(No Model.) 2 Sheets—Sheet 1.

E. HUBBARD.

PAPER PAIL MAKING MACHINE.

No. 515,958. Patented Mar. 6, 1894.

Fig. 1.

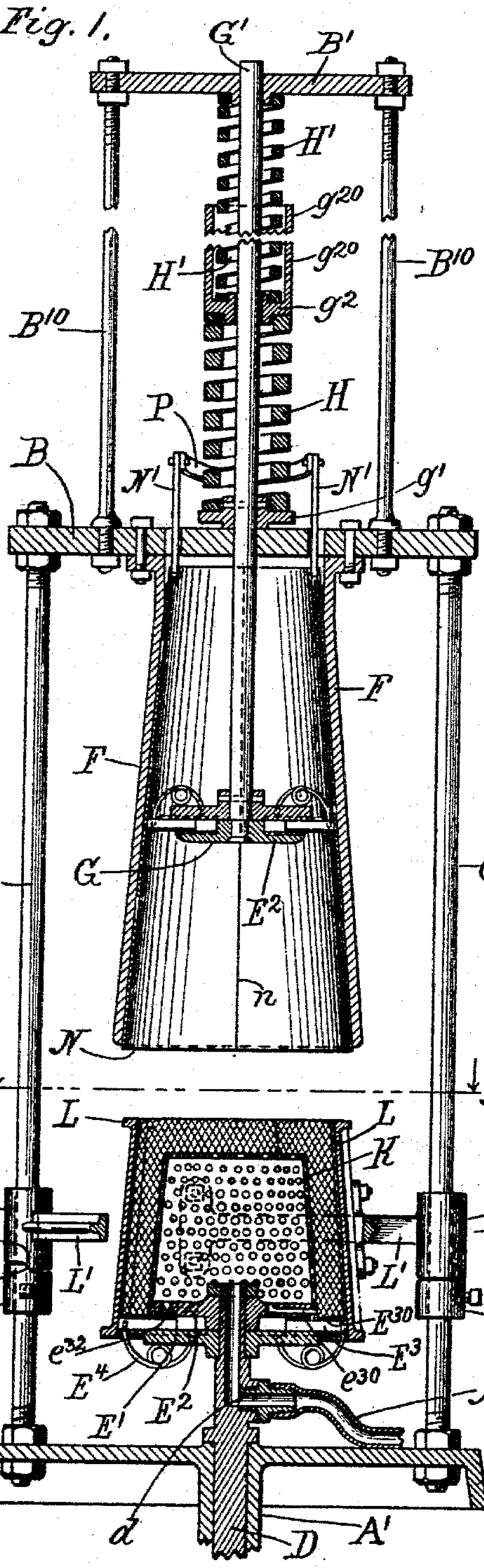


Fig. 3.

