(No Model.)

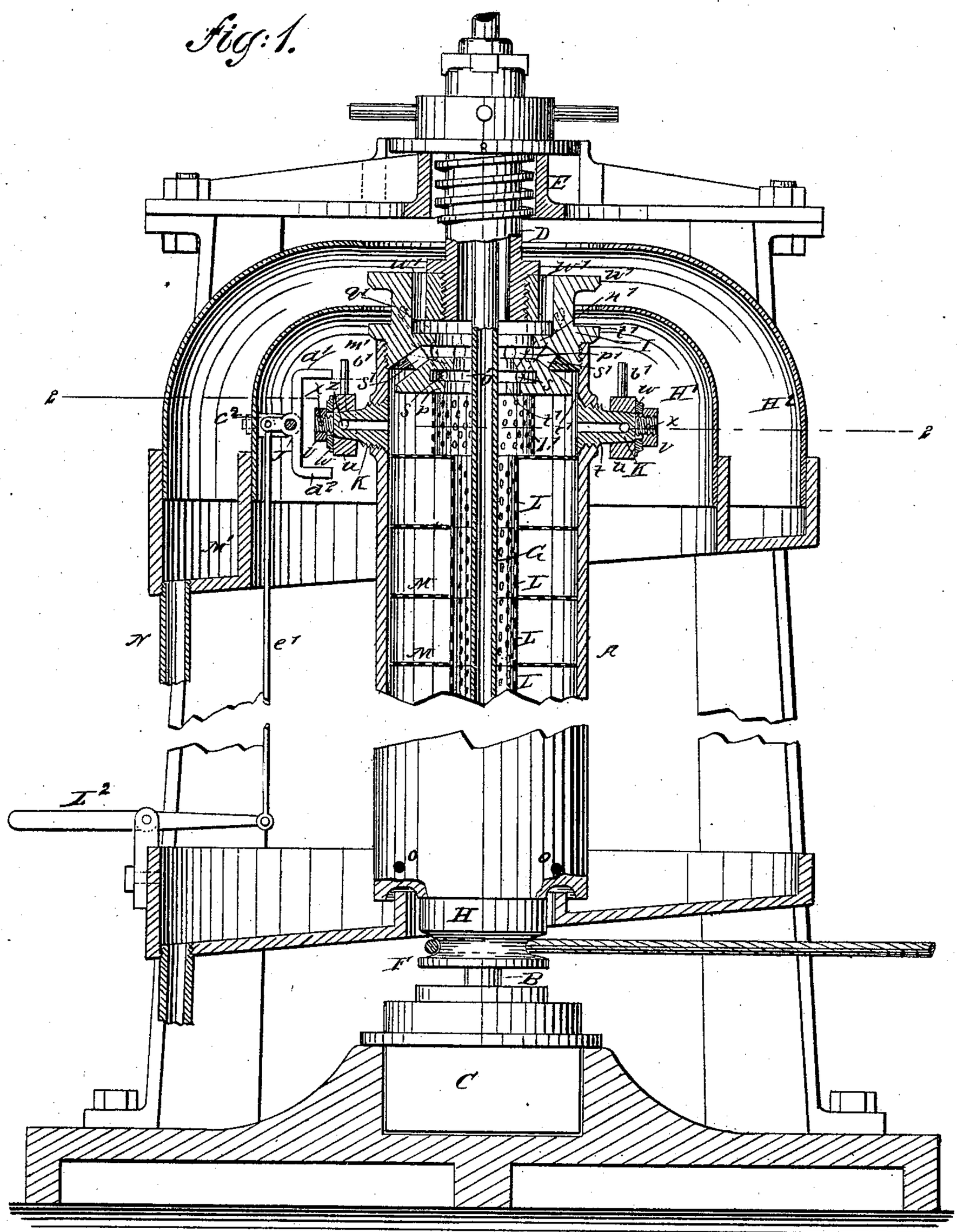
4 Sheets—Sheet 1.

P. C. HEWITT.

CENTRIFUGAL MACHINE.

No. 581,208. Patented Apr. 20, 1897.

Fig: 1.



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CENTRIFUGAL MACHINE.

