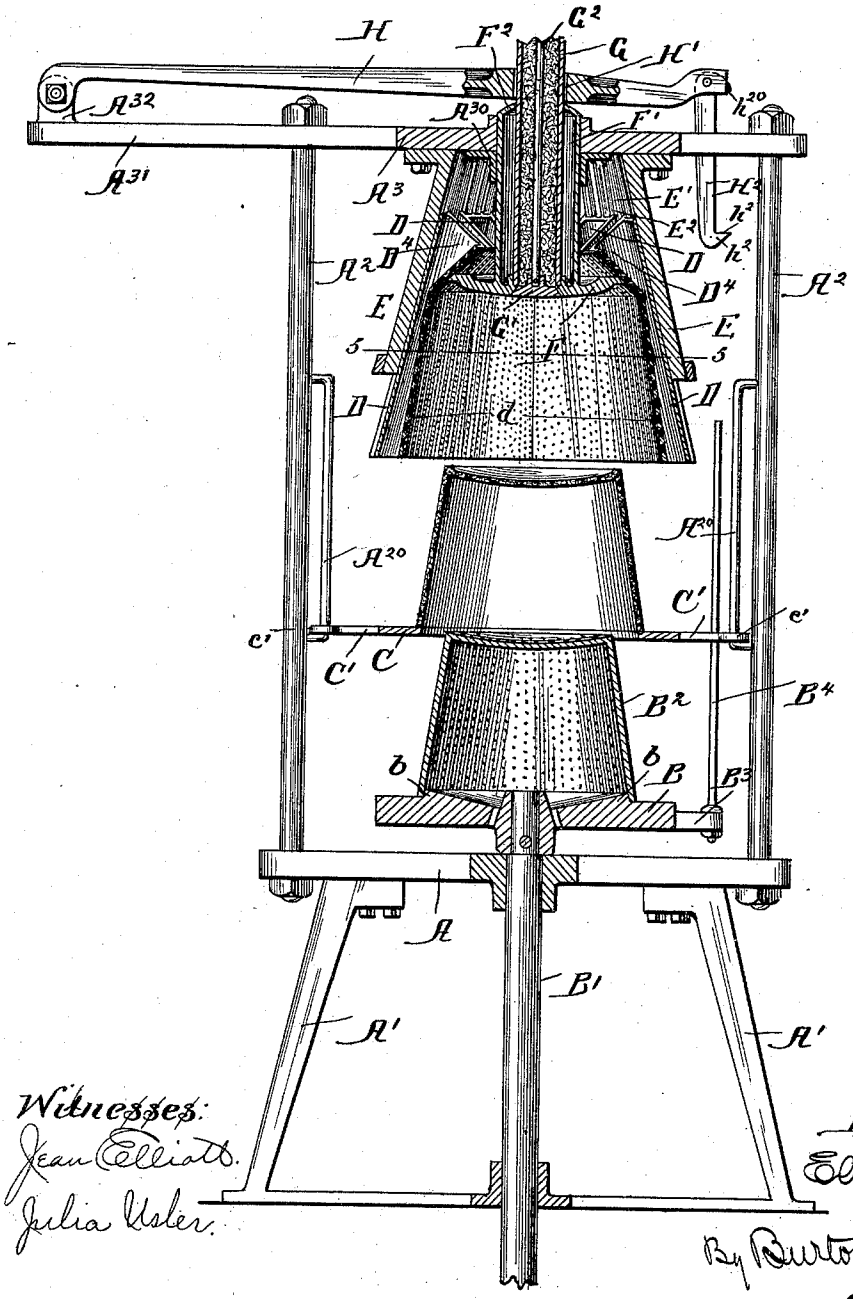
(No Model.) 4 Sheets—Sheet 1.

E. HUBBARD.

MACHINE FOR MAKING VESSELS FROM FIBROUS PULP.

