

Jan. 23, 1934.

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1,944,504

SIDE PLATE FOR CENTRIFUGAL PUMPS

Filed May 16, 1932

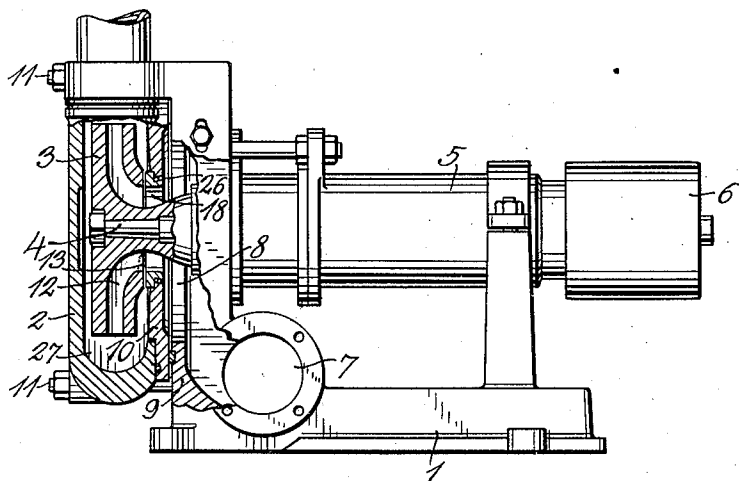


Fig. 1.

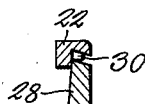


Fig. 5.

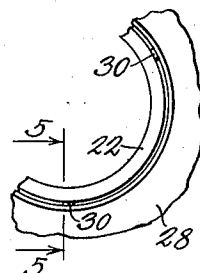


Fig. 4.

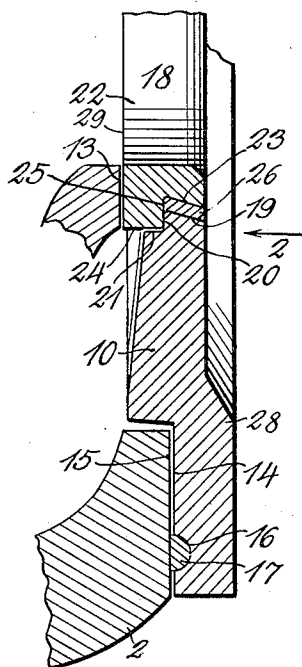


Fig. 3.

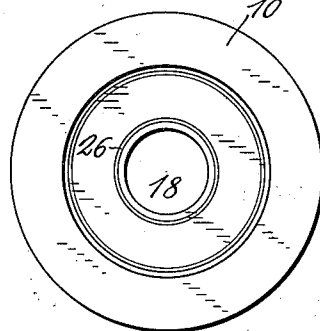


Fig. 2.

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UNITED STATES PATENT OFFICE

1,944,504

SIDE PLATE FOR CENTRIFUGAL PUMPS

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Application May 16, 1932. Serial No. 611,525

3 Claims. (Cl. 103—111)

This invention relates to improvements in side plates, follower plates, liners or equivalent parts in centrifugal pumps and similar machines for handling, pumping, and agitating liquids containing abrasive solids.

In a wide range of industries there are handled at times liquids containing solids. These mixtures are ordinarily raised from a lower to a higher level by centrifugal pumps especially constructed and employing suitable materials to resist abrasive action of the solids. Such pumps are usually single-stage and single-suction and built in either end-suction types or inside-suction types.

Centrifugal pumps of the type referred to have a runner or impeller mounted on a shaft and rotating in an impeller chamber. This chamber is encased by a main housing with side plates, liners or follower plates forming the sides of the chamber adjacent and approximately parallel to the two faces of the impeller. On end-suction pumps two such plates or equivalent parts are usually employed, and on inside-suction pumps one such plate or equivalent part is usually employed. These pumps are connected with the supply through a suction pipe and communication is established between pipe and impeller through an opening in the side plate. For efficient and successful operation, it is desirable to maintain a close running clearance between the rotating impeller and the stationary side plate on annular and concentric surfaces adjacent to the opening in the center of the side plate. This running clearance or seal, due to a slippage flow caused by a difference in pressures on either side of same, is subject to severe wear and it is therefore necessary at frequent intervals to replace the side plates.