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Fig. 1ª

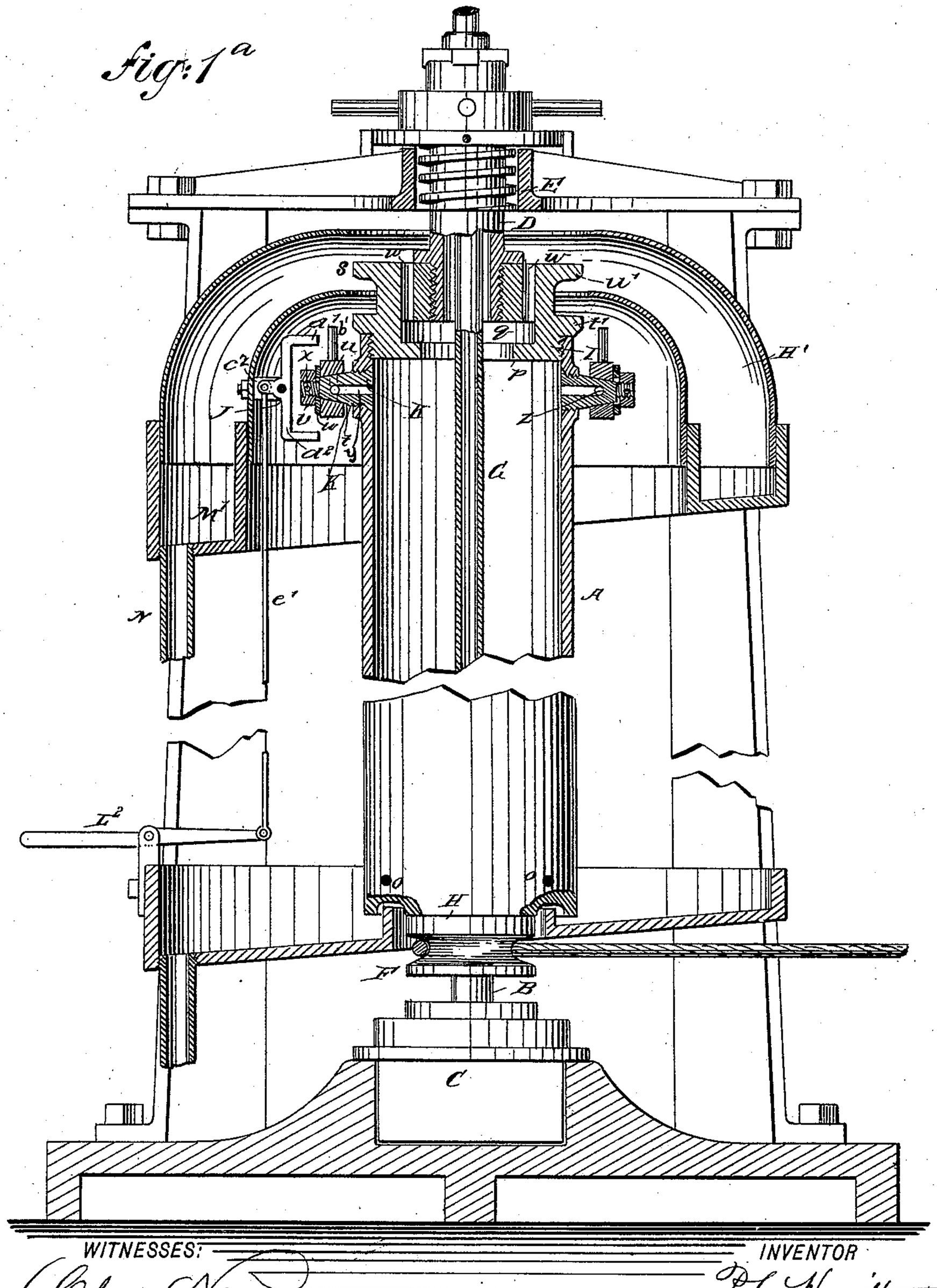

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Fig: 2.

