May 22, 1945. W. WILSMANN 2,376,744

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Fig. 1

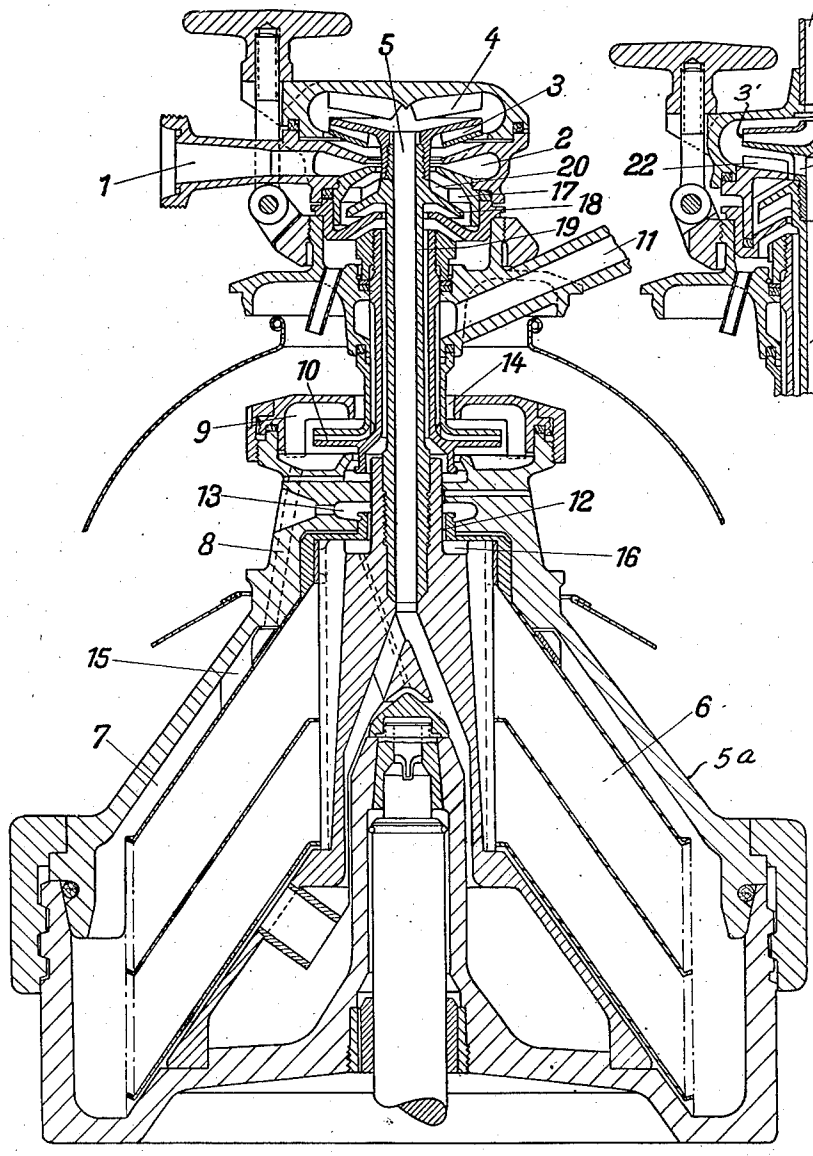


