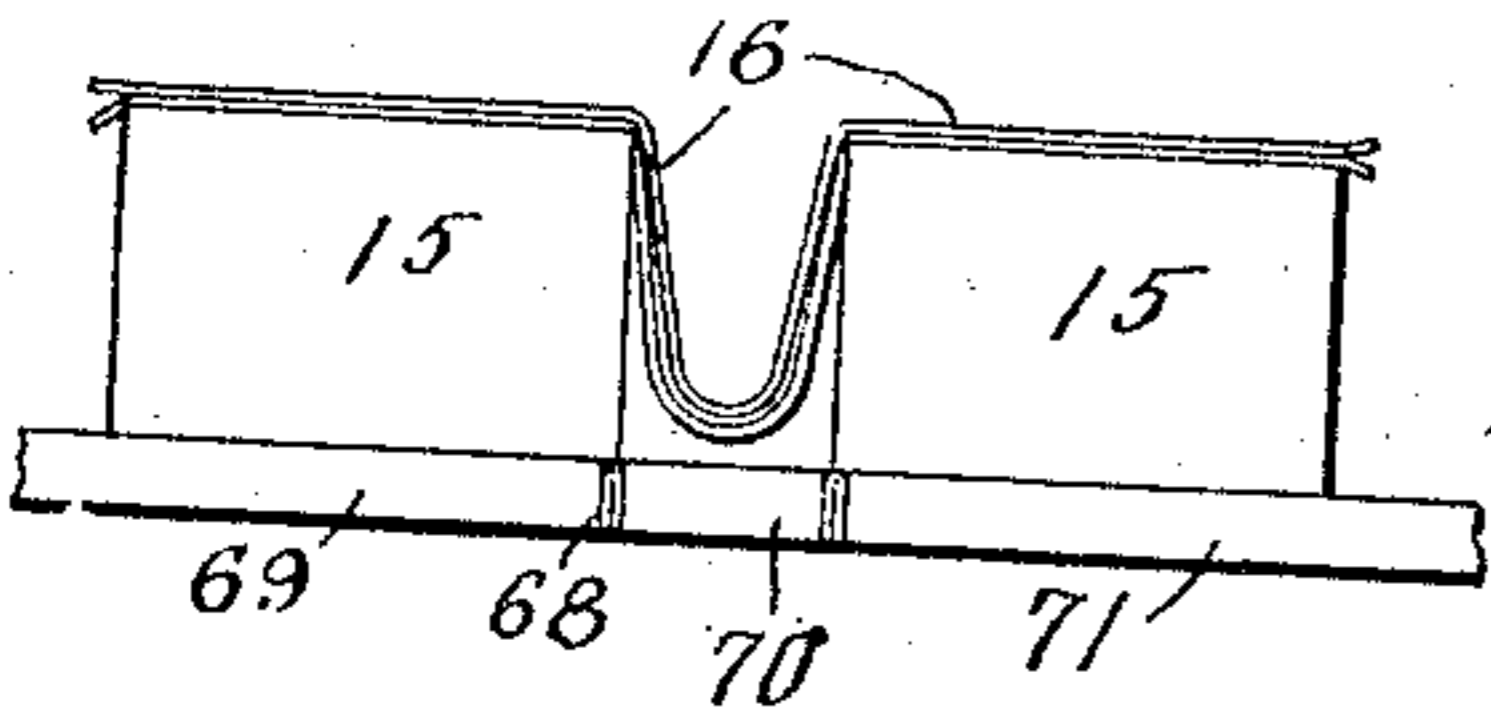


Fig 6

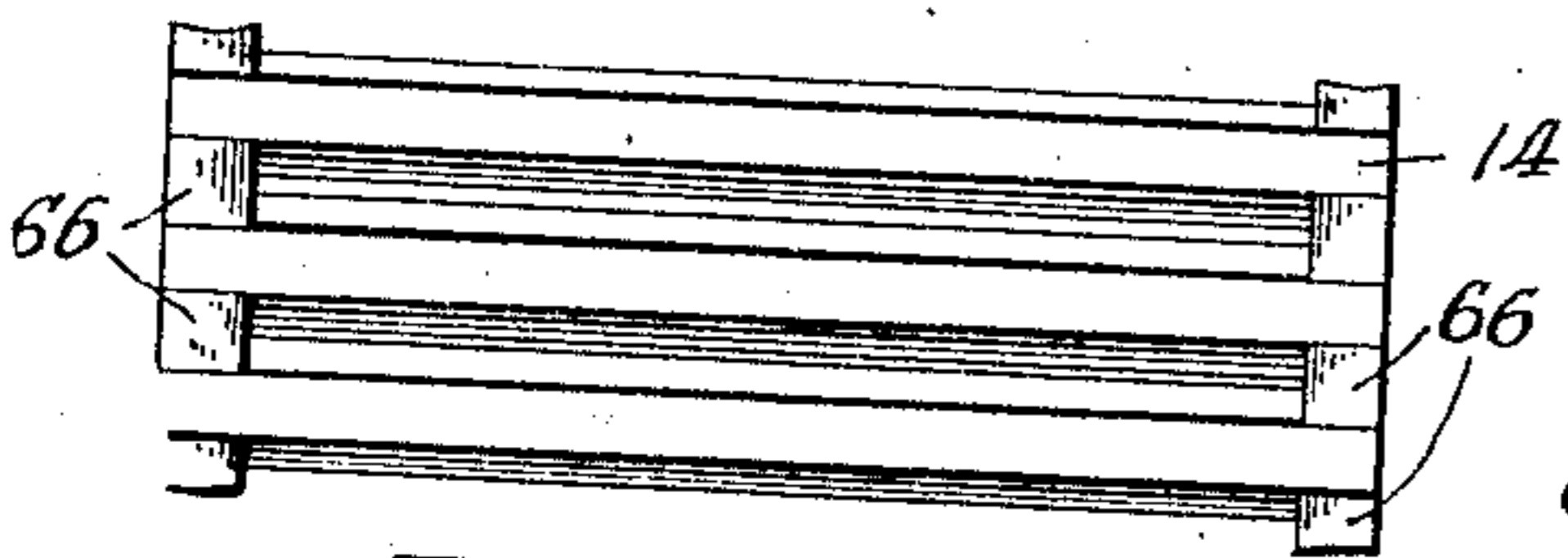
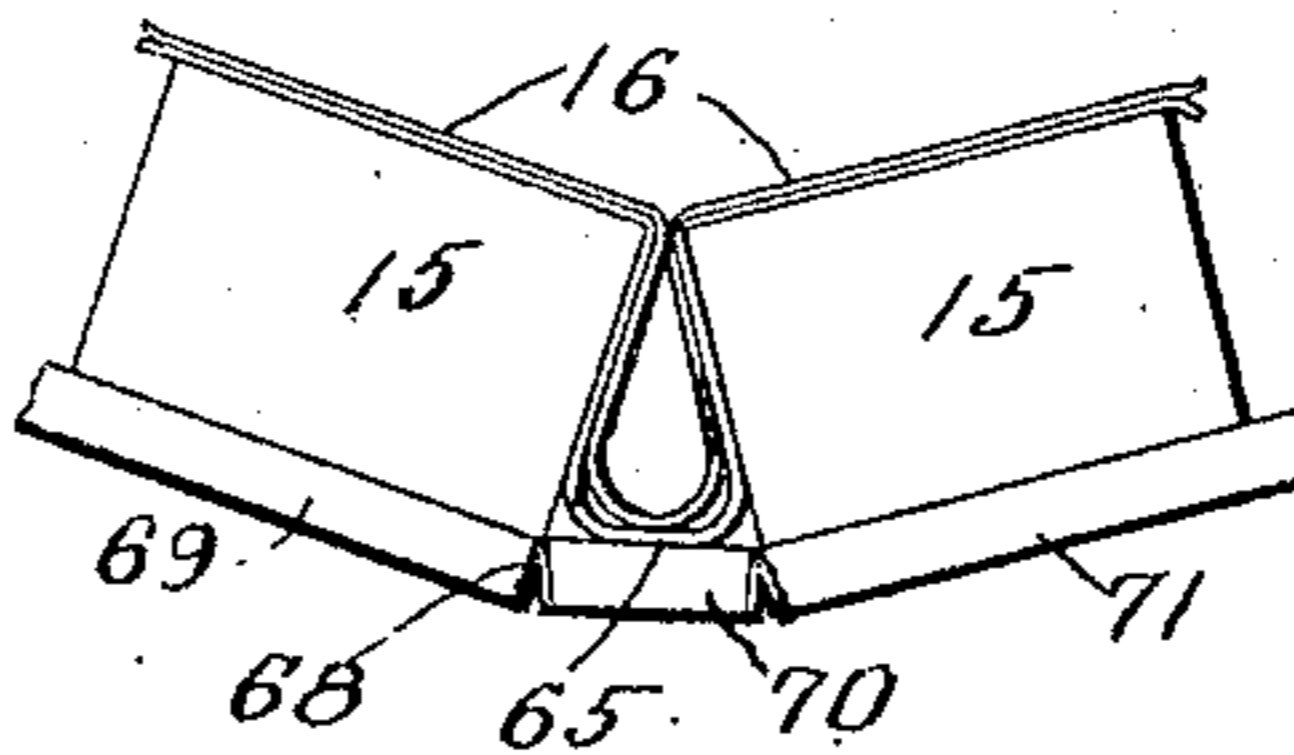


