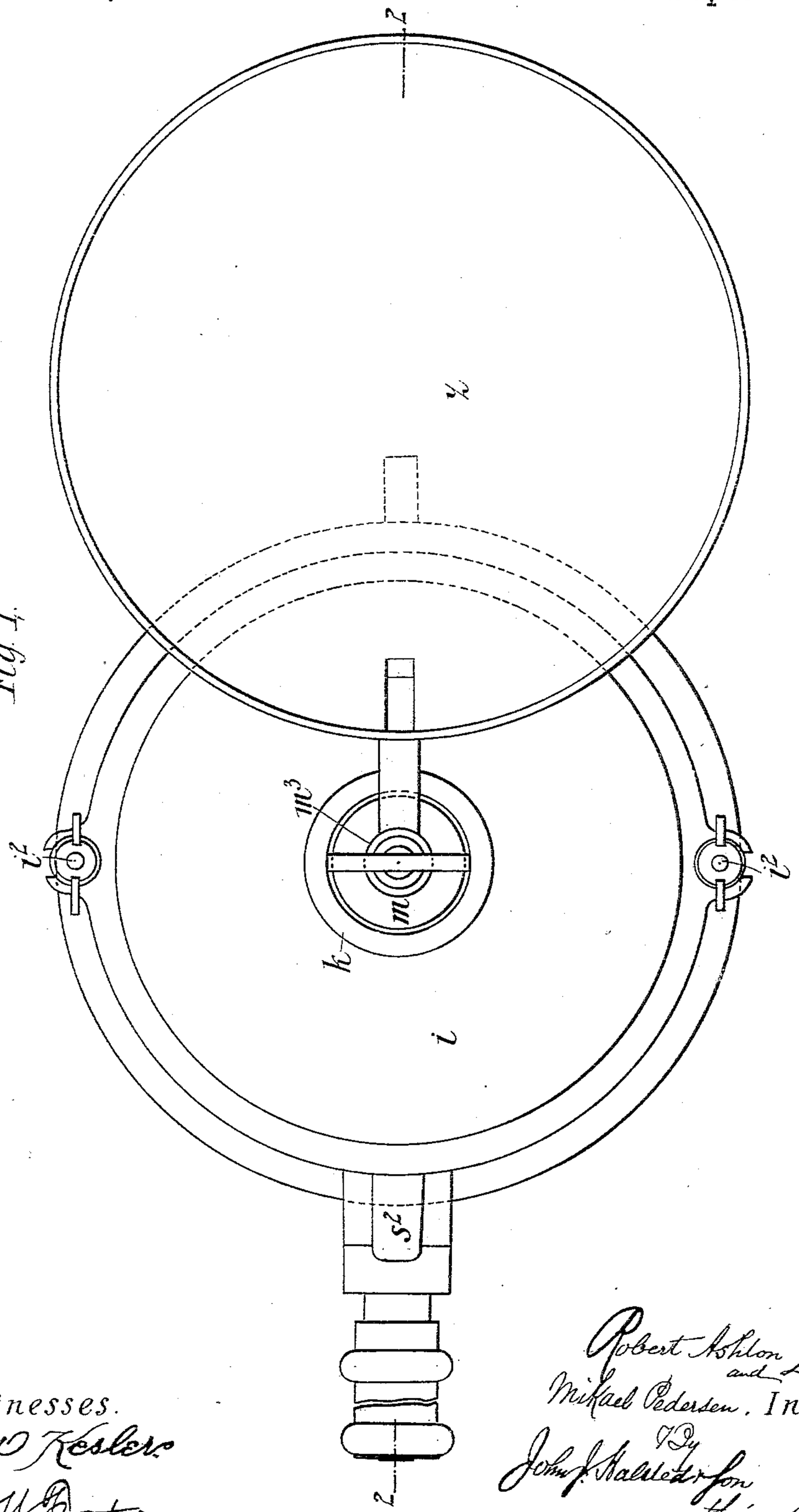
(No Model.) 4 Sheets—Sheet 1.

R. A. LISTER & M. PEDERSEN.

CENTRIFUGAL LIQUID SEPARATOR.

No. 504,809. Patented Sept. 12, 1893.

Fig. 1.



Witnesses.
C. L. Kesler
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(No Model.) 4 Sheets—Sheet 2.

