(No Model.) 3 Sheets—Sheet 1.

J. NAYLOR, Jr.

CONTINUOUS EXTRACTOR.

No. 528,735. Patented Nov. 6, 1894.

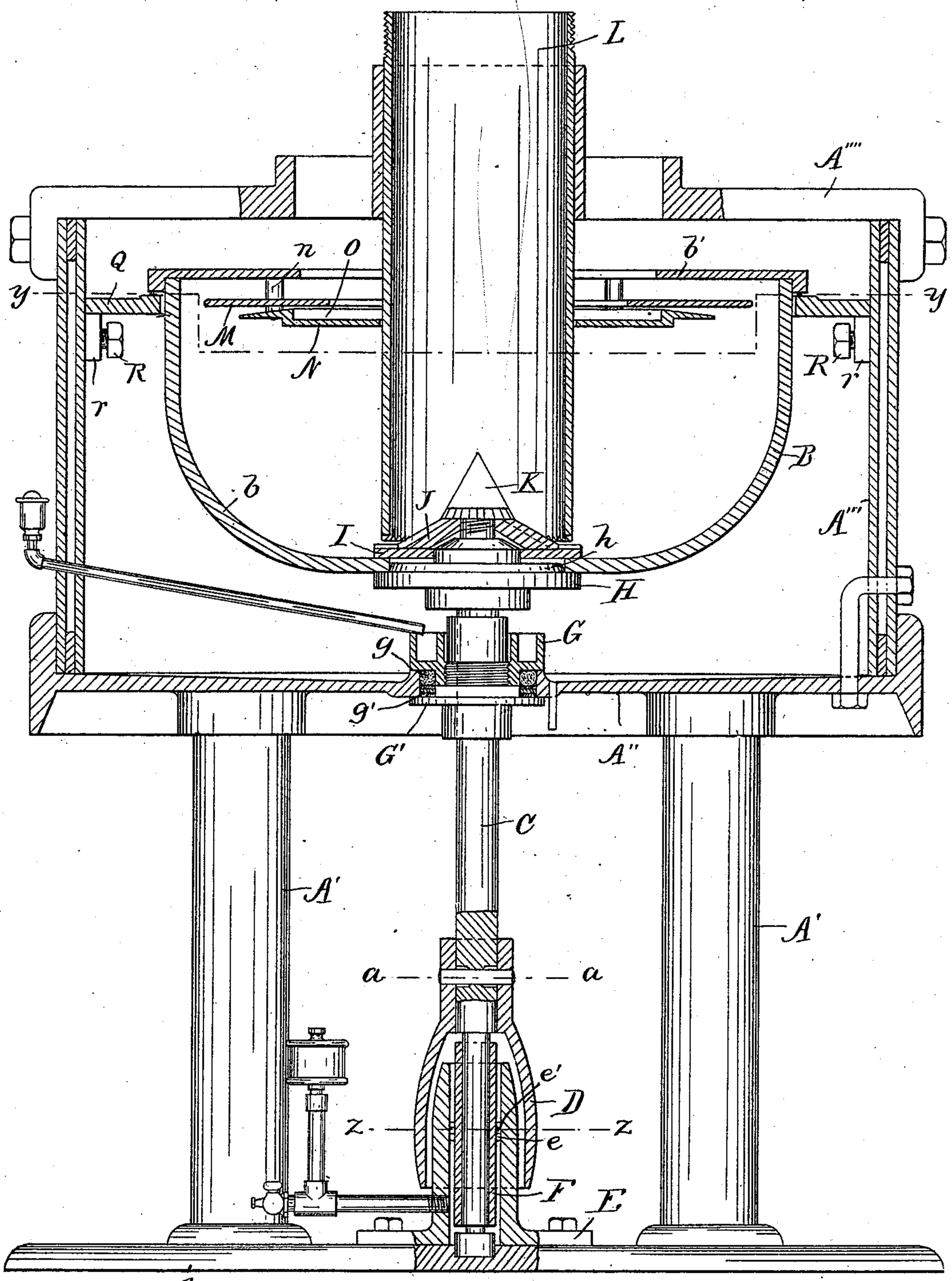

Fig. 1.

