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PUMP FOR CORROSIVE FLUIDS

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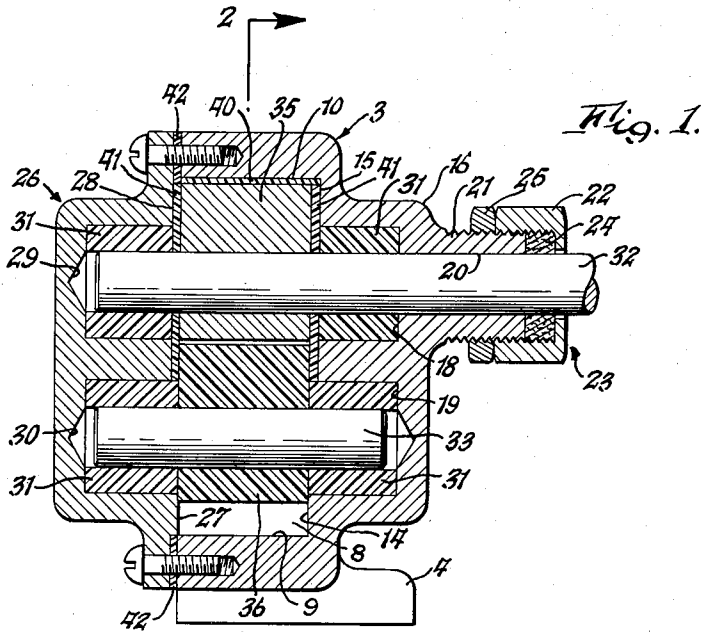
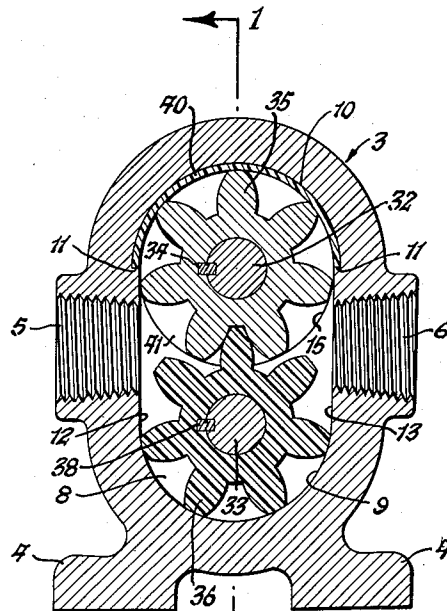


Fig. 2.



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PUMP FOR CORROSIVE FLUIDS

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4 Claims. (Cl. 103—126)

This invention relates to a pump for corrosive fluids, such as fuming nitric acid, and is more particularly shown as embodied in a gear pump.

The principal object of the present invention is to provide a pump which will handle highly corrosive fluids and which will stand up under conditions of severe and constant use for a long period of time without substantial loss in pumping efficiency.

Another object of the invention is to provide such a pump which is very low in cost considering the function which it performs.

Another object of the invention is to provide such a pump in the form of a positive displacement double rotor pump, more particularly a gear pump.

Other objects and advantages of the invention will be apparent from the following description and drawings in which:

Fig. 1 is a vertical central longitudinal sectional view taken generally on line 1—1, Fig. 2 and showing a gear pump embodying the present invention.

Fig. 2 is a vertical central transverse section taken generally on line 2—2, Fig. 1.

The invention is shown as embodied in a positive displacement double rotor pump of the gear type adapted for use in handling such highly corrosive fluids as fuming nitric acid. The pump is shown as comprising a body or casing 3 of generally oval form and made of a metal resistive to the corrosive effects of the lading, such as stainless steel. The body or casing 3 is shown as being generally of upright oval form and as provided at its lower end with feet 4. The casing or body 3 is recessed at one side to provide a working chamber 8, having an inlet 5 and an outlet 6. This working chamber also has a long semi-cylindrical working face 9 and an upright semi-circular recessed face or recess 10 which is slightly larger in diameter than the semi-cylindrical recessed face 9 and terminates in shoulders 11 at its opposite ends. Parallel planar faces 12, 13 connect these shoulders with the opposite ends of the semi-cylindrical face 9 and form continuations of the latter.

The back face 14 of the working chamber 8 is planar and perpendicular to the axes of the semi-cylindrical working face 9 and semi-cylindrical recess 10 and is provided, concentric with the semi-cylindrical recess 10, with a circular recess 15.

The body 3 is provided on the side opposite the open working chamber 8 with a hub extension 16 which is provided with a counterbore 18, and smaller blind bore 19 respectively concentric with the recessed semi-circular face 10 and semi-cylindrical working face 9. The counterbore 18 is continued in the form of a bore 20 of reduced diameter through an externally threaded neck 21 adapted to receive the cap 22 of a stuffing box indicated generally at 23. The backing for the stuffing box is indicated at 24 and a lock nut at 25.

The working chamber 8 is enclosed by a cover 26 made of a metal which is resistive to the corrosive effects of the lading and which has a planar inside face 27 paral-

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lel with and opposing the planar working face 14 of the pump case or housing 3. This face 27 is provided with a circular recess 28 which surrounds and is concentric with a blind bore 29, this blind bore being concentric with the counterbore 18. The cover is provided with another blind bore 30 opposing and concentric with the blind bore 19. The cover can be secured in any suitable manner as by the screws shown.