For centrifugal pumps of this type for handling abrasive mixtures, the parts subject to abrasion are usually constructed of a very hard, nonmachinable metal and occasionally of semimachinable metals or alloys very difficult and expensive to machine. Materials of the above general type, particularly nonmachinable metals, are those which resist the abrasive action most successfully.

It is the object of this invention to produce an improved side plate, liner, or follower plate constructed from suitable materials wherein that region of the above plates subject to the greatest and most severe wear will be replaceable and also shall consist of a preferred type of joint being new and particularly suited for the above application, so that, instead of making it neces-

sary to replace the entire plate, it is only necessary to replace a portion of the side plate, and this greatly decreases the expense of maintenance. Heretofore, due to nonmachinability and to the lack of a satisfactory joint, replaceable portions of the plates have not been used for nonmachinable metal plates or metal plates very difficult to machine.

Having thus set forth the object of the invention, the same will be described in detail, and for this purpose reference will be had to the accompanying drawing in which the improved side plate has been illustrated and shown in place in an inside-suction type of pump, and in which:

Fig. 1 is a side elevation of an inside-suction type of centrifugal pump, parts being shown in section to better disclose the relationship of the side plate to the impeller;

Fig. 2 is a front elevation of the side plate looking in the direction of arrow 2, in Fig. 3;

Fig. 3 is a section through a side plate constructed in accordance with this invention;

Fig. 4 is a fragmentary view showing the ring centered in the plate by means of lugs; and

Fig. 5 is a section taken on line 5—5, Fig. 4.

In the drawing, reference numeral 1 indicates the base of a typical inside-suction centrifugal pump, and 2 represents the impeller housing or casing. Located within the pump casing is an impeller 3 that is attached to the end of a shaft 4. The shaft is mounted in suitable bearings inclosed in a housing 5 and provision is made for the proper turning of the shaft and impeller by providing the shaft with a pulley 6. The base is provided with a suction inlet 7 which is connected with the frame opening 8, concentric with the shaft 4 and in a plane perpendicular to the axis of the shaft. Located between the pump casing 2 and the frame wall 9 that contains the opening 8 and to which casing 2 is secured by means of bolts 11 is a side plate properly held in place. The flow through the pump is then into the frame suction inlet 7, through the frame opening 8, through the side plate opening 18, into the impeller ports 12, and into the impeller chamber 27. The impeller surface 13, for efficient operation and to prevent excessive slippage, must be in close proximity to the adjacent side-plate surface 29. Unless the clearance between the surfaces is reasonably close, excessive slippage from the runner chamber 27 to side-plate opening 18 will take place. This gives rise to very excessive wear of surface 29 on the stationary side plate 10 when the liquids pumped contain abrasive solids.

In order to explain the invention most clearly, reference will now be had to Figs. 2 and 3, which show the side plate to a somewhat larger scale. The side plate has been indicated as a whole by reference numeral 10, and in this invention is constructed with an outer disc or plate 28 and an inner ring 22. The central opening of the plate or disc 28 is formed in part by frusto-conical surface 19 extending from the rear surface of the plate to the annular shoulder 20 located near the outer surface and which for centering purposes forms the bottom of a rabbet whose cylindrical wall has been indicated by reference numeral 21. This rabbet may be omitted when a number of short centering lugs or projections 30 properly spaced are cast in the ring 22 partly on surfaces 25 and 23 for the purpose of centering against the annular shoulder 20 of side plate 28, as shown in Figs. 4 and 5.