No. 474,637. Patented May 10, 1892.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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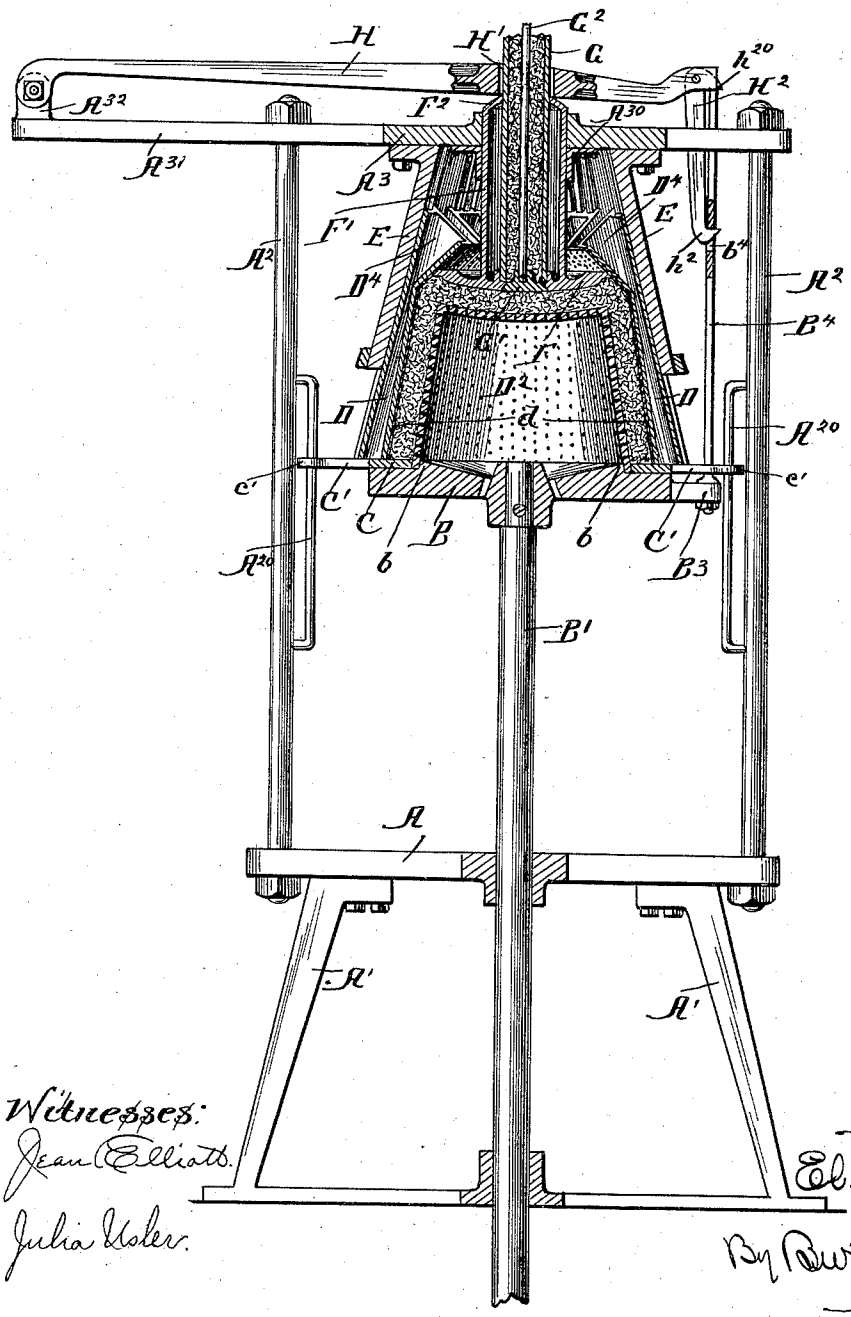
Fig. 2.



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MACHINE FOR MAKING VESSELS FROM FIBROUS PULP.