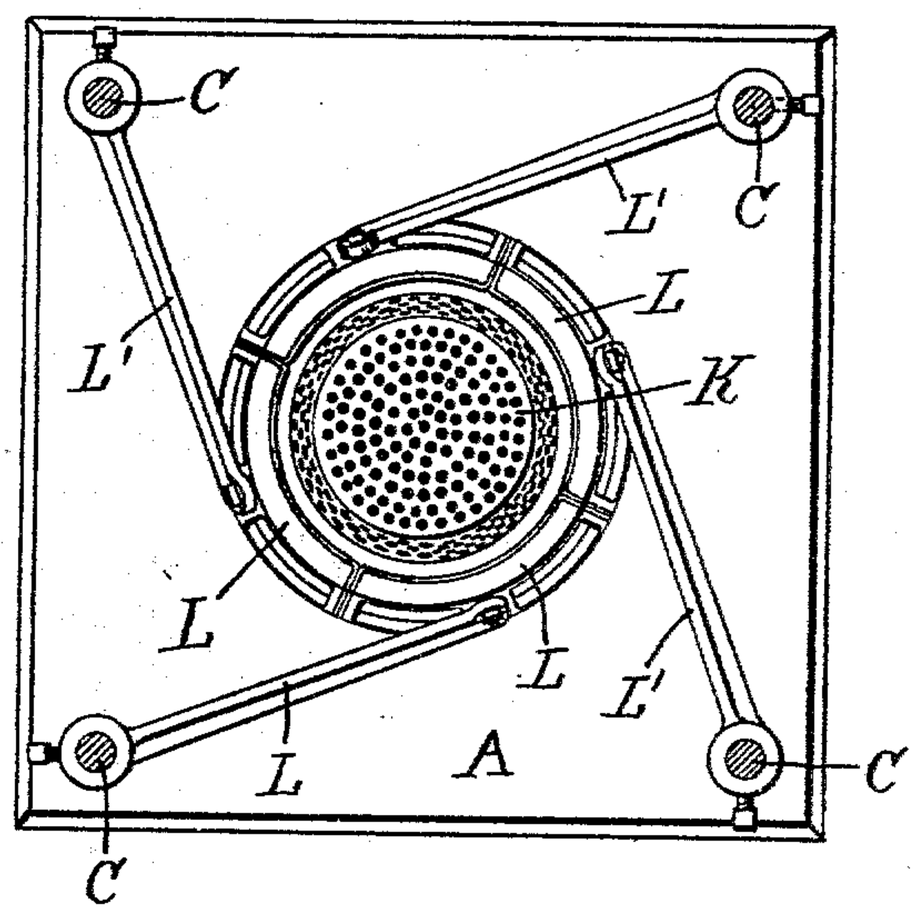
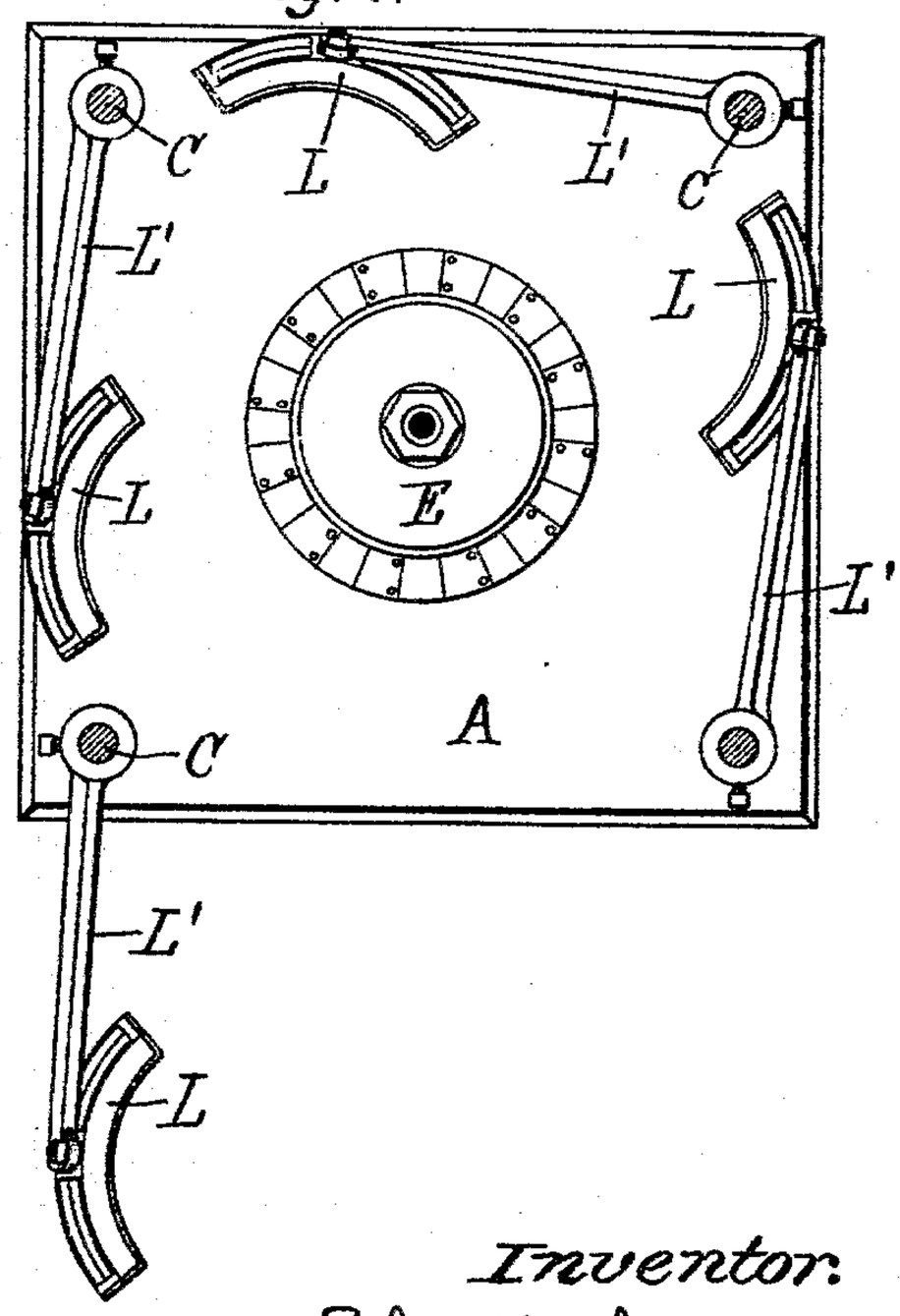


Fig. 4.



Witnesses.
E. T. Wray.
Jean Elliott.

