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Fig. 1

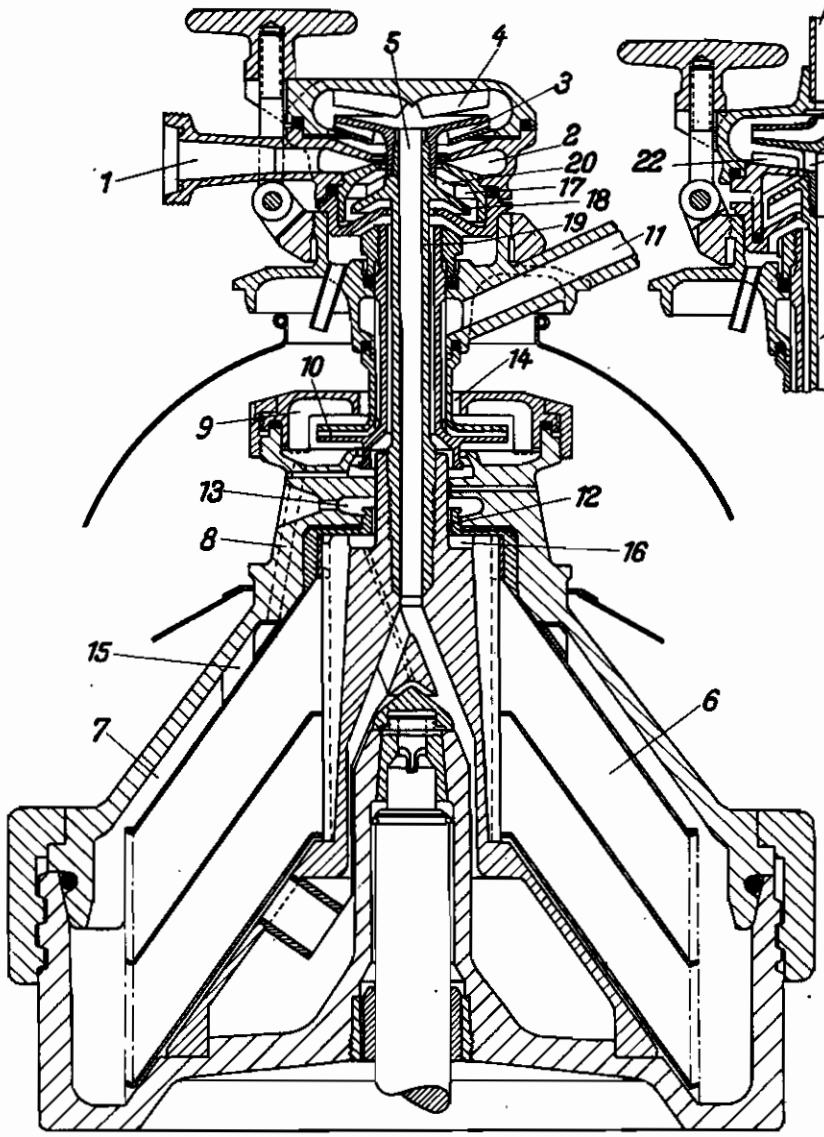

