No. 719,115. PATENTED JAN. 27, 1903.

E. HUBBARD.

MACHINE FOR MAKING FIBER VESSELS.

APPLICATION FILED AUG. 25, 1900. RENEWED DEC. 9, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

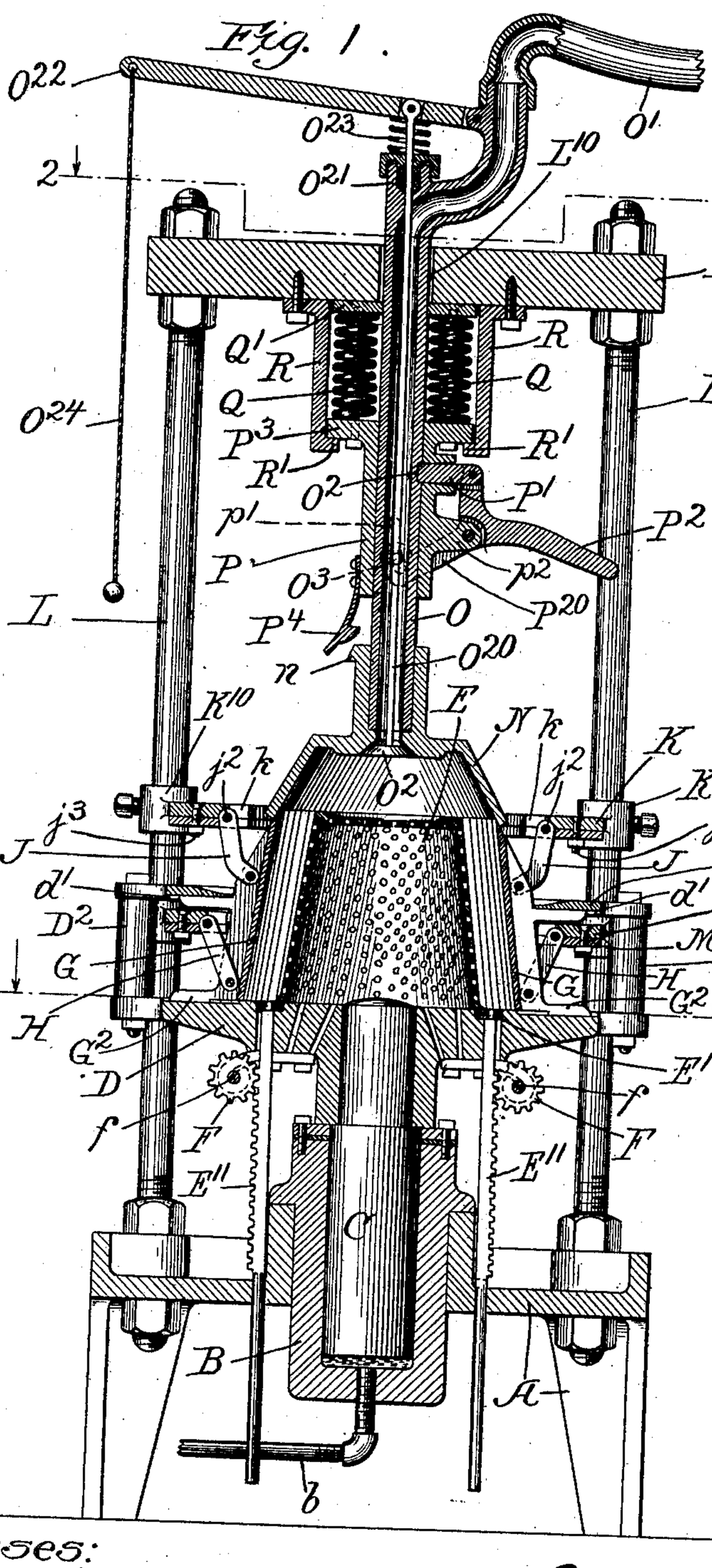
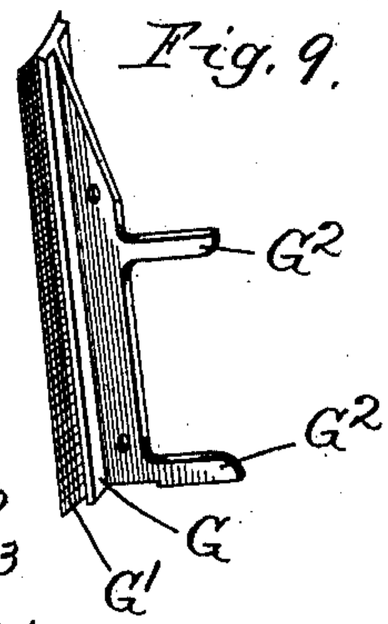


Fig. 9.



