

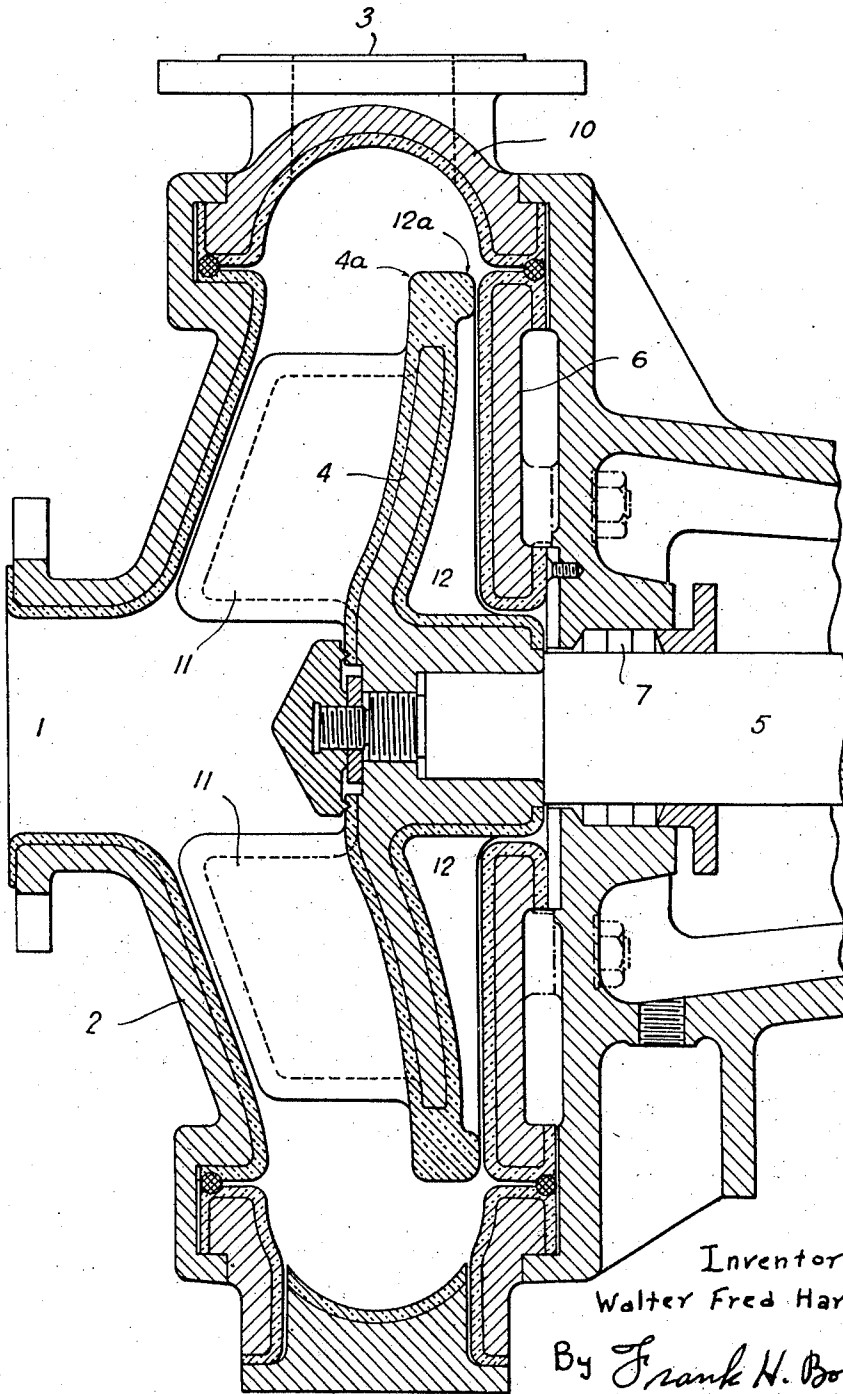
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W. F. HARLOW

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CENTRIFUGAL PUMP

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Inventor
Walter Fred Harlow
By *Frank H. Borden*
Attorney

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CENTRIFUGAL PUMP

Walter Fred Harlow, Duffield, England

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1 Claim. (Cl. 103—115)

This invention relates to centrifugal pumps and more particularly to the type used for pumping liquid containing a quantity of abrasive solids, for example grit, and liquors which have a deleterious effect on the metals usually used for constructing such pumps, in which the metal parts of the pump which would otherwise come in contact with the liquids or liquors are protected by a layer of rubber. The rubber which is used for this purpose is of various compositions and the term rubber is used in this specification to include a resilient material having as an ingredient a proportion of metallic substance.