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Fig. 4

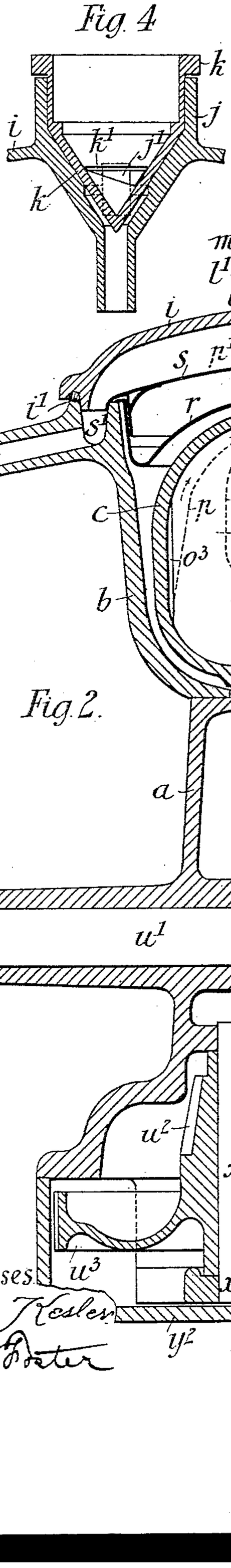

Fig. 2.