Witnesses:
Edward T. Wray.
Harry E. White.

Inventor
Elbert Hubbard
by Burton Burton
Pr attys

No. 719,115. PATENTED JAN. 27, 1903.

E. HUBBARD.

MACHINE FOR MAKING FIBER VESSELS.

APPLICATION FILED AUG. 25, 1900. RENEWED DEC. 9, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

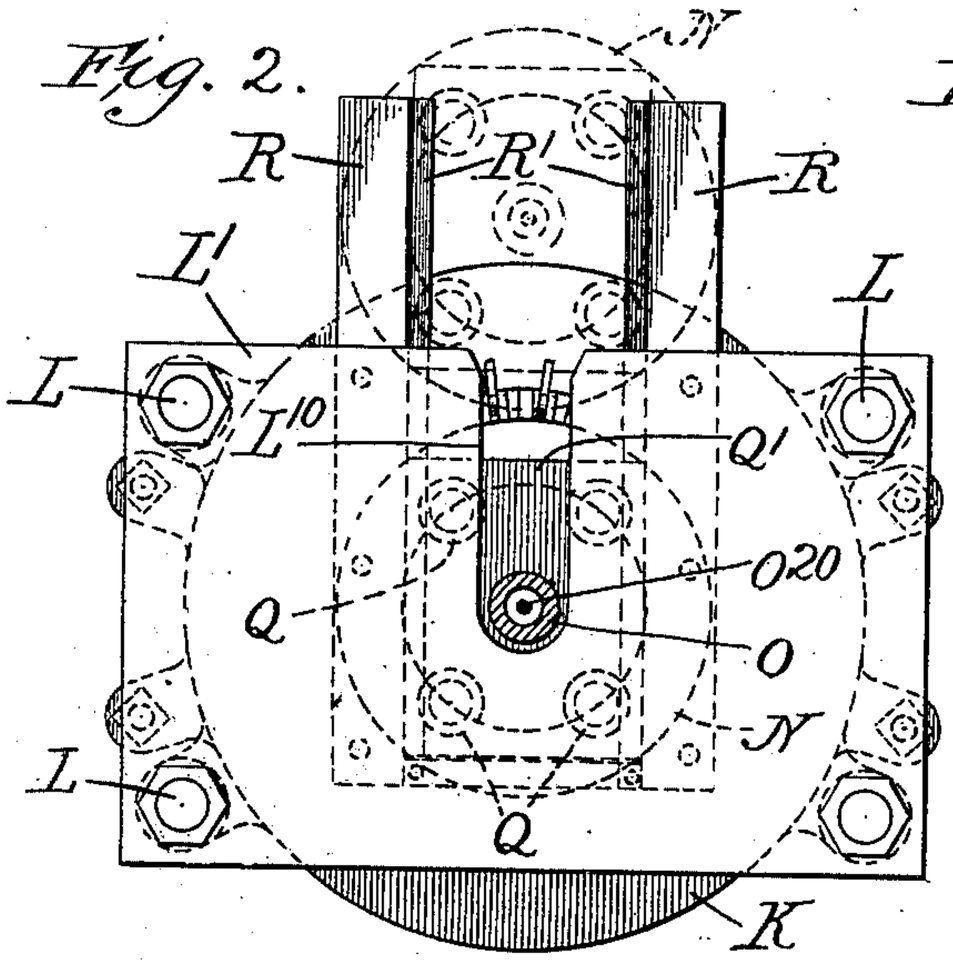


Fig. 10.