Fig. 2

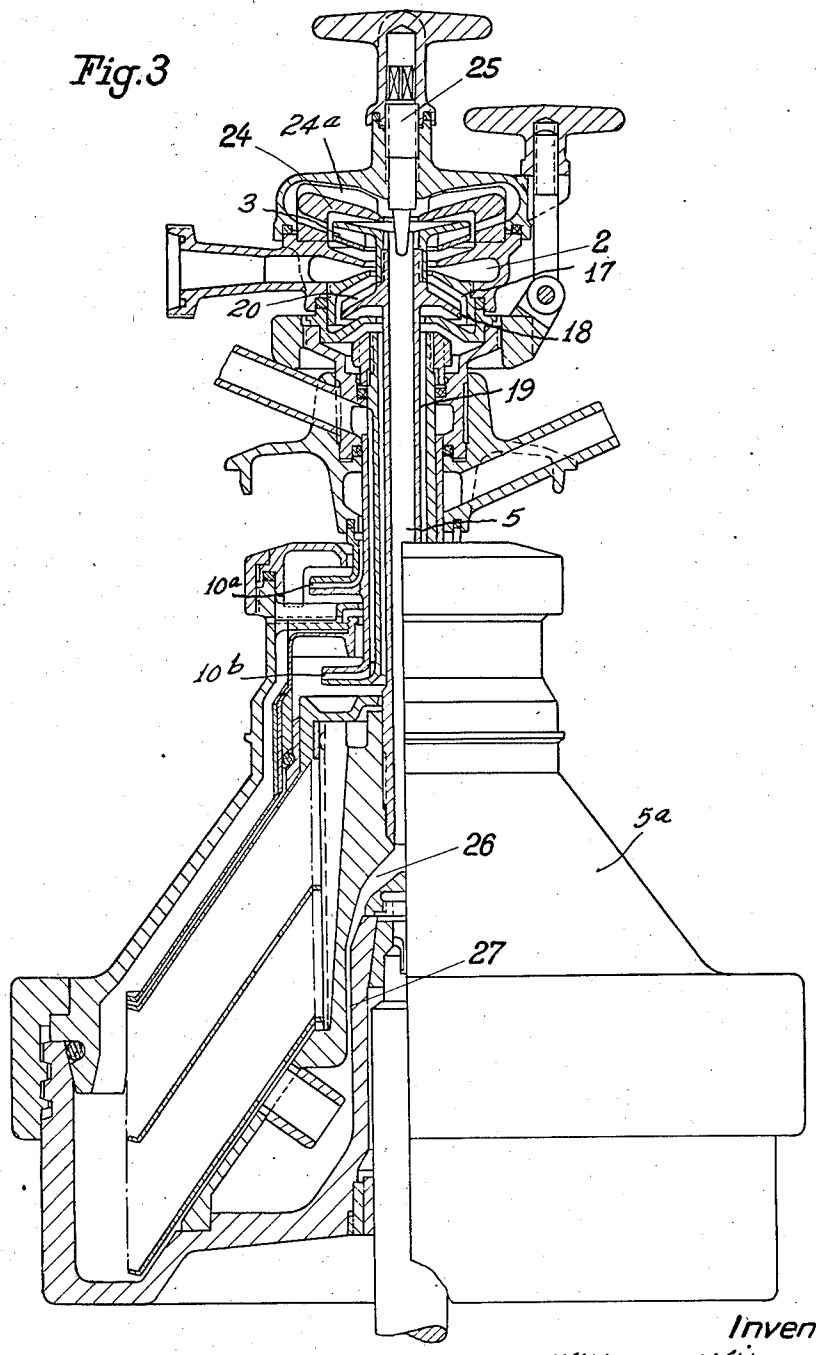
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Fig. 3