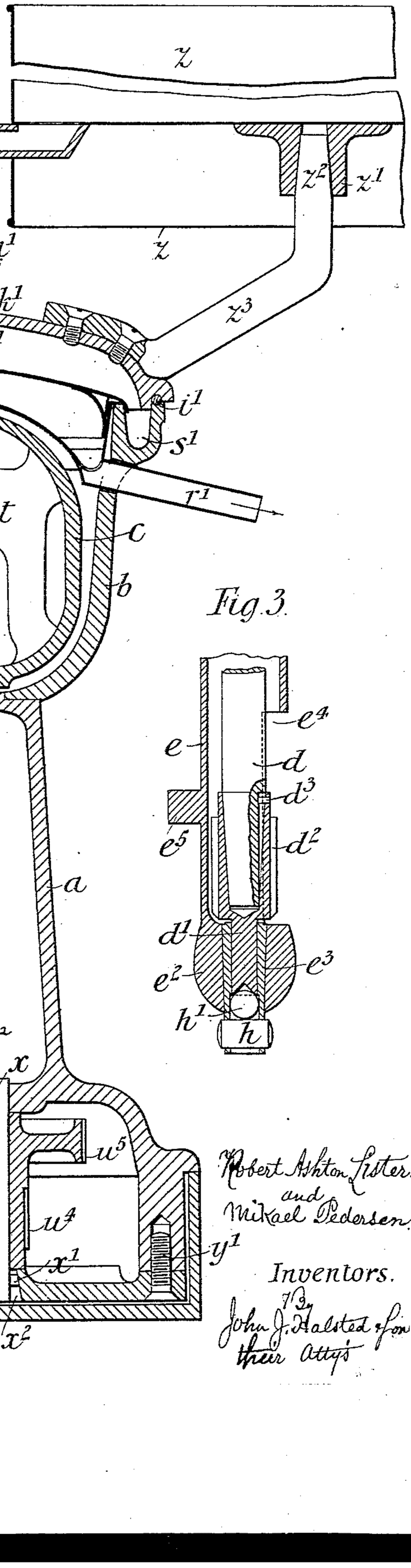

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

R. A. LISTER & M. PEDERSEN.

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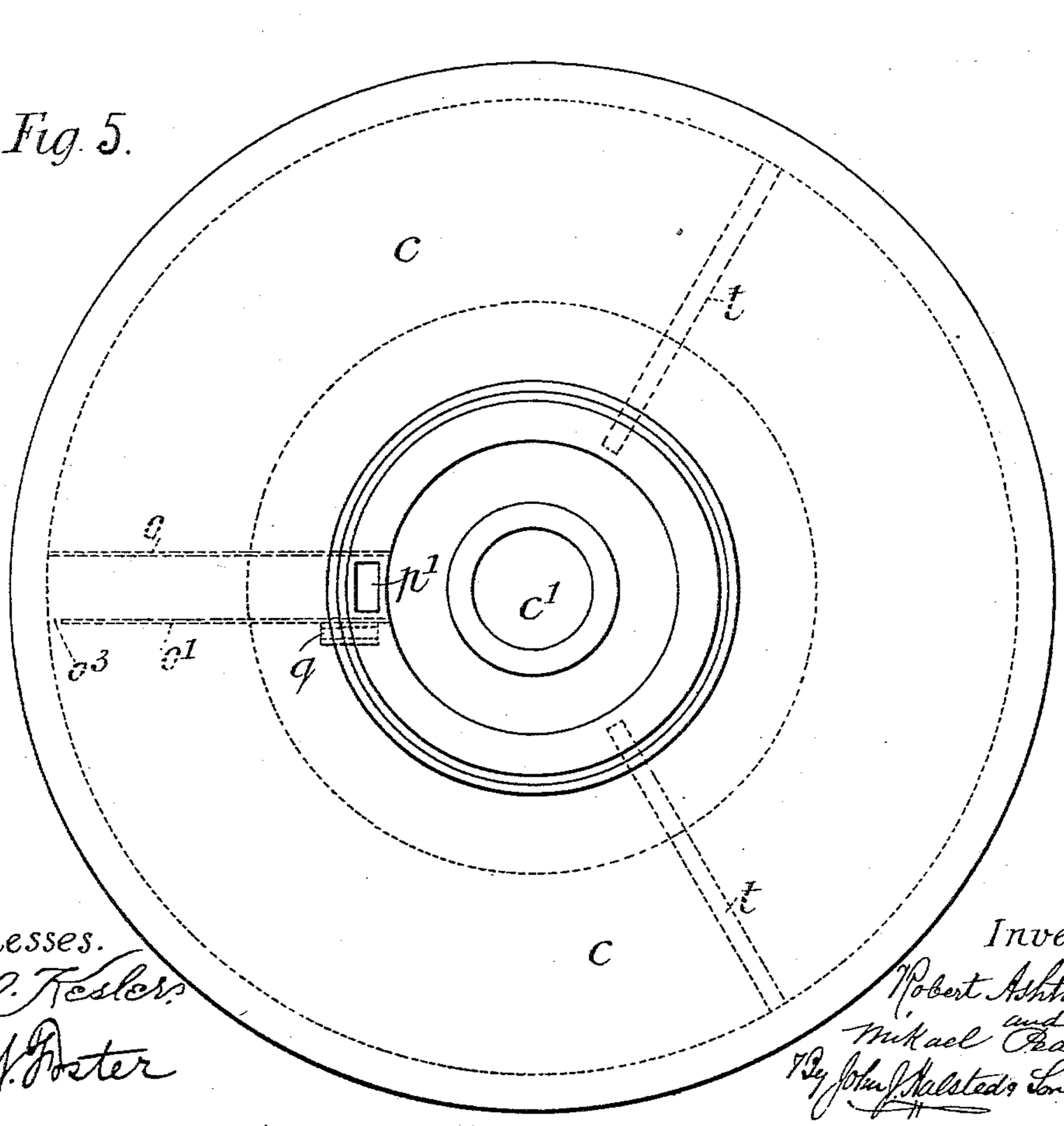
Fig. 5.



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(No Model.) 4 Sheets—Sheet 4.

R. A. LISTER & M. PEDERSEN.

CENTRIFUGAL LIQUID SEPARATOR.

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Fig. 8.