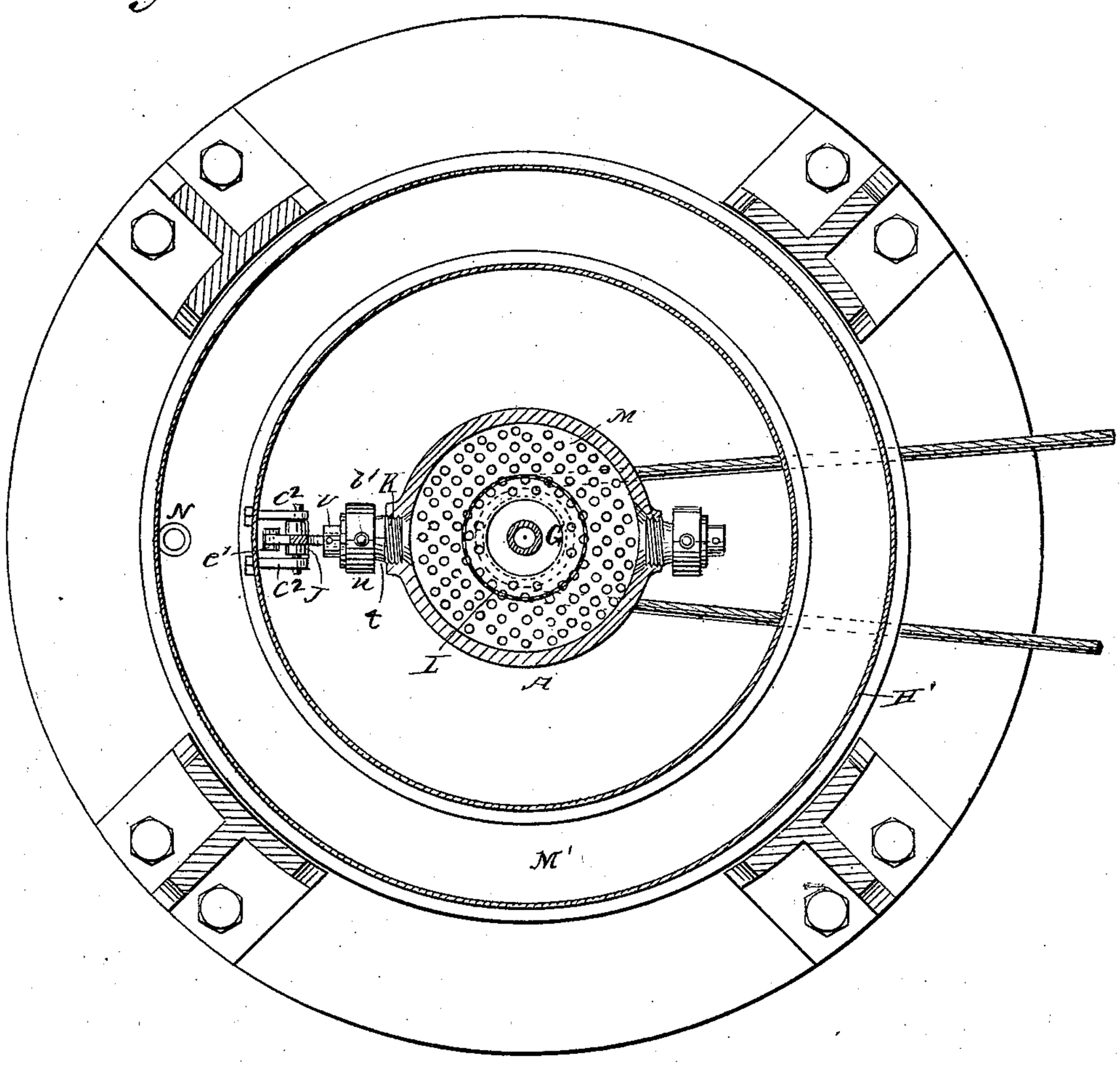

Fig: 3.

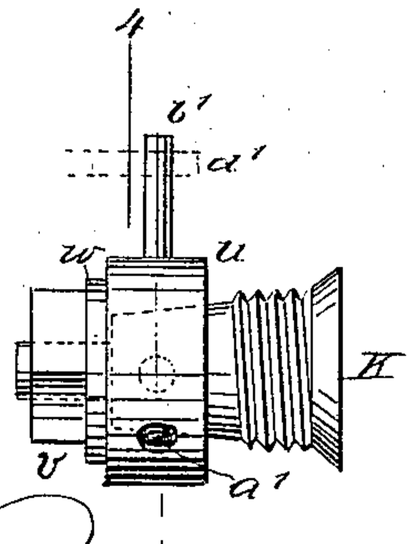

Fig: 4.