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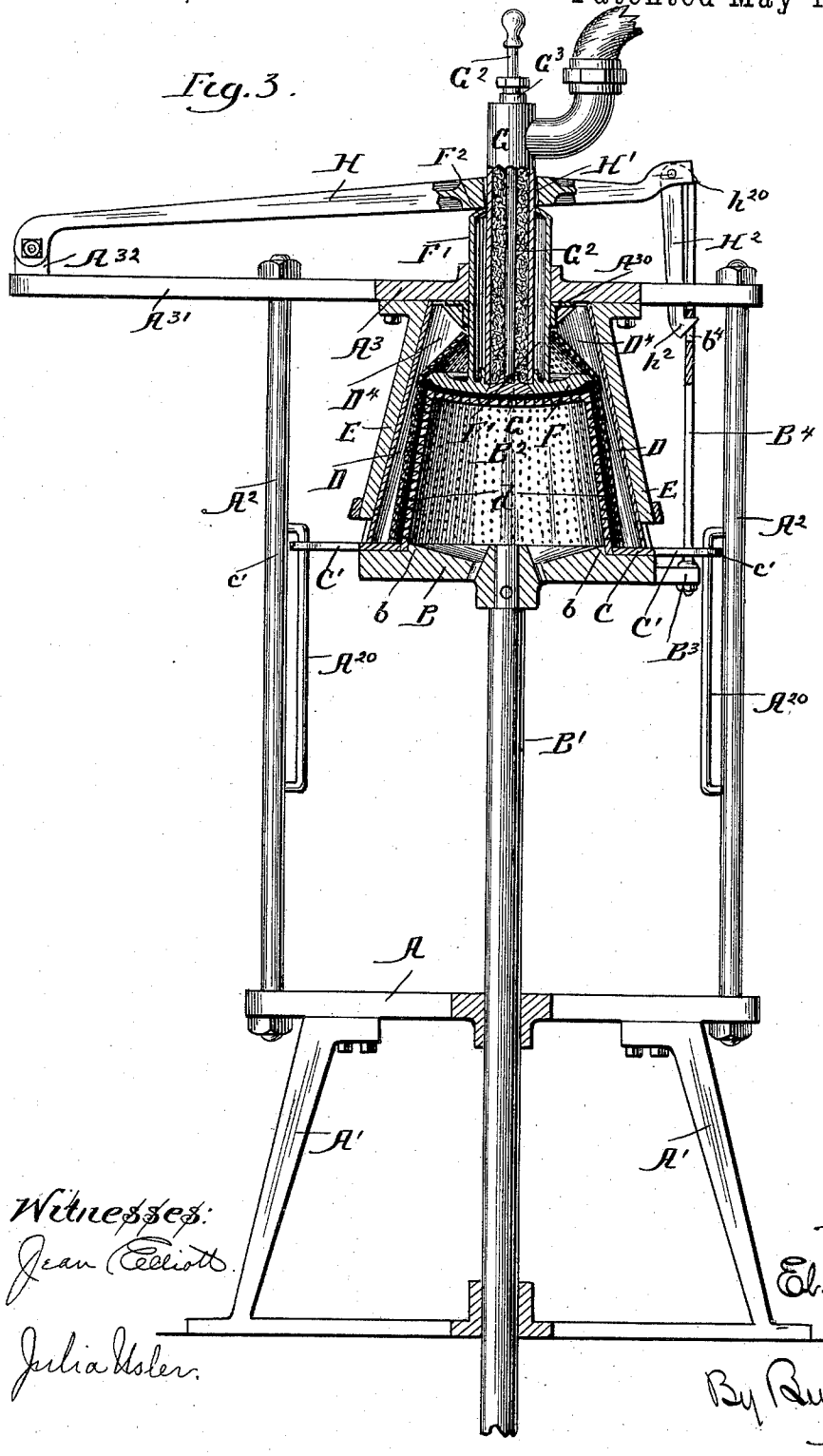
Fig. 3.



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E. HUBBARD.

MACHINE FOR MAKING VESSELS FROM FIBROUS PULP.

No. 474,637. Patented May 10, 1892.

Fig. 4.