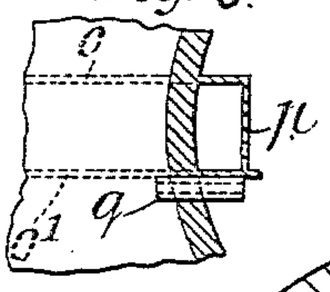
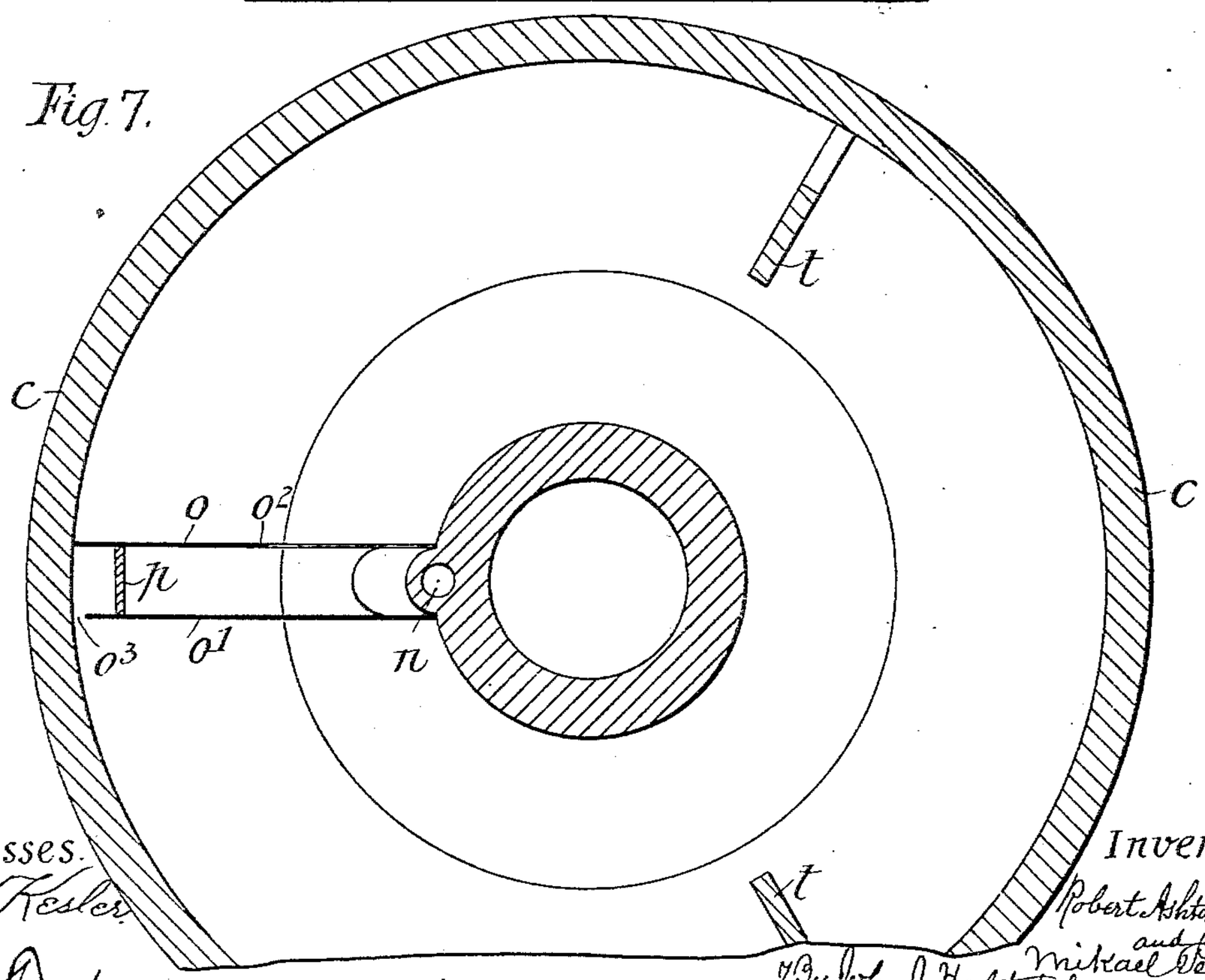


Fig. 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

ROBERT ASHTON LISTER AND MIKAEL PEDERSEN, OF DURSLEY, ENGLAND.

CENTRIFUGAL LIQUID-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 504,809, dated September 12, 1893.

Application filed November 11, 1892. Serial No. 451,687. (No model.)

To all whom it may concern:

Be it known that we, ROBERT ASHTON LISTER and MIKAEL PEDERSEN, subjects of the Queen of Great Britain, residing at Dursley, England, have jointly invented new and useful Improvements in Centrifugal Liquid-Separators, of which the following is a specification.

This invention relates to improvements in or applicable to that class of centrifugal machines employed for separating the lighter from the heavier constituent of a liquid such as in the separation of fatty or full milk into cream and skim milk.

To enable our invention to be fully understood we will describe the same by reference to the accompanying drawings, in which—

Figure 1 is a plan view of our improved separator; and Fig. 2 is a vertical section of the same on the line 2 2 Fig. 1. Fig. 3 is a view of a detail drawn to an enlarged scale. Fig. 4 is a sectional view of a detail hereinafter described. Fig. 5 is a plan of the centifugal bowl detached and drawn to an enlarged scale. Fig. 6 is a central vertical section of the same. Fig. 7 is a section on the line 9 9, Fig. 8; and Fig. 8 is a section on the line 10 10, Fig. 8.