Fig 7

Fig 8

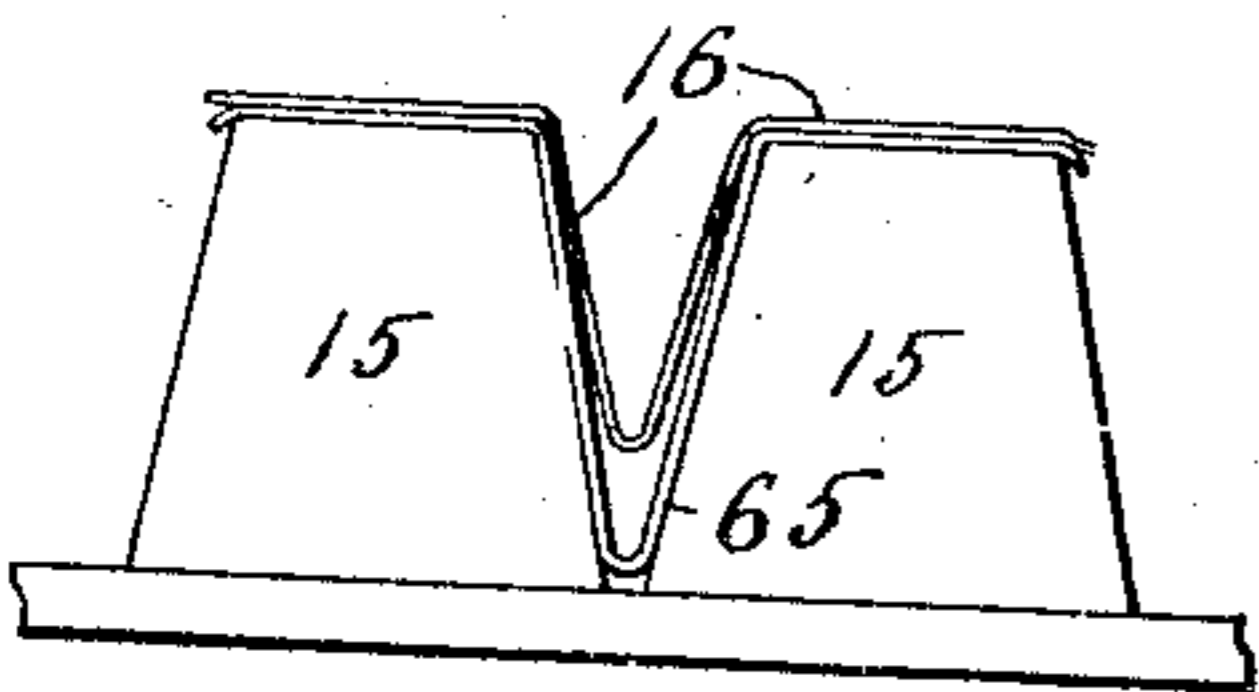
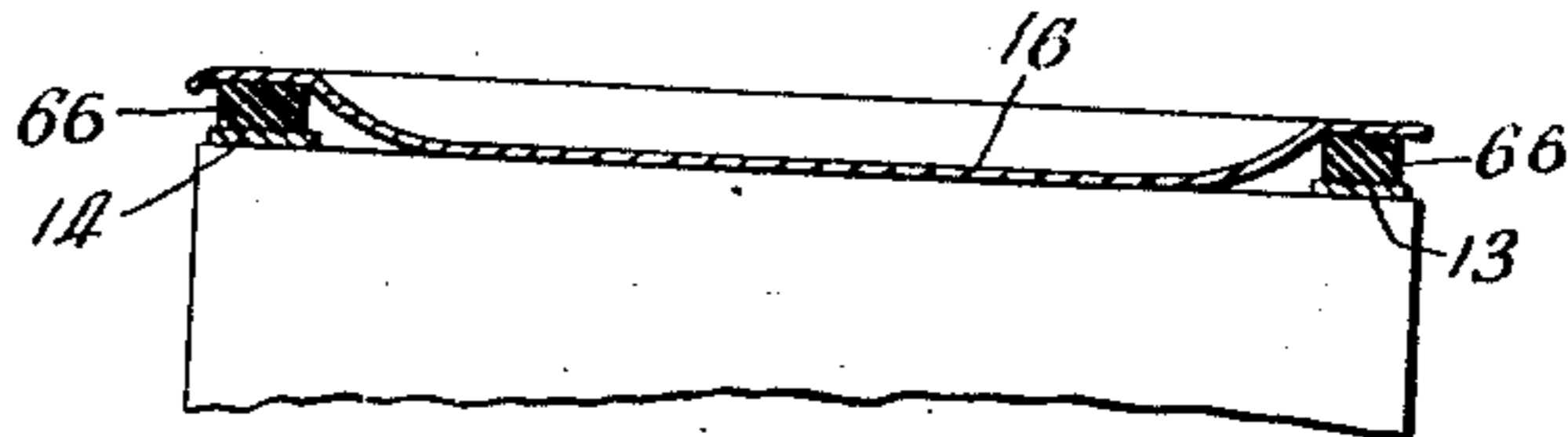