Inventor:
Eber Hubbard
By Burton & Burton
his Attys

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

E. HUBBARD.

PAPER PAIL MAKING MACHINE.

No. 515,968. Patented Mar. 6, 1894.

Fig. 2

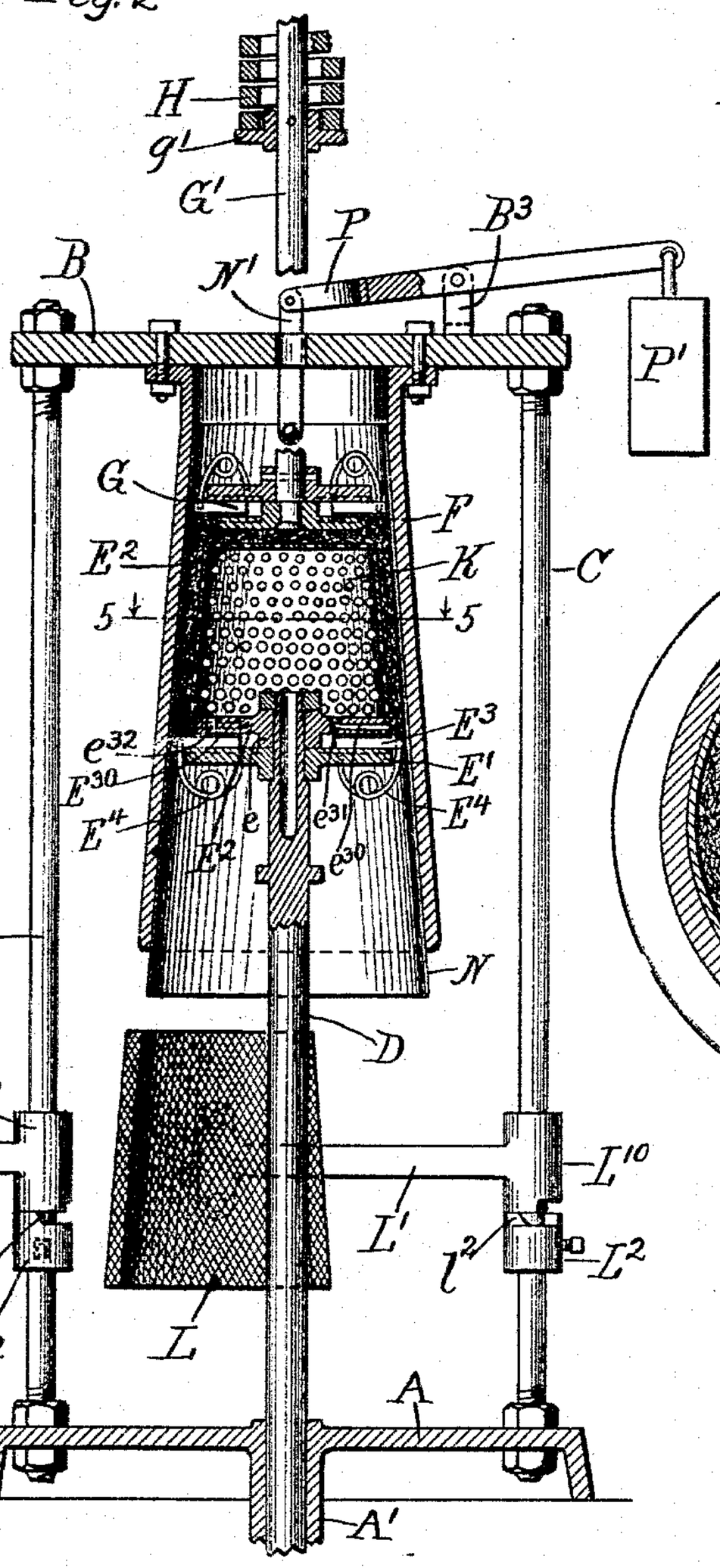
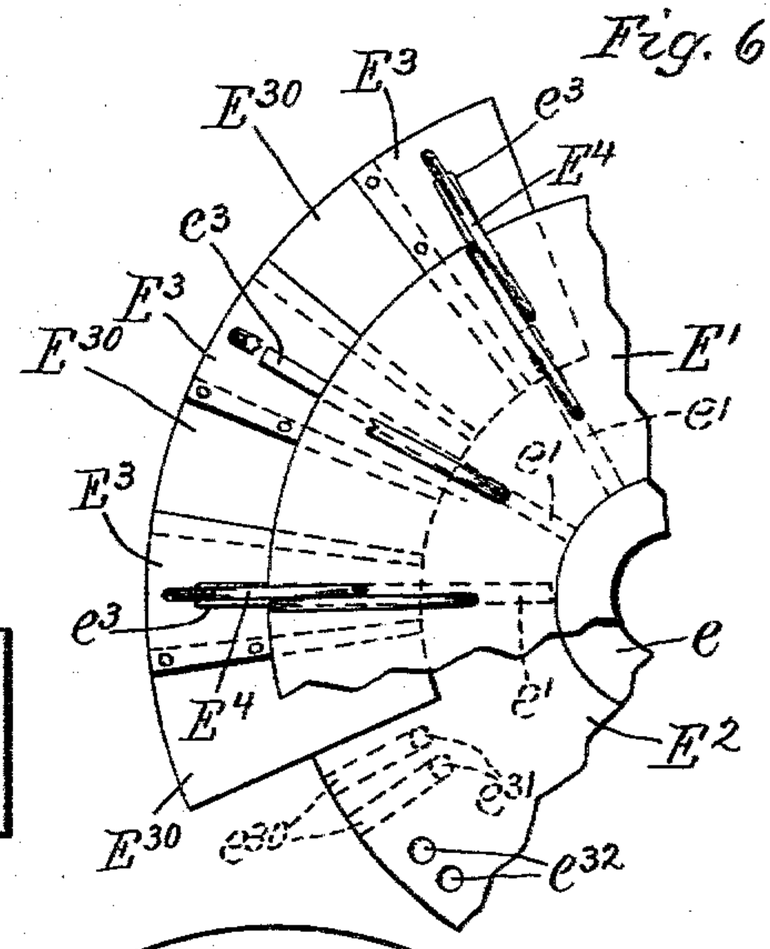


