

[54] **CENTRIFUGAL PUMP, IN PARTICULAR A SAND OR GRAVEL PUMP, AND A METHOD FOR OPERATING SUCH A PUMP**
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[57] **ABSTRACT**
A centrifugal pump of the type such as a sand pump, a gravel pump and the like, having an outer pump casing in which a sheet metal inner casing exchangeably is arranged, said sheet metal casing being provided with a liner of wear-resistant material, such as rubber.

5 Claims, 3 Drawing Figures

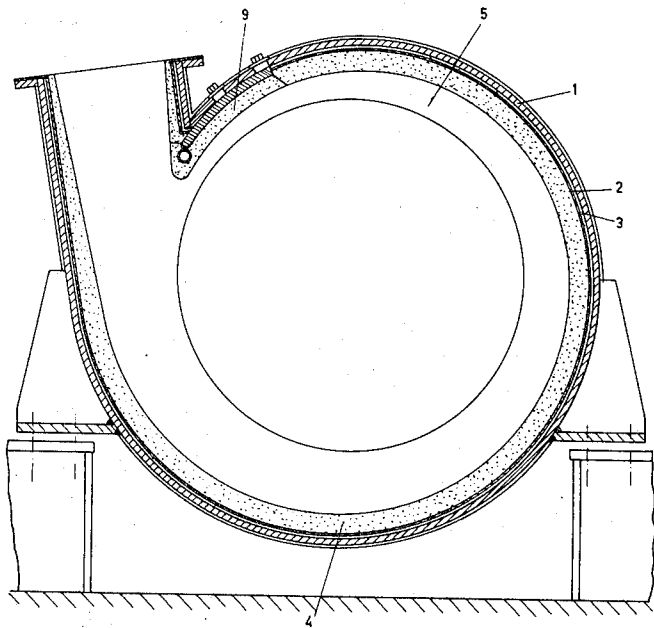
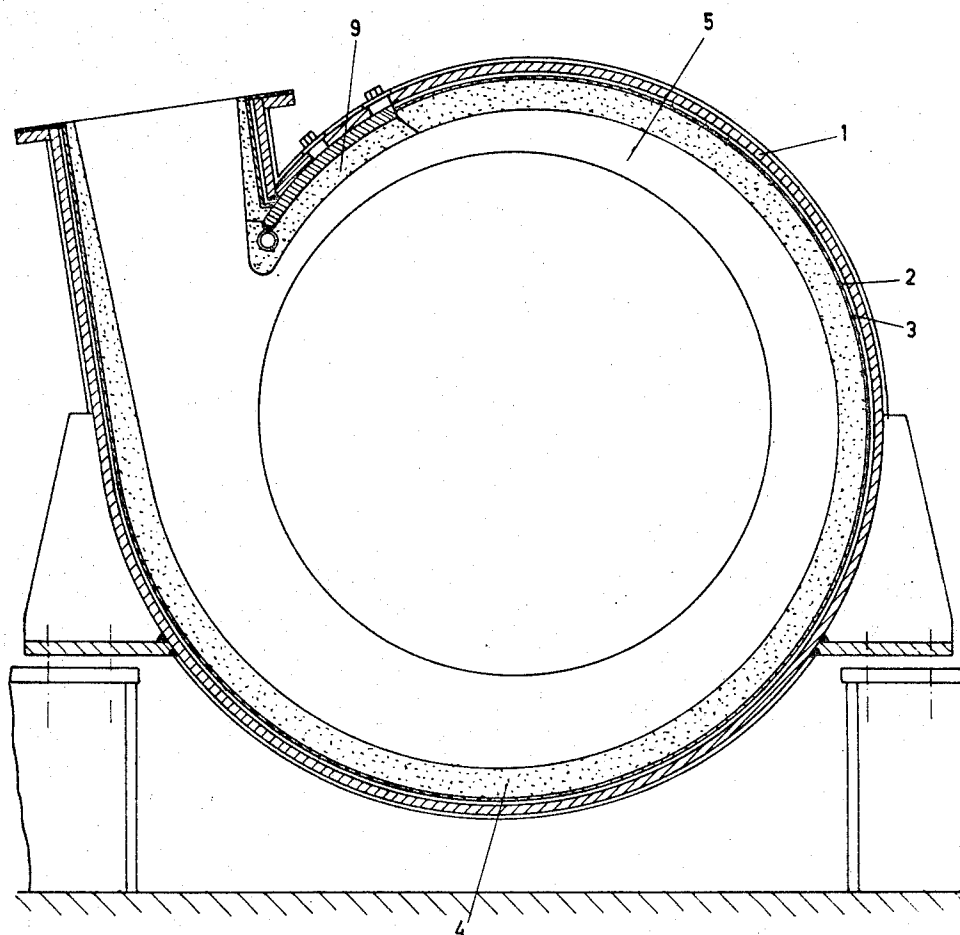