Fig 9

Fig 10

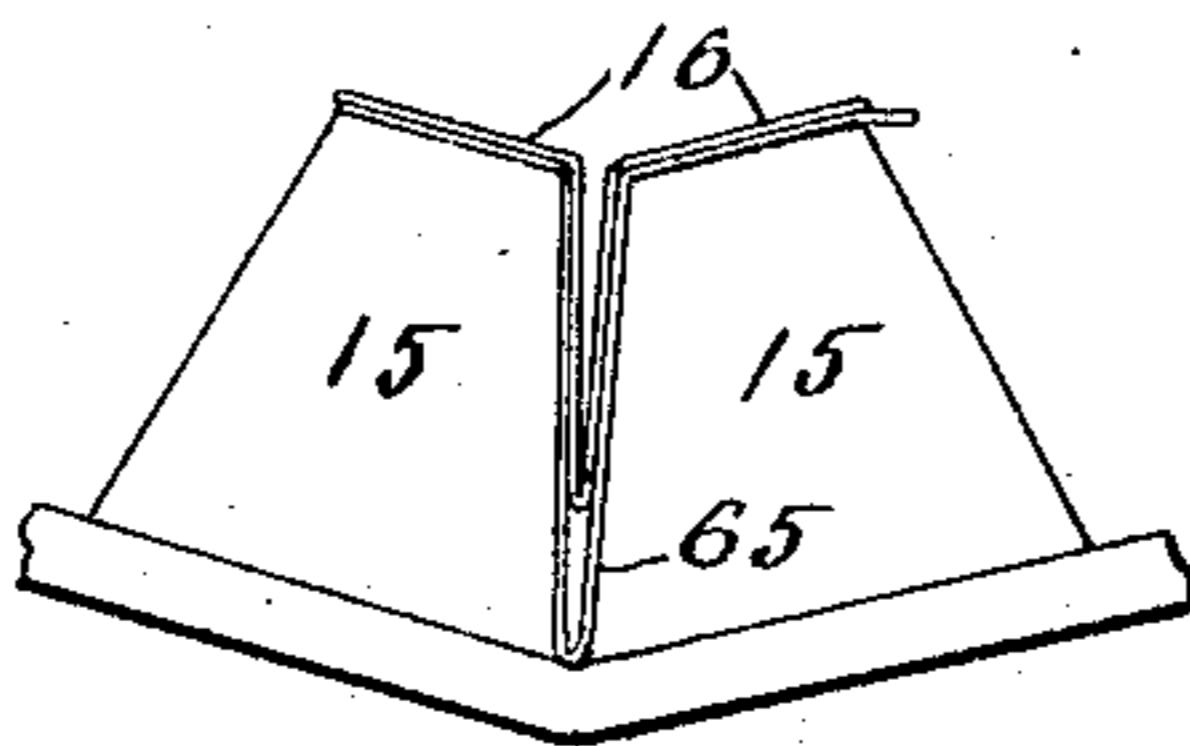
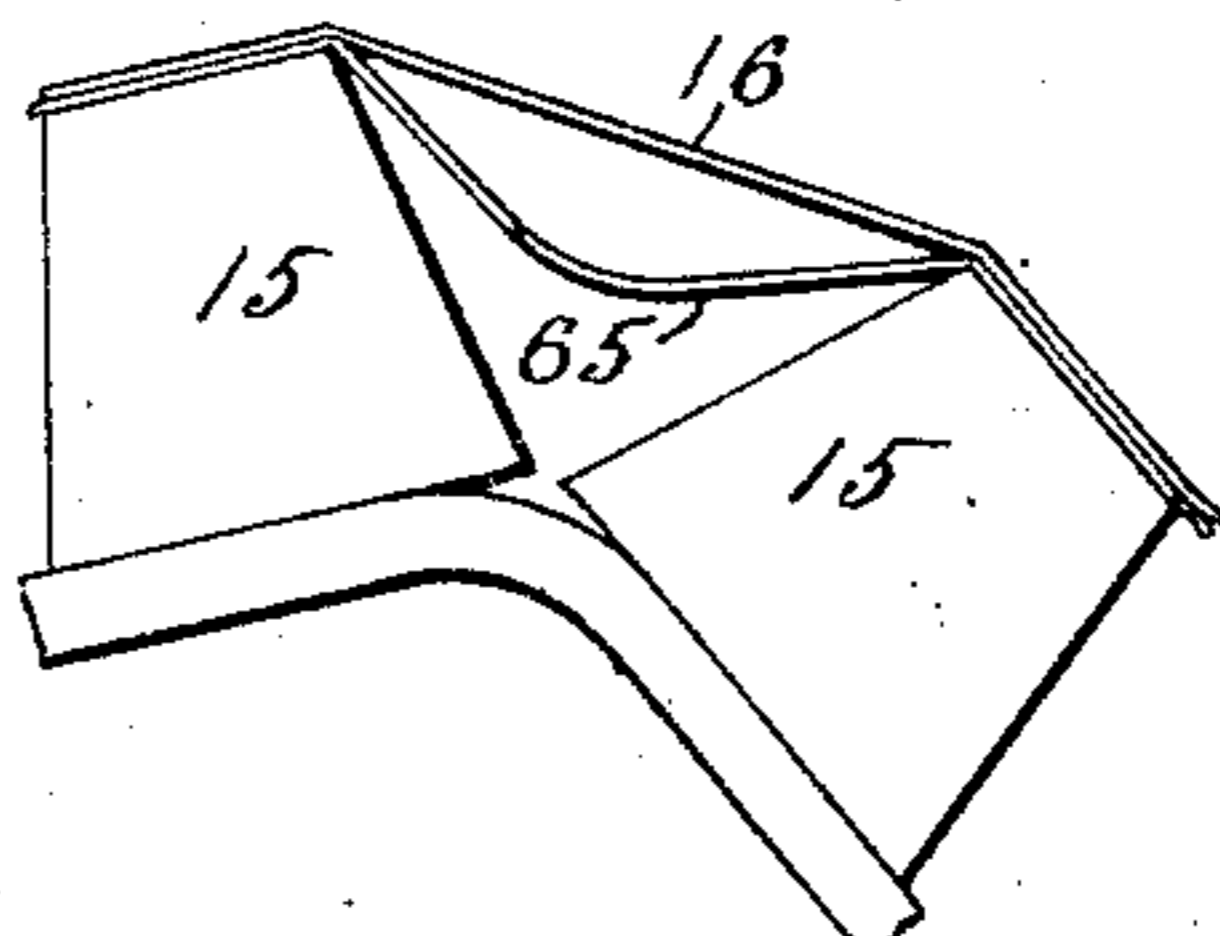