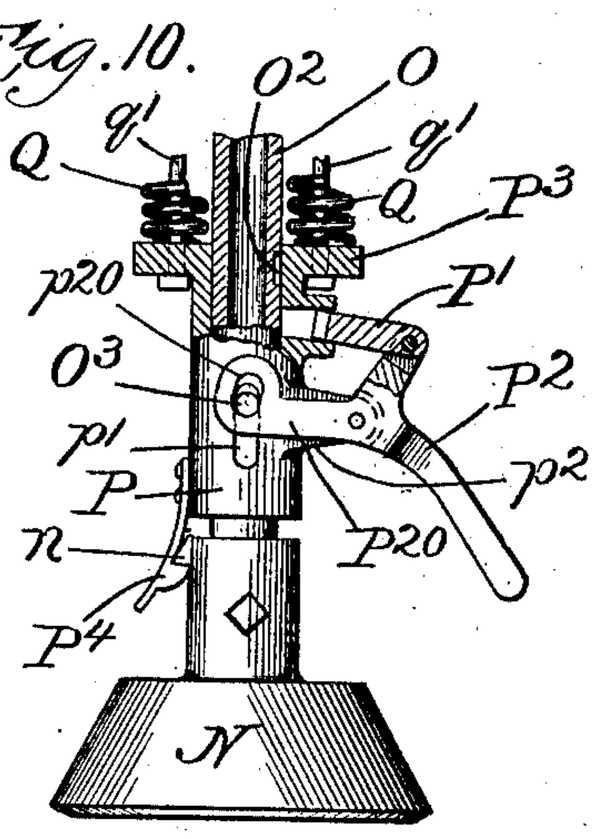


Fig. 3.

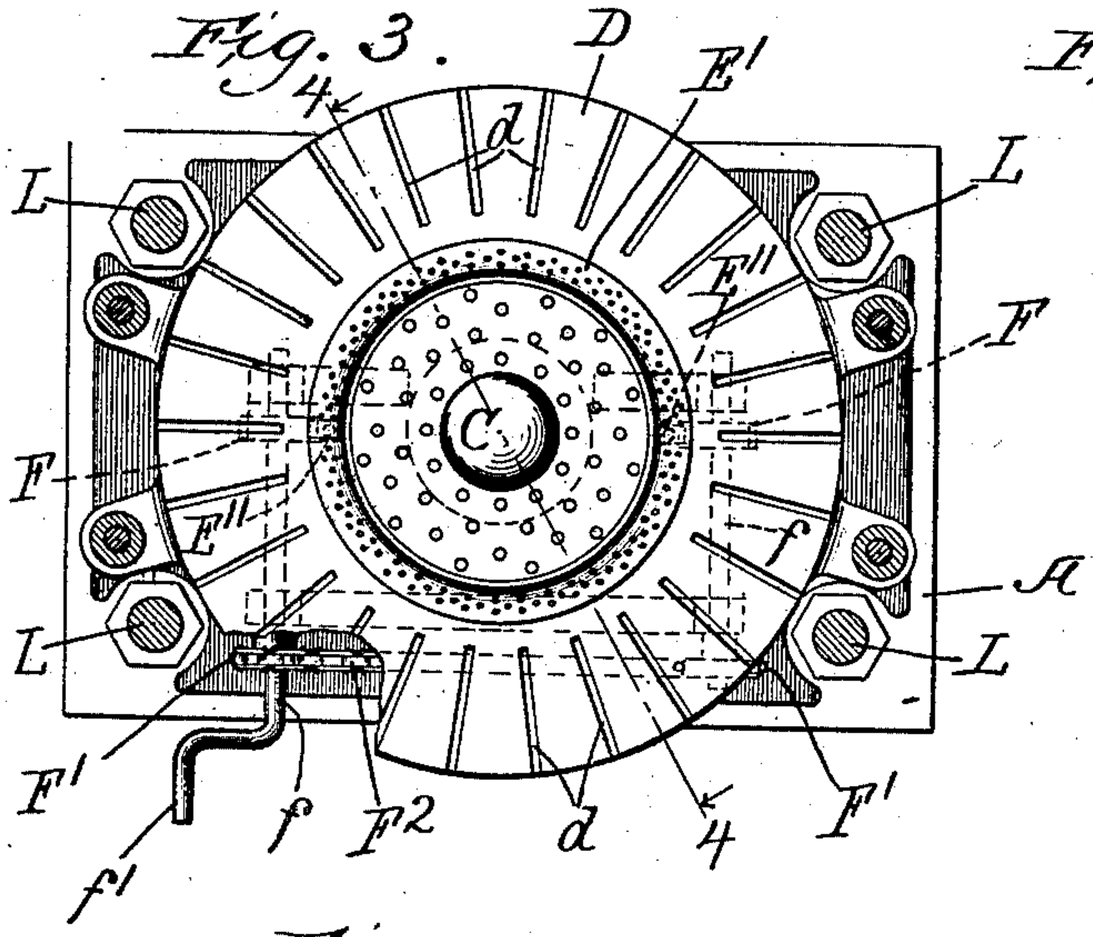


Fig. 5.