WITNESSES.
John A. Johnson.
A. Kenny

INVENTOR.
James Naylor Jr

(No Model.) 3 Sheets—Sheet 2.

J. NAYLOR, Jr.

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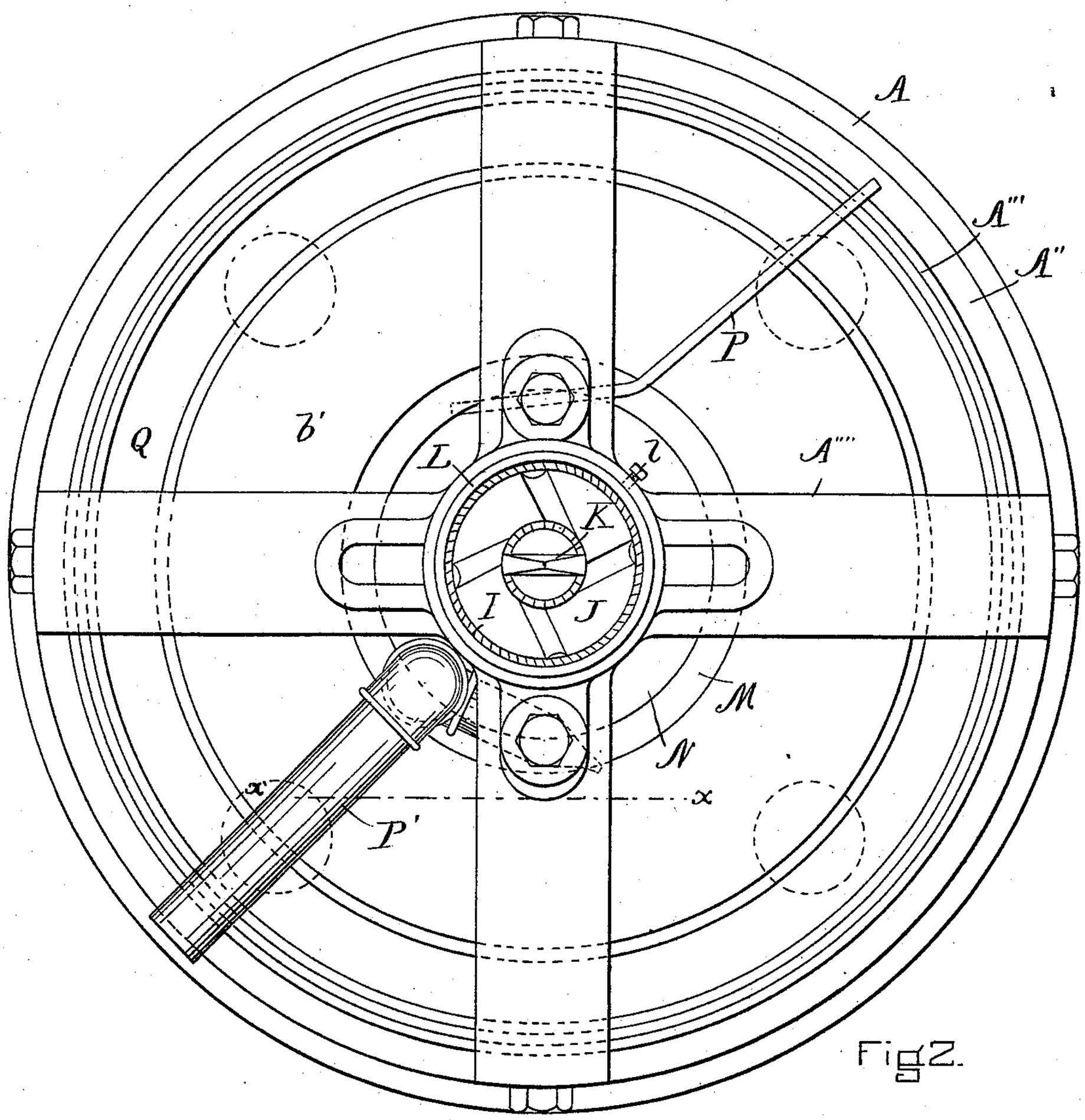

Fig 2.