Fig 11



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UNITED STATES PATENT OFFICE.

JOHN J. BERRIGAN, OF ORANGE, NEW JERSEY.

PROCESS OF AND APPARATUS FOR EXPRESSION.

994,495.

Specification of Letters Patent.

Patented June 6, 1911.

Application filed August 27, 1909. Serial No. 514,851.

To all whom it may concern:

Be it known that I, JOHN J. BERRIGAN, a citizen of the United States, residing at Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Processes of and Apparatus for Expression, of which the following is a specification.

This invention relates to processes of and apparatus for expression; and it comprises a process of expressing liquid from solids which comprises placing an endless flexible member carrying a succession of relatively small press chambers in its face in revolutionary motion and during such motion producing lateral pressure between corresponding faces of such press chambers, as by placing small portions of material to be expressed between projecting portions or elements on the face of a flexible belt and giving said belt one or more concave bends in such a manner as to produce a forcible lateral compression of such portions of material between such projecting elements; and it also comprises certain apparatus useful in performing said process, said apparatus comprising a belt presser member provided with depressions on its presser face, means for feeding relatively small portions of material into such depressions and means for alternately giving said belt an inward and an outward curve, respectively on such presser face, whereby said material is first laterally compressed by the walls of said depressions and is then permitted to expand; all as more fully hereinafter set forth and as claimed.

In the ordinary methods of expression used for oil seeds, fish scrap, slaughter house scrap, bagasse and many other materials, it is desirable to use some continuously-operating type of mechanism but the types now in use suffer from the disadvantage that no great amount of pressure can be applied; not so much, for example, as can be applied in the ordinary types of discontinuous press, such as a hydraulic or screw press. This is for the reason that it is difficult to clear the presser members or force the feed after the expression if relatively high pressures be employed. In using a belt press consisting of a presser belt working in coöperation with presser rolls, for instance, the roll in moving

away from the belt tends to carry with it adhering material from the cake while it is difficult to induce material to enter the "pinch" if the pressure be very great or the material be finely divided. With a high degree of pressure between roll and belt, if the material can yield away it will do so and the use of such high pressure is generally attended with a banking up of unpressed material before the "pinch". As a typical instance may be taken diffusion bagasse chips from sugar cane which are in the form of short half inch pieces, too short to enter the "pinch" well, or to be dragged in well if once induced to enter, and which are of a very corky, resilient nature. These chips though carrying upward of 90 per cent. water have never been successfully pressed by any continuous press. Small oil seeds, such as mustard seed are also difficult to press by continuous presses for similar reasons.

In the present invention I have devised a new method of operation in continuously pressing liquid-yielding bodies which can be applied to pieces or particles as small as may occur, and in which it is indeed desirable that the size of the several pieces or particles be quite small, wherein as high a degree of pressure may be applied as may be desired. To this end, instead of feeding a large body of material continuously to the "pinch" between the presser members of the press and expressing by the pressure between the faces of such presser members, as is the usual custom, I provide a flexible member carrying small depressions or pressure chambers on its presser face and after filling these depressions with the material to be expressed, which is preferably, as stated, in relatively fine pieces or particles, I give the flexible member an inward or concave bend as regards the face carrying such chambers or depressions. Conceiving the depressions to be vertical-walled in the normal shape of such flexible presser member, it will be obvious that in giving the face a concaved form from these depressions become narrower and in section more or less of the shape of an inverted V; that is, the mouth is narrower than the bottom. Or if the depressions are V-shaped in the normal position, on concaving the walls of the depressions approach

each other and, if the curvature be on the correct radius, such depressions tend to become obliterated. Simultaneously, of course, the side walls of the depression exert lateral pressure upon the contents thereof. If the flexible member be, as it usually is, a traveling belt passing over a roll in the concaving operation, it will be obvious that the closeness of the "pinch" between the faces of the belt and roll has nothing to do with the feed or with the pressing operation directly and the pressure therebetween may be as high as may be desired. But such pressure is not directly exercised upon the material between the belt and roll; it is indirectly exercised in lessening the volume of the depressions and of the contained material. The operative pressure is not between the face of the belt and the face of the roll. The face of the roll, for present purposes, may indeed be considered as largely a closure for the depressions during the pressing operation, preventing such material yielding outward at this time.

For mechanical reasons, the apertured presser member is preferably some form of belt, flexible enough to be passed around rollers or is carried by one or more such belts. By providing a plurality of such rollers around which the belt passes with its presser face alternately convexed and concaved, a useful mode of operation is devised since the portions of material may be fed into the depressions in a convex bend, when they are widely open at the mouth, expression performed during a concave bend when they are narrowed at the mouth and the material subsequently removed when they are once more opened out at the mouth. And if the expression be, as it preferably is, performed in a plurality of successive stages, in the intermediate stages when the belt is convexed and the pressure on the sub-cakes in the depressions is relaxed, sprays of water, steam or oil may be directed on the expanding and porous sub-cakes prior to repressing. Or the depressions in the flexible member may be filled while such flexible member is in a flattened position, excess of material being removed by a suitable scraper beyond the feeding means, and the flexible member thereafter given alternate concave and convex flexures or bends in the manner described. This mode of operation is particularly convenient where a filter cloth or presser cloth is used in addition to the belt or flexible member proper. For mechanical reasons, in a structure of this type it is desirable to use a relatively heavy belting material in the flexible member and such belting material is not well adapted for the passage of liquids therethrough. But by using a belt of any suitable material, perforated at intervals and placing an ordinary filter press cloth thereupon, both strength and

percolation may be secured. Using such a filter cloth upon the belt proper and adjusting the relative lengths of the press cloth and the belt properly, in a flat position of the belt the filter cloth may extend down into the depressions, forming bags in which the material may be placed. Upon concaving the compound belt and thereby exerting lateral pressure upon the material in these bags the liquid contained is expressed and passes away through the filter cloth. Upon now passing the compound belt around a roller of short radius in such manner as to give a short convex bend the filter cloth, being on the outer side of the bend, if of the proper length straightens out of the depressions so as to form a flat surface from which the expressed solids may be easily scraped off. A useful type of flexible presser member for this purpose is provided by placing cross-slats on a pair of parallel belts or carriers or on a single, perforated belt and laying a filter cloth over the top of the slats. The spaces between the slats form presser chambers. The filter cloth is advantageously somewhat longer and wider than the belt, so that when such belt is flat it still sags within the depressions between the slats as a depending bag. Into this bag the portions of material to be pressed may be fed. In the convexed turn, the bagging may be obliterated or may still persist, this depending upon the length of such cloth and the radius of curvature.