FIG. 1



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FIG. 2

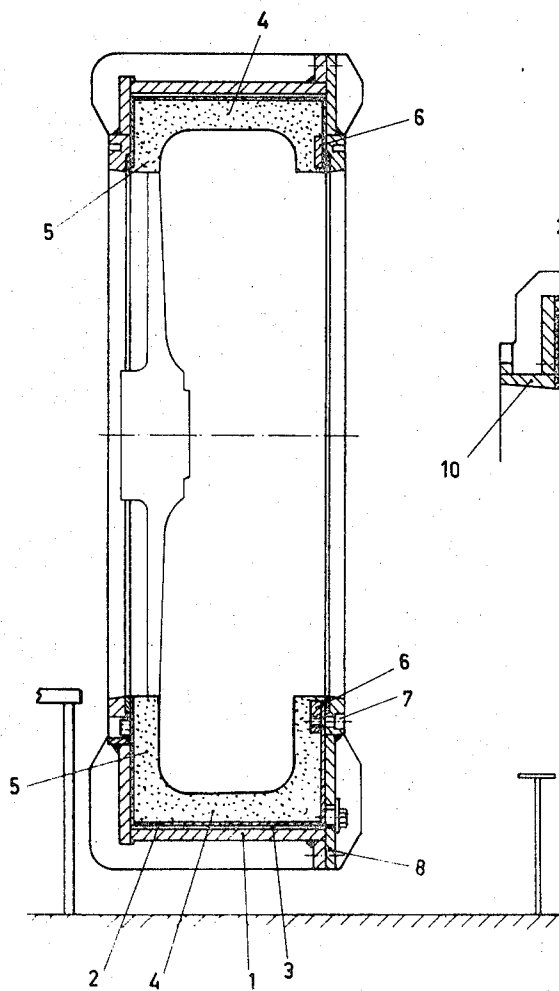
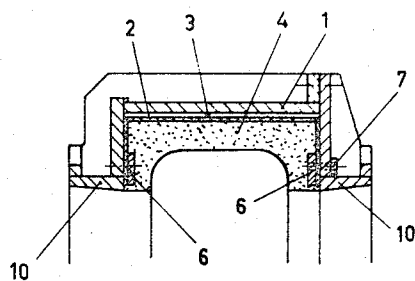


FIG. 3



CENTRIFUGAL PUMP, IN PARTICULAR A SAND OR GRAVEL PUMP, AND A METHOD FOR OPERATING SUCH A PUMP

This invention relates to a centrifugal pump in particular a sand or gravel pump, which is destined to suck sand and to convey it under pressure to a required site, and also relates to a method for operating such a pump.

If the mixture of water and sand and/or gravel would come into direct contact with the inner wall of a pump casing, said casing would be rapidly worn away as a result of the abrasive action of the sand on said inner wall. In order to prevent said wear up till now the pump casing is lined with a rubber layer or with some other material of high wear-resistance. When the liner is worn away, it can be removed and replaced by a new one. However, for this purpose it is necessary to send the pump casing to the factory where this work may be done. The removal of the old liner is not only a laborious job so that replacing a liner by a new one is expensive, but the transportation of a pump casing from the work to the factory is also expensive. The pump casings which are lined have in average a diameter of 250 cm. and a height of 100 cm., the weight amounting to about 7,000 kg. Dispatching the pump casing to the factory, replacing the old liner by a new liner and returning the newly lined pump casing do not only require much time, but, moreover, during this time the work is at a standstill. If this interruption of the work is not allowable, it is necessary to have an extra pump casing in stock.

The present invention aims at avoiding these drawbacks which is accomplished with a centrifugal pump according to the invention in that the pump casing a sheet metal inner casing is arranged, such as to be exchangeable, said inner casing being provided with a liner. When the liner of the inner casing is worn away, said inner casing is removed from the pump casing and is replaced by a new inner casing, which may be done on the site. In comparison with the pump casing such an inner casing is inexpensive so that there is no objection to keep it in stock on the site. Since, when the liner is worn out, only the metal, usually steel, of the inner casing is of some value and the wall thickness of the inner casing is only small, said inner casing with the worn out liner may be discarded as scrap-iron. Furthermore, it is possible to replace the inner casing of a pump by an inner casing with another liner, if the mixture to be pumped changes.

Constructing the inner casing, such that it fits accurately in the pump casing entails an expensive machining, and replacing such an inner casing by another inner casing requires much time. In order to remove these drawbacks the invention teaches that at least between the pump casing and the curved portion of the sheet metal inner casing facing the curved portion of the pump casing there is an intermediate space which is filled up with finely granulated filler material, such as sand. A clearance of about 10 mm. may be applied with advantage. The filler material, for example fine sand, may be introduced into the intermediate space by injection. When the intermediate space is entirely filled up with sand, high pressures may be absorbed. When the inner casing must be removed or when the liner is worn away down to a predetermined thickness, the sand may be washed away or may be squirted from the intermediate space with the aid of water. In con-

sequence of the fact that there is an intermediate space between the pump casing and the inner casing, neither the inner wall of the pump casing nor the inner casing require to be accurately machined so that the cost of manufacturing is low and a rapid manufacture is possible.