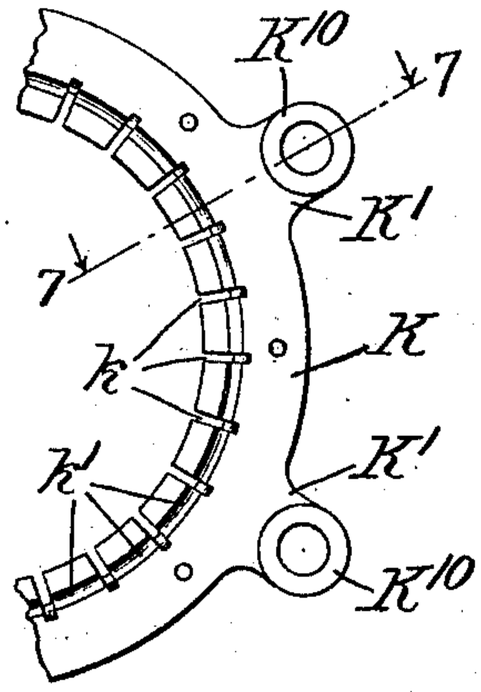


Fig. 4.

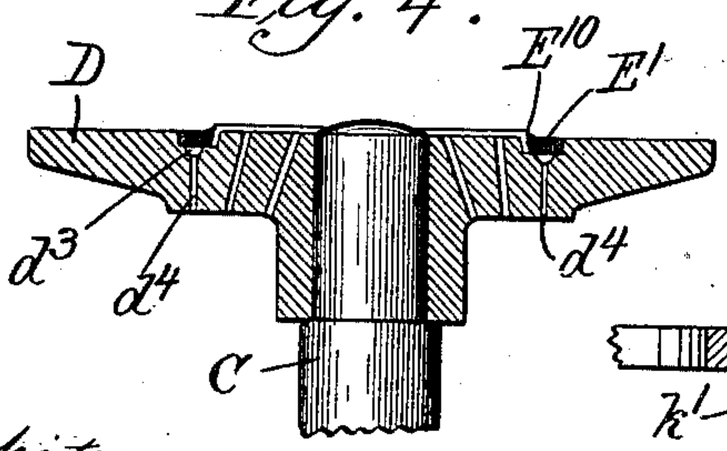


Fig. 7.

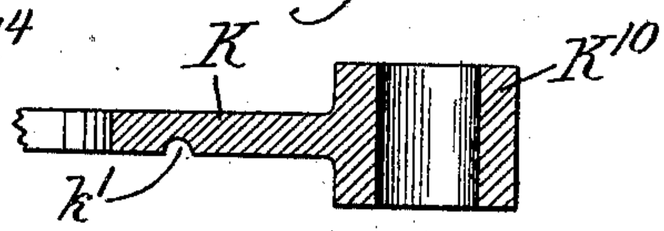
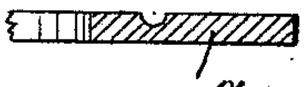
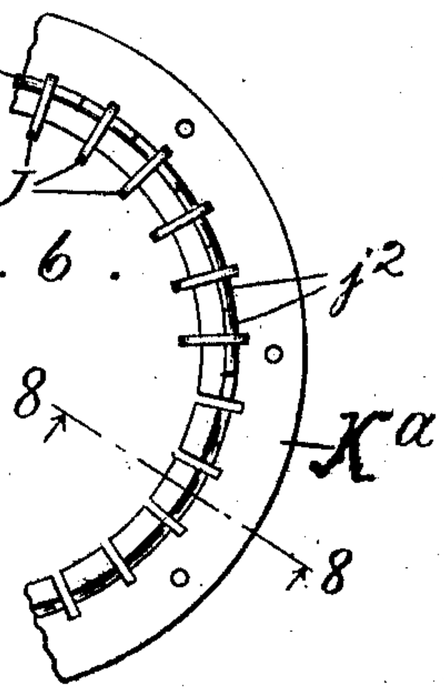


Fig. 8.



Fa

Fig. 6.