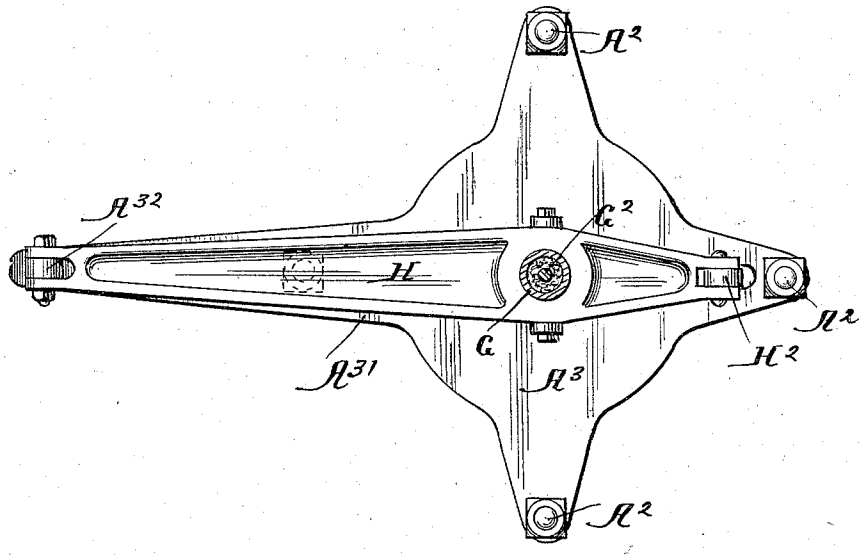
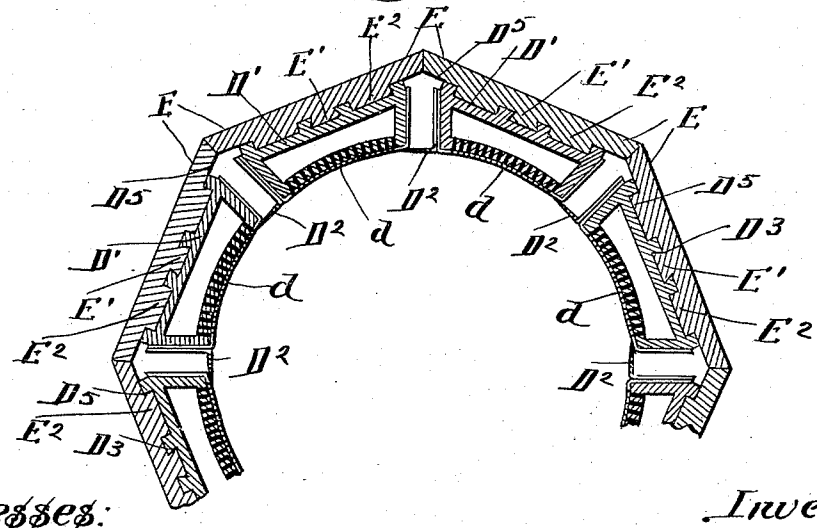


Fig. 5.



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UNITED STATES PATENT OFFICE.

EBER. HUBBARD, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE STANDARD FIBER-WARE COMPANY, OF MANKATO, MINNESOTA.

MACHINE FOR MAKING VESSELS FROM FIBROUS PULP.

SPECIFICATION forming part of Letters Patent No. 474,637, dated May 10, 1892.

Application filed August 16, 1890. Serial No. 362,146. (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 a Machine for Making Vessels from Fibrous Pulp, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide new and simpler mechanism for forming vessels—such as water-pails—from fibrous pulp by molding and pressing.

In the drawings, Figure 1 is a vertical axial section through a machine of the nature of a mold and press which embody my invention, the parts being in the position occupied at the conclusion of their operation, when the pail is ready to be removed. Fig. 2 is a similar sectional view of the same machine, the parts being in the position occupied when the mold is being charged with pulp. Fig. 3 is a similar view showing the parts in the position occupied near the limit of the pressing action of the machine. Fig. 4 is a top plan of the same. Fig. 5 is a section at the line 5 5 on Fig. 1.

The frame of this machine comprises a rigid standard made up of the base A and legs A′ and an upright frame supported on the base, comprising the posts A^2 and the top frame A^3, secured at the upper ends of said posts.

B is a table or tablet, having the vertical spindle B′ extending downward from its center through the center of the base A, said spindle obtaining vertical guidance in said base and in bearings which may be provided below the base, said spindle being adapted to have power applied to it to reciprocate it vertically through its slide-bearings and carry the table up and down within the frame above the base A.

B^2 is a form shaped to correspond to the interior of the vessel to be molded and pressed, being, as illustrated, a frustum of a cone to correspond with the interior of the water-bucket. This form is preferably hollow, though this is not material. The table B has a concentric bead or boss *b* of diameter corresponding to the larger (which is the lower) end of the form B^2 and serves to fix the position of said form on the table when it is located thereon in use. Preferably the form is made fast on the table by any convenient means. The table B has projecting from one side an arm B^3, which serves to support the upright rod B^4, which has a purpose which will be hereinafter explained.