Fig. 6.



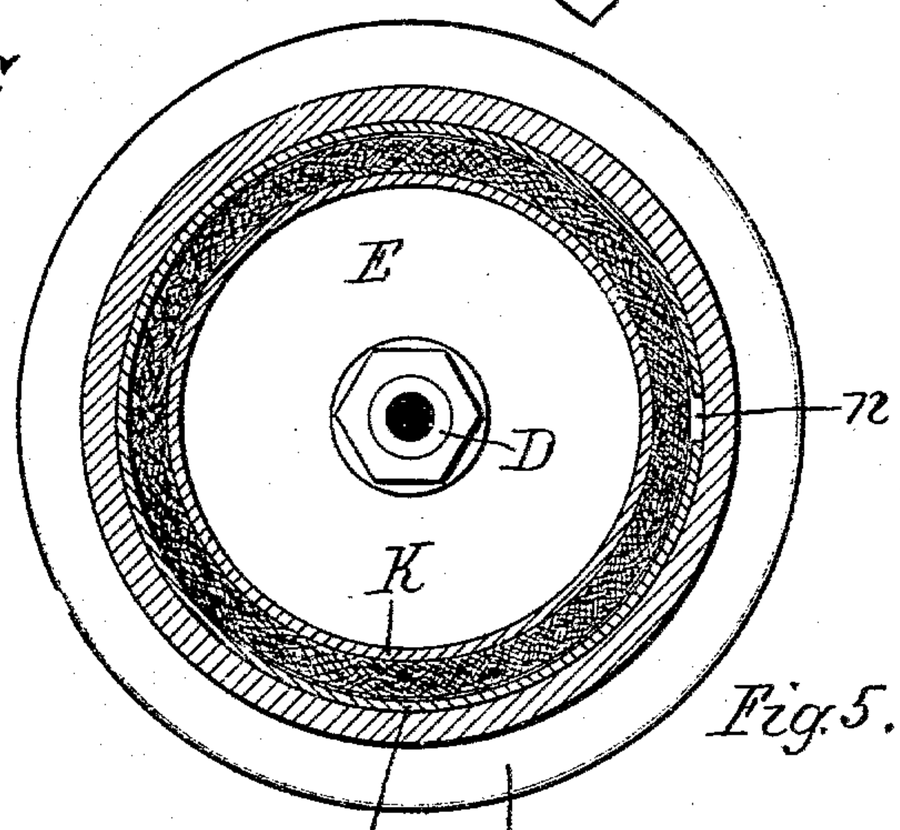


Fig. 5.

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UNITED STATES PATENT OFFICE.

EBER HUBBARD, OF CHICAGO, ILLINOIS.

PAPER-PAIL-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 515,958, dated March 6, 1894.

Application filed June 2, 1893. Serial No. 476,392. (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 Paper-Pail-Making Machines, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

This invention is designed to provide an improved machine, for making pails and other vessels from fibrous pulp.

