United States Patent

Leffers

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[54] LIQUID PUMP, PARTICULARLY AN OIL PUMP FOR REFRIGERATING MACHINES

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[51] **Int. Cl.** **B21d 43/28,** B21k 3/04

[58] **Field of Search** ..... 72/324, 367; 29/156.4, 156.8 B; 416/189

[56] **References Cited**

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[57] **ABSTRACT**

The invention relates to a method for making an oil pump for refrigeration machines. The pump comprises a tube formed by drawing which is press fitted into the bore of a motor rotor. The tube is initially formed with an inwardly domed, closed end portion. Circumferentially and radially extending incisions are made in the domed end portion to form cantilever portions which in turn are bent inwardly relative to the end of the tube to form blades.

1 Claims, 4 Drawing Figures

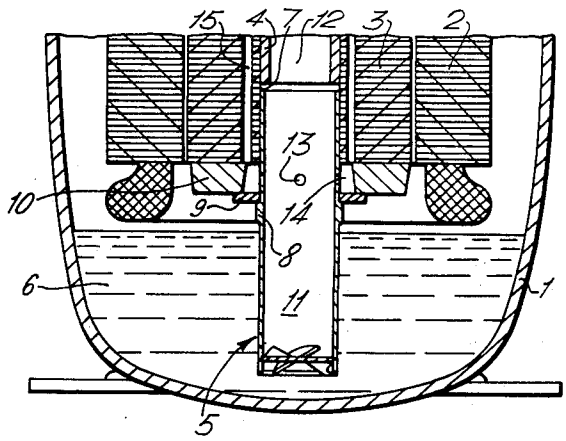
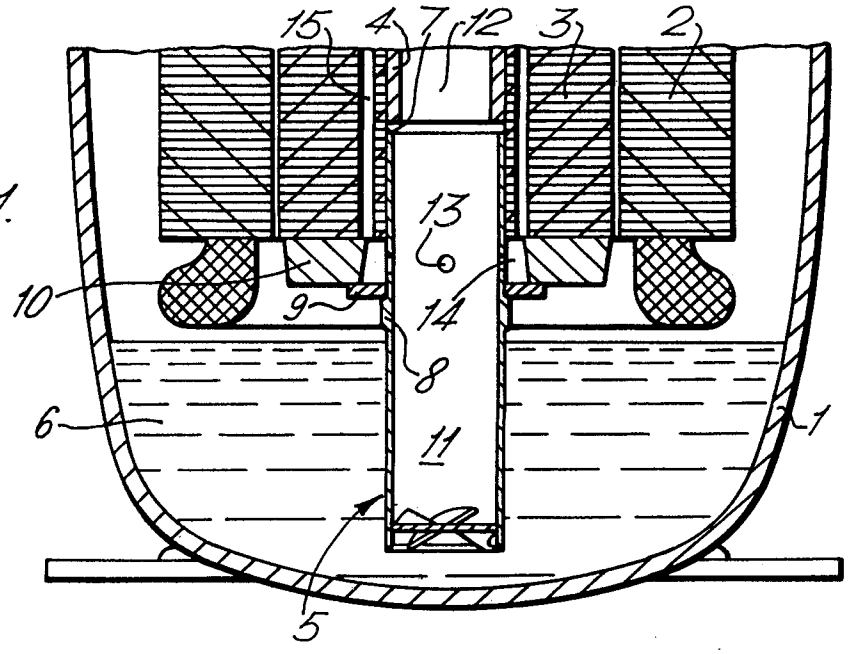


Fig. 1.