Witnesses:
Edward T. Wray
Harry E. Whitelite.

Inventor:
Eber Hubbard
by Burton Burton
his attys.

UNITED STATES PATENT OFFICE.

EBER HUBBARD, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE AMERICAN THREAD COMPANY, A CORPORATION OF NEW JERSEY.

MACHINE FOR MAKING FIBER VESSELS.

SPECIFICATION forming part of Letters Patent No. 719,115, dated January 27, 1903.

Application filed August 25, 1900. Renewed December 9, 1902. Serial No. 134,575. (No model.)

To all whom it may concern:

Be it known that I, EBER HUBBARD, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Machines for Making Fiber Vessels, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings, Figure 1 is an axial section of my improved machine for making vessels from fibrous pulp. Fig. 2 is a section at the line 2 2 on Fig. 1. Fig. 3 is a section at the line 3 3 on Fig. 1. Fig. 4 is a section at the line 4 4 on Fig. 3. Figs. 5 and 6 are respectively direct and inverted plans of two parts which are adapted to be clamped together to form the fulcrum-support of the levers or links which control the movement of the staves of the jacket. Figs. 7 and 8 are transverse sections at the lines 7 7 and 8 8, respectively, on Figs. 5 and 6, respectively. Fig. 9 is a perspective of one of the staves. Fig. 10 is a detail elevation, partly sectional in axial plane, of the upper cap and devices for lifting and detaining it.

My improved machine is substantially a press which comprises a reducible mold for forming the vessel, the pulp being adapted to be fed in at the top and the walls being perforated to permit the water to be drained away and the pulp to solidify, while the mold is condensed or reduced in exterior dimensions in order to compress to proper density the fibrous substance which remains after the water is drained or forced out.

A is a base or standard which supports the remainder of the structure.

B is the cylinder of a hydraulic ram, which is mounted at the center of the base A and supplied with water through the pipe *d*.

C is the ram. At its upper end it carries a table D, rigidly secured to the ram. At the center of the table and concentric therewith there is supported the inner form of a mold, which is a perforated shell E, conformed to the inner cavity of the vessel to be produced. The lower end of the form E is lodged in a circular groove in the table, fitting accurately about the inner wall of the groove, the remainder of the groove being occupied by an annular fillet E′, which fits snugly about the lower margin of the form E and at its inner margin has an upwardly-extended feather-edged lip E^{10}, which is outwardly concave. The purpose of this fillet is to give the desired inwardly-convex form to the upper edge of the vessel. The fillet is perforated, as seen in Fig. 4, so that the water may be drained through it from the edge, so that said edge portion may have a thoroughly compact and uniform texture. The bottom of the groove in which the fillet is lodged has a drainage-channel d^3, extending all around under the fillet, from which drainage-ports d^4 lead through the table to conduct away freely the water which passes through the perforations of the fillet. The fillet E′ is provided with downwardly-extending rack-arms E^{11} E^{11}, which are guided in the table, which they penetrate, and below the table they are engaged by gear-pinions F F on shafts *f f*, which have also sprocket-pinions F′ F′, around which the chain F^2 travels, so that, one of the shafts *f* being rotated by a crank-handle *f′*, with which it is provided, the gears F F, engaging the rack-arms, serve to raise and lower the fillet E′, and by this means the vessel when molded is lifted off the inner form and carried to any height necessary in order to conveniently remove it from the mold. The outer wall of the mold, termed a "jacket," is made of staves G G, &c., having overlapping thin lips G′ G′ and a guide, which being cut away in the middle portion of its length leaves guide-stems G^2 G^2, which are guided in the radial grooves *d d′*, formed, respectively, in the upper surface of the table D and in the lower surface of a ring or annular plate D′, which is rigid with the table at a distance above the latter and overhangs the outer portion thereof, said ring D′ being rigidly connected to the table by the posts D^2 D^2 D^2 D^2. The grooves *d* and *d′* in the table D and plate D′, respectively, are radial with respect to the form, so that the staves are adapted to move in radially toward the center. To control their movement and cause them all to travel equally, and so at all positions to constitute a closed circular form or