In the drawings,—Figure 1 is a vertical section of my improved machine through the center line of the molding and pressing devices; the position of the parts being that at which the mold is ready for the pulp. Fig. 2 is a vertical section in a plane at right angles to that of Fig. 1, showing the parts in the position occupied when the pail has been compressed to the utmost and has commenced to withdraw from the rigid tapering frame by which the compression is effected. Fig. 3 is a section at the line 3—3 on Fig. 1. Fig. 4 is a section at the same plane as Fig. 3, but showing the parts in the position occupied after the pail has been compressed and removed, and before the mold has been closed up preparatory to a new charge. (The position of the four quarters of the outer wall of the mold in this figure corresponds to that of Fig. 2.) Fig. 5 is a section at the line 5—5 on Fig. 2, upon an enlarged scale. Fig. 6 is a detail bottom plan of a portion of the radially reducible and extensible table or follower which forms the bottom wall of the pail mold, being the same as a top plan of the follower or head which constitutes the upper wall of the mold which defines the bottom of the pail. This detail is enlarged beyond the scale of the other figures.

In a former patent granted to me, No. 495,039, dated April 11, 1893, I have described a machine for pressing pails and similar vessels of fibrous pulp, in which the pail, having first been molded in sections and applied upon an inner form corresponding to the cavity of the vessel, was advanced into a tapering jacket or frame, the table or bottom tablet or follower, on which the inverted molded vessel was supported at its lower edge, and an upper follower of the nature of a piston in the conical jacket or frame, constituting respectively the lower and upper boundaries of the chamber in which the vessel was compressed, said upper and lower followers being radially reducible as the form advanced longitudinally into the tapering jacket or frame, so that the cavity was kept perfectly closed at both ends throughout such longitudinal advancement, and the vessel was thus compressed by virtue of the taper without possibility of the material being squeezed out at the ends, but in such manner that there was longitudinal compression, as well as lateral compression by reason of the taper. In the machine herein shown, the same general method is observed, and the followers are in general of the same character, changed only in the detail which will be hereinafter pointed out. But in the present invention, instead of first molding the pail in sections and applying it to the form on which it is pressed thus fully formed except as to compression and junction of its parts, I provide a complete mold as a part of the machine and mold the pail integrally upon the inner form instead of first molding it and placing it thereon, so that there are no junction seams to be united by the pressure, but an integrally molded seamless body. And in order that the form thus molded may be compact and uniform in thickness and density, so that it may be compressed in the rigid jacket to a proper density without excessively great reduction in thickness, and so that when thus compressed, it may be substantially uniform in density throughout and be well surfaced exteriorly as well as interiorly by contact with the mold walls and jacket, I provide means for draining and exhausting the water from the liquid pulp as it is put into the mold by suction, drawing the fibers onto the form and ultimately filling the mold with a well-compacted fibrous mass, from which the water has been to a large extent extracted, before pressure is applied to complete the process.

In the use of the machine shown in my patent, No. 495,039, above mentioned, I found that although the molded pail could be ad-

vanced without difficulty into the tapering jacket, and would slide on the surface of the latter without so adhering thereto as to tear or disarrange the fiber, and in that respect would operate with entire satisfactian to produce a well compressed vessel, nevertheless, some difficulty was occasionally experienced in withdrawing the vessel thus molded from the tapering jacket by reason of the adhesion of a fibrous material to the surface of the jacket, causing it to be slightly torn or roughened in starting it out. This did not interfere with the practical operativeness of that device, because there are expedients which may be resorted to to prevent the adhesion, and with proper care, in any event, the vessel can be detached from the jacket. But in the present invention, I have provided a means for overcoming this difficulty entirely, consisting in a jacket of spring metal which lines the rigid frame which supplies the necessary resistance for compression as the molded form is advanced into the tapering jacket, such spring metal being integral, but longitudinally rifted at one line and tending elastically to spring open so that when the withdrawal commences, if the adhesion of the compressed vessel to the jacket is such as to give rise to the difficulty above mentioned, the jacket itself will slip in the rigid frame for a little distance, and thereupon, immediately, the elasticity of the jacket will cause it to spring off from the molded vessel and so permit the ready withdrawal of the latter.

The machine which, as a whole, may be called a "press," comprises the base A; cap or top frame B; vertical posts C C C C, which bind the base and top frame together and resist their separation under the strain of compression.

D is the stem of a hydraulic ram which is not shown but may be located below the press, the stem extending up through the central hub A′ of the base A, and carrying at its upper end the table or lower follower E.

F is a rigid tapering frame which may be of any material affording the necessary strength and rigidity. It is made rigid with the cap or top frame B at its upper, which is the smaller, end.

G is the upper follower. Its stem G′ extends out through the cap B, and obtains longitudinal guidance therein and also in the horizontal cross-bar B′, which is connected by rods B^{10} B^{10} rigidly with the cap B at a distance above the latter.

g' is a collar pinned fast on the stem G′ above the cap B, which affords a seat upon which rests a heavy coil spring H, which encircles the stem G′. Upon the upper end of the spring H, there is seated another collar g^2, which, for a reason hereinafter stated, has an annular flange g^{20}, making it of the nature of a cup, upon or in which is seated a spring H′, lighter than the spring H, which also encircles the stem G′, and at its upper end rests against the under side of the cross-bar B′.