In such pumps it has been found necessary to prevent the material being pumped from leaking into the gland where the pump spindle enters the pump casing. The gland is usually disposed on the side of the pump casing opposite to that containing the pump inlet and the amount of leakage to the gland has been lessened by providing auxiliary vanes on the back of the impeller, i. e. the face of the impeller adjacent the side where the gland is located, which are designed to have a greater centrifugal action than the main pumping vanes on the front of the impeller.

It is found that in such pumps the life of the working parts depends largely on the thickness of rubber covering the various parts, but owing to considerations of mechanical strength it has been found necessary to provide a metal structure of which the various parts are sufficiently substantial to resist such shocks as may be caused by the entry of comparatively large solid masses into the pump. The thickness of rubber which it has been permissible to use has, therefore, been restricted to a comparatively thin layer, which is usually about $\frac{1}{4}$ " to $\frac{1}{2}$ " thick.

It is found that in pumps with auxiliary vanes as described above considerable wear takes place at the tips of the vanes. The auxiliary vanes usually project radially to the circumference of a disc on which are carried the pumping vanes, the latter being substantially less in diameter than the disc.

This wear is probably due to the fact that an accumulation of solid material takes place at the bottom of the pump casing when the pump is shut down and these solids may even agglomerate during such periods. The solid material is liable to become trapped between the auxiliary vanes and the casing and, even though no agglomeration takes place, this, together with the effect produced by the high peripheral speed of the outer annular part of the impeller when the pump is run may cause excessive wear. In consequence the rubber

may become perforated and detached from the metal it is designed to protect so that the exposed metal is liable to rapid destruction.

It is found that the excessive wear at the outer parts of the impeller, including the outer parts of the auxiliary vanes, is prevented, while preserving efficient operation of the pump, by the invention according to which, in spite of its not having been found possible to do without any metal core for the impeller and make the latter wholly or mostly of rubber, the outer annular part of the impeller is made wholly of solid rubber.

Preferably, the invention is carried into effect by making the centre metal disc of the impeller of about the same diameter as the pumping vanes while the outer annular part of the disc, together with the adjacent portions of the radially projecting auxiliary vanes, are made wholly of rubber united to the rubber covering of the remainder of the impeller.

According to a further aspect of the invention the effect of the auxiliary vanes in maintaining the desired conditions at the gland is improved by so arranging the impeller that the height of the auxiliary vanes is progressively increased towards the impeller boss by a total or final amount equal to at least twice the initial height at the periphery, which latter, in turn, is at least six times the dimension of the clearance between each vane and the casing; the centre disc, in a cross-section of the impeller, may thus appear to have a re-entrant hollow at the back of the impeller.

It is found that the ratio of the height measured in the direction of the axis of rotation of the auxiliary vanes to the clearance between the vanes and the back plate of the casing has an important effect on the action of these vanes and it is desirable to make the vanes project from the centre disc as much as possible since the clearance must be relatively large by reason of the rubber covering. It is undesirable, however, that the height of the auxiliary vanes at the periphery of the disc should be large as this would increase the width of the casing at this point.

Even though the auxiliary vanes be comparatively shallow at their periphery they will still be better than vanes of a uniform and shallow construction and it is found that even when the vanes are badly worn at their periphery the centre portions are sufficient to prevent serious pressure at the gland.

The invention is illustrated by the accompanying drawing, which is a longitudinal section of a centrifugal pump embodying the invention.

The pump comprises an inlet 1 in the side 2 of the pump casing, and a discharge outlet 3 in the wall 10. The impeller is mounted on a shaft 5 which passes through an opening in the rear wall 6 of the pump casing. An annular space is left between the shaft 5 and the wall 6, which is packed by suitable material 7 such as is normally used in packing glands, so as to seal the pump chamber at the point where the shaft 5 enters. The shaft is carried in bearings (not shown). The impeller comprises a disc 4 and main impeller blades 11. On the side of the disc 4, which is opposite the blades 11 and faces the wall 6, is mounted a set of auxiliary blades 12. The disc 4 and the auxiliary blades 12 are of larger diameter than the main blades 11. The auxiliary blades and disc are so shaped that the height of the former measured parallel to the shaft 5 increases progressively towards the centre of the pump. The walls, 2, 6 and 10 and the main part of the disc 4 are made of metal lined with rubber. The

outer part 4a of the disc 4 is made of solid rubber, which is united with the rubber lining of the central part of the disc. The tips 12a of the auxiliary blades 12 are also made of solid rubber, and are united to the rubber annulus 4a.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:

In centrifugal pumps a casing, a shaft extending into one side of the casing, an impeller mounted on the shaft, said impeller comprising a center disc, main vanes mounted on the disc on the side opposite to the shaft, auxiliary vanes of larger diameter than the main vanes mounted on the disc on the side toward said impeller shaft, the outer annular part of said disc and the adjacent peripheral portions of said auxiliary vanes being made wholly of solid rubber, and the remaining portions of the auxiliary vanes comprising a core of rigid material.

WALTER FRED HARLOW.