C is a ring whose center is in the axis of the form B^2 and which is provided with opposite lugs or arms C′, which are guided on the posts A^2. A convenient means for providing such guidance consists of the rods A^{20}, having the ends bent and secured in the posts, the lugs C′ having eyes *c*′, through which the rods A^{20} enter, so that the eyes slide on the rods. Whatever means of providing this guidance is adapted, the ring is stopped at the lower limit of its vertical movement just above the level of the top of the form B^2. When the rods are used as guides, the inbent ends of the rods, which serve as a means for securing them to the posts, serve, also, as stops for the ring. The inner diameter of this ring is exactly equal to the outer diameter of the lower end of the form B^2, so that when the form is elevated and passed through the ring, when the table B B reaches the ring, the latter will rest thereon and fit closely about the bottom of the form, occupying thereto the relation of a flange.

D D D are staves, which make up a jacket, which constitutes the outer section of a mold, of which the inner section is the form B^2. These staves are each composed of a body D′ and a lip D^2, projecting from the one lateral edge of the body. The body is most conveniently formed of cast-iron or other metal of sufficient thickness to be rigid, is longitudinally tapered, and has the inner face horizontally concave, the outer face being a plane except as to certain longitudinal ribs and grooves hereinafter described. This body may be, as illustrated, a shell—that is, hollow between the inner concave and outer plane surface—to save weight of metal. The lip D^2 is preferably formed of quite thin sheet metal. As illustrated, and as most convenient, the lip is made by folding a piece of sheet metal in right-angular form, attaching one of the lips of the angle-bar thus made to one lateral edge of the body, the other lip projecting in

the plane of the concave face of the body and being similarly slightly concaved, so that its inner face forms the continuation of the concave face of the body. This projecting lip, as stated, is quite thin, and it may be tapered to an edge, as shown in the drawings, the opposite margin of the concave face of the stave being slightly beveled to receive the corresponding lip of the next adjacent stave, which laps onto it in the operation of the press. Each of the staves has the face perforated and preferably covered, also, with finely-perforated sheet metal *d*, and at the outer or rearward side has a longitudinal dovetailed groove D^3 extending the entire length, and by means of these dovetailed grooves the staves are supported on the dovetailed bars E, which are secured rigidly at their upper ends to the top frame A^3 and arranged in a circle about the axis of the form B^2 and project divergently downward. Each of the staves D has at the upper end an arm D^4, projecting inward at an angle to the longitudinal direction of the face of the stave. This arm is concave, like the remainder of the stave, and the lip D^2 may be continued along the edge of this arm as along the corresponding edge of the lower portion of the stave. The back or outer surface of the staves having the dovetailed groove is straight throughout, both back of the lower and back of the upper or inwardly-deflected end of the stave. The dovetailed bars E may have, beside the dovetailed tongue E′, the straight tongues E^2, parallel with the dovetail and fitting in straight grooves D^5 in the staves, to afford additional guidance to the staves as they slide, as will hereinafter be explained, on said bars E, the purpose of the dovetail being merely to keep the stave in connection with the bars while they are adapted to slide thereon.

F is a disk, which acts as a follower and which forms the upper end of the mold and gives shape to the bottom of the pail formed in the mold. To its upper side there is secured the large cylindrical stem F′, which is guided in the slide-bearing A^{30}, formed for it on the top frame A^3, consisting of a cylindrical flange, which projects downward from said top frame. Through the center of the cylindrical stem F′ of the disk F there extends the tube G, and said tube at its lower end connects with a central aperture in the disk F, which is adapted to be closed by the valve G′. Said valve has its stem G^2 extending up through the tube G and through a stuffing-box G^3 at the upper end of said tube, so that the valve can be operated from the outside. To the tube G, just below the stuffing-box G^3, there is connected a pulp-supply pipe, which by flexible connection extends to the tank from which the pulp is supplied. The cylindrical stem F′, which is most conveniently and for the sake of lightness made tubular, is preferably closed at the top, except where the tube G necessarily extends from it and penetrates its top. The top plate F^2 is conical, as illustrated, for a reason which will hereinafter appear.

H is a lever, which is pivoted on the arm A^{31} of the top frame, said arm being for that purpose extended beyond the post A^2 and having at its outer end the upwardly-projecting brackets A^{32}, between which the lever H is pivoted. This lever H extends diametrically across the press, having at the point where it passes the center the aperture H′, through which the tube G passes freely, said lever being adapted to rest upon the conical top plate of the tubular stem F′ outside the pulp-feeding tube G. The inner end of the lever H is inside the circle of the posts A^2 and directly above the end of the arm B^3 of the table B. To this end of the lever there is loosely pivoted the depending latch H^2, which has at its lower end the tooth h^2 and at its upper end, just below the pivot, the shoulder h^{20}, facing downward. The rod B^4 has the aperture b^4 at a distance below its upper end just equal to the distance from the shoulder h^{20} to the top h^2 on the latch H^2, said rod B^4 and its aperture b^4 co-operating with the latch H^2 by means of the shoulder h^{20} and tooth h^2 in the performance of a function which will hereinafter be explained.