K is a perforated metal form corresponding to the cavity of the vessel to be made. It is placed inverted,—that is, mouth downward,— upon the table or lower follower E, and constitutes the inner wall of the mold in which the vessel is to be produced preparatory to pressing. The outer wall of this mold is made in four sections L L L L, each comprising one-fourth of the circumference and adapted to be withdrawn outwardly after the vessel has been molded. In order to facilitate their withdrawal to open the mold and their adjustment to complete it, they are each secured upon the end of a lever arm L′, said lever arms being fulcrumed respectively on the corner posts C C C C. The divisions between the quarter sections L L L L are preferably at such points that a radial plane at some point,—preferably the center—of the width of each, is tangential at the inner surface of the quarter section to an arc about the pivot of the lever arm which carries it; or, to state the same fact differently, said divisions are at such points that a radius may be drawn from the pivot of the lever which pertains to any one of the quarter sections tangential to the inner surface of said section,—preferably at the middle point of the width of such section, so that each section, in withdrawing from the molded form, starts off as nearly as possible radially. Each of the quarter sections L L L L has its face and edges covered with textile fabric, such a material as cotton flannel being preferred, to which the fibrous pulp will not adhere, and which, at the abutting edges of the quarter sections, serves to make a substantially water-tight joint when the sections are closed together. This four-part outer mold is of such diameter and length that when closed together it encompasses the lower follower whose radially extensible sections abut at their outer end or circumference upon the inner wall of the outer mold L L L L, so that when said four sections of the outer mold are closed together they are also closed against the ends of the sections of the follower, and the mold cavity is thereby closed up except at the top.

In order to cause the sections L L L L to close together with some pressure at their junction edges, and with sufficient force to push inward the sections of the follower E, the slight distance necessary, advantage may be taken of the weight of the sections L L L L by mounting their lever arms L′ L′ on the corner posts C, above stop collars L^2 L^2, &c., and providing the lower ends of the hubs L^{10} L^{10}, &c., of the lever arms, and the upper ends of the stop collars L^2 with corresponding inclinations l^2 and l^{10}, which are in contact at the time the mold is closed up, whereby the tendency to slide down the incline results in a radially approaching tendency of the sections L L, &c., until they stop against each other. In opening the mold by throwing apart these sections L, the hubs will ride upon the inclines until the horizontal portions

of the ends of the hubs and collars are set one upon the other, and at such position, the quarter sections will stand wherever placed.

The detail construction of the followers, as above stated, is substantially that shown in my former patent mentioned, with the exception of the means for moving radially the sections to expand or reduce the diameter of the follower. I will therefore describe in detail the lower follower or table E, and such description will answer for the upper follower, which is identical except in point of size and detail shape at one point which will be hereinafter mentioned. This follower or table consists of two disks E′ E², adapted to be secured at their co-inciding centers upon the end of the stem D. Their proximate faces are held apart by providing one of them with a short central hub *e*. One of said proximate faces has radial grooves *e′ e′*, which serve as means for guiding the sections E³ E³, &c., which are interposed between the disks E′ and E², and provided with suitable ribs *e*³ to engage the grooves in the disk. The sliding sections E³ E³, &c., have thin metal lips or flanges E³⁰ secured to one edge of each and overlapping the proximate edge of the adjacent section; said thin metal lips and said proximate edges being correspondingly sharply beveled to permit the overlapping described without leaving a perceptible shoulder or ridge in the resulting continuous surface of the follower. To control the position radially of the sliding sections E³, I provide for each a bow-spring E⁴, one end of which is secured in the lower disk E′, and the other end in the under side of the section E³, as seen in the drawings, said spring tending to resist both centripetal and centrifugal movement of the sections E³ from a certain position, which, as the springs are coiled and set, is one in which the diameter of the follower will be but slightly greater than the inner diameter of the outer four-part mold L L L L, so that when said four parts are closed together they will come in contact with the outer ends of the sliding sections E³,—which is the circumference of the follower,—just before they come into contact at their edges with each other, whereby certainty of closing up the mold cavity at the bottom is obtained. This maximum diameter of the follower under the control of the springs E⁴ is also such as will permit the follower to enter freely the lower end of the jacket hereinafter described, in which the compression takes place. To facilitate complete drainage or exhaustion by suction of the water from the pulp when it is poured into the mold, the disk E² is provided with a number of holes *e*³⁰, drilled in from its circumferential edge, and meeting short vertical holes *e*³¹ drilled from the upper surface. For the same purpose, other holes *e*³² are drilled through the disk where it is in contact with the sliding section. The upper end of the stem D is hollow for a short distance and connects with a lateral opening *d*, at which connection is made with a suction and drainage pipe *m*, through which the water is exhausted, said pipe running to a pump,—not shown—for that purpose. This pipe is flexible for a distance to accommodate the vertical movement of the table or follower in compressing the pail.