While the rollers over which the belt passes may be simply revolvably mounted in a stationary housing, it is advantageous that the whole system of belt and rolls be mounted for revolution around an included axis in the manner described in another and co-pending application, Ser. No. 490,415, filed April 16, 1909, wherein I have claimed broadly means and methods for performing expression by mechanical pressure while centrifugally positioning the material to be expressed. By so centrifugally positioning the material, many advantageous results are secured. By giving a system of belt and rolls a rapid movement about an included axis, the material tends to cling to the interior face of the traveling, rotating belt in a positive way while since included rollers in rotating away from the belt must turn their faces toward the center of the system, centrifugal action tends to prevent clinging of expressed material to such inwardly moving faces. And by giving the traveling belt an outward looping about the whole system in such a manner that the face which was inwardly located during the pressing operation becomes an outward face in passing over the outward side of the stated system, material after expression may be likewise positively and centrifugally expelled from such face. In other words, with the de-

scribed system, centrifugal force retains the material on the presser face during the expression and liberates it therefrom after the expressing operation is complete.

5 In the accompanying illustration, I have shown, more or less diagrammatically, certain embodiments of the many types of apparatus within my broad invention and useful in performing my process.

10 In this showing:—Figure 1 is a vertical section of a system comprising a flexible belt and rollers mounted in a stationary housing; Fig. 2 is a vertical transverse section of a similar system mounted for revolution about an included axis; Fig. 3 is a longitudinal section of the structure of Fig. 2; Fig. 4 is a view on an enlarged scale of a detail of Fig. 1; Fig. 5 is a detail view showing rectangular pressing members; Fig. 6 is a detail view showing the structure of Fig. 5 given a concave bend; Fig. 7 is a detail plan view showing a pair of narrow belts or carriers provided with cross bars or slats; Fig. 8 is a transverse section of Fig. 7 showing a filter cloth in position; Fig. 9 is a view showing slats having the section of a truncated triangle; Fig. 10 is a similar view showing the slats in the position assumed in a concave bend; Fig. 11 shows the same slats with a convex bend; and Fig. 12 is a plan view of a perforated belt.

In the structure of Fig. 1, a series of rollers, shown as nine in number and marked, respectively, 1, 2, 3, 4, 5, 6, 7, 8 and 9, are mounted in a housing 10 and given rotary motion by a power belt 11. Roller (8), as shown, is of less diameter than the others for a purpose later appearing. Over these rollers passes a belt or flexible member 12, which may be either a single perforated or indented belt (see Fig. 12) or a pair of belts or linked members 13 and 14 (see Fig. 8) connected by cross-slats or bars 15 (see Figs. 5 and 7). A layer of filter cloth 16 is preferably attached to the presser surface of the belt. Hopper 17 delivers material to the presser face of the belt, sprocket or toothed wheel 18 operates to force the filter cloth within the presser chambers and scraper 19 operates to level off the surface of the material in the chambers. Pipes 20 serve to deliver water, steam, oil or other fluid to the material under treatment. Expressed solids are removed by scraper or doctor 21 and delivered into chute 22. Beneath the belt in pressing position is mounted a liquid-receiving pan 23 having an outlet 24. The belt passing beyond the scraper is taken through a washer device 25 to be cleansed prior to passing into operative position again.

In the structure of Fig. 2, the belt 26 is looped around a series of rollers 27, 28, 29, 30, 31, 32, 33, and 34, in such manner as to

form a double loop, the presser face being interior of the system during one part of its progress and exterior during another. Belt and rollers are mounted in a casing 35 provided with orifice 36 for the discharge of solids, the orifice being interiorly flanged at 37 to retain liquid on the interior surface of the casing. The casing is contained in a stationary housing 38 and is provided with a sweep 39 to carry forward solids discharged against such housing to a point of discharge 40. Duct 41 discharges material to be pressed against the inner face of the belt. The rollers are rotatably mounted in the end walls 42 (see Fig. 3) of the casing, one or more being so mounted, as at 43, to be radially movable or adjustable. The casing is itself journaled in bearings 44 carried in standards 45 and is given rotary motion by belt wheel 46 on hollow shaft 47. This shaft also carries gear wheel 48 meshing with pinion 49 on a short shaft 50 which imparts rotary motion through gears 51 and 52 to a stub shaft 53 extending through the hollow shaft and journaled therein on roller bearings 54. This stub shaft carries a sprocket and chain drive 55 actuating the rollers which carry the presser belt and at its outer end it carries a pulley 56 driving a shaft 57 through belt 58. This latter shaft extends through the base of the machine and its other end drives, through belt 59 and suitable pulleys, the shaft 60. This shaft carries a worm feed 61 feeding material into the apparatus from hopper 62. The rotary casing is provided with a liquid outlet 63 near its periphery and discharging into liquid-collecting housing 64.

Fig. 4 shows the first two rollers and the belt of Fig. 1 on a larger and clearer scale. As there shown, the slat belt carries two facing layers of textile material, one the filter cloth belt or layer (16) already described and the other a layer of stronger cloth 65 serving to support it.

Fig. 5 shows a belt carrying cross-slats (15) of rectangular shape which, in the flat position of the belt as shown, form a rectangular chamber between each pair of slats which in the concaved position of the belt, as shown in Fig. 6, assumes the shape of an inverted V. Between the ends of the slats is placed a rubber dam or spacing piece 66 which serves to prevent sidewise displacement of the material to be pressed. In the pressing operation, this rubber yields as far as may be necessary. The belts carrying these slats may be of flexible belting material or may be, as shown in Figs. 5 and 6, composed of pieces 69, 70 and 71 hinged at 68. The layer or layers of filter-cloth on the belt are preferably wide enough to lap over the ends of the slats and spacing pieces, as shown in Fig. 8. The outer layer of cloth, where two are used, should be of such

length as compared with the presser belt proper as to sag within the depressions or cavities in the face of the presser belt when such belt is in a flat position (see Figs. 5 and 7) or a concave position (see Figs. 6, 9 and 10) while flattening out when the belt is given a convex bend (see Fig. 11). With a filter cloth of the proper length as compared with the main belt, such cloth may be forced into the depressions to form material receiving bags as by the toothed member (18) of Fig. 1 and flattened out again to permit easy cleaning as by the doctor (21) of the same figure.