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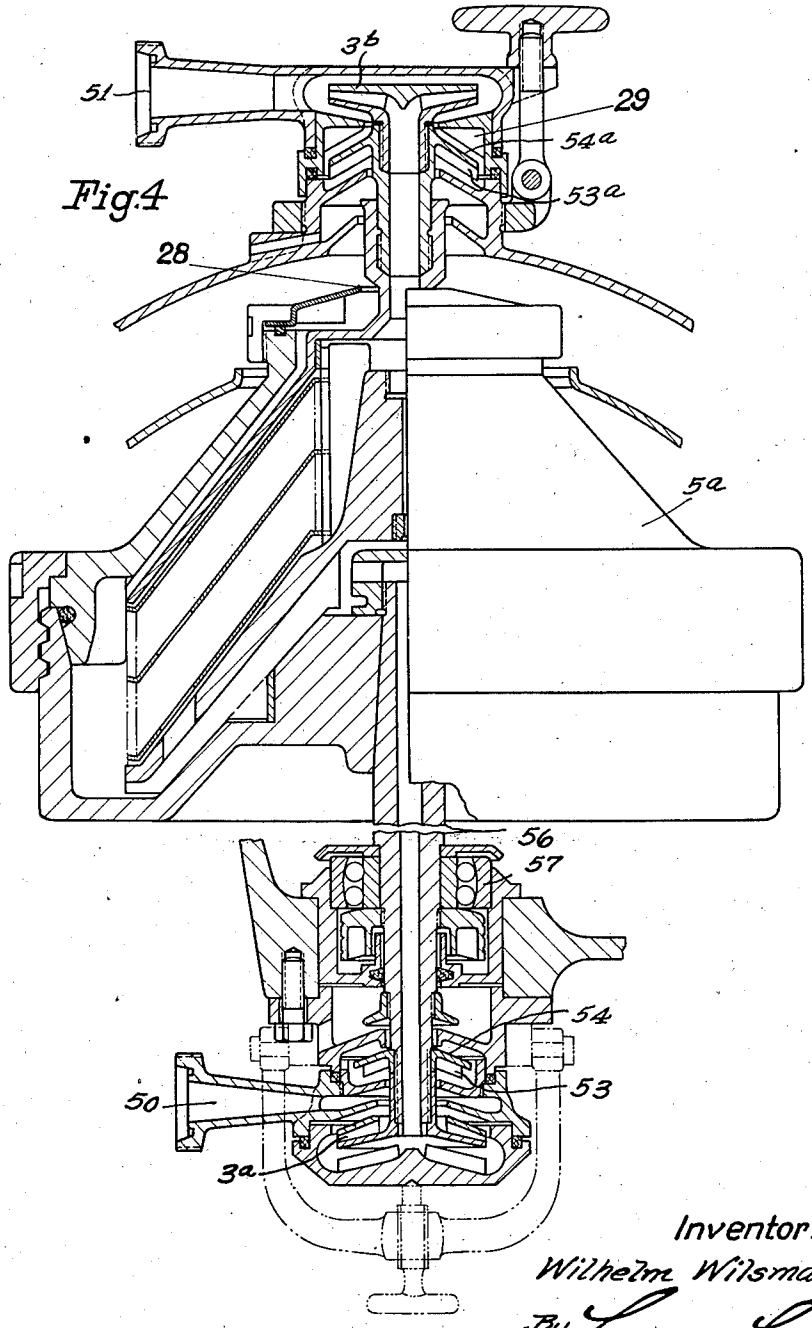
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Fig. 4



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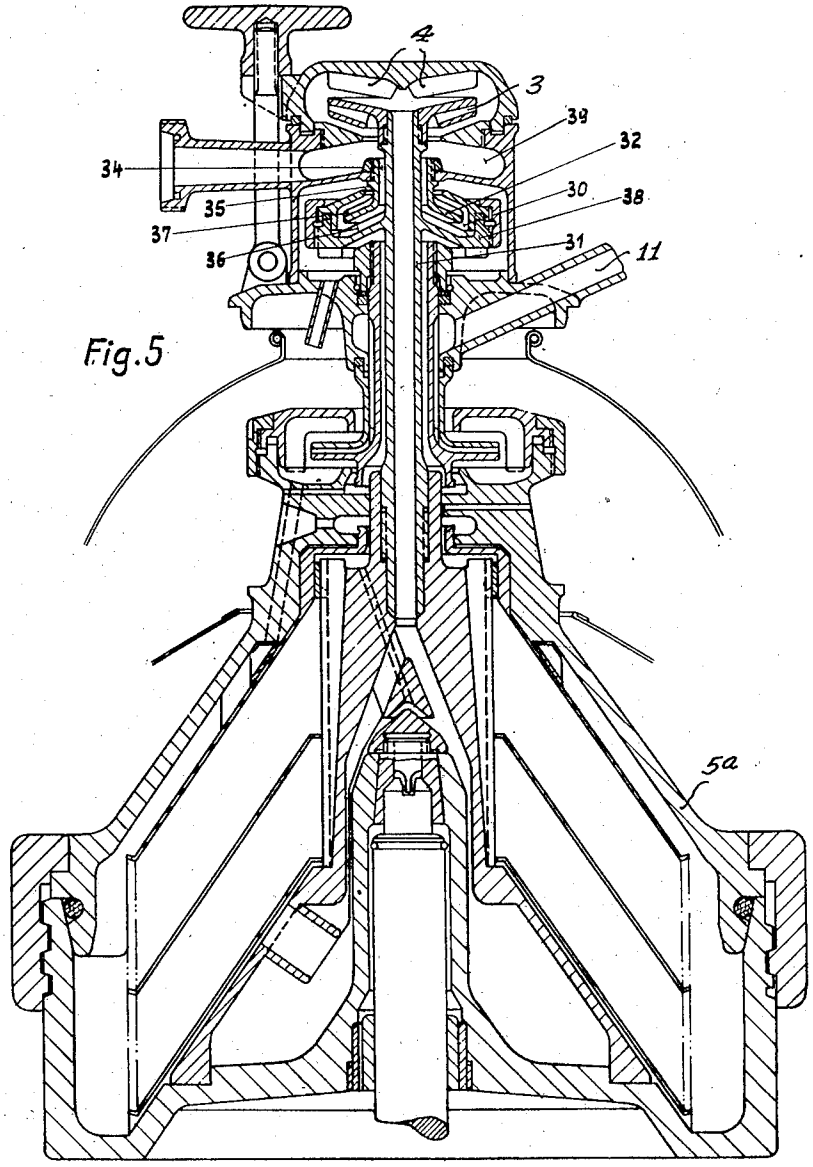


