Mar. 13, 1923.

J. E. NOEGGERATH

1,448,080

PUMPING BODY FOR VISCOSITY PUMPS WITH CURVED PUMPING GROOVES

Filed July 8, 1920

Fig 1.

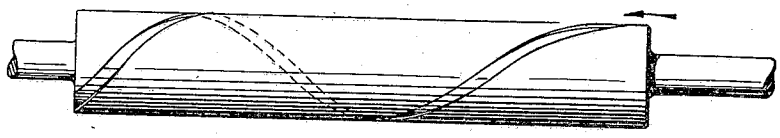
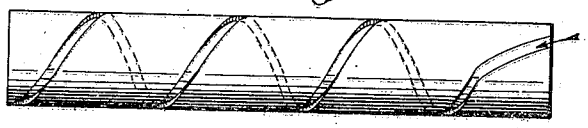


Fig 2.



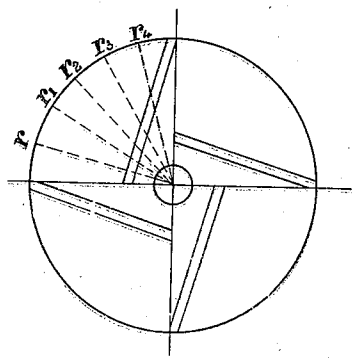


Fig 3.

Inventor:

Jacob Emil Noeggerath

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UNITED STATES PATENT OFFICE.

JACOB EMIL NOEGGERATH, OF THE HAGUE, NETHERLANDS.

PUMPING BODY FOR VISCOSITY PUMPS WITH CURVED PUMPING GROOVES.

Application filed July 8, 1920. Serial No. 394,863.

To all whom it may concern:

Be it known that I, JACOB EMIL NOEGGERATH, a citizen of the United States, residing at 105 Riouwstraat, The Hague, Netherlands, have invented certain new and useful Improvements in Pumping Body for Viscosity Pumps with Curved Pumping Grooves, for which I filed an application in Germany April 24, 1917, and of which the following is a specification.

My invention refers to the pumping of liquids and more especially to viscosity pumps with curved channels.

In contradistinction to centrifugal pumps, for instance, to screw pumps, to gear wheel pumps, to turbine pumps and so forth, the action of the viscosity pumps depends on making use of the viscosity, the cohesion of the particles of the liquid and their adhesion to the walls to create pressure and to convey the liquid.

Up till now the opinion prevailed that the longer the viscose contact surface of viscose threads, the higher the pressure. That meant for a given axial length a maximum number of threads, that is the smallest pitch. Further it was believed that the quantity of the liquid, semi-solid or gaseous matter pumped depended mainly on the section and the speed. I have now ascertained that this is erroneous. In contradistinction to the universal belief regarding viscosity pumps the following facts have been established.

When the pitch is very small, that is, when the axis of the groove approaches the direction of rotation, the following holds:

1. The viscose component of conveying the substance in the direction of the rotation becomes a maximum, the component in the direction of the axis of rotation, in which the final conveying takes place, a minimum.

2. The number of turns in series becomes a maximum which favorably influences the creation of pressure.

3. The angle of admission becomes more unfavorable.

4. The total sections of the grooves at right angles to the direction of pumping and the number of grooves become a minimum. Supposing the pitch to be 4 to the inch which means that there are four threads in "series," then the total space available for width of thread plus ridge is .25″. Then the width of the groove may be for instance .18″ and of the ridge .07″.

If, however, the angle of the thread is chosen to correspond to a pitch of 2 to the inch, then there are only two grooves in "series," and the total width available for groove and ridge is .5″. Then there may either be in parallel two grooves of the above dimensions or it is possible to construct a single one with a width of groove of for instance .43″, the ridge having a width of .07″. So with decreasing pitch the fluid-carrying or propelling section is increased. In the above mentioned examples the increase is 2 and morefold.

The consequence of conditions 3 and 4 is:

a. That the amount of liquid propelled becomes small.

b. That the pressure is reduced also, which means that condition 2 cannot come to full effect, because the loss current which along the gap returns towards the suction end, assumes large proportions.

5. The total width of the ridges which serve to seal the pressure, becomes a minimum, therefore the pressure is reduced.

These reflections lead to a pumping body for viscosity pumps possessing curved pumping grooves which are chosen in the following manner according to the pressure, the quantity, or to the energy required:

To obtain the greatest possible energy, the pumping body is to be provided with a thread the tangent of the pitch angle of which lies between 0.08 to 2.5, while for obtaining the highest possible pressure it lies between 0.03 and 1, and for obtaining the greatest possible quantity it lies between 0.125 and 3.