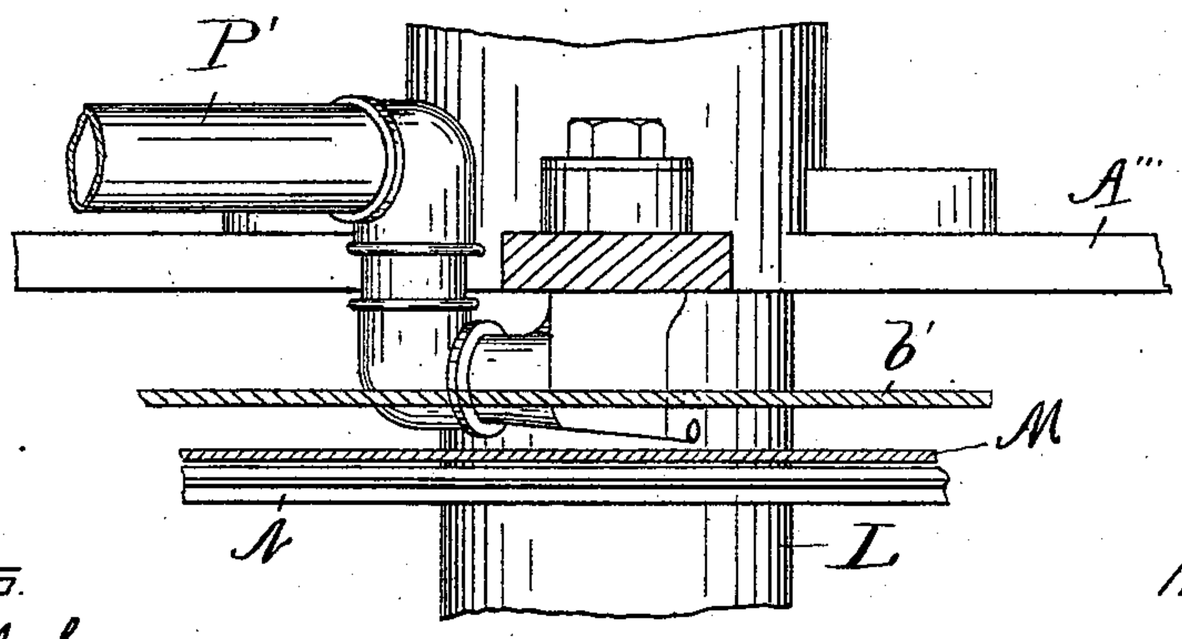

Fig. 3.

WITNESSES.

John A. Johnson.
A. Kenny

INVENTOR.

James Naylor Jr

(No Model.) 3 Sheets—Sheet 3.