jacket, I provide the lever-links H H H and J J J, the former pivotally connected to the ribs G^2 of the staves, respectively, near the lower end and the latter to said ribs near their upper end, the links H being also pivotally connected to a ring, which I term the "fulcrum-ring," K. This ring has lugs K′ K′ K′ K′, which end in vertically-perforated bosses K^{10} K^{10}, &c., which are penetrated by the strain-rods L L L L of the press and are secured rigidly to the latter, so that the ring is held in fixed horizontal position substantially at the level of the upper end of the inner form E. As a convenient means of pivotally attaching the links J J, &c., to this fulcrum-ring I construct the ring with radial notches *k k* in its inner periphery corresponding to the periphery of the several staves, and from notch to notch on the under face of the plate I form half-round grooves *k′ k′*, &c., and through each of the links at the end which is pivoted to the ring I insert a short stud j^2, projecting at both sides and adapted to lodge in the groove *k′*, and to secure them in such position I provide the ring K^a, similarly notched and grooved and adapted to be applied up against the under side of the ring K, with its notches and grooves facing and meshing those of the latter ring, and the two rings being then suitably brought together by bolts or screws, as seen at j^3, the links are all held securely at their pivotal connections to the ring. For the fulcrum connection of the rings H H, &c., I provide a similar fulcrum-ring M, similarly secured to the strain-rods L and similarly notched and grooved and provided with a similar clasp-plate M^a to retain the links H, which are provided with fulcrum-pins similar to the links J. Figs. 5, 6, 7, and 8, which are designed as details of the structure above described of the rings K and K^a and lettered accordingly, represent accurately also the structure of the rings M and M^a, which are not otherwise illustrated. The links H and J are of such length that when the jacket formed by the staves G G G is most expanded, as seen in Fig. 1, the links hang from their fulcrums at the rings K and M at an angle of about thirty degrees from vertical, the lower ends, which are pivotally connected to the staves, respectively, being inward from the vertical line of their upper fixed fulcrums. From this construction it results that when the table D is thus upheld by the action of the hydraulic ram the staves, being compelled to travel upward with it and being guided radially with respect to the table by their ribs engaging the table and the upper guide-plate D′, are forced to travel inward as the lower ends of the links swing upward about their fixed fulcrums on the rings H and M. The parts are so proportioned that by the time the links are substantially horizontal the jacket has been reduced in diameter, so that between it and the inner form E there remains space equal only to the thickness of the vessel which is to be molded and compressed in the mold. In order quickly to close up the mold, and thus insure the compression which would not result if it were open at the top, so that the pulp could be forced out by the lateral compression, I provide a cap N, which is an inverted hollow-cone frustum, the bottom being conformed to the shape of the outer surface of the bottom of the vessel to be produced. The taper of the side walls of this cap N may be at any angle, according to the degree of compression which it is found necessary to give the bottom of the vessel in order that its density may be equal to that of the sides when it has been reduced to the desired thickness. Whatever be this angle the ribs of the staves at their upper end are preferably cut away at the same angle, or at least so that the angle between the inclined inner face of the stave and the outer edge of the rib at the upper end is not greater than the angle between the axis of the cap and the sloping sides. The cap N is secured at the end of a tubular stem O, through which the pulp is supplied from any suitable source by means of the flexible hose connection shown at O′. O^2 is a valve which controls the ends of the pulp at the entrance of the pipe into the cap. This valve has a stem O^{20} extending up through the pipe and out through a stuffing-box O^{21}, above which it is connected to a lever O^{22}, between which and the stuffing-box a spring O^{23} is located, reacting with a tendency to seat the valve, which may be unseated to admit the pulp by means of the pull-cord O^{24} at the outer end of the lever. This stem O extends through a sleeve P, to which it is adapted to be latched by means of the dog P′. To secure it at the lowest position relatively to the sleeve, the dog P′ is connected to a lever P^2, fulcrumed on a lug p^2, which projects from the sleeve. Said lever has fork-arms P^{20} extending on opposite sides of the sleeve and engaging the ears O^3 O^3, which project from the sleeve O through slots *p′* in the sleeve. The operator, depressing the end of the lever P^2, withdraws the dog P′ from a groove O^2 in the outer surface *f* of the tubular stem O, the movement necessary for such withdrawal being permitted by the elongation (seen in Fig. 10) of the apertures p^{20} in the lever-arms P^{20}, which engage the lugs *p′* of the stem O. Further depression of the lever P^2 causes the arms P^{20} to lift the stem by the lugs *p′*, and thereby withdraw the cap N away from the form, and thus open the mold at the top. The lower end of the sleeve carries a spring P^4, and the upper end of the hub of the cap N has a tooth *n*, adapted to be engaged by the catch P^4 to retain it in the upper position to which it is lifted. This operation is performed when the vessel is molded and is to be removed. When, however, the mold is closed by the lodgment of the cap N about the upper ends of the staves of the jacket, the sleeve P is latched to the stem O by the dog P′, and the elevation of the table D, carrying up the