The operation of the described apparatus is apparent from the foregoing. In using the apparatus of Fig. 1, the belt is cleaned in the washing tank 25 and passed under 18 which bags the filter cloth into its face cavities or depressions. These are filled with material to be pressed in passing under 17, any extra material being held back by 19. In passing over roller 1 and roller 2, the belt is held in a flattened position and the spaces between the slats open up for the reception of material. In now passing under roller 3 with a concave bend, the spaces between the slats close up, such slats exerting a lateral pressure on the material therebetween. Expressed oil, water or other liquid passes through the filter cloth and drips into pan 23. Passing now over roller 4, the spaces open up again and the movement of the shortening filter cloth (which is now on the long side of the belt) allows the cake to change its position more or less and expose new faces for a subsequent pressing. The cake in each depression also expands more or less, becoming porous as the pressure is relieved. At this time, if desired, water, oil or steam may be sprayed down upon the porous material. In concaving under 5, convexing over 6 and again concaving under 7, these operations are repeated. As many successive pressings may be resorted to as are deemed advisable. In the apparatus shown, 3 pressings are employed. In now passing over 8, which is a roller of small diameter, the convexing is, or may be, sufficient to straighten out the filter cloth 16 (see Fig. 11) so that the cake may be scraped off by 21. Any material clinging to the belt beyond the scraper 21 drops off in wash tank 25 as the belt passes under 9.

The shape assumed by the pressure cavity with various configurations of slats or cross-members is shown in Figs. 5, 6, 9, 10 and 11. With rectangular cross-members, the pressure space in the flat position of the belt is rectangular also while when the belt is concaved, the cavity assumes the shape of an inverted V, the mouth closing. This is convenient with some sticky solids which have a tendency to cling to the roller since the closure prevents direct contact with the

press cake during the period of heavy pressure while the angular shape of the cake causes it to key in the cavity. With less sticky solids the generally triangular section of Figs. 8, 9, 10 and 11 is convenient since it enables the exertion of a substantially direct pressure on all portions of the cake as shown in Fig. 10 in a right line laterally. It also permits a better flattening out of the filter cloth on a convex bend with a bend of smaller radius. The presser belt may be as shown in Fig. 12, a simple belt of heavy belting material provided with perforations 67.

In the operation of the structure of Figs. 2 and 3, the pressure between the faces of cavities in the belt is, as in Fig. 1, that resulting from a concave bend of the presser face. With the structure shown however the filter cloth need not have special means for forcing it into the cavities, since centrifugal force impels it inward in pressing position and removes it in discharging position. Casing 35 of Figs. 2 and 3 and the included elements being in rapid rotation imparted by drive wheel 46 and the belt and rollers being given an independent motion, either slower or faster, by stub shaft 53, material fed in through 41 and centrifugally discharged against the inner face of the belt and between the spaces or cross bars of the presser belt 26. Against the belt it clings and is positioned by centrifugal force. The charged belt is concaved around roller 28, lateral pressure being exerted by the walls of the cavities on the belt face. Passing around roller 29 on a convex bend, the cavities are opened up again and the material permitted to expand while in passing around 30 another pressing is given. So far, the presser face has been inwardly located, facing the axis and material has therefore clung thereto without tendency to leave the belt for the rollers. The belt now passes over 31, the spaces being again opened up, until the presser face assumes an outward position facing orifice 36 through which the material is centrifugally expelled against the inner face of the housing 38, whence it is carried forward to 40 by the action of 39 which acts both as a scraper and a fan producing a current of air. The belt passes onward from 31 around the idler rollers 32, 33, 34 and 27 until its presser face once more assumes operative position. One of the presser rolls, as 30 (see Fig. 3) is mounted for radial movement or adjustment so that the belt may be maintained as tense as desired. The pressure between the faces of the belt and the rolls, however, does not directly produce the expressive pressure, the rolls acting more as closures of the pressure cavities during expression.

Liquid expressed from the material finds its way through the belt and is centrifugally

thrown against the inner face of casing 35, which is chiefly useful as a liquid collector in this embodiment of my invention. On this inner face it accumulates as a thin clinging film, being prevented from joining the solids by dam 37 and being constantly withdrawn by orifice 63.

What I claim is:—

1. The process of expressing liquids which comprises placing portions of material to be pressed between the walls of depressions in a flexible member and concaving such member to exert lateral pressure on such portions.

2. The process of expressing liquids which comprises placing portions of material to be pressed between the walls of depressions in a flexible member, concaving such member to exert lateral pressure on such portions and convexing such member to permit expansion and removal of the pressed material.

3. The process of expressing liquids which comprises placing portions of material to be pressed between the walls of depressions in a flexible member, and alternately concaving and convexing such flexible member a plurality of times to produce a plurality of compressing actions upon such portions and to permit intermediate expansion of such portions.

4. The process of expressing liquids which comprises placing portions of material to be pressed between the walls of depressions in a flexible member while said member is in a non-concaved position, concaving said member to produce lateral pressure on said portions and convexing said member to permit removal of said portions.

5. The process of expressing liquids which comprises giving a flexible member carrying depressions on an inner face a rapid rotation about an included axis, placing material to be pressed in said depressions and concaving said member to produce pressure between the walls of said depressions and upon the material therebetween.

6. The process of expressing liquids which comprises giving a flexible belt-like member carrying depressions on an inner face a rapid rotation about an included axis and also an independent traveling motion, feeding material to be pressed to the depressions and concaving said member during such traveling motion to produce pressure between the walls of such depressions and upon the material in such depressions.

7. The process of expressing liquids which comprises giving a flexible member carrying depressions on an inner face a sufficiently rapid rotation about an included axis to cause material to cling to such face centrifugally, feeding material to be pressed into such depressions and concaving said flexible member to produce pressure between

the walls of such depression and upon material therein.

8. The process of expressing liquids which comprises giving a flexible belt-like member having depressions on an inner face a rapid rotation about an included axis and also an independent traveling motion, feeding material to be expressed into such depressions on the inner face, giving the member a concave bend to produce pressure between the walls of the depressions and upon material therein and removing the expressed material from said depressions.

9. The process of expressing liquids which comprises giving a doubly-looped flexible belt-like member having depressions on one face a rapid rotation about an included axis and also an independent traveling motion adapted to bring said depressions alternately on an inward and an outward face, feeding material to be pressed into such depressions while on an inner face, giving said member a concave bend to produce pressure between the walls of the depressions and upon material therein, giving said member a convex bend, giving said member another concave bend and thereafter giving said member another convex bend prior to bringing the depressions to the outward face.