Similar letters of reference indicate corresponding parts in all the figures.

a is the frame or standard of the machine, upon the head of which standard is mounted a casing *b* for containing the centrifugal bowl or drum *c*.

d, *d'* are the two parts of the vertical spindle carrying the said drum, the longer part *d* having at its upper end a hemi-spherical head upon which the said drum *c* is directly supported and having its lower end tapered so as to fit into a correspondingly tapered hole in the shorter or lower part *d'* of the spindle, as shown most clearly in Fig. 3, which lower part *d'* is provided with gear teeth d^2 to form it into a pinion. The turning of one part of the spindle relatively to the other is prevented by forming in the tapered part of the spindle *d* as shown also in Fig. 3 enlarged a groove designed to engage with a pin d^3 in the hole in the part *d'* also as shown in Fig. 3. With this arrangement it will be obvious that, while the weight of the drum will keep the two parts of the spindle in position when in work, the upper part of the spindle can be easily raised and detached from the lower part.

e is the tube or sleeve inclosing the spindle, the main or neck bearing of which is formed in the upper end of the said sleeve by a bushing *e'* while the lower end e^2 is preferably of a spherical shape as shown most clearly in Fig. 3 and provided with a central vertical hole which forms the bearing at the lower end of the spindle, the said lower bearing, as shown, being provided with a lining or bushing e^3 which projects downwardly below the bottom of the spherical end e^2. One side of the tube is cut away at e^4 in order to allow a gear-wheel to engage with the teeth d^2 on the part *d'* of the spindle. The tube *e* is supported at its lower end in a cup-shaped hanger or bracket *f* formed upon the frame *a*, and having a seat in which the spherical end e^2 of the said tube rests, as shown in Fig. 2, in such a manner that slight lateral movements of the tube can take place. The sleeve is prevented from turning by a projection e^5 on it engaging with a notch in the frame *a*.

g is the ring of india-rubber or other flexible material which fits upon the tube *e* between two collars *g'*, *g'* near its upper end and also fits within an opening g^2 in the upper end of the standard *a* for allowing slight lateral movements of the spindle to take place. The weight of the spindle is supported in the tube *e* by means of a roller *h*, inserted transversely through the projecting portion of the bush e^3 in the spherical end e^2, an anti-friction ball *h'*, being placed between this roller *h* and the lower end *d'* of the spindle, which lower end is preferably countersunk, as shown.

i is the cover of the casing *b*, the said cover being provided with an india-rubber or other packing ring *i'* to prevent the escape of liquid between the cover and the casing and adapted to be fixed in position by pivot bolts i^2.

j is the funnel which is formed integral with the said cover and serves to direct the milk into the central receiving cup *c'* of the drum *c*, the said funnel in its conical portion being provided with a groove or recess *j'* extending downward to the spout of the funnel.

k is the regulator which fits within the fun-

nel, as shown, and which is provided with a tapering opening k' formed in it in a circumferential direction in such a manner that the quantity of milk flowing through the funnel may be regulated by turning the regulator so as to present a broader or narrower part of its opening k' opposite to the groove j' in the funnel. The arrangement of the groove j' in the funnel and of the opening k' in the regulator will be readily understood by reference to Figs. 2 and 4.

l is the strainer which is composed of wire-gauze or other suitable material and provided at its upper part with a ring l' resting upon a shoulder within the regulator.

m is the float which is also of conical shape and which normally rests upon the ring l', suitable distance-pieces m' being arranged upon the ring l' or upon the float in order to afford a space between the said float and the ring through which the milk can flow. The upper end of the float is arranged in conjunction with the cock m^3 through which the milk flows from the receiver to the separator in such a manner that if the milk is flowing into the funnel faster than it flows from the funnel into the separator the said float will rise and more or less close the outlet of the cock.

m^2 is a wire upon the top of the float which enters the passage of the cock m^2 and serves to retain the said float in its proper position relatively with the cock.

n is the passage or pipe through which the milk which enters the central receiving cup c' of the drum flows into the drum proper, and o, o' are the two plates or vanes between which the passage or pipe n is situated. The vane o extends right across one side of the drum between the center dome and the inner periphery except where it is represented as being cut away by the dotted line o^2, while the other plate o' does not extend quite to the periphery of the drum at that part having the largest diameter so that it will not cut through that part of the liquid which is perfectly separated, but leave an opening or passage o^3.