N is a spring metal jacket already mentioned. Its taper corresponds to the inner surface of the frame F and to the outer surface of the vessel to be molded. It is rifted down one slant side and tends to spring open a short distance as shown in Fig. 5. At the upper end, it has two lugs N′ N′ on the opposite sides, which extend up through the top frame or cap B, and above the latter are connected to the two ends of a fork or yoke P, which is fulcrumed upon the upper side of the cap B upon a bracket B³, and extending radially out beyond the cap B, carries at the outer end a weight *p′* sufficient, in view of the leverage obtained by the position of the fulcrum B³, to overbalance the weight of the jacket N, and, in addition, to pull it up with sufficient force within the tapering frame F, to condense the jacket or coil it until its edges at the rift *n* meet, and it is thereby completely closed up and constitutes a lining for the frame F.

The mode of use of this machine and its operation will be as follows:—The ram being withdrawn so that the table or follower E is at the lowest position, as shown in Fig. 1, the perforated form K, being placed in position upon the lower follower, as shown in Fig. 1, the four quarters L L L L of the outer mold will be closed and will appear as seen in Fig. 1. Pulp will now be introduced at the upper open end of the mold cavity in any convenient manner. The pump with which the drainage pipe M is connected being in operation and tending to draw air from within the form K, will produce the suction which will draw the water through the perforations as soon as the form is covered with the liquid pulp. The supply of pulp will be maintained so as to keep the mold cavity full,—flowing, or being poured in as fast as the water is exhausted therefrom by the suction. The suction taking effect through the perforated form will cause the fibrous pulp to cling first around that form, on all sides and at the top, and but for the continuous supply of liquid pulp would leave an annular cavity around the pulp next to the outer mold wall, but the continuity of the supply preventing this, the fresh liquid pulp will pass down in what would otherwise be such an annular cavity to the bottom, and the result will be that the bottom portion of the mold cavity will first become fully occupied with fibrous pulp from which the water has been so far extracted by suction that it practically seals the drainage apertures, causing the suction to take effect through the apertures higher up. Thus gradually the mold will fill up from the bottom with compacted fiber, and as it accumulates, its own weight and that of the still liq-

uid pulp above it will cause it to settle solidly, and be forced not only against the inner wall of the mold upon which it has been drawn by suction, but also upon the outer wall of the mold, which will thereby give it a surface as definite and uniform as that which the inner form gives to the inner surface. The first supply of pulp will preferably be in such volume as almost instantly to fill the mold, so that suction will begin to take effect instantly all over the form. The subsequent supply of pulp outside of the film which will thus be sucked onto the inner form, even to the very last increment upon the exterior before the mass becomes so thick and compact that suction no longer operates through it, will be in thin liquid carrying the fibers evenly and uniformly to all parts of the surface, and producing, therefore, a body of very uniform density and texture, and having naturally, and without regard to the compression afterward to be exerted upon it, a surface almost as smooth as would be produced by a liquid film subsequently hardened upon the surface. In this respect the texture and surface will differ to an important degree from that which would be produced by aggregating pulp in a mere plastic condition, in which it might be handled and manipulated into shape. In this manner, gradually, the mold will fill up from the bottom, both inner and outer surfaces of the pail being formed accurately upon the surfaces of the mold, and last of all, the top portion, which constitutes the bottom of the pail, will be similarly compacted by the suction, and the pulp in thin liquid being supplied as long as there is any space left in the mold, the upper surface will be as accurate as that of a liquid which has solidified; and the suction may be continued until the required degree of density is obtained in the bottom (of the pail), that degree having already been obtained in the side portions gradually from the bottom (of the mold) upward. The operator will now swing outward the four quarters L L L L of the outer mold to the position shown in Fig. 4, and the hydraulic pressure being brought into operation to lift the table and molded form thereon, it will be carried up into the lower mouth of the jacket N in which the upper follower G, at the lower end of the stem G′, stands at such position that when the lower follower has entered the jacket a short distance, the molded form will come into contact with the lower face of said upper follower, and be imprinted or shaped thereby to the extent of the formation of a cavity in the bottom,—or in what is to be the bottom,—of the pail, within what is to form the chine; such cavity being formed by the lower disk E^2 of the upper follower, which is shaped suitably for that purpose, this shape constituting the only essential difference between the upper follower and the lower. The mold cavity, it will now appear, is fully closed up, and farther upward movement of the follower and molded body thereon will force upward the upper follower against the resistance of the spring H′ and the weight of the spring H, until after the limit of compression of the spring H′ is reached, or the upper end of the cup or flanged collar g^2, which guards the spring H′, comes into contact with the cross-bar B′. The resistance of the spring H′ is designed to be comparatively little, so that the bottom (of the pail) will not be compressed unduly during this upward movement until the sides have been compressed by the long taper of the jacket nearly to the requisite density. When, however, the stroke is nearly completed and the lateral portion of the pail is nearly compressed to the desired degree, the limit of compression of the spring H′ being reached or a positive stop against its further compression being afforded in the manner described, the heavier spring H comes into operation to resist the longitudinal movement of the upper follower. This spring should be strong enough to exert upon the bottom of the pail in the last fraction of an inch of the stroke of the ram, as much pressure as is exerted upon the sides in the same finishing portion of the stroke. If, for example, proper density requires that the pressure should be one hundred and fifty pounds to the square inch at the sides, this spring must be sufficiently strong to exert that pressure directly at the bottom, so that the density of the entire pail, both sides and bottom, shall be substantially the same as the result of this method of compression. The limit of the stroke being reached, and the compression being completed, the water pressure being withdrawn, the reaction of the springs H and H′ will immediately cause the upper follower to force the pail down as fast as the retiring ram will permit. The very first movement downward will cause the compressed pail by its adhesion to the spring jacket N to carry that jacket with it, pulling it out from the tapered inner surface of the rigid frame F a short distance; but just as soon as the spring jacket is free from the restraint of the rigid frame F, its elasticity will cause it to spring open and relieve itself from the molded pail, and then, instantly, the weight p', through the medium of the lever P, will pull the jacket back into its place upon the inner surface of the rigid frame F, leaving the pail to descend with the lower form out of the jacket and to the position at which the mold was first filled. One of the quarter sections L may now be swung entirely outside of the frame, as shown in Fig. 3, opening the way for the lateral movement of the pail, which will be taken off the inner form K, and placed on a plain form, on which it may remain while being dried or further treated, according to methods familiar in this art.

