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Haupt

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[54] **GEAR PUMP FOR HIGHLY VISCOUS MEDIA**

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[52] **U.S. Cl.** **418/206**

[51] **Int. Cl.** **F01c 1/24**

[58] **Field of Search** 418/205, 206; 425/237, 425/363

[56] **References Cited**

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[57] **ABSTRACT**

A gear pump for highly viscous media includes a housing having an inlet passage at one end and a discharge passage at the opposite end and a pair of pump gears are rotatably supported within the housing and have intermeshing teeth. The inlet passage comprises an inwardly converging cone havng an angle aperture of 36° to 60° and leads centrally to the space overlying the meshing gears. On a side of the inlet passage which overlies the side of one of the gears, there is provided an additional rectangular opening or recess having a cross-section with a width substantially equal to the width of one of the gears and a length corresponding substantially to the double outside diameter of each gear wheel minus a tooth height.

5 Claims, 3 Drawing Figures

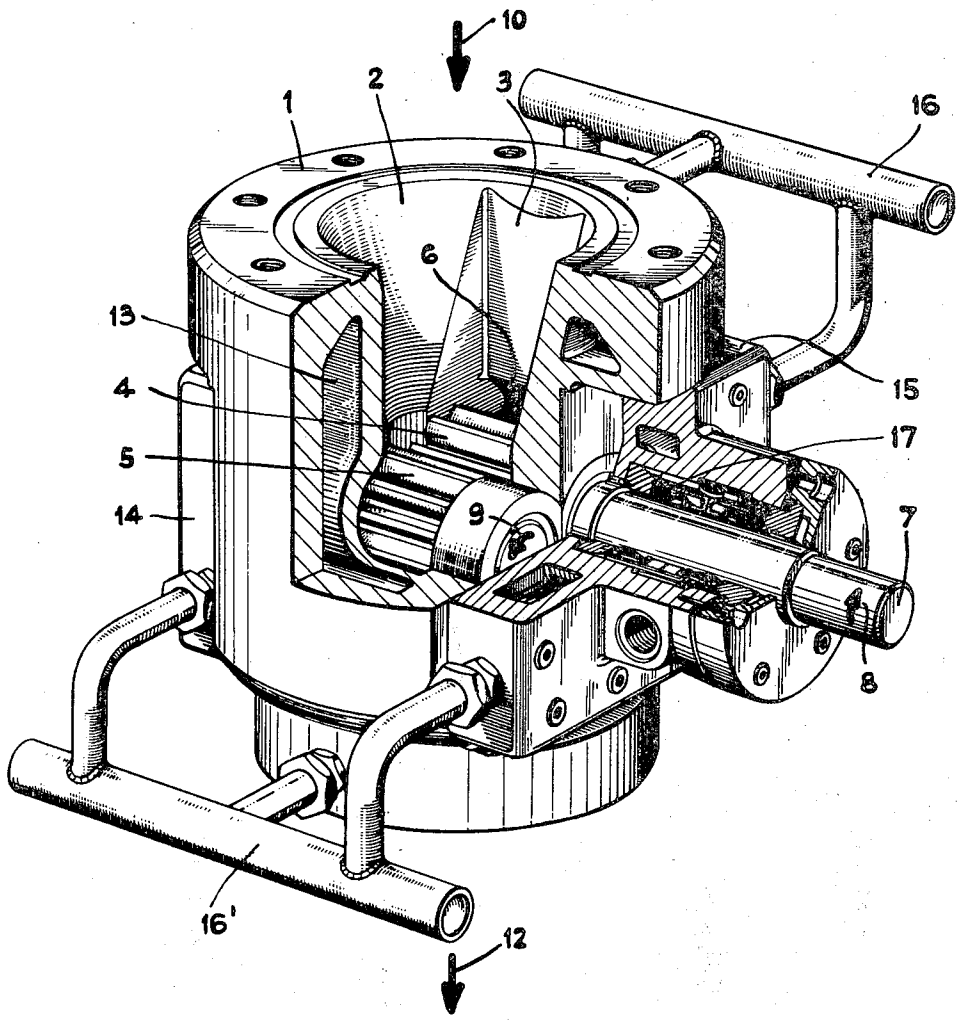


Fig. 1

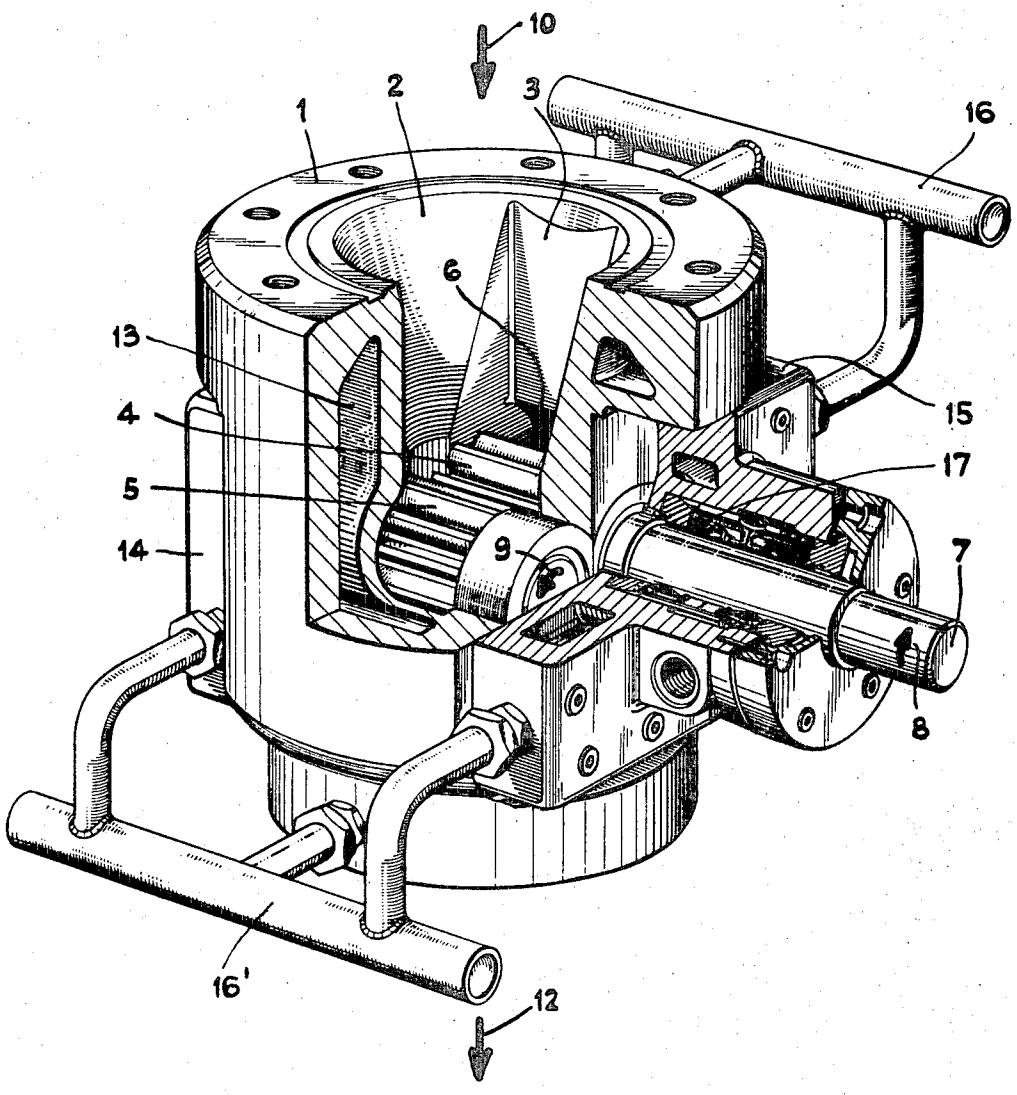


Fig.2

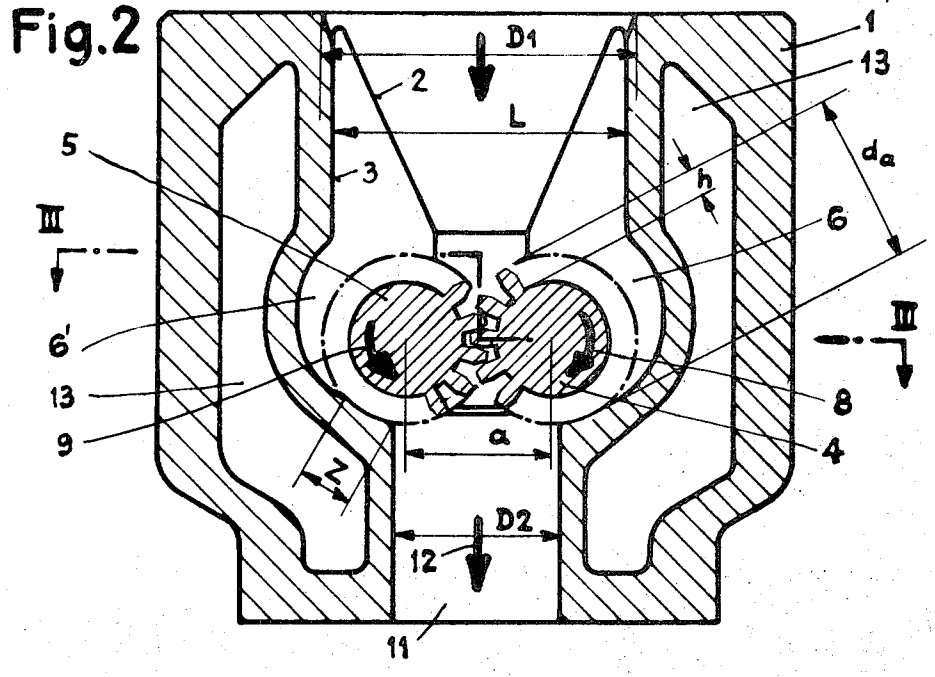
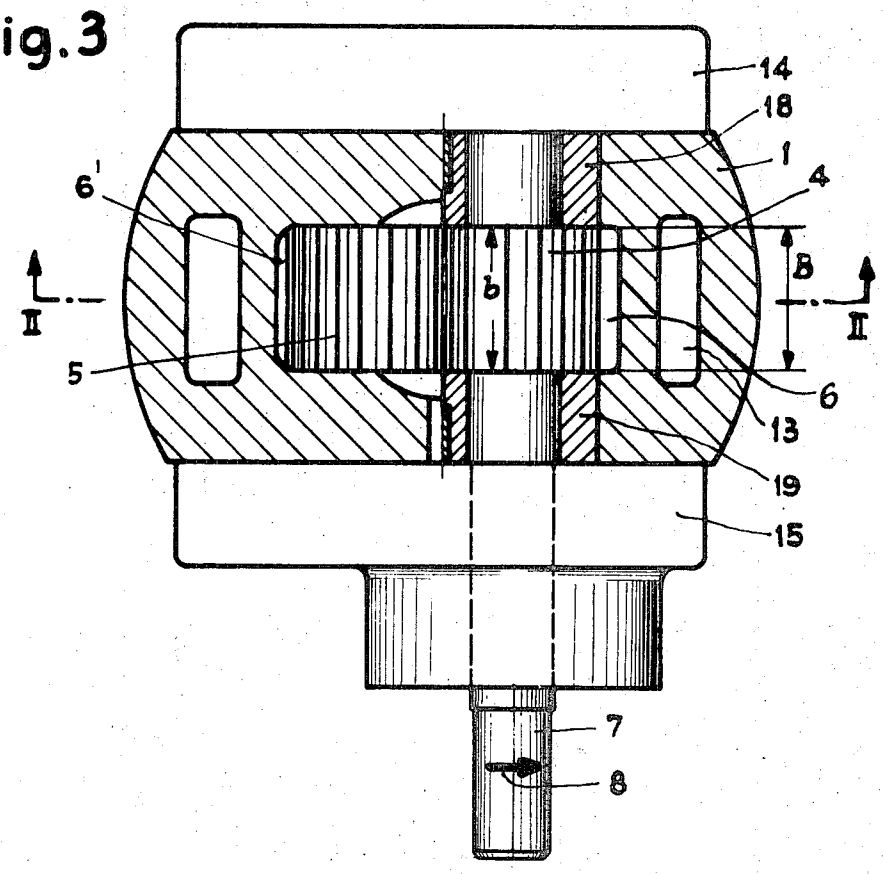