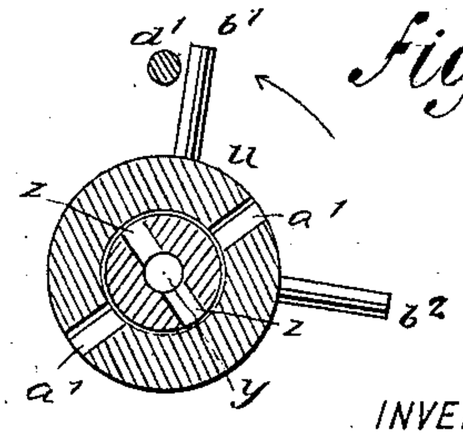

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Fig: 5.

Fig: 7.

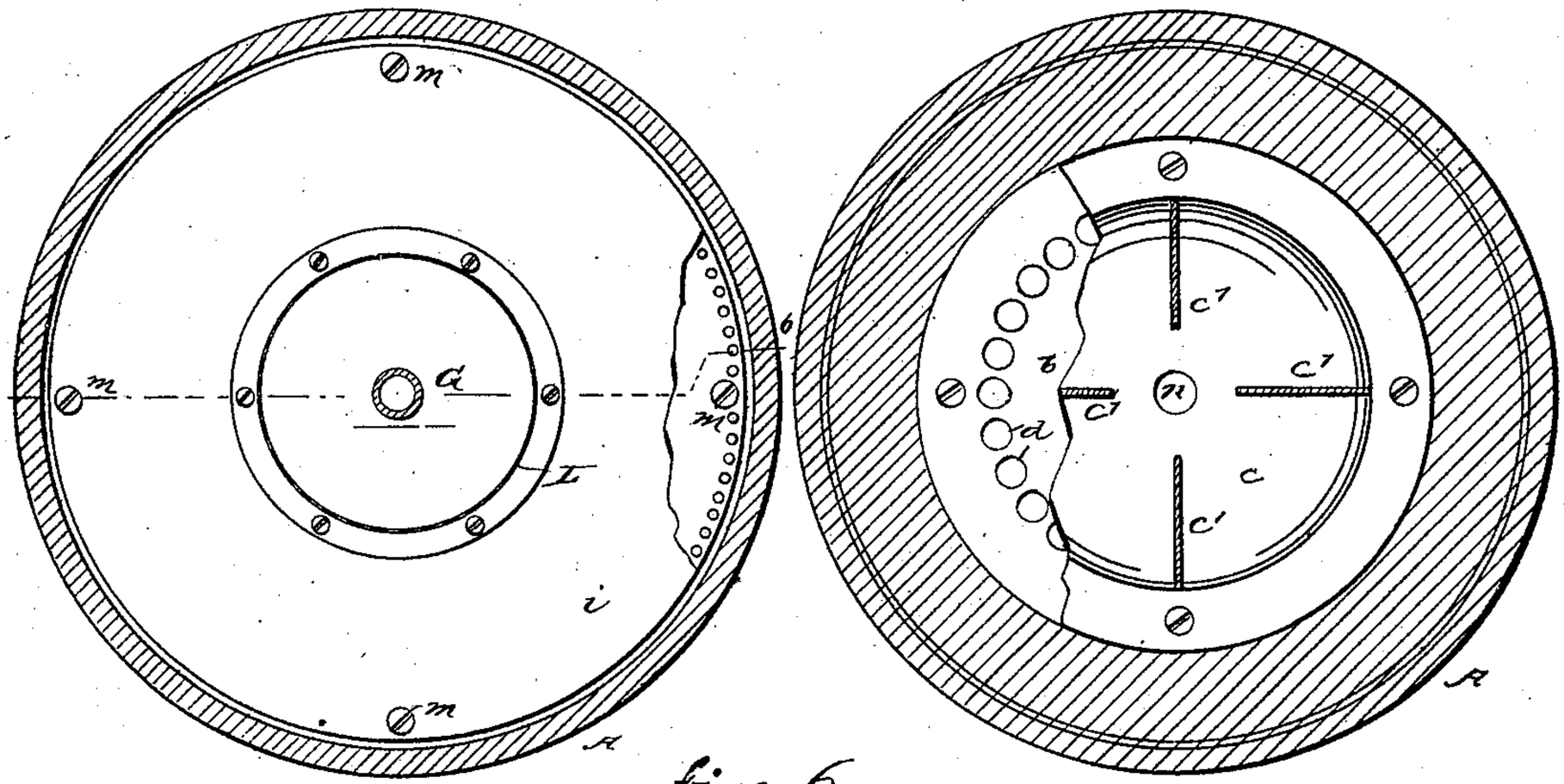
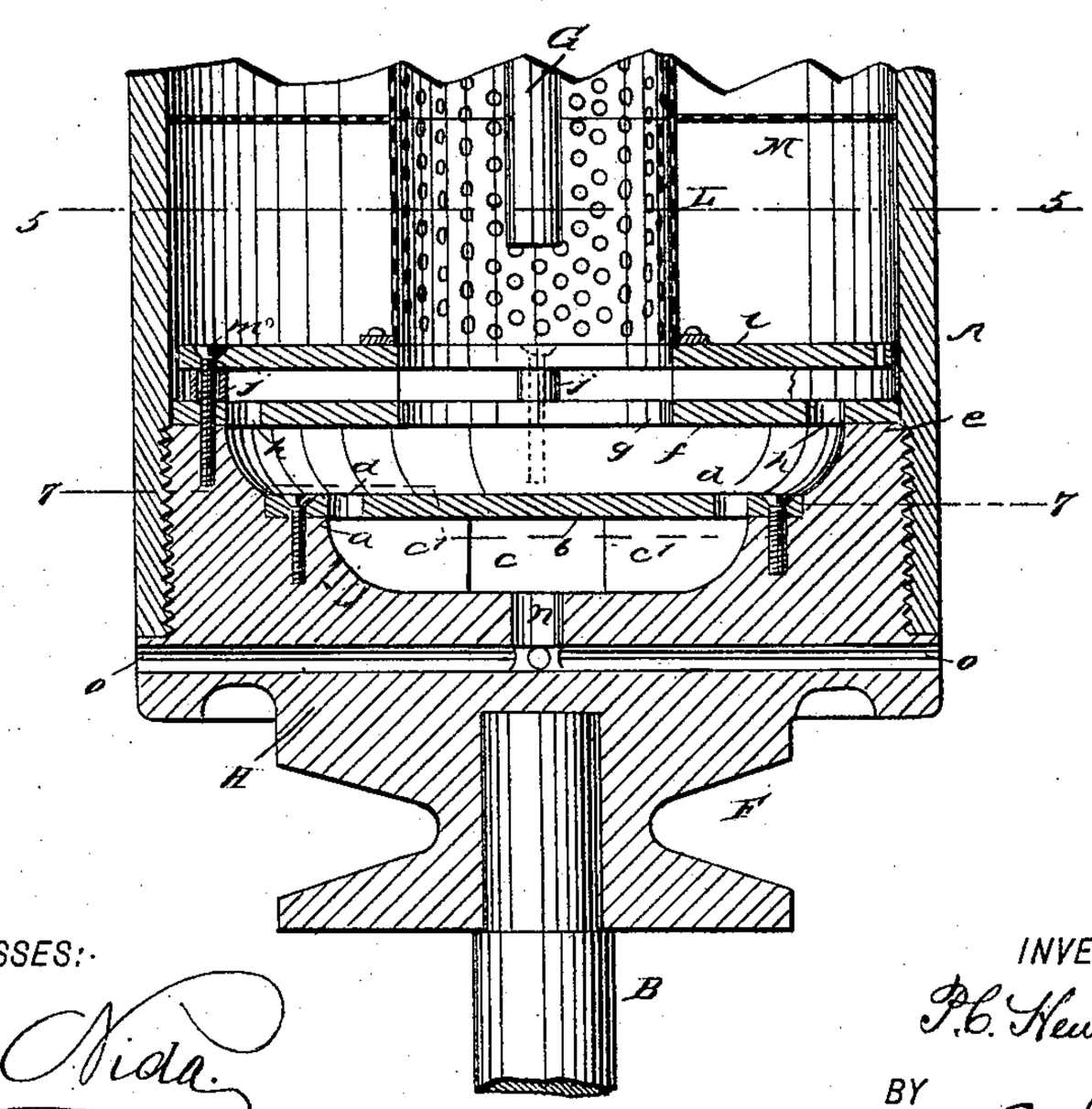


Fig: 6.