The tangent of the pitch angle is height of pitch divided by circumference.

To decide whether, in the meaning of this invention, a pump is an energy pump or a pressure pump or a quantity pump, the following definition may be given:

$$K=40PD2dt/Qv\mathrm{L}$$

whereby the maximum pressure is given in atmospheres, the speed in number of revolutions per minute, the maximum quantity in liters per minute, the dimensions in millimeters and the viscosity v in proportion to the viscosity of water.

The constant 40 is a measuring constant depending on the measure chosen. The constant equals 40 if the above mentioned measures are chosen.

If this formula gives a result between 1 and ∞ then the pump is a pressure pump.

If it lies between 1 and 0, then it is a quantity pump, if it lies between 1/40 and 40, then it is an energy pump.

Sometimes viscosity pumps are designed for a higher pressure than the one at which they actually work and in that case they pump a correspondingly greater quantity. Such pumps are fit as well for high pressure as for great quantity, and the range of tangents of their pitch angles lies inside of the mentioned limits of the general range. Within the limits given above it is a matter of design what pitch to choose.

Formerly viscosity pumps for obtaining the highest possible pressures have been constructed with pitches of less than 0.015, because in using these small tangents the resulting length of the groove is very great for a pumping body of a given axial length and because the opinion prevailed that for this reason the pressure would be high. But with these pitch angles less than $\frac{1}{6}$ of the pressure attainable by the invention is reached.

Apart from the correct choice of the pitch very often output and energy can be considerably enlarged by applying threads of different pitch or by altering the pitch angle of the pumping groove. Thus sometimes, while using small angles, the output is enlarged, if on the suction side of the pump the tangent is larger than near the pressure side.

The reason for this lies partly in the fact that a better admission angle is obtained.

In the drawings affixed to the specification and forming part thereof several modifications of the device embodying my invention are illustrated diagrammatically by way of example. In the drawings—

Fig. 1 is a plan view of a viscosity pump piston with a groove of gradually changing pitch angle, while

Fig. 2 is a similar view of a piston having a groove, the pitch angle of which changes suddenly.

Fig. 3 is a diagram of a viscosity pump piston of disc shape.

Fig. 1 is self-explanatory. In the modification disclosed in Fig. 2 the thread body is preferably composed of several parts so as to facilitate manufacture.

As has been mentioned in the beginning, the invention does not apply exclusively to viscosity thread pumps but comprises generally speaking all viscosity pumps, in which curved channels of any shape are employed for pumping. Thus the channels need not be arranged on cylindrical faces but also on conical or discoid faces. In the last mentioned case they become approximately spirals.

A special case of the application of different pitches with channels arranged upon a disk is that of a viscosity pump such as shown in Fig. 3. The grooves or the ridge run in straight lines and parallel to a radius. They form different angles to the radii r, r^1, r^2, r^3, r^4, which they intersect, and thus to the direction of the drive, this being perpendicular to the radii. The grooves may be disposed on the rotary or the stationary part and on the outside or inside surface.

If in the foregoing description high pressure was mentioned, this expression is only to be regarded as relative, and is not merely relative in the every day sense of the word, for the height of the pressure attained by viscosity pumps or the resulting velocity of the pumped liquid depends as well for instance upon the viscosity and upon the rotation speed of the pumping body. While therefore, for instance, with oil several atmospheres are to be considered as a high pressure, a pressure of a few centimetres must be considered as high in the sense of the invention with liquids possessing little viscosity.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. In a viscosity pump in combination, a conveying body and a fluid-propelling groove on said body, the tangent of the pitch angle of said groove lying between 0.03 and 3.

2. In a viscosity pump in combination, a rotary conveying body and a fluid-propelling groove on said body, the tangent of the pitch angle of said groove lying between .03 and 3.

3. In a viscosity pump in combination, a rotary conveying body and a fluid-propelling groove on said body, the tangent of the pitch angle of said groove lying between 0.08 and 2.5 for energy pumps, between 0.03 and 1 for pressure pumps and between 0.125 and 3 for quantity pumps.

4. In a viscosity pump in combination, a rotary conveying body and a fluid-propelling groove on said body, the tangent of the pitch angle of said groove varying and lying between 0.03 and 3.

In testimony whereof I affix my signature.

JACOB EMIL NOEGGERATH.