May 12, 1942. G. FABIG 2,282,569

AUTOMATIC SUCTION CIRCULATING PUMP

Filed April 17, 1939

Fig. 1

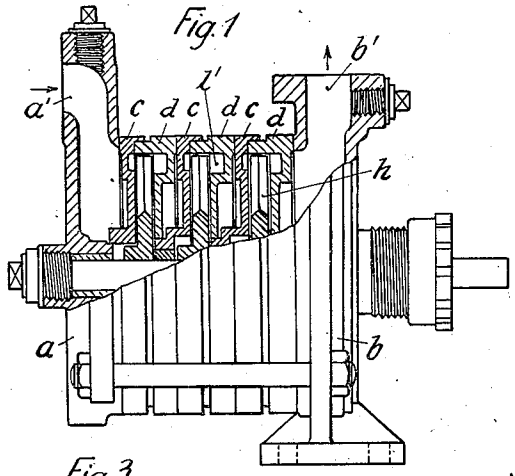


Fig. 2

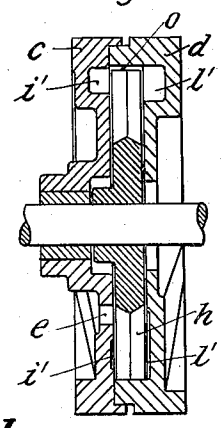


Fig. 3

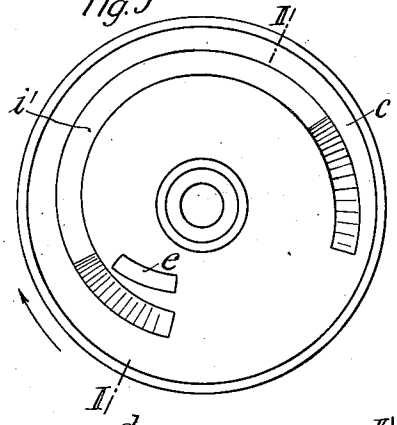


Fig. 4

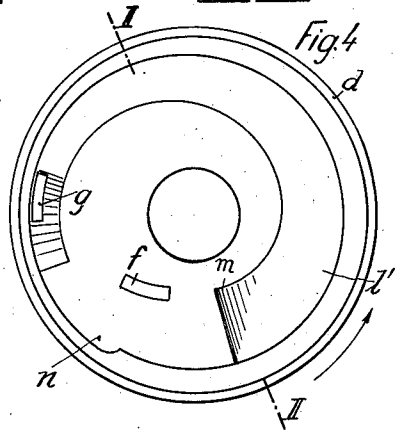


Fig. 5

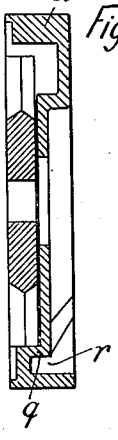


Fig. 6

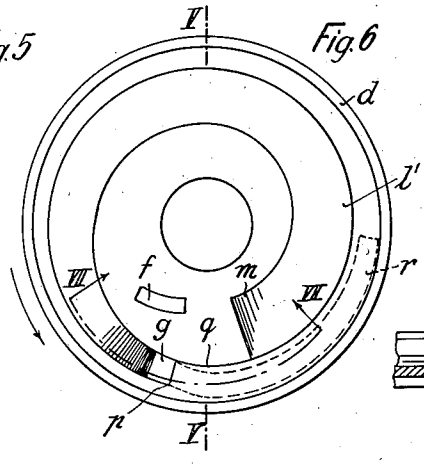
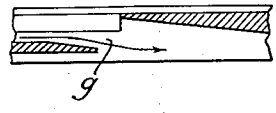


Fig. 7



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AUTOMATIC SUCTION CIRCULATING PUMP

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In Germany April 21, 1938

6 Claims. (Cl. 103—96)

This invention relates to an automatic suction circulating pump which operates partly as water ring pump and partly as centrifugal pump, a more favorable efficiency being obtained than in the case of water ring pumps proper. Therefore, only the sucked-in air and a small quantity of the sucked-in liquid are forced by means of the water ring through the pressure slot located near the wheel hub into the pressure chamber of the pump, whereas the main quantity is flung out of the pallet wheel by the action of centrifugal force and conducted into the pressure chamber preferably through an outer outlet arranged near the periphery of the wheel. So as to obtain at the same time a large quantitive delivery it is important to force into a suitably arranged reception chamber in the casing, herein called the pressure channel, the quantity of liquid to be delivered by centrifugal effect, immediately after it has been sucked-in (or after its supplementing quantity has been sucked-in), that is while it is still within the sector in which the suction slot is located, and to allow this quantity of liquid to circulate in this channel with the pallet wheel until it reaches the passage leading to the pressure chamber. Such a construction is known from German Patent No. 618,414, granted to applicant.