Fig. 2

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Fig.4

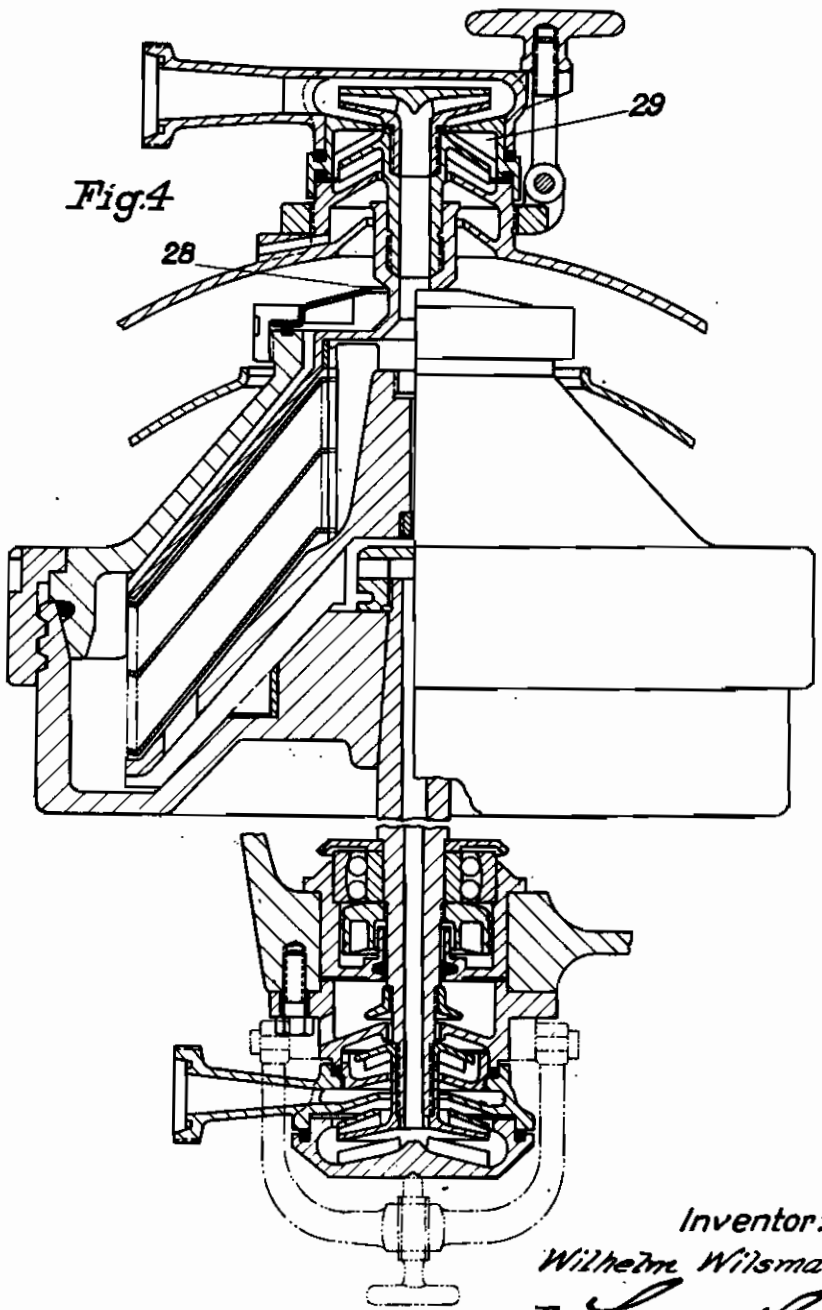