J. NAYLOR, Jr.

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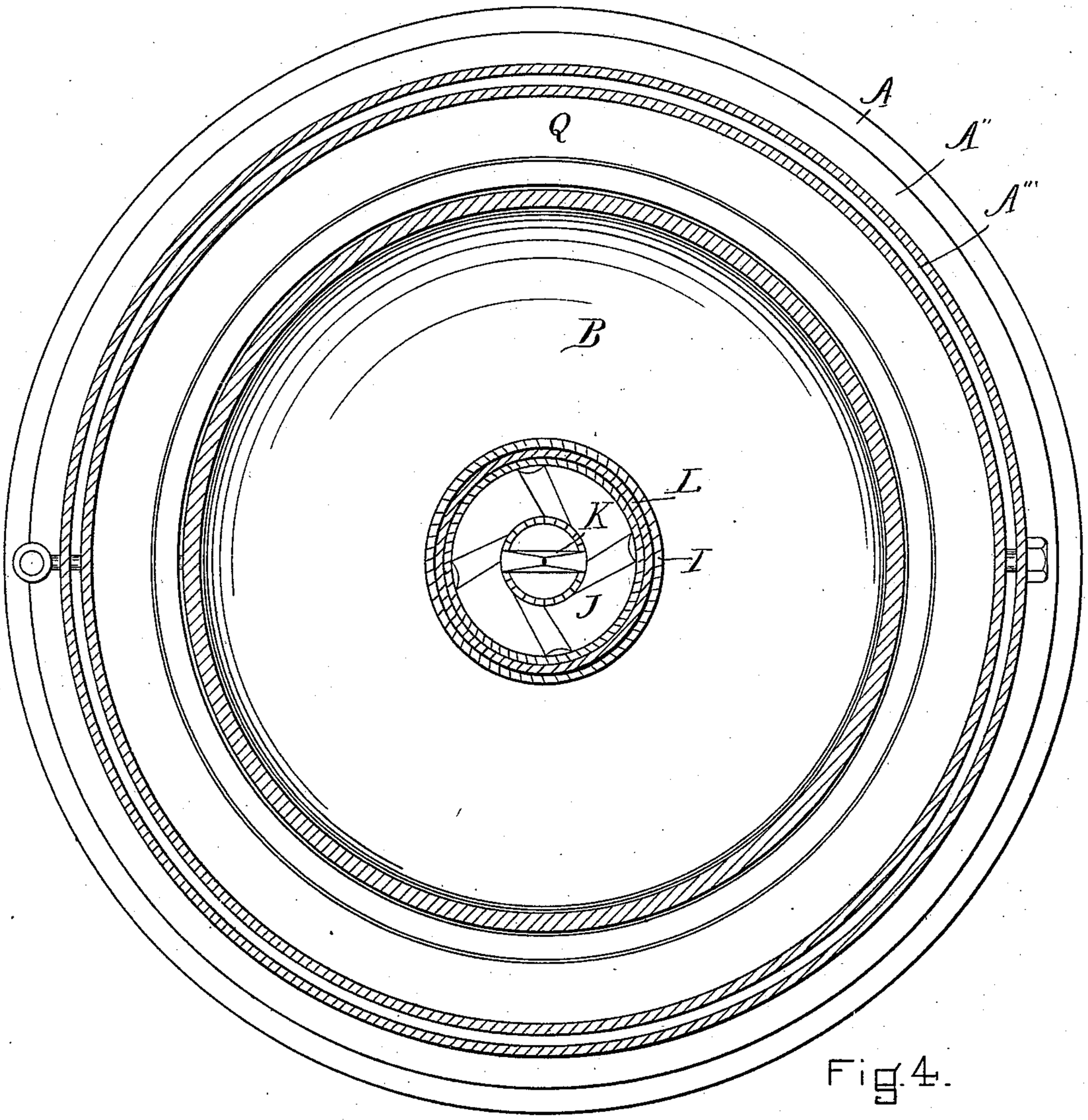

Fig. 4.

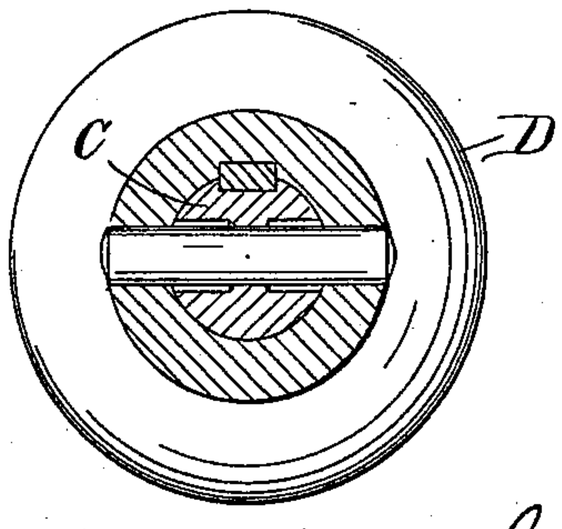

Fig. 5

WITNESSES.
John A. Johnson
A. Kenny

INVENTOR.
James Naylor Jr

UNITED STATES PATENT OFFICE.