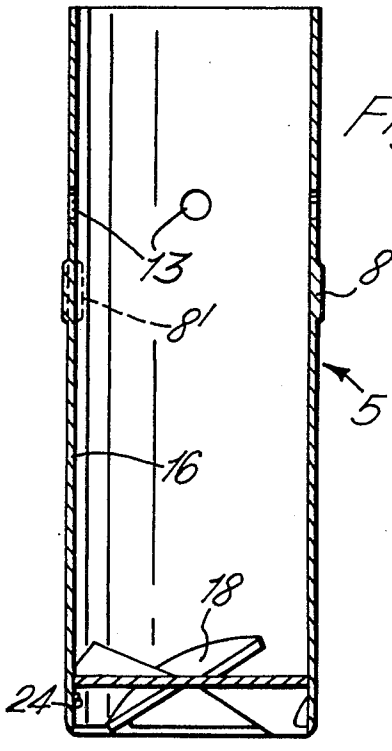
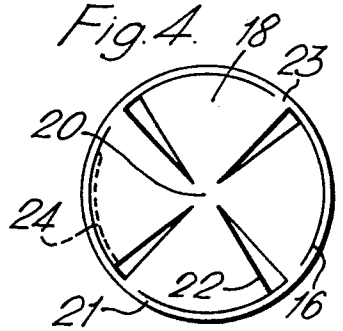


Fig. 2.

Fig. 3.



Fig. 4.



LIQUID PUMP, PARTICULARLY AN OIL PUMP FOR REFRIGERATING MACHINES

The invention relates to a liquid pump, particularly an oil pump for refrigerating machines, in which a bladed rotor is located at the lower end of a tube.

In accordance with an earlier proposal, a very simple but nevertheless very effective liquid pump can be produced by clamping a bladed rotor, stamped from sheet metal and then bent, in the lower end of a sheet metal tube. This tube is pressed into the lower end of a longitudinal bore in the vertical shaft of an encased motor compressor. A pump of this kind delivers large quantities of oil used for lubricating and cooling the motor compressor.

The object of the present invention is to provide a liquid pump of similar capacity which involves still less expense in its manufacture and can be produced with great precision.

According to the invention, this object is achieved by making incisions in the base of a drawn sleeve, which base is integral with the sleeve, and by bending over the material of the base between the incisions to form the blades.

A one-piece liquid pump is obtained in this manner. The sleeve can be of very small wall thickness; nevertheless the bladed rotor is held in an absolutely reliable manner. The bladed rotor occupies and retains a definite position and endows the free end of the thin walled sleeve with considerable stability as regards shape. Although it is unusual to carry out further work on drawn workpieces by stamping or bending them since the drawn material is brittle and hard, it is however only necessary to operate on the base when producing the blades, and the material of the base will have lost only little of its original ductility during the drawing operation.

In a preferred construction, the incisions extend part way along the circumference and run towards the centre, so that they are contiguous with the circumference. When the incisions are disposed in this way, the material of the base needs only be bent about a substantially radially extending line in order to provide very effective blades.

It is particularly advantageous if the base of the sleeve is domed inwards. A greater area of base material is made available in this manner. No danger then arises of slits remaining at the circumference when bending the blades, which slits lead to undesirable loss of capacity. Furthermore, it is then easier to arrange for the blades to be positioned entirely within the sleeve. There then arises no danger that parts of the blades, projecting downwards from the sleeve will "stir" in the liquid without providing a good delivery action. In particular, all the blades can be bent from the domed surface only towards the interior of the sleeve.

If the base is appropriately domed, it is even possible to make available so much material that the peripheral edges of the blades are bent over at least partially at the circumference of the sleeve in the axial direction. This results in additional increase in strength and in safe avoidance of capacity-reducing slits at the circumference.

In a preferred embodiment the domed portion is constituted by a conical part merging at the center with a planar part to which the radial incisions extend. This results *inter alia* in reinforcement in a plane precisely at right-angles to the axis of the tube.

The doming involves no additional operation; instead it can be effected during the drawing operation simply by using a drawing ram of appropriate shape which, if necessary, cooperates with a die of complementary shape.