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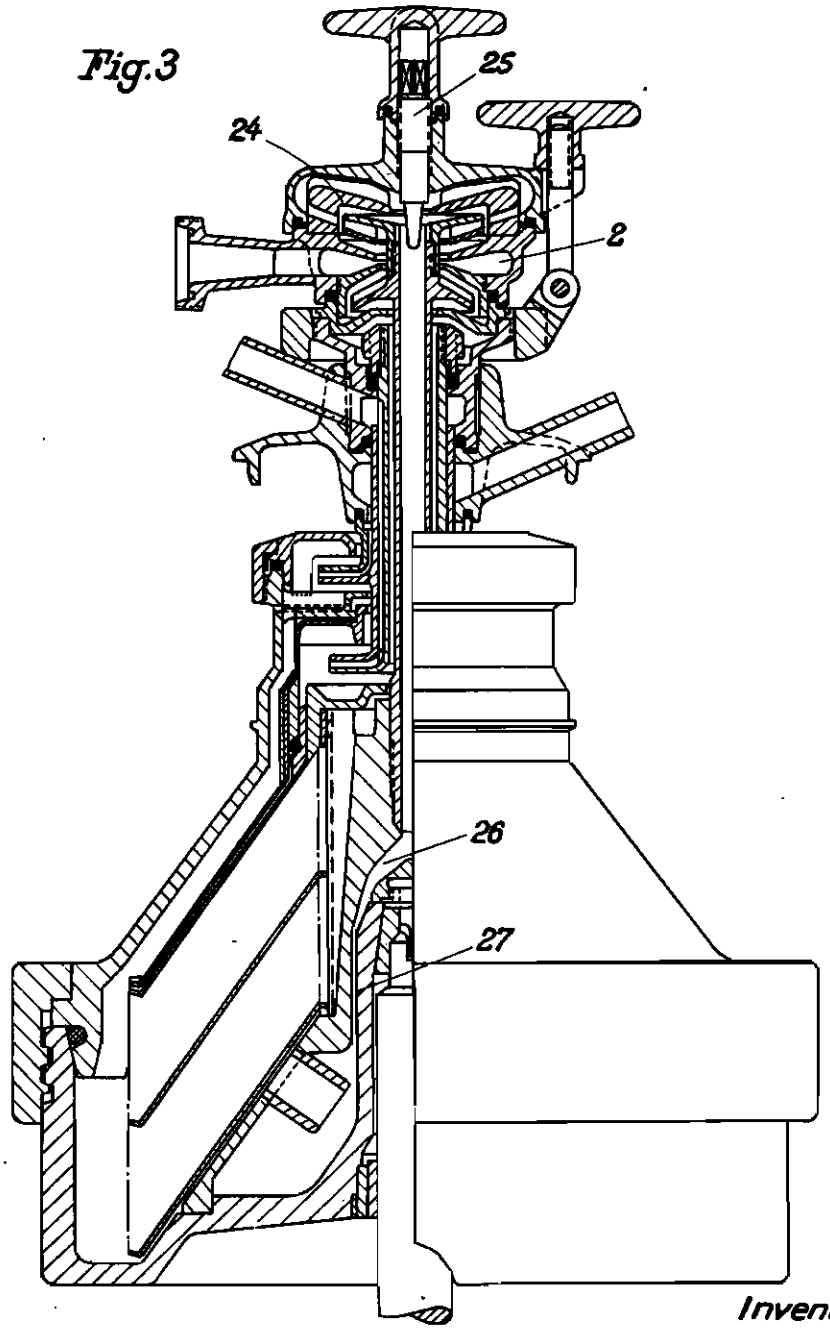
Fig. 3