10. The process of expressing liquids which comprises giving a flexible belt-like member provided with transverse bars or slats on one face a rapid rotation about an included axis, and also an independent traveling motion, feeding material to be expressed between said bars, giving said member a concave bend to produce pressure between said bars and upon material therebetween, giving said member a convex bend and thereafter removing the expressed material.

11. The process of extraction which comprises placing a consecutive series of comparatively small press chambers having lateral compression walls adapted for relative movement and a top adapted to receive and deliver material, in revolutionary movement, filling each such chamber while in a position in the revolution adapting it to retain material, producing a lateral compression on each such chamber after filling, such pressure being effective over the entire surface of the compression walls, and during the movement and thereafter removing the expressed material when such chamber reaches a position in the revolution where it will not retain material.

12. The process of extraction which comprises placing a consecutive series of comparatively small press chambers having lateral walls adapted for relative movement and a normally open top adapted to receive and deliver material, in revolutionary movement, filling each such chamber while in a position in the revolution adapting it to

retain material, producing a series of alternating lateral pressures and releases of pressure and thereafter removing the expressed material when such chamber reaches a position in the revolution where it will not retain material.

13. The process of extraction which comprises placing a consecutive series of comparatively small normally open press chambers having compression walls in a belt-like holding member in revolutionary motion, each such chamber being adapted for lateral compressive pressure effective over the entire surface of the compression walls, filling each successive chamber of the series as it passes under a filling device, exerting a lateral compression on each filled chamber as it passes beyond the filling device and thereafter removing the contents of each such chamber, all in continuous operation.

14. The process of extraction which comprises placing a consecutive series of comparatively small press chambers having compression walls in a belt-like holding member in revolutionary motion, each such chamber being adapted for lateral compressive pressure effective over the entire surface of its compression walls, filling each successive chamber of the series as it passes under a filling device, exerting a plurality of successive and alternating lateral compressions and releases of pressure as it passes beyond the filling device and thereafter removing the contents of each such chamber, all in continuous operation.

15. In a press, the combination of a flexible member provided with vertical walled depressions on one face, means for feeding material to be pressed to such face and means for concaving said face to produce lateral pressure between the walls of such depressions.

16. In a press, the combination of a flexible member provided with vertical walled depressions on one face, the walls being adapted to act as presser faces, means for feeding material to be pressed to such face, means for concaving said face to produce lateral pressure between said walls, and means for convexing said face.

17. In a press, the combination of a flexible member provided with vertical walled depressions on one face, the walls being adapted to act as presser faces, means for feeding material to be pressed to such face and means for alternately curving said face in each direction a plurality of times.

18. In a press, the combination of a flexible belt provided with spaced projecting members, means for feeding material to be pressed therebetween and means for giving the belt a concave curve or bend to approximate said members and produce pressure therebetween.

19. In a press, the combination of a flexi-

ble belt provided with projecting transverse members spaced apart, means for feeding material to be pressed therebetween, and means for giving the belt a concave curve or bend to approximate said members and produce pressure therebetween.

20. In a press, the combination of a flexible belt provided with spaced transverse cross-bars on one face, means for feeding material to be pressed therebetween, and means for giving the belt a concave curve or bend to approximate said bars and produce pressure therebetween.

21. In a press, the combination of a flexible belt having depressions therein, a textile material belt on one face of the flexible belt, means for feeding material on this face, means for concaving the belt to produce pressure between the lateral walls of said depressions and means for convexing the belt to release said pressure.

22. In a press, the combination of a flexible belt having depressions therein, a textile material belt on the face of the belt carrying the depressions, means for causing the textile material to enter said depressions, means for feeding material to be pressed upon the textile material in such depressions, means for concaving the flexible belt to produce lateral pressure upon such material and means for convexing the belt.

23. In a press, the combination of a flexible belt having depressions therein, a textile material belt on the face of the belt carrying the depressions, means for causing the textile material to enter said depressions, means for feeding material to be pressed upon the textile material in said depressions, means for concaving the flexible belt to produce lateral pressure upon such material, means for convexing the belt and means for removing pressed material from the belt in such convexed position.

24. In a press, the combination of a flexible belt carrying spaced vertical walled members, a cloth of textile material upon such members, means for causing the textile material to enter the spaces between such members, means for feeding the material to be pressed upon the textile material in such spaces, and means for concaving the belt to produce lateral pressure upon such material.

25. In a press, the combination of a flexible belt carrying spaced transverse cross-bars, a cloth of textile material upon the cross-bars, means for causing the textile material to enter the spaces therebetween, means for feeding material to the spaces, and means for concaving the flexible belt to produce pressure between the cross-bars.

26. In a press, the combination of a flexible belt provided with vertical walled depressions on one face, a plurality of rollers around which such belt is looped to give such face alternating concave and convex

bends, means for feeding material to be pressed upon such belt prior to a concave bend and means for removing expressed material from such belt during a convex bend.

27. In a press, the combination of a flexible belt provided with spaced vertical walled projecting members on one face thereof, a plurality of rollers around which such belt is looped to give such face alternating concave and convex bends, means for feeding material to be pressed upon such belt prior to a concave bend and means for removing expressed material from such belt during a convex bend.

28. In a press, the combination of a flexible belt provided with spaced vertical walled projecting members on one face thereof, a filter cloth upon such face, a plurality of rollers around which such belt is looped to give such face alternating concave and convex bends, means for feeding material to be pressed upon such belt prior to a concave bend and means for removing expressed material from such belt during a convex bend.

29. In a pressing apparatus, the combination of a flexible member having depressions on its face, means for feeding material to be expressed to said depressions, means for giving said member a rapid rotation about an included axis and means for giving said member a concave bend during such rotation.

30. In a pressing apparatus, the combination of a flexible belt-like member having depressions on its face, means for feeding material to be expressed to said depressions, means for giving said member a rapid rotation about an included axis and means for giving said member a concave bend during such rotation.

31. In a pressing apparatus, the combination of a flexible endless belt-like member having depressions on an inner face, means for feeding material to be expressed to said depressions, means for giving said member a rapid rotation about an included axis and means for giving said member a concave bend during such rotation.

32. In a pressing apparatus, the combination of a flexible endless belt-like member having depressions on an inner face, means for feeding material to be expressed into such depressions, means for giving said member a rapid rotatory motion about an included axis, means for giving said member successively a concave and a convex bend and means for removing material upon giving such convex bend.

33. In a pressing apparatus, the combination of a flexible endless belt-like member having depressions on an inner face, means for feeding material to be expressed into such depressions, means for giving said

member a rapid rotation about an included axis, means for giving such member a succession of alternating concave and convex bends, and means for removing material upon giving a convex bend.