Located in the opening in the side plate 28 is a replaceable ring 22 that is made from a very hard and highly abrasion-resisting material. The inside diameter of ring 22 is so proportioned that it is substantially equal to the diameter of the eye of the impeller as represented by the distance between the outer surface of the openings 12 as they extend through the surface 13. The ring 22 has a flat surface that faces the surface 13 of the impeller and which makes a close running clearance with the latter when the impeller is in operation. The outer surface of the ring 22 consists of a frusto-conical surface 23 that is inclined substantially at the same angle as the frusto-conical surface 19 of the side plate 28. The other part of the outer surface of the ring 22 consists of cylindrical surface 24 and this is joined to the inner end of the frusto-conical surface by an annular surface 25 that lies in the plane of the ring 22. The diameter of the cylindrical surface 24 is substantially equal to the diameter of the cylindrical surface 21 so that when the ring is in place it is centered by the co-action of the two surfaces when the rabbet in the inner surface of the plate 28 is used. When this rabbet is not used, the ring 22 is centered by short lugs or projections cast in the ring common to the surfaces 25 and 23. The outer diameter of such lugs when used is substantially that of shoulder 20 on plate 28, so that easy centering may be accomplished without the rabbet in the plate. The flange on the inner end of ring 22 serves as a stop and prevents the ring from being pushed outwardly by the operation of the impeller. In addition, the flange also serves as a protecting covering for the joint and protects the softer joint filling material from erosion by the abrasants contained in the liquid pumped. The flange at the end of the ring therefore serves four distinct functions, namely, (1) it serves as a closure for the annular space when molten metal is poured thereinto and as an abutment during the peening operation; (2) it serves as a stop and limits the outward movement of the ring; (3) it serves as a protecting cover against the erosion of the softer joint filling material; and (4) it also serves as a centering means for the ring when the construction shown in Fig. 3 is employed. The larger diameter of the frusto-conical surface of the ring is slightly less than the smaller diameter of the frusto-conical surface 19 of the plate 28 so that the ring 22 can be inserted into the opening in the plate. After the ring has been put in place, the space between the two frusto-conical surfaces is filled with any suitable nonplastic or self-hardening or suitable

material 26 which serves to hold or lock the ring securely in place. After the plate has been used so that the ring 22 is worn away to a certain predetermined limit, the side plate is removed from the pump and the ring removed and replaced with a new ring which is secured to the plate by the same means. It has been found from tests that depressions in the frusto-conical surfaces are not necessary to provide locking action against torque or turning of the ring 22. The action of the joint in combination with the frusto-conical surface is that the ring is locked in place against any movement either transverse or longitudinal to the shaft. By means of the expedient above described, the expense of maintaining side plates, liners, follower plates or equivalent parts in centrifugal pumps or similar machines when handling liquids containing abrasive grits is greatly reduced.

Having described the invention what I claim as new is:

1. In a centrifugal pump comprising an impeller housing having a removable side plate made from suitable material and provided with an opening, a renewable wear ring located in the opening, means comprising lugs integral with the ring for centering in the opening, means for attaching the ring to the plate comprising readily fusible malleable material placed in the space between the ring and the wall of the opening, and means for protecting the fusible material from erosive action by the material pumped, said means consisting of a protecting flange projecting outwardly from the ring and positioned to bear against the side plate on the impeller side thereof.

2. In a centrifugal pump or similar machine employing side plates, a two part side plate having a central substantially circular opening, the side wall of the opening being frusto-conical, and a wear ring located in the opening, the outer surface of the ring being formed by a cylindrical surface and a frusto-conical surface joined by an annular surface lying in the plane of the ring, the ring having properly spaced integral centering lugs common to the annular surface and the frusto-conical surface for centering the ring in the opening in the plate, the width of the frusto-conical surface of the ring being substantially equal to the width of the frusto-conical surface of the central opening, the outer diameter of the frusto-conical surface of the ring being substantially the same as the centering lugs and also slightly less than the smaller diameter of the frusto-conical portion of the central opening in the plate whereby the ring can be inserted in the opening in the plate and at the same time center itself by means of the centering lugs, and means for securing and locking the ring in the opening, said means consisting of filling the space between the ring and the central opening in the plate with a suitable material.

3. In a centrifugal pump or similar machine employing a side plate having a central substantially circular opening, and a wear ring located in the opening, the outer surface of the ring being formed by two circular surfaces of different diameters joined by an annular surface lying in the plane of the ring, the ring having properly spaced integral lugs common to the annular surface and the circular surface of smaller diameter for centering the ring in the opening in the plate, the width of the circular surface of smaller diameter being substantially equal to the width of the wall of the circular opening in the side plate,

the outside diameter of the smaller circular surface of the ring being slightly less than the inside diameter of the circular opening in the side plate whereby when the ring is inserted in the opening in the plate it will be centered therein by the lugs and so positioned that an annular space is formed between the adjacent circular surfaces of the plate and the ring, the diameter of the larger portion of the ring being greater than the diameter of the opening in the plate whereby it will extend onto the plate adjacent the opening and form a stop for limiting outward movement, and means for securing the ring in the opening, said means comprising a filling of readily fusible metal located in the annular space.

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65	140
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