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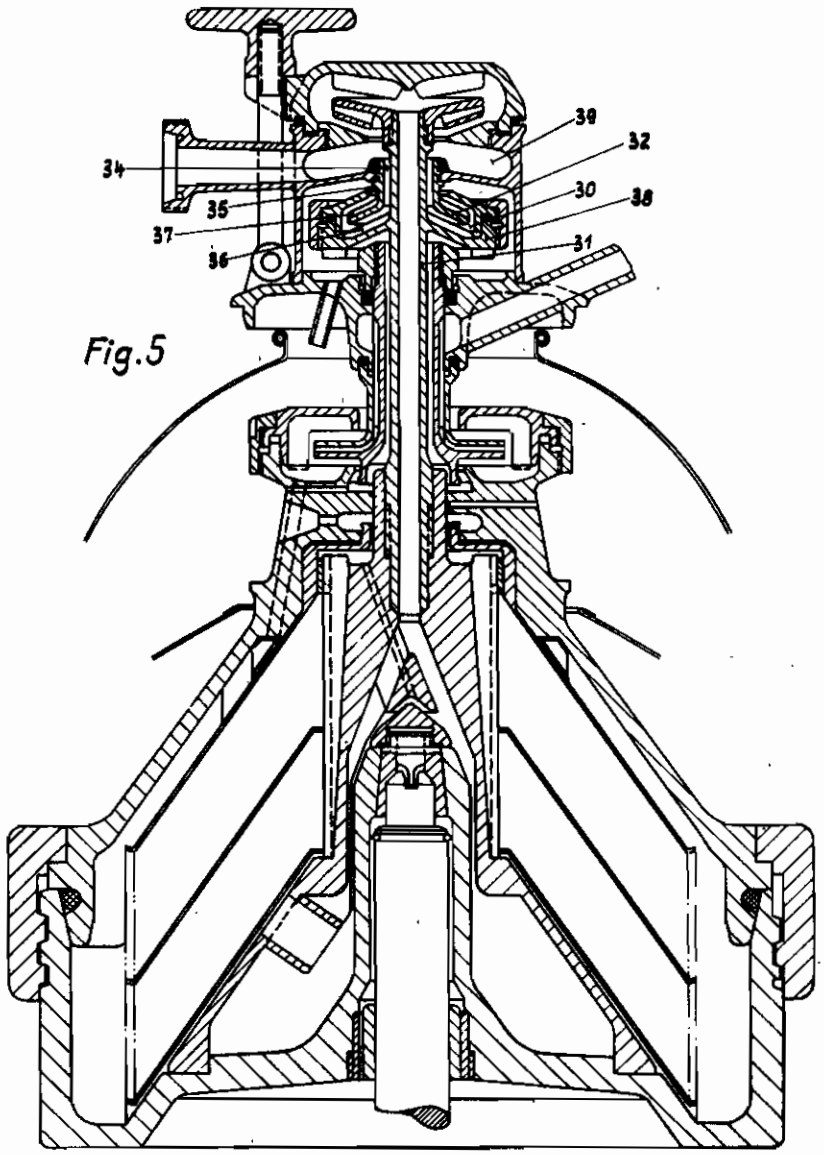

Fig.5

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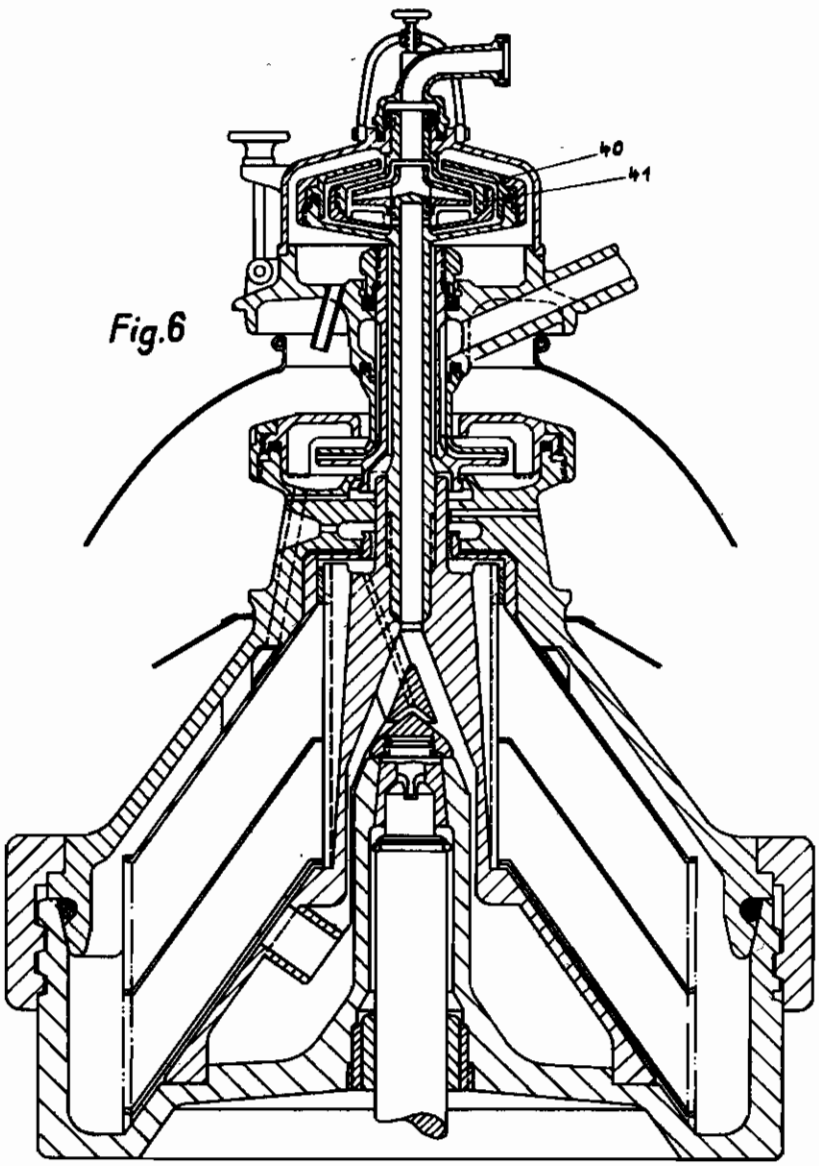
Fig.6