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UNITED STATES PATENT OFFICE.

PETER COOPER HEWITT, OF NEW YORK, N. Y.

CENTRIFUGAL MACHINE.

SPECIFICATION forming part of Letters Patent No. 581,208, dated April 20, 1897.

Application filed April 12, 1895. Serial No. 545,521. (No model.)

To all whom it may concern:

Be it known that I, PETER COOPER HEWITT, of New York city, in the county and State of New York, have invented a new and Improved Centrifugal Machine, of which the following is a full, clear, and exact description.

My invention is an improvement upon the centrifugal machine for which application for Letters Patent of the United States, Serial No. 535,128, was filed by me January 16, 1895; and the object of my present invention is to adapt the machine to the separation of liquids and such solids and semisolids as are discharged from the separating-bowl with difficulty; also for the separation of living organisms which have a different density from the liquid they grow in, but have the power to remain suspended in the liquid.

My invention consists in the combination, with the separating-bowl, of weirs for controlling the distribution of the liquid or mixture to be operated upon.

It also consists in a peripheral discharge, a valve, and a valve-operating mechanism for controlling the discharge.

It also consists in the combination, with the bowl, of perforated hoops and perforated annular plates placed within the bowl for checking the free circulation of the material being operated upon, all as will be hereinafter more fully described.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the views.

Figure 1 is a vertical transverse section of a centrifugal machine embodying my improvements. Fig. 1ª is a similar view of a slightly-modified form of the machine shown in Fig. 1. Fig. 2 is a horizontal section taken on line 2 2 in Fig. 1. Fig. 3 is a detail side elevation of the peripheral discharge-valve. Fig. 4 is a transverse section taken on line 4 4 in Fig. 3. Fig. 5 is a horizontal section taken on line 5 5 in Fig. 6. Fig. 6 is a vertical transverse section taken on line 6 6 in Fig. 5, and Fig. 7 is a horizontal section taken on line 7 7 in Fig. 6.

The centrifugal machine to which my improvements have been applied consists of a bowl A, formed of a metal tube of small diameter and considerable height, attached at its lower end to a shaft B, which revolves in a step C, and having at its upper end a tubular bearing D, running in a vertically-adjustable journal-box E. The shaft B is provided with a pulley F, which receives the belt for revolving the bowl A, and a tube G passes through the tubular bearing D into the bowl for feeding the bowl with material to be separated. The solid head H, forming the lower portion of the bowl, is provided with a ledge *a*, to which is secured the plate *b*, leaving a space *c* below the plate. In the space *c* are inserted radial wings *c'*, which extend from the ledge *a* toward the center of the space. In the plate *b*, adjoining the ledge *a*, are formed perforations *d* for the discharge of the contents of the bowl as its speed is slackened.

To the annular top *e* of the solid head H is secured an annular plate *f*, having a central opening *g* of smaller diameter than the opening of the stop *m'* in the upper head and a series of perforations *h* adjoining the inner edge of the top of the head H. Above the annular plate *f* is placed an annular plate *i*, which rests on distance-pieces *j*, standing on the annular plate *f*. The central opening of the plate *i* is of the same size as the opening *g* of the plate *f*, and the said annular plate *i* has a discharge opening or openings at or near its periphery. Screws *m*, passing through the plate *i*, the distance-pieces *j*, and the plate *f*, enter the head H and clamp the several pieces mentioned in the position of use. A central passage *n* extends from the space *c* to radial discharge-passages *o*, formed in the head H.

In the upper end of the bowl A is secured a steel head I, which is bored axially to receive the upper journal D and to form weirs *p n'*, the stop *m'*, and the intervening spaces *o' p' q'*. The inner portion of the head I is made smaller in diameter than the bowl A, leaving an annular space *r'*, and radial passages *s'* are formed in the head I between the annular space *r'* and the space *p'* below the weir *n'*. The passages *s'* are inclined outwardly from the space *p'* to the annular space *r'*. The head I is provided with two flanges *t' u'* for the discharge of liquids of different densities emerging from the different passages of the head I. Radial passages *s s* extend obliquely upward and open at the upper surface of the flange *t'*. Passages *w'* extend from the space *q'* to the top of the head I.