JAMES NAYLOR, JR., OF BOSTON, MASSACHUSETTS, ASSIGNOR OF THREE-FOURTHS TO GEORGE THOMAS McLAUTHLIN, OF SAME PLACE.

CONTINUOUS EXTRACTOR.

SPECIFICATION forming part of Letters Patent No. 528,735, dated November 6, 1894.

Application filed November 9, 1892. Serial No. 451,439. (No model).

To all whom it may concern:

Be it known that I, JAMES NAYLOR, Jr., a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Continuous Extractors, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to machines for continuously extracting a liquid from solid matter or a solid from a liquid as the case may be; the object being to lessen the cost of production of various commodities and to obtain increased yields.

It consists in the peculiar construction and arrangement of its parts in such a manner that well known natural laws are used to effect the results; also of means whereby the machine is made safe to operate; all of which will be herein fully specified and set forth in the claims.

Figure 1 is a vertical section. Fig. 2 is a plan view; Fig. 3, a vertical section on line *x x*, Fig. 2; Fig. 4, a horizontal section on line *y y*, Fig. 1; Fig. 5, a section on line *a a*, Fig. 1.

A A′ A″ A‴ A⁗ constitute the frame work of the machine. The bottom plate A, posts A′, center-plate A″, body part A‴ and top piece A⁗, are all secured together. The only parts having motion are the bowl B and contents, the arbor C and pulley D. Secured to the bottom plate is the lower bearing case E, and within it the lower bearing box F is held by the annular projection *e*, and held from turning by a pin and notch *e′*. A suitable step is arranged to support the weight of the arbor and bowl. The upper bearing box is made in two parts, one part G being above the center-plate A″, the other part G′ being below it. The upper part serves as an oil cup and a support for the lower part, which is screwed into it as shown, so that it is held vertically to the center-plate A″, but horizontally it has a scope of movement allowed it by the soft intervening rubber spring *g* and a like limited movement by the hard intervening rubber spring *g′*. This construction allows to the arbor C a free revolving and limited gyratory motion.

The pulley D is secured to the arbor C by an improved means. It is first keyed on as ordinarily, the taper of the key being upward. A hole is then drilled through the shaft and hub in relation to the key as shown at Fig. 5. The pulley is then removed from the arbor and the hole in the arbor counter-drilled as shown. The pulley is replaced and a pin driven tight through the hub and arbor. The key is then driven tight. This prevents the pulley dropping down if the key should become loose, and on redriving the key the pin does not prevent the hub from hugging close to the arbor.

The horizontal dotted line *z z* represents the plane of the center or middle of bearing, center of bearing box, center of annular projection, center of pulley, center of belt, and therefore center of oscillation of the arbor in its revolutions. This arrangement necessitates the improved fastening of the pulley to the arbor previously described, at some distance above the dotted line *z z*.

A flange H having a rabbeted edge *h* is a part of the arbor and upon it and centrally held by the rabbet is the bowl B, it being held down and to the flange by the collars I and J and screw K. The upper surfaces of these collars and screw are serrated as shown, and present a series of sharp cutting edges upward and outward.

L is the feed hopper sustained in a rigid central position within the bowl from the top piece A⁗, and has a vertical range of adjustment. Its lower edge is serrated and comes in close proximity to the cutting edges of the collar I below it. A set screw *l* serves to hold it in position. The cutting edges of collar I are horizontal, and correspond with the serrated edge of the feed hopper, so that in the gyrations of the arbor, the space between them is not materially changed. The cutting edges of the collar J and nut K cut obliquely and against the perpendicular wall of the hopper. The cutting edges upon the collars and nut are to all intent and purpose integral with the bowl and arbor and with the stationary hopper constitute the means whereby the feed is so reduced as to pass into the bowl.