Fig.5

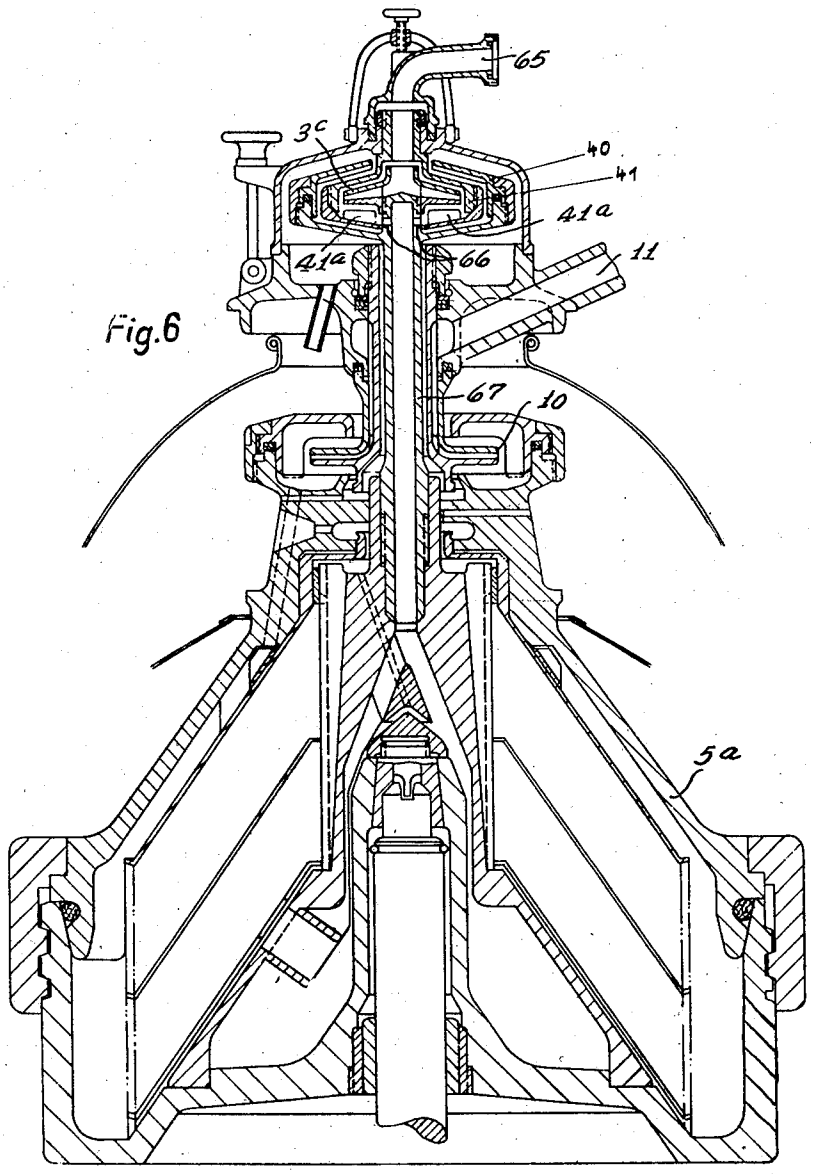
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Fig.6



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Patented May 22, 1945 2,376,744

UNITED STATES PATENT OFFICE

2,376,744

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Wilhelm Wilsmann, Oelde, Germany; vested in the Alien Property Custodian

Application December 27, 1940, Serial No. 372,013
In Germany December 27, 1939

5 Claims. (Cl. 103—103)

This invention relates to separators for liquids provided with centrifugal pumps. In the known machines of this class, in which the pump wheel is connected with the drum or with the hollow spindle, the tight closure against the drum is effected by packings or the like. When using the said tightening means in machines which rotate rapidly, disturbances through drainage occur as soon as the liquid feed to the drum is temporarily interrupted.