The operation of this mold and press is as follows: The press being empty and ready for use, the spindle B′ is forced upward, carrying with it the table B and the form B^2 thereon, the form entering the ring C and passing up through it until the table collides with the ring, whereupon the ring will be carried up with the table resting upon it and fitting closely around the base of the form B^2. In its further upward movement the form will enter the jacket made up of the staves D and pass up within that jacket for a distance without any change of position of the parts occurring until the ring C, resting on the table, reaches the lower ends of the staves. It will be observed that the ring C from this point on in the process may be considered as a part of the table, since it moves and operates as integral therewith up to a certain point. While the parts are in this position, the valve G′ being opened, pulp in a liquid condition is emitted through the tube G, and fills the space intervening between the form B^2 and the jacket made up of the staves D, said space being bounded at the bottom by the table and the ring C thereon and at the top by the bottom-forming disk F. This bottom-forming disk by reason of its action from this point onward may be termed a "follower," being of the nature of a compressing-piston. The space within the mold being thus filled with the liquid pulp, the valve G′ will be closed either by the operator or by the action of the pulp itself floating it up against its seat. The table B and form B^2 being now further elevated will force upward the staves whose lower ends rest upon and are pushed by the table. The staves moving upward and being controlled in that movement by the bars

E, which converge from below upward, will be forced inward, also, at a rate corresponding to the angle of convergence of the bars. In this process it will be observed that the thin lips D^2 of the staves, which lap upon the adjacent bodies, will slide thereon, keeping the jacket at all times closed, notwithstanding its diminishing capacity. The staves being thus advanced radially toward the axis of the form will compress the pulp in the mold, driving out the water through the apertures d' in the body. It will be observed that in the absence of any provision to the contrary the disk or follower F would be approached by the upper end of the form B^2, which is the inner wall of the portion of the mold which forms the bottom of the vessel at the full rate, at which the said form is being elevated, while the staves would approach the lateral surface of the form at a rate very much less than that dependent only upon the rate of convergence of the arms E, and that the bottom would thereby be compressed very much more than the sides. This is prevented, however, by means of the rod B^4 operating the lever H, for at the instant the lower ends of the staves are reached by the table as the latter rises the upper end of the rod B^4 reaches the shoulder h^{20} on the latch H^2. The first effect of this collision of the rod with the shoulder is to swing the latch slightly outward, causing its tooth h^2 to enter the aperture b^4 in the rod B^4, thereby temporarily locking the rod to the lever. As the table continues to rise, the rod B^4, being now engaged with the shoulder h^{20}, and also with the end of the lever H, which coincides with the shoulder h^{20}, will lift that end of the lever, and thereby lift the disk with the follower F by means of the links H^3, which connect said lever with the cylindrical stem F′ of the follower. The connection of the lever to the follower, however, being nearer to the pivot of the lever than the point at which the rod B^4 engages the lever, said disk or follower F will not be lifted as great a distance as the table B and form B^2. The pivot of the lever H is so located as to make the difference between the upward movement of the follower F and the end of the lever equal the inward movement of the staves caused by the convergence of the arms E. It will be obvious that this can be easily arranged, the ratio between the longer and shorter arms of the lever—that is, between the distance from the pivot of the lever to the end and the distance from said pivots to the links H^3—being proportioned to the proper functions of the angle of convergence of the arms E. This provision, however, would not alone assure the compression of the bottom of the pail equally with the sides, because after a considerable degree of compactness was attained the disk or follower F might be pushed up by the compact pulp itself faster than it would be lifted by the lever H. Such action, however, is prevented by the engagement of the tooth h^2 in the aperture b^4 of the rod B^4, and thereby the rate of approach of the form endwise toward the follower is made to agree exactly with the rate of approach laterally of the form to the jacket. It will be understood that when the table first strikes the bottom of the staves, so that the mold is completed and the space to receive the pulp is inclosed, the distance of the sides of the form from the staves is the same as the distance of the top of the form from the follower F, so that an equal reduction of that space will give equal compression of the inclosed pulp. The inwardly-deflected arms D^4 of the staves serve as a further and simultaneously-operating means for causing the follower F to approach the end of the form B^2 at a rate equal to that at which the staves approach the sides of the form. These arms abut against the periphery of the disk or follower F, and their inclination is such relatively to the inclination of the stave proper that the radial approach of the staves toward the axis of the form causes these inwardly-deflected arms D^4 to crowd the disk or follower F downward relatively to the staves at the same rate at which the staves move inward radially. It will be observed that this is the same result which is accomplished by the locking of the lever H to the rod B^4 by means of the latched tooth H^2, and either means might be omitted, the other alone accomplishing the result; but the latch being a means which operates most positively is a desirable addition to the means which the arms D^4 afford, said arms operating with considerable friction, for the purpose stated, upon the beveled edge of the disk F, and, on the other hand, said arms D^4 serve a further purpose in that they close up the mold completely, making junction by contact with the follower F from the commencement of the compressing action and keep it closed during the change in diameter, which results from the radial approach of the staves as they rise, so that the pulp is not liable to be forced out around the follower which molds the bottom; but all the pulp is kept snugly within the mold, and the resulting vessel is clearly outlined by the mold and uniformly compressed at all parts without the waste which would result if the mold were not closed up around the margin of the follower F and without the variation in density which would result, also, from the same cause if a portion of the pulp were forced out at that point before the vessel were fully compacted. It will be noticed that the conical top plate F^2 of the tubular stem F′ of the follower affords by means of its taper a pivotal support, over which the lever H rocks as it crowds the follower down, and such is the purpose of giving this form to the top. After the vessel is completely molded and compacted in the press, as described, the table B and form B^2 are withdrawn downward. The entire jacket, made up of the staves D, as well as the follower F, will descend with the form at the first downward movement of the latter, and by that move-