The bowl is what is commonly known as imperforate, and is made as follows:—The lower piece *b* is forged with an open top and turned to fit the flange of the arbor C. The cover *b′* has

the rings M and N secured to it by studs. An annular passage is provided between the periphery of the ring M and the inner surface of the part of the bowl *b*, and this passage is also continued between the upper surface of the ring M and the lower surface of the part *b'* of the bowl. The capacity of this passage is such as not to create too much friction of the moving hard matter. Another passage is provided between the rings M and N. This passage converges toward the axis, until the two rings come in very close proximity. Nearer the axis the passage is wide to form the gutter O. These rings, openings, and cover are all concentric with each other, and their different dimensions and arrangement in different machines provide for the various purposes for which they are intended.

P and P' are skimmers, securely bolted to the top piece A'''' of the frame for removing the respective liquid and solid constituents of the material after the separation of such has been effected within the bowl. These are of ordinary make except that the one is exceptionally large to allow discharge of heavy matter. The large skimmer is set into the upper opening, the smaller one into the lower opening or gutter O. These skimmers do not require any delicate adjustment, and therefore no provision is made for such.

To prevent excessive damage in event of a bowl bursting from any cause whatever, a safety arrangement is devised.

Q is a ring, encircling the bowl having a clearance of one-sixteenth inch to one-eighth inch, and is true and smooth on its inner surface. This ring is reinforced by the wrought iron body part A''' of the frame, to which it is held by means of set screws R through the lugs *r* and screwed against the body part, which at this point consists of an inner and outer shell with an intervening space.

Should the bowl ever reach such a speed as to stretch the metal, the bowl will come in contact with the reinforcing ring Q, causing such friction as will quickly reduce the speed, and thus prevent disastrous results.

The gyratory motion caused by the varying load is limited by the striking contact of the bowl against the safety ring and frame; and also the hard rubber ring of the upper bearing against the frame at the same time; so as to prevent undue strain upon the arbor. This motion is liable to occur at any instant in greater or less degree, but when limited it soon regains its easy motion.

The operation is as follows:—The preparatory filling of the imperforate bowl is effected by feeding the substance into the hopper, where it is reduced by the cutters and thrown into the bowl. The continued feed increases the mass of solid matter. Meanwhile the liquid is expressed from and through the interstices of the mass to the outlet between the rings M and N. When there is sufficient head to cause a movement of the hard matter around the ring M and to the skimmer P', the machine is in continuous operation. The continued feed maintains the horizontal head, by which sufficient force is obtained to move the impacted matter at the periphery over the ring M to the skimmer P'. The liquid part is continually expressed, being filtered through the entanglement of solid matter and finally discharged through the skimmer P.

The speed of the bowl, the horizontal head, the bulk of solids carried, the amount and regularity of feed, are the important factors effecting the result.

This machine is especially adapted for extracting the liquid part of fruit and vegetables from the fibrous or solid portion; and has been mostly operated as an extractor of apple juice. The apples are fed continuously into the stationary hopper where they are reduced to pulp by the cutters secured to the arbor and bowl; and by the continued feed the semi-fluid pulp flows down the hopper and finds exit therefrom in an extremely fine and well distributed discharge owing to the high rate of speed.

The pulp in the bowl becomes compressed by the centrifugal action which squeezes out the liquid from the mass, said liquid passing off at the outlet provided for it; and as the incoming pulp adds to the mass already in the bowl there is more compression, more exudation of juice and more solid matter carried in the bowl. This action continues until the mass of solids is so heavy and so influenced by the centrifugal action that it is forced thereby to move toward the discharge provided for it. By the continued feed the machine is now in continuous operation and as heretofore stated the horizontal head is maintained to which the speed gives force to exert pressure in the depths of the mass to squeeze out the juice and to keep the whole on a move in the direction of the respective discharges. By varying the dimensions of the several parts and the passages for the material to pass through, the machine can be made so as to adapt it for other uses.