The primary object of this invention is a construction by which the said drawbacks are avoided. The improved separator is provided with a centrifugal pump arranged axially beside the drum, whereby the wheel of the pump is connected with the drum or the hollow spindle, and whereby the pump space, axially adjacent the pump wheel and surrounding the pump wheel shaft, is sealed against the latter by means of a stationary annular chamber filled with liquid and separated from the pump space by a special front wall and by an annular body dipping into the liquid in the said annular chamber. The front wall has an inner opening for the passage of the pump wheel shaft, which opening is of smaller diameter than that of the pump wheel.

Other objects of this invention are set forth in the following specification

A feeding device on the drum for separated liquid contents, and the sealing by means of a liquid seal has already been proposed. In the known arrangement a feed worm is used which only engenders a small feed pressure, and which needs for this reason only a small sealing pressure. The dipping annular body is radially positioned outside of the feed worm and around the head of the drum, and a large annular gap has to be sealed. The device consumes much power, and the direct connection of the tightening chamber with the radially remotest space of the worm chamber, while rotating at a maximum speed causes a permanent breaking and mixing of the liquid being processed with the tightening liquid.

In the accompanying drawings several embodiments of the invention are illustrated, in which,

Fig. 1 shows a separator with a feed pump and an annular tightening body beneath it, the said elements being arranged above the drum of the separator, which separator has a stripper for the heavy liquid components and free discharge for the light liquid components.

Fig. 2 shows a modification with another inlet to the drum.

Fig. 3 shows a modification with reversing leading blades screened by a wall and with a throttle valve, in combination with two strippers.

Fig. 4 shows a separator having the inlet to the drum through the hollow spindle from below, and a second arrangement for the discharge of the liquid on top of the drum.

Fig. 5 shows a separator with another arrangement of the means for tightening the pump space at the pump wheel shaft, and

Fig. 6 shows a modification of the construction according to Fig. 5.

According to Fig. 1 the liquid flows through the inlet 1 into the chamber 2, and from there into the pump wheel 3. The liquid is fed along the stationary leading blades 4 and the central inlet tube 5 into the drum 5a. The heavy liquid components, such as skimmed milk, flow to the periphery of the drum and from there through conduits 7 and 8 to the stripping chamber 9, from which the said liquid components are pressed by the stripper 10 to the outlet 11. The inlet tube 5 passes centrally through the stripper 10, which latter forms a circular body concentric about the axis of rotation. By this arrangement a small diameter of the pump and a limited space of the assembled parts is attained, so that the elements for the inlet and for the outlet are close together. The light liquid components, consisting especially of cream, flow towards the centre and from there, over the weir 12 to the free discharge from the drum at 13. In consequence of the arrangement of the ducts 12 and 14, having a greater radial distance from the centre, the liquid flow radially passing the drum might break off in the inlet tube 5. For avoiding such a breaking and for keeping the said tube always completely filled, radial interruptions 15 and 16 for the ducts of both the skimmed milk and the cream are provided. When radially passing the said interruptions, the liquid rotates due to its inertia with a velocity towards the outside, which velocity is greater than that in the zones beneath of said interruptions. In these zones the liquid flow is radially guided, and in consequence of this fact the liquid is forced in the said points towards the outside. Upon the lengths of the chambers 15 and 16, the magnitude of the over-pressure depends.

