Oct. 16, 1934. O. SIEMEN ET AL 1,976,896

ROTARY PUMP

Filed May 3, 1933

FIG. 1.

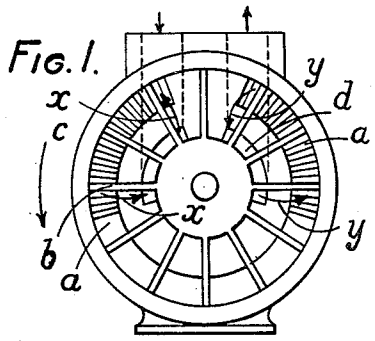


FIG. 3.

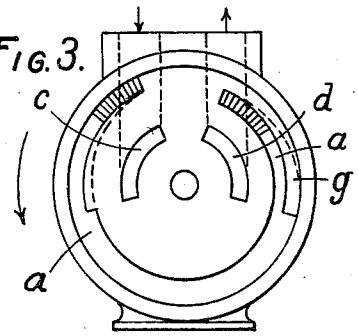


FIG. 2.

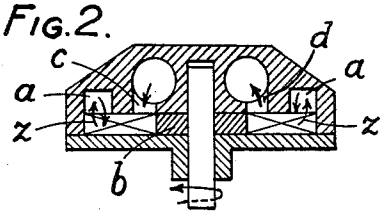


FIG. 4.

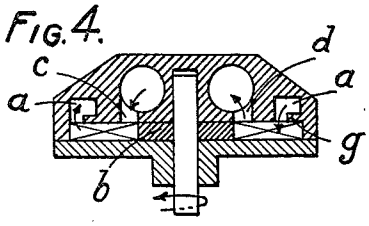


FIG. 5.

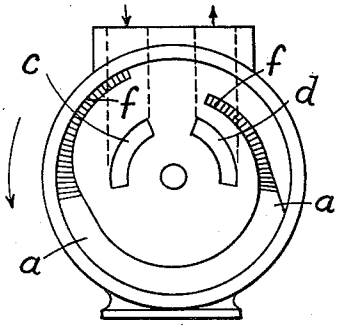


FIG. 6.

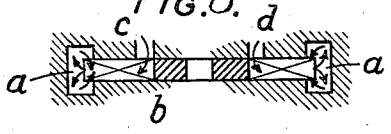


FIG. 7.

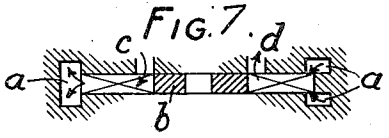


FIG. 8.

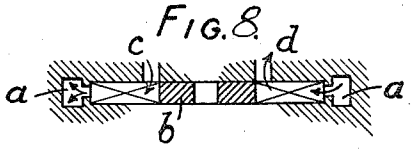
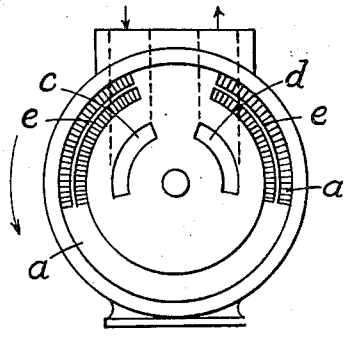


FIG. 6.



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Patented Oct. 16, 1934 1,976,896

UNITED STATES PATENT OFFICE

1,976,896

ROTARY PUMP

Otto Siemen and Johannes Hinsch, Itzehoe, Germany

Application May 3, 1933, Serial No. 669,082
In Germany January 7, 1933

3 Claims. (Cl. 103—96)

This invention relates to a rotary pump of the kind operating with a vaned rotor and with a liquid annulus contained in a casing having a concentric or eccentric annular circulating channel which opens directly into the cells between the vanes and communicates through the cells at one end with a suction port and at the other end with a pressure port both disposed radially inward of the channel, the casing being either stationary or rotatable or formed with a rotatable section.

The object of the invention is to reduce or eliminate the back pressure which generally occurs at the ports, and the invention consists broadly in restricting the area of communication with the rotor cells of those parts of the circulation channel which communicate through the cells directly with the ports.