ment the staves will be drawn out radially on account of the engagement of their dovetailed grooves with the dovetails on the bars E, and the follower F, being still controlled by the lever H, which is in turn controlled by the rod B^4, will not descend so rapidly as the form B^2, and will therefore in the same manner be withdrawn from the bottom of the vessel molded on the form B^2. As soon as the staves are out of contact and free from the collision of the molded vessel they will, by their own weight, descend as rapidly as the descent of the follower F will permit, the arms D^4 of the staves hanging on the edge of the follower F, and the staves being thus prevented from falling out of engagement with the bars E. The ring C will descend with the table B and form B^2 until its descent is stopped by the means provided, as described—to wit, the inbent ends of the guide-rods A^{20}—and as soon as these stops are encountered the ring will halt in its descent. At this point the operator will release the latch H^2 from the rod B^4, but the table and form, continuing to descend, will be withdrawn from the vessel, which will remain supported by its bottom edge on the ring, and the table and form will descend to the initial position at the bottom of the press-frame. It will be noticed that at the lowest position of the staves D their lower ends are above the level of the top or form B^2 at its lowest position a distance somewhat greater than the entire length vertically of the vessel which is molded on the form, so that it can be removed horizontally from the ring on which it is left standing. Having been thus removed, it will be properly treated by suitable drying or hardening process, which forms no part of my invention; but it should be noticed that the vessel is, as to exterior and interior form, substantially finished, requiring no turning off of the surface except, perhaps, that which may be accomplished by slight sandpapering to remove, if desired, the very slight lines which will mark the imprint of the edges of the lips D^2 of the staves and the very slight burrs which will sometimes be left at the edge of the chine and at the top edge of the pail, the burr on the chine being caused, if at all, by fibers which are forced around the edge of the follower F, between it and the staves, and the burr at the top edge of the pail being similarly formed by fibers forced between the ends of the staves and the ring C. The chine, it will be observed, is molded by the follower F, which has a rabbet *f'* around its margin for that purpose. The pail-bottom is made convex inward by the shape of the upper end of the form and the corresponding shape of the follower F, because it is found that that shape gives the best result in drying, the shrinkage being sometimes such as would cause the straight bottom to draw in the sides and distort the vessel.