A preferred embodiment of the centrifugal pump according to the invention is characterized in that the inner casing with the wearing layer is supported exclusively at the outlet and/or at the inlet side of the pump. Apart from the support or connection at the outlet and/or the inlet side of the pump the inner casing provided with the liner is cantilevered in the pump casing.

The inner casing is preferably provided at the inner side of each of the faces with a metal ring, said rings each being secured by means of bolts to a removable part of the pump casing. The removable part of the pump casing may, according to the invention, be formed, for example, by a cover of the pump casing.

A preferred embodiment of the pump according to the invention is characterized in that the metal ring situated at the inner side of at least one of the faces of the inner casing is secured with the aid of bolts to an annular intermediate element arranged between the cover of the pump casing.

A method for operating the centrifugal pump according to the invention is characterized in that, calculated on the service life of the wearing layer, operation is carried out during the initial period with a sand filling and during the subsequent end period without a sand filling the space between the pump casing and the inner casing.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawing, wherein:

FIG. 1 is a cross-section of a pump casing;

FIG. 2 is a longitudinal section of said pump casing;

and

FIG. 3 is a longitudinal section of part of another embodiment of the pump casing.

The pump casing 1 is constructed in a usual manner so that it will not be described in detail.

In the pump casing 1 there is provided an inner casing 2 of sheet metal, preferably of steel, which is situated at a distance of about 10 mm. from the inner wall of the pump casing 1 thus forming an intermediate space 3 between the curved inner wall of the pump casing 1 and the curved outer wall of the inner casing 2, said intermediate space being filled up with sand. The inner casing 2 is provided at its inner side with a liner 4 of rubber or some other wear-resistant material. In one of the faces 5 of said liner a steel ring 6 is provided, said steel ring being fastened by means of bolts 7 to the cover 8 of the pump casing 1.

As an example of a material for a wear-resistant liner a rubber composition of the following components may be mentioned:

Sheets I and II	80 - 90 parts by weight
Polybutadiene rubber	10 - 20 parts by weight
Kaolin	30 - 50 parts by weight
Soot (semi-active)	20 - 50 parts by weight
Coumarone resin	4 parts by weight
Paraffin wax	0.5 part by weight
Stearic acid	2 parts by weight
Antioxydant	1 part by weight

Zinc white	3-5 parts by weight
MTBS	0.8 part by weight
DPG	0.4 part by weight
Sulphur	2-3 parts by weight

For the adhesion of a rubber liner of this composition to the inner casing a normal primer available in the market may be used, for instance as may be purchased under the trade marks "Chemlock," "Thixon," or "Ty Ply," said primer being provided with a solution of the above-mentioned rubber mixture to which tackifiers are added, as may be purchased under the trademarks "Amberol" or "Pentalyn K."

As is apparent from FIG. 1, the liner 4 connects to a lined end portion which by means of bolts is fastened to the pump casing.

In the embodiment according to FIG. 3, there is provided on either side of the pump casing an annular intermediate element 10 which is secured to the inner casing with the aid of bolts 7 engaging in threaded holes of rings 6 arranged in the liner. The intermediate element itself is also secured to the pump casing by means of bolts. Pump covers (not shown) are connected to said intermediate element. With the aid of said intermediate element the inner casing may easily and rapidly be removed from the pump casing.

If during the operation of the centrifugal pump the liner 4 is worn off to such a degree that as a result of the inner casing 2 being supported by the sand filling located between said inner casing 2 and the pump casing 1 said liner is not sufficiently yielding any more, it is possible, according to the invention, to remove said sand filling so that consequently the inner casing 2 is not supported any more and the wall of said inner casing may likewise yield.

In this way an extreme abrasion of the liner is rendered possible without a considerable change in the operation of the centrifugal pump. Moreover, this prolongs the life of the inner casing with the liner.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is shown in the drawings and

described in the specification.

What is claimed is:

1. A centrifugal pump of the type such as a sand pump, a gravel pump and the like comprising:
 - an outer pump casing having an outlet-inlet side, a sheet metal inner casing exchangeably arranged in said outer pump casing removably secured to the pump,
 - a liner of wear-resistant elastic material lining said sheet metal inner casing forming a single unit with said inner casing,
 - said inner casing being secured exclusively at at least one of the sides of said outer pump casing formed by said outlet-inlet side of said pump casing, an intermediate space between said outer pump casing and said inner casing which are positioned spaced from each other, and
 - finely granulated filler material filling said intermediate space.
2. The centrifugal pump of claim 1, further characterized by:
 - said liner being of rubber.
3. The centrifugal pump of claim 1, further characterized by:
 - said filler material being sand.
4. The centrifugal pump of claim 1, further characterized by:
 - a cover on said outer pump casing,
 - a metal ring provided at least at one of the sides of said inner casing and connected by bolts to said cover.
5. The centrifugal pump of claim 1, further characterized by:
 - a cover on said outer pump casing,
 - an annular intermediate member positioned between said cover and said outer pump casing,
 - said intermediate member, at one of its sides, bolted to said outer pump casing, and at its other side, bolted to said cover,
 - and a metal ring provided at least at one of the sides of said inner casing and connected by bolts to said intermediate member.

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