It will be understood that the forms K may be completely covered with wire gauze, as is customary in this art to cover mold surfaces

through which water is to be drained. Such wire gauze is not illustrated, and it could not be illustrated without great exaggeration, and would obscure other features and is a familiar expedient.

I claim—

1. In combination with the table which constitutes the bottom of the mold cavity, the perforated hollow form K, adapted to rest upon it, and the suction pipe M leading in through the table and communicating with the cavity of the perforated form; the table having drainage ducts leading from its upper surface underneath the form to the edge or shoulder of the table at the lower edge of the form, whereby the suction tends to drain the water from the pulp to the lowest point of the mold cavity: substantially as set forth.

2. In combination with the inner perforated wall of the mold, the outer wall consisting of a plurality of sectoral parts L, said sectoral parts being supported each upon an arm pivoted at a distance from the center of the inner form: substantially as set forth.

3. In combination with the table E, the perforated hollow form K, constituting the inner wall of the mold, the outer wall composed of a plurality of separable sections and lever arms by which the sections are respectively carried; such lever arms being pivoted at a distance from the center of the inner form; lines from their pivots respectively, being substantially tangent to the outer mold wall of inner surface of such sections: substantially as set forth.

4. In a machine for pressing vessels of fibrous pulp, a rigid frame F having a tapering interior; an elastic tapering metal jacket adapted to fit within the rigid frame and longitudinally rifted at one side, and tending elastically to spread at the rift, in combination with a form adapted to carry the molded vessel into such tapering jacket: substantially as set forth.

5. In combination with the table or lower follower and the inner form thereon, the tapering frame and the upper follower therein; means for advancing the lower follower into the tapering frame, the upper follower being provided with a stem extending upward; a stop on the stem, and two plungers above the stop, and a stop fixed with respect to the frame above the springs, whereby the springs tend to resist the upward movement of the follower; one of said springs being much lighter than the other, whereby it is compressed to a pre-determined limit before the resistance of the heavier spring takes effect: substantially as set forth.

6. In combination with the lower follower or table, and the form thereon; a means for advancing them into the tapering frame, said tapering frame and the elastically expanded jacket therein, and means for holding the jacket yieldingly up into the frame to the limit of compressibility of the jacket: substantially as set forth.

7. In combination with the table and the form thereon; the rigid frame into which they are adapted to be advanced longitudinally; the elastically expanding tapering jacket N within the rigid frame; the counter-weighted lever P, and link connections therefrom to the jacket, whereby the weight tends to hold the jacket up yieldingly within the frame: substantially as set forth.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 29th day of May, 1893.

EBER HUBBARD.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.