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ALIEN PROPERTY CUSTODIAN

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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 having a great number of revolutions 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 the pump space axially adjacent the pump wheel and surrounding the pump wheel shaft is tightened 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 said front wall having 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 tightening 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 tightening 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 tightened. The device consumes much power, and the direct connexion of the tightening chamber with the radially remotest space of the worm chamber and the simultaneously proceeding maximum of rotating speed causes a permanent breaking and mixing of the liquid goods with the tightening liquid.

In the accompanying drawings several embodiments of the invention are illustrated.

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 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 against 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. The heavy liquid components such as skimmed milk flow to the periphery of the drum and from there through conducts 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 centrally passes 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, and 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 there due to its inertia with a velocity towards the outside which is greater than that in the zones beneath of said interruptions, in which zones the liquid flow is radially guided, and in consequence of this fact the liquid is forced in the said points towards the outside. From 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 beside the pump wheel. The said chamber is tightened against the pump wheel shaft 18 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 tightening 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 tightening 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 20 which act against the vacuum in the annular gap of the chamber 2. The same effect may be attained by providing locking wings on the lower wall of the annular chamber. But also both of the said different sorts of wings 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 over-pressure existing in the annular gap the driving and locking wings may be used in a reversed arrangement.

Fig. 2 shows a similar arrangement, but the centrifugal pump 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 tightens 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 which pressure exists in the inlet duct.

Fig. 3 shows an arrangement substantially corresponding with that of Fig. 1. But according to Fig. 3 the leading blades 4 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. 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 in application for the inlet and the outlet of the liquid to be centrifuged. The inlet is executed through the hollow spindle from below and the outlet from the drum is above the latter. On the inlet the tightening chamber mostly tightens against a vacuum, and on the outlet for the liquid the said chamber tightens against pressure, and correspondingly the driving ribs or wings must be on the dipping body, whereas the locking ribs are on the annular chamber. The drum according to Fig. 4 is especially adapted for purifying oil. The purified oil is lead off by the upper pump, whereas the separated water has a free outlet over the weir 28.

The application of the invention is not limited to the described examples. The 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 of a meter arranged between the controlling device and the pump is often vibratory.

When using corresponding liquid tightening 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 according to Fig. 4 the worm of the driving gear is rigidly mounted, and the hollow spindle of the drum 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. Between the jacket of the worm and the spindle of the drum the known connections are provided which allow oscillatory movements.

According to Fig. 5 the means for tightening the pump space against the pump wheel shaft are reversed in kinematical respect to the tightening means shown in Figs. 1–4 which are otherwise of the same construction and operation. According to Fig. 1 the annular chamber 17 is stationary and the annular body 18 is rotating. But 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 33 has on the side facing the liquid gap 34 means 36 for driving the liquid and 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 which the 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 according to which the rotating annular chamber 40 surrounds the stationary pump body 41.

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 tightening means are outside of the liquid flow.

A stripper may be arranged in rear of the pump.

WILHELM WILSMANN.