D1
L
h
2
3
5
III
6'
13
9
1
13
d_a
6
III
8
4
a
Z
D2
12
11

Fig.3


14
18
1
6'
4
II
b
B
II
5
6
13
19
15
7
8

GEAR PUMP FOR HIGHLY VISCOUS MEDIA

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to the construction of gear pumps and, in particular, to a new and useful gear pump particularly for the conveyance of highly viscous media which includes a housing with an inlet passage of inwardly tapering conical form with a recess portion on one side which has a width which is substantially equal to the width of the gears and a length which is substantially equal to double the diameters of the gears minus a single tooth height.

2. Description of the Prior Art

This invention deals with the construction of a gear pump which is particularly adaptable for pumping viscous media. A pump of this nature is particularly useful for pumping plastic melts and it includes a top inlet opening and heating jacket for heating the material which is being pumped. Such gear pumps are usually used for discharging highly viscous media up to viscosities of 20,000 poise from reaction vessels, and the pumps are usually attached directly to such vessels. One of the difficulties in construction of such a pump is the design of the inlet passage which must be designed optimally to obtain a uniform flow without long stay periods of the materials being pumped and also to provide for the complete filling of the pump with the highly viscous medium even in a high vacuum condition. The known pumps of this type are susceptible to a large number of difficulties in their operation and they are limited in respect to the range of viscosity of media that they can handle and, in addition, their operating speed and capability of operating with vacuum is very limited.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a pump which includes a pump housing having an inlet passage at one end and a discharge passage at the other end between which is mounted rotatable gears having teeth in meshing engagement which are in central alignment in respect to a conically formed inlet. The inlet is also provided with a recess or cutout portion overlying one side edge adjacent the gears and extending through the inlet passage to a height which is substantially equal to double the diameter of the gears minus a single tooth height and which includes a width substantially equal to the width of one of the gears. With the invention, by providing the entrance passageway in a conical configuration having an aperture angle of from between 36° to 60° and the additional rectangular opening with a width which is substantially equal to the tooth width and a length which corresponds to the outside diameter of the gear wheel minus a tooth height, it is possible to convey media with viscosities up to 100,000 poise with great reliability and the range of use is much wider in respect to both speed and vacuum applications.

Accordingly, it is an object of the invention to provide an improved pump construction which comprises a pair of rotatably mounted gears having teeth in meshing engagement arranged for rotational movement within a housing which has an inlet passage of conical configuration leading to the area between the gears and tapering toward the gears and which has a cutout portion or recess portion in the inlet passage overlying a side edge of the gears which is of a width substantially equal to the gears and a height substantially equal to double the diameter of the gears minus a tooth height.

A further object of the invention is to provide a pump particularly for pumping viscous liquids which includes a jacket having means for circulating a heating medium therethrough and which includes an inlet passageway arranged in alignment with a discharge passageway of substantially half its diameter and wherein the inlet passageway is conical and includes a rectangular cutout recess therein.

A further object of the invention is to provide a gear pump which is simple in design, rugged in construction and economical to manufacture.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a front top perspective view, partly broken away of a pump constructed in accordance with the invention;

FIG. 2 is a transverse section through the pump shown in FIG. 1 and taken along the line II—II of FIG. 3; and

FIG. 3 is a horizontal section taken along the line III—III of FIG. 2.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in particular, the invention embodied therein comprises a gear pump which includes a casing 1 having an inlet passage at one end for example the top, which is formed as a hollow cone 2, in accordance with the invention. The angle of the hollow cone inlet passage aperture is from between 36° and 60°. In accordance with a feature of the invention, the inlet passage is also provided with a recess or indentation which has a width B as shown in FIG. 3 which is substantially equal to the tooth width *b* of each of the gears 4 and 5 which are rotatably mounted in the housing between the inlet passage and a discharge passage 11. The length L of the rectangular recess 3 is substantially double the outside diameter of the gear wheels minus a tooth height *h*.