In the bowl A are placed a number of perforated hoops L, which together form a tube. Each hoop L supports a perforated annular disk M, having an internal diameter about equal to the diameter of the stop m' or weir p and an external diameter equivalent to the internal diameter of the bowl A.

On the upper disk M is placed a hoop L', which in this case is larger in diameter than the others, the hoops L, as shown, being preferably smaller in diameter than the interior of the hollow liquid cylinder contained by the bowl, while the hoop L' is larger in diameter than the interior of the hollow liquid cylinder, and therefore lies within the body of the liquid composing the cylinder. The perforated hoops and disks prevent the liquid contained by the bowl from circulating and forming currents within itself.

In a screw-threaded perforation in the side of the bowl A, near the top thereof, are inserted the plugs t of discharge-valves K. The portion of the plug t adjoining the outer surface of the bowl A is made tapering to receive the conically-bored ring u, which is held in place on the tapered portion of the plug by a nut v on the threaded outer end of the plug, and a washer w placed between the ring u and nut v. As an additional safeguard a pin x is passed through the threaded end of the plug and through the nut. The plug t is bored axially to a point opposite the center of the ring u, forming a passage y, and is bored transversely, forming passages z z, which communicate with the passage y. The ring u is bored transversely, forming passages a' a', which at one point in the revolution of the ring coincide with the passages z z. In the ring u are inserted two studs b' b^2, projecting radially, forming with each other an angle of about ninety degrees.

Between ears c^2, secured to the inner wall of the hood H', is pivoted a three-armed lever J, having the arms d' d^2, which project above and below the pivot of the lever, the ends of the said arms being bent at right angles in the direction of the axis of the bowl A, and the said lever J is placed in such relation to the ring u and studs b' b^2, carried thereby, as to be able to engage the studs when the lever is tilted in the manner presently to be described. To the shorter arm of the lever J, which is arranged at right angles to the longer arms, is pivoted one end of a rod e', the other end of which is pivoted to a lever L^2, fulcrumed on a standard attached to a fixed part of the separator.

The operation of my improved centrifugal machine is as follows: The bowl A being in motion, the material to be acted upon is admitted to the bowl through the pipe G, and falling upon the plate b it partakes of the motion of the plate and is thrown by centrifugal force against the wall of the head H and is caused by the pressure thus created to rise through the apertures h of the plate f, and the pressure of the material in a radial direction in the space between the plates f i causes it to move outwardly between the said plates, when it is thrown outwardly against the wall of the bowl A and is discharged upwardly through the space between the annular plate i and the wall of the bowl, or through the holes in the plate i, near its periphery, when a series of perforations is preferred to the annular space, at the same speed of rotation as that of the bowl. The material rises in the bowl A and the heavier or solid portions take a position adjoining the wall of the bowl, while the lighter liquid portions escape over the weirs p n' into the spaces o' or p', thence through the passages s' w', when it is thrown off by the flanges t' and u' and projected against the concave outer wall of the hoods H' and H^2, the heavier portions going to the hood H^2 and the lighter to the hood H'.

As my improved form of centrifugal machine is especially adapted to the purification of beer, when beer is treated in the machine the pure liquid is discharged in substantially the manner described over a single weir p through the passages w', finding its way to the hood H^2 and gutter M', whence it is removed by the pipe N. The yeast and other impurities contained by the beer accumulate along the wall of the bowl and are disposed of periodically by opening the discharge-valve K. This is accomplished by tilting the lever J so as to throw the angled end of the arm d' into the path of the stud b', thus causing the arm to engage the stud and turn the ring u through a quarter of a revolution, thereby causing the passages a' a' to coincide, allowing the heavy material lying next to the wall of the bowl to escape through the valve. By tilting the lever J in the opposite direction by means of the lever L^2 the arm d^2 of the lever J is thrown into the path of the stud b^2, thus causing the ring u to turn in the opposite direction, closing the discharge-apertures.

The practical method of discharging the yeast is to stop the bowl, allowing the beer to discharge itself by gravity through the openings n o, then to open the valve K and revolve the bowl, and after the discharge of the yeast to close the said valve and proceed with the separation.

I have hereinbefore referred to plates b and f, which act successively on the liquid to impart to it the requisite velocity. Said parts I term a "starting device" and a "distributing device," respectively, on account of their particular functions, which I will now clearly define.