staves, causes the cap end to be forced up to an extent less than the upward movement of the table, which depends upon the angle at which the links H and J are hung and the angle of the slope of the sides of the cap N. It will be seen that if the inward movement of the staves, due to the swing of the links H and J for a given upward movement of the table, should be equal to the spread of the cap N, corresponding to the length in the direction of its axis equal to such upward movement, the cap would not be moved at all, but it is lodged upon the upper end of the staves, closing the mold, the staves moving upward into the cap at a speed so related to their movement inward as to keep them following the slope of the cap without moving the latter. Inasmuch, however, as the inward movement of the staves due to the swing of the links is greatest at the start, when the links are most nearly vertical, and steadily diminished toward the stem O as the links approach horizontal position, it will be seen that in order that the cap may remain constantly in contact with the upper end of the staves, as is necessary in order to keep the mold closed, it must be held down onto the upper end of the staves yieldingly, so that while the staves are moving inward rapidly the cap may be, if necessary, forced downward, and when the links become nearly horizontal, so that the staves are moved inward very slowly, the cap may, if necessary, yield upward, being still held close onto the upper ends of the staves. For this purpose I provide a yielding resistance to the upward movement of the stem, such resistance being made to operate primarily upon the sleeve P, and thus to operate upon the stem so long as it is latched to the sleeve. The sleeve has a flange P^3 at the upper end which constitutes a platform for a group of springs Q Q, &c., and on the upper ends of these springs I lodge an annular washer Q′, which is tied to the flange P^3 by bolts q' q', extending through the springs, respectively, forming, as it were, a spring-cushion, which bears upon the upper end against the under side of the head-plate L′ of the press. The sleeve P is suspended, by means of the flange P^3, in a hanger or group of hangers R R R, secured to the head-plate L′ and having at the lower end lips or lugs R′ R′, on which the flange P^3 rests when the sleeve is at the lowest position. The resistance afforded by the springs Q Q, &c., is calculated to be greater than the resistance of the pulp which forms the bottom of the pail to compression after it has been compressed to the necessary density—that is, the springs are strong enough so that the sleeve will not yield to permit the stem O, latched to the sleeve, to move upward under any pressure which is transmitted to the pulp alone up to the maximum desired density of the pulp—and in practice I make the springs sufficiently strong to resist very much greater pressure than the pulp at maximum density is adapted to transmit, so that the cap at all times is held down with considerable pressure onto the upper ends of the staves, thus making at all times a sufficiently-tight joint with the staves to keep the mold substantially tight. In practice I find that when the pulp is admitted to the mold at the top thereof the drainage which occurs at the bottom part of the mold into which the pulp immediately flows leaves the pulp more dense at that part of the mold, the density diminishing from that point upward, because the drainage is diminished as the apertures at the lower part become stopped by the fibers of the pulp and also because the bottom portion has more time for drainage, and particularly I find that the pulp last discharged into the mold and which forms the bottom of the vessel is liable to be considerably less dense as the result of drainage before pressure is applied than the portion which forms the lateral walls, and that if the bottom of the vessel is to have the same thickness as the sides and also the same density greater depth must be allowed for the bottom than for the sides before compression is commenced. In Fig. 1 I have shown a difference in the depth of the pulp, the bottom space being greater than the lateral space, and the angle of slope of the side walls of the cap-bottom N, it will be observed, necessarily corresponds to the difference in depth of the two portions, so that when the mold is fully closed up the cap has moved in toward the bottom of the inner form, the bottom being thus compressed a greater distance, but compressed only to the same thickness as the sides, and if the allowance in this respect has been correctly made in the construction of the apparatus the bottom and side walls will have substantially equal density. A little experience in handling the pulp and observing the rate of drainage will enable the operator to produce vessels in which the bottom and side walls shall have substantially equal density; but in order to insure this result with varying pulp and under varying conditions I make the side walls of the cap a little more steep than absolutely necessary, so that the excess of depth of mold at the bottom over the sides and the excess of range of reduction at the bottom is a little greater than necessary, so that the operator may after one or two experiments with any particular quality of pulp ascertain how nearly to fill the mold in order to have the proper quantity of pulp at the bottom of the vessel in order to produce the proper density when the mold is fully closed up, so that the bottom has the same thickness as the sides.