The invention consists in that symmetrical paddle wheels with continuous side edges are employed. The channel for the liquid conveyed by centrifugal force effect is provided on the one side, and the channel for the liquid conveyed by displacing effect is arranged on the other side of the paddle wheel in the pump casing. The discharge aperture for the displaced liquid is separated from the discharge aperture for the liquid conveyed by centrifugal force effect.

The two channels for the liquid conveyed by centrifugal force effect and for the liquid conveyed by displacer effect extend practically unsymmetrically the one relative to the other. The course of the channels depends on their different manner of operation. The cross-section of the channel designed for receiving the circulating watering can reduce in the sector of the discharge aperture for the liquid conveyed by centrifugal force effect. This liquid is thereby deflected and the flowing out through the discharge aperture is assisted. The channel which takes up the liquid conveyed by centrifugal force effect may extend in spiral shape, so that the distance of the channel from the axis of the pump gradually increases. The increase of pressure caused by the centrifugal force effect is thereby increased.

In the accompanying drawing:

Fig. 1 shows a side elevation partly in section of a pump according to the invention, which has three pressure stages.

Fig. 2 shows one of these stages on slightly enlarged scale and in section on line II—II of Figs. 3 and 4.

Figs. 3 and 4 show each an elevation of the inner side of the two parts of the casing of one stage, which parts are folded asunder, the paddle wheel being removed.

Fig. 5 is a section according to line V—V of Fig. 6 through the paddle wheel and through another construction of one-half of the casing.

Fig. 6 shows the casing half shown in section in Fig. 5 viewed from the inner side, and

Fig. 7 is a section through a portion of this casing half on the line VII—VII of Fig. 6.

In Fig. 1 *a* designates the body forming the suction chamber and *b* the body forming the pressure chamber of the pump, *a'* is the inlet and *b'* the outlet for the liquid to be delivered. Between the bodies *a* and *b* clamped together by bolts one or several pump stages may be arranged each of which is formed of two parts, *c* is the suction side which has the inlet port or suction slot *e*, *d* is the pressure side in which the two outlet parts *f* and *g* are provided. The parts *c* and *d* enclose the working space of the stage in which the pallet wheel *h* rotates. In the case of a single stage pump, it is evident that the parts *a* and *c*, or *b* and *d* may be made as single pieces.

The channel *i'* begins in the sector of the admission port *e*. The cross-section of this channel enlarges in this sector. In the sector of the discharge port *g* of the channel *l'* for the liquid conveyed by centrifugal force effect the cross-section *i'* reduces again, that is, at this point the water from the channel *i'* again enters from the side into the chambers of the pallet wheel and thereby assists the outflow of the water through the port *g* and presses a portion of the liquid to be conveyed through the discharge port *f* into the next following pump stage or into the pressure socket *b'*.

The pressure channel *l'* for the liquid conveyed by centrifugal force effect begins at *m* also in the sector of the admission port *e* and has at its commencement a shallow depth in axial direction at correspondingly larger radial height. The liquid current to be conveyed by the pallet wheel is therefore in intimate contact with the edges of the pallets over their entire length. The chan-

nel is made in spiral shape so that at its end *n* it is located chiefly outside the periphery of the pallet wheel. At the same time the cross-sectional shape of the channel changes gradually in such a manner that the depth in axial direction increases whereas the radial height decreases. This increase in depth in axial direction need only be up to the beginning of the outer outlet aperture *g*, the depth can then become gradually less in proportion as the liquid is lead off through this outlet.

In this form of construction the reception chamber *i'* for the water ring is formed in the housing of the pump chamber laterally of the pallet wheel, so that the inward and outward movement of the water ring takes place in axial direction. The chamber *i'* is constructed as a spiral channel whose end extends beyond the periphery of the pallet wheel. The axial depth of the chamber *i'* increases at the beginning and decreases at the end corresponding to the return movement of the water ring. The radial width is assumed to be constant in this form of construction, it may, however, vary in the same manner as in the case of the pressure channel *l'*. The pallet wheel *h*, when the water ring chamber is thus constructed, need have no recesses, that is may have pallets of constant axial width.

It is advisable to provide a recess *o* in the housing parts *c* and *d* by which recess the ends of the two channels *i'* and *l'* are connected across the periphery of the pallet wheel. Thus, an axial pressure is exerted on the liquid current in the passage *l'* by the bevelled side faces of the chamber *i'* outside the pallet wheel, and this pressure assists the deflection of the liquid at the outlet aperture *g*.