The housing 1 is constructed with an inner wall forming a curved portion surrounding a side of each gear 4 and 5 so that a substantially crescent-shape recess 6 and 6′ is formed on the outer side of each gear. The recess 6 represents the compression zone of the flow medium inside the pump housing leading away from the inlet passage 2. The maximum thickness of this zone starts preferably with an amount that corresponds at least to the tooth height *h*. The packing zone which is shown at Z in which the casing wall is closely adjacent the periphery of each gear 4 and 5, corresponds in extent to one tooth division between the gears of the gears 4 and 5.

The input or driving gear 4 is advantageously provided with a shaft 7 which is connected to drive means (not shown) so that it may be rotated, for example, in the direction of the arrow 8 and in such a case the gear 5 will rotate in the opposite direction 9. The medium to be conveyed is thus carried along from the inlet pas-

sage 2 in the direction of the arrow 10 and enters the tooth gaps between the gear wheels 4 and 5 and is compressed in the compression zone 6 and 6', and forced completed into the tooth gaps. The material then issues again through the outlet opening 11 in the direction of the arrow 12.

The inlet diameter D1 of the hollow cone 2 is preferably selected so as to be from 2.1 to 2.3 times the center distance *a* between the centers of the gears 4 and 5. The diameter of the outlet opening D2 is selected preferably to be substantially half the maximum inlet diameter D1.

The pump is supplied with a temperature control medium which is circulated through a space 13 defined between inner and outer walls of the pump housing 1 and cover elements 14 and 15 and it is supplied through an exterior conduit 16 and discharged through a similar exterior conduit 16' on the opposite of the housing. The cover 15 carries packing 17 which seals the flow medium from the shaft 7 which is introduced from outside into the gear pump housing. The shaft 7 is rotatably supported on bearings 18 and 19 as shown in FIG. 3.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A gear pump particularly for pumping highly viscous media, comprising a housing having an inlet passage at one end and a discharge passage at an opposite end, a pair of pump gears located between said inlet passage and said discharge passage having intermeshing teeth and being rotatably mounted in said housing, said inlet passage being of generally conical configuration tapering inwardly toward said pair of pump gears and having an angle aperture of from 36° to 60° and being provided with a rectangular recess with a cross-section in which the width is substantially equal to the gear wheel width and the length is substantially equal to double the outside diameter of the gears minus a tooth height.

2. A gear pump, according to claim 1, wherein the inlet diameter of said passage at its entrance end corresponds to from 2.1 to 2.3 times the center distance *a* between the centers of said gears.

3. A gear pump, according to claim 1, wherein said housing includes an interior wall extending in close proximity to a portion of the periphery of each gear and curving gradually outwardly therefrom on each side of said inlet passage and having a maximum width between the periphery of said gears and said passage which correspond at least to the tooth height of the gears, the length of the portion of the housing overlying the periphery of the gears defining a packing zone which corresponds at least to one tooth division of said gears.

4. A gear pump, according to claim 1, wherein the discharge passage has a diameter substantially half the maximum inlet diameter.

5. A gear pump, according to claim 1, wherein said housing is a double wall construction, an inlet conduit connected into said housing into the space between the double walls, an outlet conduit connected into said housing in the space between said double walls, said inlet and outlet conduits providing means for circulating a medium for controlling the temperature of said housing and for regulating the temperature of the medium being pumped, said inner wall defining a crescent-shaped recess extending from said inlet toward said gears, said conical housing being centered in respect to said two gears with the narrowest dimension overlying the nip over said gears, one of said gears having a shaft extending through said housing and being rotatably supported in bearings outside of said housing and being adapted to be connected to a drive for rotating said gears.

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