The chamber 2 is arranged around the pump wheel shaft and alongside the pump wheel. The said chamber is sealed at the pump wheel shaft 19 by a stationary annular chamber 17 filled with liquid and by a rotating annular body 18 dipping into the liquid in the said chamber. For this sealing the liquid may be used which is subjected

to separation, as the annular chamber 17 is automatically filled with the said liquid. But in special cases, other sealing liquids may be used, such as mercury or water, for the centrifuging of benzine. The side of the annular body 18 adjacent the chamber 2, is provided with driving wings or vanes 20 which act against the vacuum in the annular gap of the chamber 2. The same effect may be attained by providing locking wings or vanes on the lower wall of the annular chamber. But also both of the said different types of wings or vanes may be used for raising the effect. In the case that the liquid to be centrifuged is fed to the inlet 1 with such a pressure that the vacuum in the annular gap is canceled, a smooth annular chamber and a smooth annular body suffices, and in the case of a highly augmented pressure and an overpressure existing in the annular gap, the driving and locking wings or vanes may be used in a reversed arrangement.

Fig. 2 shows a similar arrangement, but the centrifugal pump 3' is here provided with a central inlet 21. The liquid flows over leading ribs 22 and apertures 23, into the inlet tube 5. As in this case the annular chamber, together with the annular body rotating in this chamber, seals against the pressure space of the pump, the ribs or wings are here, in all cases necessary as in the case previously described, according to the type of pressure existing in the inlet duct.

Fig. 3 shows an arrangement substantially corresponding with that of Fig. 1, however, according to Fig. 3 the leading blades 24*a* are screened against the pump wheel by an annular wall 24. By means of a valve 25, the pressure side of the pump may be locked and adjusted for a pre-determined passage of liquid. The discharge of the liquid components is here effected by two strippers 10*a* and 10*b*. The radial interruptions of the liquid feed for avoiding the breaking of the liquid flow are here arranged in the inlet duct at 26. A break may also be avoided by narrowing the cross-section as shown at 27. The narrowed passage 27 has to be arranged in the radial direction, at least in the height of the discharge for the separated liquid.

Fig. 4 shows the construction according to the invention applied to for the inlet and the outlet of the liquid separator. The inlet 50 is provided in the hollow spindle at a point below the drum, and the outlet 51 is disposed at a point above the drum. On the inlet the chamber mostly seals against a vacuum, and on the outlet for the liquid the said chamber seals against pressure, and correspondingly the driving ribs or wings 53 and 53*a* must be on the dipping bodies 54 and 54*a*, whereas the locking ribs 29 are on the annular chamber. Pump 3*a* is provided at the lower inlet. The drum according to Fig. 4 is especially adapted for purifying oil. The purified oil is lead off by the upper pump 3*b*, whereas the separated water has a free outlet over the weir 28.

The application of the invention is not limited to the described examples. A pump for the inlet, and one or several pumps for the outlet of the same construction, may be arranged on the same side of the drum. The new device may, in any desired number, be provided for an open inlet only for the frothless discharge or for a frothless inlet in drums with open outlet. The construction according to the invention may be used in combination with all known inlet and outlet arrangements. The inlet tube or the outlet tubes with the pump wheels may be fixed either to the distributor or to the separating plate, to any inserted element, to covers or partitions of the drum, to hollow spindles or to other elements.

When using a closed inlet a liquid meter is preferably provided, whereby the inlet controlling device is arranged between the meter and the pump. The indication meter arranged between the controlling device and the pump is often vibratory.

When using corresponding liquid sealing means the pump is of a good sucking capacity, so that the liquid to be centrifuged is also sucked through apparatus arranged in front of the pump. A pumping necessary in a manufactory may, under circumstances, be effected by the separator itself. Additional pumps are ordinarily not necessary.

When feeding the liquid through the hollow spindle 56, according to Fig. 4 the worm of the driving gear is rigidly mounted, and the hollow spindle of the drum 5*a* passes through said worm. The driving worm may then also be held against axial movement. A hold against axial movement is always necessary when globoid-worms are used.

The hollow spindle of the drum may be mounted with its upper portion in an independent bearing of known construction, and with its lower portion either in the jacket of the worm or in special bearings 57. Between the jacket of the worm and the spindle of the drum the known connexions are provided which allow oscillatory movements.