p is the division plate or partition between the two vanes and which serves to form a passage between the vanes through which the skim milk which enters through the opening o^3 between the vane o' and the wall of the drum may be conveyed to the skim milk outlet p' formed in the neck of the drum and also to direct the incoming milk to the edge o^2 of the vane o where it mingles with the milk already in process of separation with the least possible disturbance. Or the skim milk may be conveyed to the outlet in the neck of the drum by a tube in the usual manner. In this case, however, we dispense with the division p and opening o^3.

q is the cream outlet which is arranged near the top of the vane o', as shown in Fig. 8, where the discharge of cream is not liable to be interfered with by the incoming milk, the cream having to pass all around the interior of the vessel before it escapes through the said outlet q.

r is the tray fitted in the upper end of the casing b over the drum c and into which the cream escaping through the opening q is discharged, the cream passing out from the said tray through the exit pipe r'.

s is a cover which is placed over the tray r and which serves to direct the skim milk escaping through the outlet p' into the groove or gutter s' around the upper part of the casing b, from which groove or gutter the said milk flows out through the pipe s^2.

t, t are plates arranged within the drum for preventing any great disturbance of the milk from vibration and for balancing the plates or vanes o, o' so as to insure the drum rotating as evenly as possible.

The arrangement of gearing which we advantageously employ for imparting motion to the drum comprises a bevel-wheel u mounted on the driving-shaft u' and gearing with a bevel-pinion u^2 formed integral with a cylindrical gear-wheel u^3; which wheel u^3 engages with a pinion u^4 formed integral with a wheel u^5 engaging with the gear-teeth d^2 upon the lower part d' of the drum spindle.

In practice we prefer to employ gearing having skew teeth so that the said gearing will run as noiselessly as possible. The shaft u' of the bevel-wheel u runs in a long bearing in the frame of the machine and the wheel itself is placed on the end of the shaft inside the frame with the teeth facing outwardly, the handle or driving pulley on the end of the said shaft serving to prevent the shaft from moving backward and thus prevent the bevel-wheel getting out of gear with its pinion u^2.

The shafts x, x carrying the combined bevel-wheel u^2 and cylindrical wheel u^3 and the combined spur-pinion u^4 and spur-wheel u^5 are supported at their upper ends in the framing a and at their lower ends in a cross piece y attached to the base of the frame a by screws y', y'. These shafts x, x have keys or studs x', x', fixed to them and adapted to enter key-ways x^2, x^2 in the cross piece y, the said keys being beveled at their ends and the said key-ways being correspondingly shaped so that when the said keys x', x' are pushed upward into position they will be tightly wedged. The shafts x, x are prevented from falling out by a plate y^2 forming part of a dish which is attached to the base of the separator by screws y^3 and forms a suitable bottom for the same.

z is the receiving vessel for the milk. This vessel is provided with a tapered socket z' adapted to fit on a tapered pin z^2 of a bracket z^3 secured to the cover i of the separator. By thus mounting the receiving tin the latter can be readily turned so as to bring the discharge cock m^3 over the funnel j of the separator.

Having now particularly described and as-

certained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a centrifugal liquid separator, a top cover having a grooved inlet funnel within which is fitted a hollow regulator having a tapering opening therein, such regulator being adapted to be turned so as to place a wider or narrower part of its said opening opposite said groove or channel in the funnel, substantially as described.

2. In a centrifugal liquid separator, a hollow regulator, combined with the inlet funnel and float, the regulator fitting within the funnel and having a shoulder for supporting the strainer ring and the float placed within it, all substantially as set forth.

3. In a centrifugal liquid separator, the combination with the drum or bowl of the two imperforate vanes or plates *o*. *o'*. placed near together to form a narrow vertical passage through which the fluid to be separated enters the drum, one of said vanes at its outer end or edge extending beyond that of the other vane, but not quite to the periphery of the drum.

4. In a centrifugal liquid separator having two plates or vanes *o*, *o'*, placed parallel and near together to form a narrow passage through which the fluid to be separated enters the drum, a partition *p*. at right angles thereto, located between the vanes near the wall of the drum and serving to divide the space between the vanes into two parts for entry of the milk and exit of the skim milk, substantially as described.

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