The hangers R R are extended horizontally, as seen in Fig. 2, and their flanges R′ R′ constitute tracks on which the flange P^3 of the sleeve P may ride, and the cap-plate L′ is notched, as seen at L^{10}, to afford an open path for the tubular stem O when the sleeve and stem are moved laterally, the flange P^3 riding on these tracks. This structure is adopt-

ed in order to permit the operator after he has completed the compression of the vessel in the mold and lifted the cap N to latched position, as seen in Fig. 10, when it is entirely clear of the remainder of the mold, to slide the entire structure supported on the hangers R R laterally out from over the mold, so that the vessel being lifted off from the inner form by means of the fillet E′, as described, may encounter no obstruction, but may be removed freely by the operator. I design the lever P^2 to be sufficiently strong and strongly mounted on the sleeve to serve as a handle by which such lateral movement may be effected.

I claim—

1. In a machine for making vessels from fibrous pulp, a mold comprising a table, an inner form and an outer reducible jacket on the table, such jacket consisting of staves, and a head for the mold consisting of a cap having inner inclined walls bearing on the ends of the staves of the reducible jacket, combined with means for advancing the table, means for forcing the staves of the jacket inward radially as the table is advanced, and means for holding the cap with its inclined walls bearing yieldingly on the ends of the staves to close the mold; the angle of slope of said walls of the cap being so related to the devices for forcing the jacket-staves inward as to afford greater depth or pulp-space at the bottom-forming portion than at the side-forming portion of the mold.

2. In a machine for making vessels from fibrous pulp, a mold, comprising a table, an inner form and an outer reducible jacket on the table, such jacket consisting of staves, and a head, consisting of a cap having inner inclined walls bearing on the ends of the staves of the jacket; means for advancing the table, together with the form and jacket; links connected to the staves of the jacket and swinging radially to cause the staves to be forced radially inward as they are advanced with the table, the angle of slope of the inclined walls of the cap bearing on the ends of the staves being related to the angle through which the links swing in closing up the mold, so as to afford greater depth or pulp-space at the bottom-forming portion than at the side-forming portion of the mold.

3. In a machine for producing vessels from fibrous pulp, a mold, comprising a table, an inner form and an outer reducible jacket on the table, and a suitable head to close the upper end of the mold-space, the table being provided with drainage-perforations immediately outside the base of the inner form.

4. In a machine for producing vessels from fibrous pulp, a mold comprising a table, an inner form and an outer reducible jacket on the table, a head to close the upper end of the mold-space, a fillet E′ lodged in the table about the base of the inner form and perforated to permit drainage through it, the table having also drainage-passages leading from the other side of the fillet to carry off the water which passes through the latter.

5. In a machine for making vessels from fibrous pulp, in combination with a fixed frame a mold, comprising a table adapted to be advanced in the frame, an inner form and an outer reducible jacket on the table, such jacket consisting of staves and a suitable head for closing the upper end of the mold-space; rings, K and M, fixed with respect to the frame, and two sets of links, fulcrumed to said rings respectively, the links being at their inner ends pivotally connected to the staves respectively, one set near the upper and the other set near the lower ends of the staves; the staves having radial guide-pieces, and the table having radial grooves for the lower ends of the guide-pieces, and a ring-plate D′ upheld rigidly by the table and located between the lever and the rings M and K, and having grooves in its lower face for the upper ends of the ribs of the staves.

6. In a machine for making vessels from fibrous pulp, in combination with a fixed frame a table adapted to be advanced therein, an inner form and an outer reducible jacket on the table; means for advancing the table, such jacket consisting of staves and means for moving the staves of the jacket inward radially as the table is advanced; a cap having tapering inner walls adapted to bear upon the upper ends of the staves; a spring which holds the cap yieldingly thereon; the cap having a tubular stem, and a pulp-supply connection at the upper end.

In testimony whereof I have hereunto set my hand, at Chicago, Illinois, in the presence of two witnesses, this 7th day of January, A. D. 1900.

EBER HUBBARD.

In presence of—
CHAS. S. BURTON,
JEAN ELLIOTT.