34. In a pressing apparatus, the combination of a doubly-looped flexible belt-like member having depressions on one face, means for giving said member a rapid rotation about an included axis and also an independent traveling motion adapted to make said face alternately inward and outward, means for feeding material to be expressed into said depressions during the inward position, means for giving the member a concave bend during such inward position and means for giving said member a convex bend.

35. In a pressing apparatus, the combination of a double-looped flexible belt-like member having depressions on one face, means for giving said member a rapid rotation about an included axis and also an independent traveling motion adapted to make said face alternately inward and outward, means for feeding material to be expressed into said depressions during the inward position, means for giving the member a concave bend during such inward position and means for giving said member a plurality of successive concave and convex bends during such inward position.

36. In a pressing apparatus, the combination of a flexible member provided with depressions on one face, means for rotating said member about an included axis with said depressions in an inner position, means for feeding materials to be expressed into said depressions and means for giving such member a concave bend during its rotation.

37. In a pressing apparatus, the combination of a flexible member provided with depressions on one face, means for rotating said member about an included axis with said depressions in an inner position, means for feeding materials to be expressed into said depressions and means for giving such member a concave bend followed by a convex bend during such rotation.

38. In a pressing apparatus, the combination of a flexible member provided with depressions on one face, means for rotating said member about an included axis with said depressions in an inner position, means for feeding materials to be expressed into said depressions and means for giving such member a plurality of successive concave and convex bends during such rotation.

39. In a pressing apparatus, a flexible belt-like member provided with projecting transverse cross-members on one face, means for giving said member a rapid rotation about an included axis with the cross-members in an inner position, means for feeding material to be expressed between such pro-

jecting cross-members and means for giving said member a concave bend during such rotation.

40. In a pressing apparatus, a flexible belt-like member provided with projecting transverse cross-members on one face, means for giving said member a rapid rotation about an included axis with the cross-members in an inner position, means for feeding material to be expressed between such projecting cross-members and means for giving said member a concave bend followed by a convex bend during such rotation.

41. In a pressing apparatus, a flexible belt-like member provided with projecting transverse cross-members on one face, means for giving said member a rapid rotation about an included axis with the cross-members in an inner position, means for feeding material to be expressed between such projecting cross-members and means for giving a plurality of successive and alternating concave and convex bends during such rotation.

42. In a pressing apparatus, a flexible belt-like doubly-looped member provided with projecting transverse cross-members on one face, means for giving said member a rapid rotation about an included axis, means for giving said member an independent traveling motion bringing said face alternately inward and outward, means for feeding material to be expressed between said projecting members during the inward position and means for giving the flexible member a concave bend during such inward position.

43. In a pressing apparatus, a flexible belt-like doubly-looped member provided with projecting transverse cross-members on one face, means for giving said member a rapid rotation about an included axis, means for giving said member an independent traveling motion bringing said face alternately inward and outward, means for feeding material to be expressed between said projecting members during the inward position and means for giving the flexible member a concave bend followed by a convex bend during such inward position.

44. In a pressing apparatus, a flexible belt-like doubly-looped member provided with projecting transverse cross-members on one face, means for giving said member a rapid rotation about an included axis, means for giving said member an independent traveling motion bringing said face alternately inward and outward, means for feeding material to be expressed between said projecting members during the inward position and means for giving the flexible member a plurality of alternating successive concave and convex bends during such inward position.

45. In a pressing apparatus, the combina-

tion of a flexible belt-like member carrying projecting transverse cross-members on one face, means for looping said member about an included axis, means for rotating it about said axis, means for giving it an independent traveling motion, means for feeding material to be expressed between said projecting members and means for giving said member a concave bend followed by a convex bend during its travel.

46. In a pressing apparatus, the combination of a flexible belt-like member carrying projecting transverse cross-members on one face, means for giving said member a rapid rotation about an included axis, a series of rotary members over which said member is looped, certain of said rotary members being adapted to give said belt-like member a concave bend and others to give it a convex bend, means for giving said rotary members an independent motion, means for feeding material to be expressed between said projecting members prior to a concave bend and means for removing expressed material upon a convex bend.

47. In a pressing apparatus, a doubly-looped flexible belt-like member carrying projecting transverse cross-members on one face, means for giving said flexible member a rapid rotation about an included axis, a series of rotary members over which said flexible member is so looped as to present said face in an outward and in an inward position, means for giving said flexible member an independent traveling motion around said rotary members, certain of said rotary members being adapted to give said face a concave bend and certain others to give it a convex bend, means for feeding material between the projecting members in the inward position prior to a concave bend and means for removing material upon a convex bend in turning the flexible member to an outward position.

48. In a pressing apparatus, the combination of a doubly-looped belt-like member carrying projecting transverse cross-members on one face, a series of roller-like members around which such belt-like member is looped in such manner as to give a succession of concave and convex bends thereto and to bring such face alternately inward and outward, means for giving the assemblage a rapid rotation about an included axis, means for giving the belt-like member an independent traveling motion about said roller-like members, means for feeding material to be expressed between said projections in an inward position prior to a concave bend and means for removing expressed material after such concave bend.

49. In a pressing apparatus, a rotary casing having a perforated wall, a flexible belt-like presser member within said casing and carrying a plurality of projecting

transverse cross-members on one face, a plurality of roller-like members within said casing carrying and supporting said belt-like member, certain of said roller-like members being adapted to give said belt-like member a concave bend and certain others a convex bend, means for rotating said casing and presser member about an included axis, means for giving said belt-like member an independent motion around said roller-like members and means for feeding material to be expressed between said projecting members prior to a concave bend.

50. In a pressing device, the combination of an endless belt-like member adapted to travel in a closed circuit or path, said member being provided with a plurality of relatively small normally open press chambers having compression walls adapted to produce lateral compression on the contents thereof, means for filling such chambers at one point in the course of the travel of said member, means for producing substantially uniform lateral pressure on the contents of each such chamber as it passes beyond the filling means, and means for removing the

contents of the chambers after passing the compressing means, all in continuous operation.

51. In a pressing device, the combination of an endless belt-like member adapted to travel in a closed circuit or path, said member being provided with a plurality of relatively small press chambers having walls adapted to produce lateral compression on the contents thereof, means for filling such chambers at one point in the course of the travel of said member, means for producing a succession of alternating lateral pressures and releases of pressure upon the contents of each such chamber as passes beyond the filling means, and means for removing the contents of the chambers after passing the compressing means, all in continuous operation.

In testimony whereof, I affix my signature in the presence of witnesses.

JOHN J. BERRIGAN.

Witnesses:

JOHN S. PAUL,
GEORGE D. TALEMAN.