In the form of construction illustrated in Figs. 5 to 7 the spiral shape of the pressure channel *l'* and the gradual reduction in radial width thereof is utilized to enable the outlet aperture *g* to be arranged to the direction of flow. The liquid current at the point *p* passes behind the wall *q* which closely surrounds the ends of the pallets of the pallet wheel and shuts off the portion of the working space under suction from that under pressure. The pressure channel on the side of the housing part *d* belonging to the pressure chamber is extended in the manner illustrated in dotted lines, so that the liquid can pass into the pressure chamber without the necessity to change its direction of flow. This extension *r* of the pressure channel is therefore located outside its commencement *n* and on the other side of the housing wall. The smooth off-flow of the centrifuged liquid is shown particularly clearly in Fig. 7 which illustrates a portion of the housing part *d* in developed state.

The favorable effect of the new construction is proved by the improvement in the degree of efficiency of the automatic suction circulating pumps. An appreciable improvement is already noticeable when merely the pressure channel is of the spiral shape described. It has been ascertained by measuring that with a high percentage air exhaustion in the suction line such as was hitherto only attainable with purely water ring pumps, degrees of efficiency of 45% and more can be attained such as have never hitherto been attainable by automatic suction circulating pumps.

I claim:

1. Rotary suction pump, which delivers a portion of the sucked-in liquid by displacement effect and another portion by centrifugal force, comprising a pallet rotor with symmetrically formed vanes having continuous side edges, a casing enclosing said rotor and having inlet ports and outlet ports, the outlet port of the displaced portion of liquid being separated from the outlet port of the portion delivered by centrifugal force, a channel for the liquid ring exerting the displacing effect provided in said casing on one side of said vanes, the cross-section of which increases in the sector of the admission port and decreases again in front of the discharge port for the displaced portion of the liquid, and a passage for the liquid delivered by centrifugal effect arranged in said casing on the opposite side of said vanes.

2. Rotary suction pump, which delivers a portion of the sucked-in liquid by displacement effect and another portion by centrifugal force, comprising a pallet rotor with symmetrically formed vanes having continuous side edges, a casing enclosing said rotor and having inlet ports and outlet ports, the outlet port of the displaced portion of liquid being separated from the outlet port of the portion delivered by centrifugal force, a channel for the liquid ring exerting the displacing effect provided in said casing on one side of said vanes, the cross-section of which increases in the sector of the admission port and decreases in the sector of the discharge port for the liquid conveyed by centrifugal force, and a passage for the liquid delivered by centrifugal effect arranged in said casing on the opposite side of said vanes, said channel and passage extending asymmetrically the one to the other.

3. Rotary suction pump, which delivers a portion of the sucked-in liquid by displacement effect and another portion by centrifugal force, comprising a pallet rotor with symmetrically formed vanes having continuous side edges, a casing enclosing said rotor and having inlet ports and outlet ports, the outlet port of the displaced portion of liquid being separated from the outlet port of the portion delivered by centrifugal force, a channel for the liquid ring exerting the displacing effect provided in said casing on one side of said vanes the cross-section of said channel decreases in the sector of the discharge port of the liquid conveyed by centrifugal force, and a passage for the liquid delivered by centrifugal effect arranged in said casing on the opposite side of said vanes, said channel and passage extending asymmetrically the one to the other.

4. Rotary suction pump, which delivers a portion of the sucked-in liquid by displacement effect and another portion by centrifugal force, comprising a pallet rotor with symmetrically formed vanes having continuous side edges, a casing enclosing said rotor and having inlet ports and outlet ports, the outlet port of the displaced portion of liquid being separated from the outlet port of the portion delivered by centrifugal force, a channel for the liquid ring exerting the displacing effect provided in said casing on one side of said vanes, the cross-section of which increases in the sector of the admission port and decreases again in the sector of the discharge port for the displaced portion of the liquid, and a passage for the liquid delivered by centrifugal effect arranged in said casing on the opposite side of said vanes, said passage having at its beginning little axial depth but great radial height, and changing its cross-section shape in the direction of rotation so that the axial depth increases and the radial height decreases.

5. Rotary suction pump, which delivers a por-

tion of the sucked-in liquid by displacement effect and another portion by centrifugal force, comprising a pallet rotor with symmetrically formed vanes having continuous side edges, a casing enclosing said rotor and having inlet ports and outlet ports, the outlet port of the displaced portion of liquid being separated from the outlet port of the portion delivered by centrifugal force, a channel for the liquid ring exerting the displacing effect provided in said casing on one side of said vanes, the cross-section of which increases in the sector of the admission port and decreases again in front of the discharge port for the displaced portion of the liquid, and a passage for the liquid delivered by centrifugal effect arranged in said casing on the opposite side of said vanes, said passage being spiral-shaped so that the distance from the axis slowly increases in the direction of rotation.

6. Rotary suction pump as specified in claim 1, in which the outlet port of said passage is arranged so that the liquid is discharged in the plane of rotation in tangential direction, and a channel is provided in said casing and connected to said outlet port, the radial distance of this channel from the axis of the pump being greater than the distance of said passage.

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