A thin-walled sleeve, produced by drawing, runs the risk of possessing too little stability as regards shape in the area near its open end and of not being capable of being inserted in a definite manner in a holding means, e.g., the bore of a shaft. To overcome this difficulty, the sleeve may incorporate a portion of greater wall-thickness, which forms an outwardly projecting annular shoulder. This portion of greater wall-thickness constitutes a reinforcing ring. Furthermore, it ensures that the sleeve can be pushed only a certain distance into the bore of the shaft.

This portion of greater wall-thickness can also be produced during the drawing operation at no additional expense by firstly forming a portion of greater wall-thickness projecting inwards and then pressing it outwards to an extent such as to provide the outwardly projecting shoulder.

The invention will now be described in more detail by reference to an embodiment illustrated in the drawing, in which:

FIG. 1 shows, in part, a cross-sectn through an encased refrigerating machine having a vertical shaft,

FIG. 2 is an illustration, on a larger scale, of the liquid pump employed,

FIG. 3 shows the base of the liquid pump following the drawing operation, and

FIG. 4 is a view of the liquid pump from below.

FIG. 1 shows the lower half of the case 1, containing a spring-mounted motor compressor. The latter comprises *inter alia* a stator 2, a rotor 3, a motor shaft 4, a pump arrangement 5 and an oil sump 6. The pump arrangement, shown in greater detail in FIG. 2, is pressed, as is the motor shaft 4, into a central opening 7 in the rotor 3. The end position is defined by the fact that a shoulder 8 on the pump arrangement bears against a ring 9, which in turn bears against the short-circuiting ring 10 of the rotor.

The pump arrangement 5 passes oil from the sump 6 upwards through the chamber 11, a first part of the oil flowing upwards through the cavity 12 in the motor shaft 4 so as *inter alia* to provide the bearings of the refrigerating machine with lubricant, whereas a second part of the oil passes through openings 13 in an annular chamber 14 and thence rises through individual passages 15 in order to effect intensive cooling of the electric motor.

The pump arrangement 5 consists of a deep-drawn sleeve 16, the base 17 of which is used for forming blades 18. During the deep-drawing, in which a slug of metal is used as the starting material, the base 17 acquires, in the last operation, a shape such that it has an inwardly directed domed portion comprising a conical part 19 and a central planar part 20. Following the drawing operation, the domed base is provided with four incisions 21 extending circumferentially and four incisions 22 which run substantially radially from each incision 21 to the planar central part 20 of the base. In this way there are created four tabs, which are connected to the sleeve only at a locality 23, and with the planar central part 20 at a corresponding locality. These tabs are then bent into the interior of the sleeve 16 to form blades 18, as shown in FIG. 2. In this connection it is advantageous if parts of the peripheral edge of each blade 18 are bent over in the axial direction as indicated by the turned-over portions 24, shown in broken lines in FIGS. 2 and 4.

The thickened wall portion 8 of the sleeve 16, which provides reinforcement and acts as a shoulder, is likewise produced during the drawing operation. To this end, a thickened wall portion 8', projecting inwards as shown in broken lines in FIG. 2, is formed during the last stage of the drawing operation. This can be easily done with the help of an annular groove in the drawing ram. When the sleeve is stripped off, the thickened wall portion is forced by the drawing ram into the position shown in solid lines in which the shoulder juts outwards.

The bladed rotor can have an even or odd number of blades. The smaller the number of blades, the farther the blades will extend upwards into the sleeve 16 and the greater will be the delivery capacity. The illustrated embodiment comprising four blades constitutes a very good compromise, in which the greatest possible effect is achieved, given a not too excessive amount of material-shaping.

I claim:

1. A method of making an oil pump for refrigeration machines comprising the steps of forming a cylindrically shaped tube member having a closed end portion, cutting incisions in said end portion to form cantilever portions, bending said cantilever portions to form blades, said end portion being

pressed inwardly is domed to form a dome portion, said tube member being formed with a drawing operation, said dome portion being formed during said drawing operation.

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