The present invention is based upon the discovery that in handling highly corrosive fluids in a pump the corrosive effect of the fluids can be greatly reduced if the opposing working faces of the moving parts of the pump are respectively composed of a metal resistive to the corrosive effects of the lading and of a resin also resistive to the corrosive effects of the lading. For the resin, in handling fuming nitric acid as the lading, tetrafluoroethylene resin, commonly known as Teflon, has been found to be satisfactory and for mechanical strength it is desirable that this resin contain a substantial quantity of milled glass fibers. Pumps composed of all stainless steel parts do not stand up under the corrosive effects of ladings such as fuming nitric acid. Conversely, pumps composed wholly of resins resistive to the highly corrosive effects of such ladings as fuming nitric acid have not been satisfactory. With either type of such pumps a breakdown occurs at the opposed working surfaces of the moving parts. However where one of such surfaces is composed of a metal resistive to the corrosive effects of the fuming nitric acid, such as stainless steel, and the opposing surface is composed of a resin resistive to the corrosive effects of the fuming nitric acid, such as Teflon, it has been found that the pump has unusually long life in the service of pumping fuming nitric acid.

To the end of achieving such long lived service with highly corrosive ladings such as fuming nitric acid, each of the blind bores 19, 29 and 30 as well as the counterbore 18 contains a bearing bushing 31 made of a resin resistive to the corrosive effects of the lading, such as Teflon, and preferably containing milled glass fibers. The bearing bushings 31 in the blind bore 29 and counterbore 18 rotatably support a drive shaft 32 preferably made of stainless steel and which extends through the bore 20 and stuffing box 23 and can be driven in any suitable manner (not shown). The bearing bushings 31 in the blind bores 30 and 19 journal a countershaft 33 which is also preferably made of stainless steel.

Fast, as through a key 34, to the stainless steel drive shaft 32 is a gear 35 which is also preferably made of stainless steel. This stainless steel drive gear 35 meshes with a gear 36 fast, as through a key 38, to the stainless steel countershaft 33. An important feature of the invention resides in the fact that the drive gear 36 is made of a resin resistive to the corrosive effects of the lading, this driven gear also preferably being made of Teflon containing milled glass fibers.

A further important feature of the invention resides in the provision of a semi-cylindrical insert 40 in the semi-cylindrical recess 10, this insert also preferably being made of Teflon containing milled glass fibers and providing the cylindrical working face opposing the stainless steel drive gear 35. Also important to the longevity of the pump is the use of circular inserts 41 in the circular recesses 28 and 15 of the cover 26 and body 3, respectively. These circular inserts are also made of Teflon containing milled glass fibers and provide the working faces opposing the opposite ends of the drive gear 35.

Desirably the gasket 42 shown between the rim of the cover 26 and the body 3 is also made of Teflon and which can be impregnated with glass fiber although this gasket does not, of course, constitute a working face and hence could be made of any material resistive to the

effects of fuming nitric acid, or the corresponding faces of the body and cover could be ground to render the pump leakproof.

The drive shaft 32 rotates the drive gear 35, this in turn rotating the driven gear 36 thereby to draw the lading from the inlet 5 past the stainless steel working face 9 and the working face provided by the Teflon insert 40 and discharging it through the outlet 6. The drive gear 35 is made of stainless steel and works against the semi-cylindrical working face composed of the Teflon insert 40. This drive gear also works against the circular end disks 41 in the circular recesses 28 and 15 of the cover 26 and body 3, respectively. The gear teeth of the stainless steel drive gear 35 work against the gear teeth of the driven gear 36 and which is composed of Teflon. This Teflon driven gear 36 works against the stainless steel face 9 of the pump casing and also works against the back face 14 of the working chamber 8 in the stainless steel casing 3 and the inner planar face 27 of the cover 26.

Accordingly it will be seen that the stainless steel drive gear 35 essentially works against opposing surfaces made of Teflon which, for strength, are desirably impregnated with glass fibers. Conversely it will be seen that the Teflon driven gear 36 essentially works against stainless steel surfaces of the casing 3 and cover 26. It is true that the ends of the teeth of the Teflon driven gear 36 come into contact with the lowermost extremities of the circular Teflon disks 41 but since the Teflon gear 36 is a driven gear it has been found that this Teflon to Teflon contact has no material effect upon the longevity of the pump in handling fuming nitric acid.

It will also be noted that the stainless steel drive shaft 32 and counter shaft 33 are journaled in the Teflon bearings 31 so that deterioration of the shafts does not occur at these points.

As indicated above, the form of the pump is essentially based upon the discovery that a very marked increase in the resistivity of moving contacting parts of a pump to highly corrosive ladings is achieved where one contacting surface is made of a metal resistive to the corrosive effects of the lading and where the opposing surface is composed of a resin highly resistive to the corrosive effects of the lading. Also, as indicated, it has been found that stainless steel, and Teflon containing milled glass fibers have been found to be particularly effective as the metal and resin, respectively, of which the pump is composed, particularly in handling such highly corrosive ladings as fuming nitric acid. It has been found that for the resin parts of the pump a composition of 75% Teflon and 25% milled glass fibers has been found to be satisfactory.

I claim:

1. A gear pump for handling highly corrosive ladings, comprising a casing and a pair of intermeshing gears each having working surfaces moving in opposition to closely spaced working surfaces of said casing to propel said lading, one of said gears being composed of a metal resistive to the corrosive effects of said lading and the other gear being composed of a resin resistive to the corrosive effects of said lading, the said working surfaces of said casing opposing said one of said gears being composed of said resin, and the said working surfaces of said casing opposing said other gear being composed of said metal.
2. A pump as set forth in claim 1 wherein said resin is tetrafluoroethylene.
3. A pump as set forth in claim 2 wherein said resin contains glass fibers.
4. A pump as set forth in claim 2 wherein said metal is stainless steel.

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