It will be apparent upon consideration that the table performs merely the function of a flange around the bottom of the form B^2, such flange constituting the means of closing up the bottom of the mold and forcing up the staves which constitute its sides, and it is only the projecting or marginal portion of the table that is essential to this function; also, it will be apparent that so far as the process of closing up the mold and compressing the pail therein is concerned the ring C might be dispensed with, in which case the pail when molded would rest directly on the flange formed by the table B, the only purpose of interposing the ring C being to facilitate the removal of the pail when molded.

I claim—

1. In a machine for making vessels from fibrous pulp, in combination with the form B^2, the jacket made up of the staves D, the bars E, supporting respectively the staves D and provided with longitudinal slide-bearings for the same, and the frame which supports the bars E, said form being adapted to be reciprocated in the direction of its axis to advance the latter into the jacket in the direction in which the bars E converge, the marginal table projecting around the form at its base and adapted to collide with the ends of the staves when the form is advanced, substantially as set forth.

2. In a machine for making vessels from fibrous pulp, in combination with the form B^2 and a jacket into which it is advanced, the frame in which said jacket is supported and the ring C, stops on said frame above the form, which arrest and support the ring, said ring having its inner diameter adapting it to fit about the base of the form, and the marginal table projecting around the base of the form and affording lodgment for the ring, whereby the form is protruded through the ring and the ring is lodged on the marginal table as the form rises and is left on the stops as the form descends, substantially as set forth.

3. In a machine for making vessels from fibrous pulp, in combination with the form B^2 and the means for reciprocating it, the converging bars E and the frame which supports them, the staves D, having slide-bearings on said converging bars, respectively, and the ring C, adapted to fit about the base of the form B^2, and supports for said ring on the frame, located at a horizontal plane above the upper end of the form B^2, substantially as set forth.

4. In combination with the form B^2 and its horizontal marginal base and the stem by which it is adapted to be reciprocated, the converging bars E and the frame which supports them, the jacket made up of the staves D, supported and guided longitudinally on the converging bars E, respectively, the follower or bottom disk F, located within the staves D at their upper ends, and the pulp-supply tube G, discharging through said follower and provided with a valve to close its discharge-mouth, substantially as set forth.

5. In combination with the jacket composed of staves, the longitudinally-converging slide-bearings of said staves, and the form B^2, having its marginal base or table adapted to col-

lide with the staves and force them endwise as the form is advanced into the jacket, the follower or bottom disk F, adapted to be reciprocated in the same direction as the form, and a lever connected to and actuating the follower and actuated by connection with the form, the difference between the distance from the fulcrum to the point at which the lever is so actuated and the distance from the fulcrum to the point at which it actuates the follower bearing to the distance of the last-named point from the fulcrum the same ratio as the convergence of the slide-bearings of the staves toward the axis of the form for a given distance along that axis bears to such axial distance, whereby the follower is carried upward as much less than the form moves upward as the staves are forced inward during such upward movement of the form, substantially as set forth.

6. In combination with the form B^2 and its marginal base and the means by which it is reciprocated in the direction of its axis, the converging bars E and the frame which supports them, and the jacket made up of the staves D, supported and having longitudinal slide-bearings on the converging bars, respectively, and having each the inwardly-inclined portion D^4 at the upper end, and the follower F, located within said inwardly-inclined portions of the staves and adapted to reciprocate in the direction of the axis of the form, the said inwardly-inclined portions of the staves being at an angle of forty-five degrees to the direction of reciprocation of the form and follower, substantially as set forth.

7. In combination with the jacket composed of staves, the longitudinally-converging slide-bearings of said staves, and the form B^2, having its marginal base or table adapted to collide with the staves and force them endwise as the form is advanced into the jacket, the follower or bottom disk F, adapted to be reciprocated in the same direction as the form, and a lever connected to and actuating the follower and actuated by connection with the form, the difference between the distances respectively from the fulcrum of the point at which the lever is so actuated and the point at which it actuates the follower being proportioned to the distance of the last-named point from the fulcrum as the converging of the slide-bearings of the staves toward the axis of the form for a given distance along that axis is to such axial distance, the staves having each an inwardly-inclined portion D^4, standing at an angle of forty-five degrees to the direction of reciprocation of the form and follower, and the follower being located within said inclined portions of the staves, substantially as set forth.

In testimony whereof I have set my hand, this 5th day of August, 1890, at Chicago, Illinois.

EBER. HUBBARD.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.