According to Fig. 5 the means for sealing the pump space against the pump wheel shaft are reversed in kinematical respect to the sealing means shown in Figs. 1–4. The parts are other wise of the same construction and operate in a similar manner. According to Fig. 1 the annular chamber 17 is stationary and the annular body 18 is rotating. According to Fig. 5 the annular chamber 30 is rotating, as the same is rigidly connected with the rotating hollow spindle 31 of the separator. The annular body 32 dipping into the liquid in the chamber 30 is stationary. Inside of the annular chamber the rotating part 38 has, on the side facing the liquid gap 34, means 36 for driving the liquid, and has on the side facing the air gap 35, means 37 for checking the liquid motion. In many cases, either only the driving means, or only the checking means may be used. The said driving and checking means are necessary in the case that a vacuum exists in the inlet space 39. In the case that an over-pressure exists, an adjustment may take place according to the type of driving and checking means are unnecessary, and in the case of a considerably raised inlet pressure a reversed arrangement of the checking and driving means may take place.

Fig. 6 shows a modification into which the rotating annular chamber 40 surrounds the stationary pump body 41. The interior of chamber 40 is provided with vanes 40*a*, whereas the interior of pump body 41 has vanes 41*a*. Pump 3*c* is disposed within pump body 41 and serves to draw liquid into body 41 through inlet 65, and then expel the same through openings 66 into hollow shaft 67.

The opening in the front wall, through which the pump wheel shaft passes, has a diameter smaller than that of the pump wheel, and the sealing means are outside of the liquid flow.

A stripper may be arranged in rear of the pump.

I claim:

1. In a separator having a liquid-containing housing with an axial opening therein, and also

having a vertically disposed rotary impeller shaft penetrating said opening and extending from said housing, means for sealing said opening about said shaft comprising an annular member having an annular chamber therein secured to said shaft, the bottom surface of said chamber being substantially conical in shape and the upper portion thereof having a restricted opening therein coaxial with said shaft, a stationary annular member coaxial with said shaft and extending through said restricted opening into said chamber, the outer surface of said stationary member substantially conforming to the inner surface of said chamber and being disposed in spaced relation thereto, and a series of upwardly and inwardly inclined vanes disposed upon the conforming surface of said stationary member for checking the motion of the liquid at the point where said stationary member enters said chamber.

2. In a separator according to claim 1 in which an impeller is encased by said stationary member and fixedly secured upon said shaft, and in which an intake and a discharge conduit are disposed in said stationary member and shaft respectively for communicating with said impeller.

3. In a separator having a liquid-containing housing with an axial opening therein, and also having a vertically disposed rotatable shaft penetrating said opening and extending from said housing, means for sealing said opening about said shaft comprising an annular conical member having a conical chamber therein, said chamber having a bottom and a restricted opening at its top, a second conical member coaxial with said shaft and extending through said restricted openinge into said conical chamber, one of said members being supported by said rotating shaft and the other of said members being stationary, the outer surface of said second conical member substantially conforming to the inner surface of said chamber, and a series of vanes disposed on the conforming surface of said stationary conical member for checking the motion of the liquid at the point where said second member enters said chamber, said vanes projecting upwardly and inwardly toward said first-named opening which surrounds said shaft.

4. In a separator having a liquid-containing housing with an axial opening therein, and also having a vertically disposed shaft penetrating said opening and extending from said housing, means for sealing said opening about said shaft comprising an annular conical member having a conical chamber therein secured to said shaft, said chamber having a closed bottom and a restricted opening at its top, a stationary conical member coaxial with said shaft and extending through said restricted opening into said conical chamber, the outer surface of said stationary conical member substantially conforming to the inner surface of said chamber, a series of vanes disposed on the inner face of said rotary conical member for driving said fluid, said vanes projecting upwardly and inwardly toward said first-named opening which surrounds said shaft, and a second series of inwardly and upwardly projecting vanes disposed within said chamber and upon the outer face of said stationary conical member for checking the motion of the liquid at the point where said stationary member enters said chamber.

5. In a separator having a liquid-containing housing with an axial opening therein, and also having a vertically disposed shaft penetrating said opening and extending from said housing, means for sealing said opening about said shaft comprising an annular conical member having a conical chamber therein secured to said shaft, said chamber having a closed bottom and a restricted opening at its top, a stationary conical member coaxial with said shaft and extending through said restricted opening into said conical chamber, the outer surface of said stationary conical member substantially conforming to the inner surface of said chamber, and a series of vanes disposed within said chamber and projecting inwardly and upwardly from the outer face of said stationary conical member for checking the motion of the liquid at the point where said stationary member enters said chamber.

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