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

1. In a centrifugal extractor, the combination with the supported arbor, imperforate bowl and cutters; of a supported stationary feed hopper extending into said bowl and in close proximity to said cutters and means for separation and discharge of the separated constituents as herein set forth.

2. In a centrifugal extractor, the combination with the supported arbor bowl and cutters; of a supported stationary feed hopper provided with a serrated lower edge and means for separation and discharge of the separated constituents as herein set forth.

3. In a centrifugal extractor, the combination with the supported arbor and bowl the collar I provided with cutting edges revolving in a horizontal plane of the supported stationary feed hopper provided with a serrated

lower edge and means for separation and discharge of the separated constituents as herein set forth.

4. In a centrifugal extractor, the combination with the supported arbor imperforate bowl and cutters; of the feed hopper provided with a vertical means of adjustment and support, and means for separation and discharge of the separated constituents as herein set forth.

5. In a centrifugal extractor, the combination with the supported arbor and bowl; of the collars I, J and nut K provided with cutting edges, the supported feed hopper and means for separation and discharge of the separated constituents as herein set forth.

6. In a centrifugal extractor, the combination with the supported arbor bowl and cutters; of the feed hopper supported from the frame so as to be concentric to the said cutters in their revolutions, and means for separation and discharge of the separated constituents as herein set forth.

7. In a centrifugal extractor, the combination with a supported arbor and bowl, said bowl provided with the supported rings M and N; of cutters secured to said arbor and bowl, a centrally supported feed hopper and means for discharge of the separated constituents as herein set forth.

8. In a centrifugal extractor, the combination with the supported arbor and bowl, said bowl provided with the ring M of a diameter larger than that of the ring N, said ring N having a part of its upper surface flaring so as to make a tapered passage between said rings; of means for reduction and inflow thereto and discharge of the separated constituents therefrom as herein set forth.

9. In a centrifugal extractor the combination with the bowl having its opening of greater diameter than either the contained rings M and N, the ring M having its internal diameter greater than that of the ring N, the ring N having its internal diameter to clear the outer diameter of the hopper; mounted upon the supported arbor; of means for reduction and inflow of the material and discharge of the separated constituents as herein set forth.

10. In a centrifugal extractor, the combination with the supported arbor and bowl, said bowl provided with the supported ring M having its upper and lower surfaces flat, the supported ring N having its upper surface inwardly approaching the said ring M to a point about equal to the opening of the bowl, thence inwardly in a plane and at a distance below the ring M to form the gutter O; of means for reduction and inflow thereto and discharge of the separated constituents therefrom as herein set forth.

11. In a centrifugal extractor, the combination with a supported arbor and bowl, the supported ring N extending inwardly beyond the ring M and the cover *b'* of said bowl, so as to provide a space for the mass to accumulate between the lower part of said bowl and said ring N; of means for reduction and inflow thereto and for the discharge of the separated constituents from said bowl as herein set forth.

12. In a centrifugal extractor, the combination with a supported arbor and rabbeted flange provided with means for a combined revolving and gyratory motion, a bowl mounted thereon and secured thereto, said bowl carrying cutting edges; of the feed hopper L supported concentrically above said cutting edges; so that the gyratory movement of said bowl and arbor does not materially alter the opening from said hopper to said bowl, substantially as herein shown and described.

13. In a centrifugal extractor, the combination with the supported arbor and bowl provided with the ring M of greater inner and outer diameters than the ring N, the ring N extending inwardly in close proximity to the feed hopper; both rings supported by studs *n* to the cover *b'*; of means for reduction and inflow thereto; and discharge of the separated constituents therefrom as herein set forth.

14. In a centrifugal extractor the safety ring Q provided with suitable means of support to the reinforcing and body part; in combination with the said reinforcing and supported body part of the frame, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 4th day of November, A. D. 1892.

JAMES NAYLOR, JR.

Witnesses:
JOHN A. JOHNSON,
A. KENNY.