The starting device, that is, the plate b, in the construction shown, is a surface open to the liquid as first delivered to the machine, and which rotates with the bowl and is so arranged as to start the action of the centrifugal force and thereby direct the liquid toward the distributing device.

The distributing device (in the construction shown the plate f) is a device or surface which will deliver the liquid coming

from the starting device to points intermediate of the center of rotation and the wall of the bowl at approximately the velocity that corresponds to the motion of the rigid parts of the bowl at the same distance from the center. The office of the distributing device therefore is to so modify and control the flow of the liquid that said liquid will travel at approximately the same speed as the surfaces with which it engages or on which it rests.

The bowl, the starting-plate apertured near its periphery and arranged in the bowl, and the feed-pipe discharging on the starting-plate are not claimed herein, the same being claimed in the hereinbefore-mentioned application.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a centrifugal liquid-separator, a bowl having an outlet at its upper end, a starting device located at the bottom of the bowl, and arranged to start the action of centrifugal force on the liquid, a feed-pipe discharging on said starting device, a distributing device located above said starting device, and having apertures or channels at points intermediate of the wall of the bowl and the axis of rotation to cause the liquid to move at said points at approximately the same angular speed as the bowl, and an annular plate located above the distributing device yet below the outlet of the bowl, said plate having one or more peripheral discharge-passages adjacent to the wall of the bowl, substantially as described.

2. A separating-bowl having a weir in its head for the discharge of the lighter portions of the contents of the bowl, and provided in its upper portion below said weir with a peripheral discharge-opening through the wall of the bowl, said discharge being arranged for the intermittent escape of the heavier material, and a valve for closing said peripheral discharge entirely, substantially as described.

3. In a centrifugal liquid-separator, a bowl having an outlet at its upper end, a starting-plate located at the bottom of the bowl and arranged to start the action of centrifugal force on the liquid, a feed-pipe discharging centrally on said starting-plate, an annular distributing-plate above said starting-plate, and having apertures or channels at points intermediate of the wall of the bowl and the axis of rotation to cause the liquid to move at said points at approximately the same angular speed as the bowl, and another annular plate arranged above the distributing-plate yet below the outlet of the bowl, said plate having one or more peripheral discharge-passages adjacent to the wall of the bowl, substantially as described.

4. A centrifugal liquid-separator, comprising a rotatable separating-bowl, provided with an axial feed-channel and a discharge-passage extending outwardly through the peripheral wall of the bowl at the upper portion thereof, and a valve accessible from the outside and held to rotate with the bowl, said valve being arranged to entirely close the aforesaid discharge-passage, substantially as specified.

5. In a centrifugal liquid-separator, the combination with the lower head provided with a starting-plate having a cavity below the starting-plate, of one or more radial wings placed below the starting-plate, substantially as specified.

6. In a centrifugal liquid-separator, the combination, with the rotatable separating-bowl provided with a valve, said valve having a stud or projection, of a relatively stationary operating device arranged on the outside of the bowl and adapted to be projected into the path of travel of the projection of the valve to operate the latter, substantially as described.

7. In a centrifugal liquid-separator, a bowl having an outlet at its upper end, a central feed-pipe, a perforated cylindrical tube surrounding said feed-pipe, and a starting-plate arranged below and at a distance from the lower end of said perforated tube and extending outwardly to a greater distance from the axis of rotation than the radius of said tube, so that the liquid delivered on said starting-plate is carried to the outer surface of said tube substantially as described.

8. In a centrifugal liquid-separator, a rotatable separating-bowl having an outlet at one end, a central feed-pipe, a perforated cylindrical tube surrounding the feed-pipe, and perforated annular disks arranged transversely of the bowl and surrounding the said perforated pipe, substantially as described.

9. In a centrifugal liquid-separator, a bowl supported in bearings and having a contraction near its discharge end, a starting device at the opposite end of the bowl, a feed-pipe extending axially through one of the bearings, and arranged to discharge on said starting device, permanently-open discharge-passages at the contracted portion of the bowl, and valved discharge-passages between said contracted portion and the starting device, substantially as described.

10. In a centrifugal liquid-separator, a rotatable separating-bowl provided with a feed device, permanently-open discharge-passages at the top of the bowl, and valved discharge-passages arranged in the upper portion of the bowl yet below said open discharge-passages, the valve in said passages being normally closed, substantially as specified.

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