Fig. 1 of the accompanying drawing shows by way of comparison an inside view of a pump of known construction,

Fig. 2 is an axial section of the same,

Fig. 3 is an inside view of a pump construction according to the invention,

Fig. 4 is a cross-section of the latter,

Fig. 5 is an inside view of a modified form of the pump casing,

Fig. 6 is a sectional view showing by way of comparison another known channel construction,

Fig. 7 shows the same channel modified according to the invention, and

Fig. 8 is a sectional view showing a further arrangement according to the invention.

In Figs. 1 and 2, which show diagrammatically a pump of known type, the casing is stationary and has an annular circulation channel arranged at one side of the rotor *b*.

In the circulation channel *a*, of which there may be one at each side of the rotor, an increasing rise in the pressure takes place which is transmitted to the fluid in the rotor cells. This rise in the pressure is not desirable except in the median portion of the channel, i. e., that portion of the channel which is not in direct communication with the suction port *c* and the pressure port *d*, since a rise in pressure occurring at the ends of the channel brings about loss of power. This is due to the fact that the centrifugal pressure in the rotor cells which are in direct communication with the channel, is smaller than the rise in pressure occurring at the leading end of the channel under a large head. This causes a back current of the fluid from the channel *a* through the rotor cells to the suction port *c*, i. e., a local dead circulation takes place, as shown by the arrows *x*, which brings about a useless consumption of power.

When the head is large a similar action takes place at the end of the channel where the rotor cells are in direct communication with the pressure port *d*. Here the pressure in the port is determined by the highest pressure in the extreme end of the circulation channel, where the pressure is higher than it is in the median portion of the channel, and thus, here also, a local dead circulation takes place, as shown by the arrows *y*.

These losses may be eliminated by shaping the channel so that the rise in pressure is mainly relegated to the median portion of the circulation channel.

Since the rise in pressure depends to a great extent on the size of the area of direct communication between the rotor cells and the circumferential or lateral circulation channel, it is possible, by reducing this area at the ends of the channel, to reduce or eliminate the rise of pressure at these points. Since the flow of liquid from the rotor cells into the channel can only take place in that half of the channel which is farthest away from the centre of the rotor, and the return flow, only in that half thereof nearest the centre, as shown by arrows *z* in Fig. 2, the area of communication between rotor cells and channel can be narrowed down to half the width of the channel, as shown in Figs. 3 and 4. Where the channel is very wide, the narrowing can even be carried beyond one half of the normal dimension thereof. By this narrowing of the channel the local circulation of liquid between rotor cells and channel on which the rise in pressure depends, will be prevented.

In the arrangement shown in Figs. 3 and 4, the narrowing of the area of communication between rotor cells and channel is effected by means of an overhanging ledge *g*. Fig. 5 shows a modified arrangement wherein the corresponding channel portions *f* are narrowed in radial direction to achieve the object of the invention and widened in axial direction to maintain the necessary cross-sectional area of the channel.

Fig. 6 shows another known arrangement wherein the circulation channel is partly lateral and partly circumferential and wherein detrimental rise in pressure takes place at the ends of the channel as previously explained. Fig. 7 shows the end portions of the channel modified according to the invention for preventing such rise in pressure.

When the channel is entirely circumferential,

the area of communication between the rotor cells and the ends of the channel may be narrowed down as shown in Fig. 8 in order to prevent detrimental rise in pressure.

In all the constructions the modification of the channel ends will also bring about a considerable reduction in frictional losses.

We claim:

1. A rotary pump of the character described comprising a vaned rotor, a casing enclosing said rotor and forming the spaces between the vanes into closed cells, said casing having suction and pressure ports and an annular circulation channel all of which open direct into the rotor cells, said ports being disposed radially inward of the circulation channel, the area of communication between the cells and the channel in those portions of the latter which communicate with the same cells as the ports being restricted to substantially half the normal channel area for reducing local circulation of liquid.

2. A structure as claimed in claim 1 wherein the restriction of the area of communication at the suction port is confined to the inner half of the channel area and that at the pressure port to the outer half of the area relative to the centre of the rotor.

3. A structure as claimed in claim 1 wherein the channel is narrowed in radial direction to effect the restriction in the area of communication and widened in axial direction to maintain the necessary cross-sectional area of the channel.

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