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ACID PUMP

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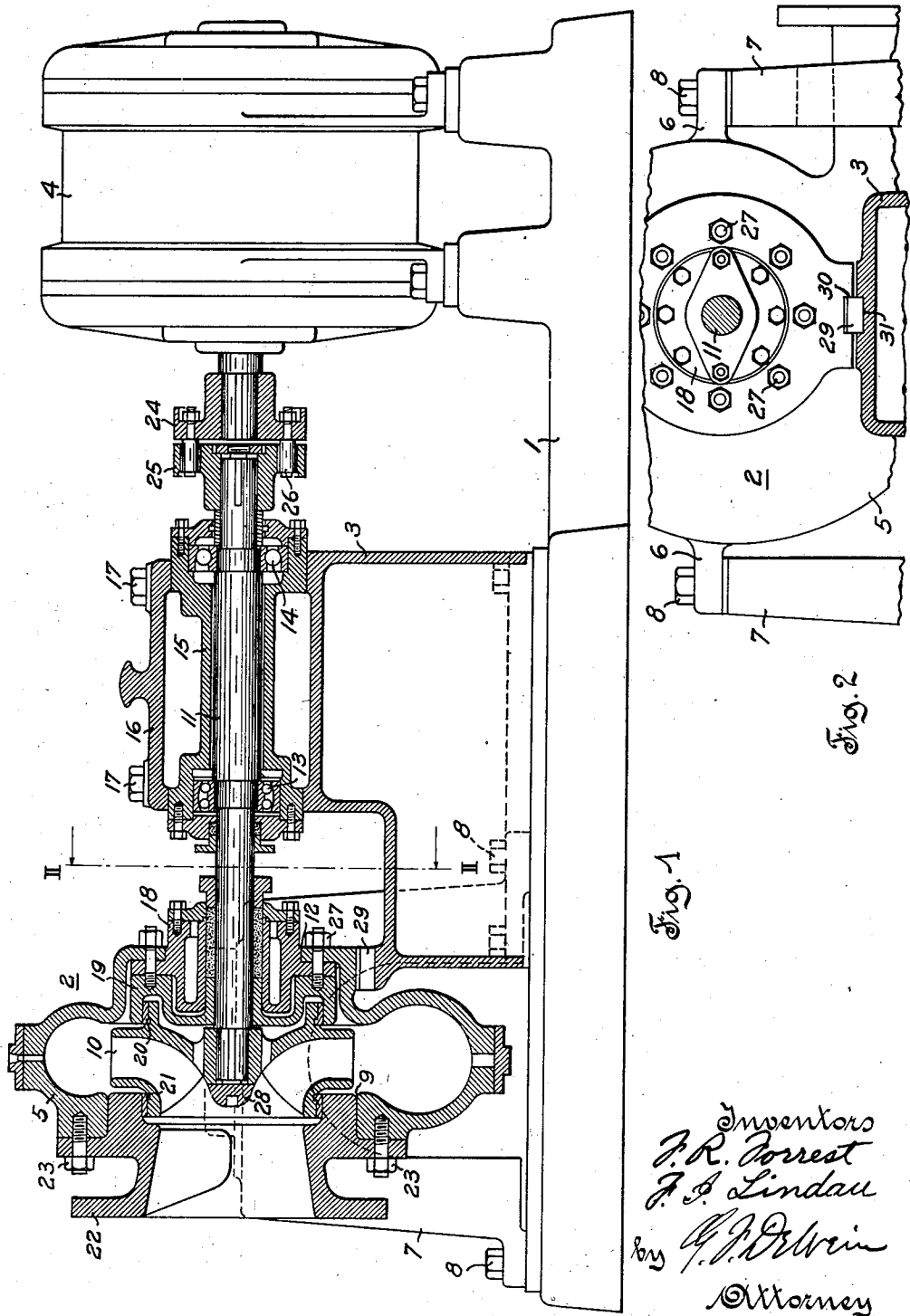


Fig. 1

Fig. 2

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ACID PUMP

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3 Claims. (Cl. 103—111)

This invention relates, in general, to centrifugal pumps, and particularly to centrifugal pumps of the type especially adapted for pumping hot acid liquid, and to a method of dismantling them.

A general object of the invention is to provide a centrifugal pump for pumping hot acid that is of simple and durable construction and that is adapted to be operated and maintained with minimum attention and labor.

Another object of the invention is to provide a centrifugal pump for pumping acid, in which the parts coming in contact with the acid being pumped are made of acid resisting material.

Another object of the invention is to provide a centrifugal pump so constructed that it may be dismantled of its rotating element readily and without disturbing the alinement of the pump casing and the pump driving means.

A more specific object of the invention is to provide a centrifugal pump in which the rotating element including the shaft and its associated parts may be withdrawn endwise through the pump casing.

Another object of the invention is to provide a method of dismantling and reassembling the rotating element of a centrifugal pump expeditiously and without disturbing the alinement of its stationary parts.

A further object of the invention is to provide a centrifugal pump having a spiral casing mounted in such manner that it may expand when heated by hot liquid being pumped without causing misalignment of the stationary and rotating elements of the pump.

According to the present invention, a centrifugal pump for pumping hot acid liquids is provided with an impeller of acid resisting metal disposed to operate within a one-piece spiral casing likewise formed of acid resisting metal. The casing is provided at one side with an inlet opening adapted to admit the impeller and at the other side with a shaft opening large enough to accommodate the shaft bearings, coupling and other members carried by the shaft. The shaft opening is normally closed by a stuffing box attached to the casing in such manner that it may be removed inwardly together with the shaft and its associated parts, and withdrawn through the inlet opening of the casing without disturbing the alinement of the pump and its driving element. The one-piece pump casing is so supported on the pump base that it may expand freely from the heat of hot liquid being pumped, but is re-

strained from moving out of alinement with the pump impeller.

The foregoing and other objects of the invention may be achieved by the centrifugal pump unit hereinafter described as exemplifying a practical embodiment of the invention and shown in the accompanying drawing, in which:

Fig. 1 is a view partly in longitudinal section and partly in side elevation of a centrifugal pump and its driving element mounted on a base; and

Fig. 2 is a fragmentary view partly in end elevation and partly in transverse section taken on the plane represented by the line II—II of Fig. 1.

The illustrated pump unit comprises, in general, a base 1 that carries in operative alinement a centrifugal pump 2, a bearing supporting pedestal 3 and a driving element 4 which may be an electric motor, as shown, or any other suitable driving mechanism.

Although the pump 2 may be utilized for pumping liquids of any nature either hot or cold, it is particularly adapted for pumping hot acid liquids. To this end it is provided with a spiral casing 5 of acid resisting metal, preferably chrome steel. As acid liquids have a tendency to attack sharp corners or projections, especially when flowing rapidly past such points, the pump casing 5 is formed in one piece as an integral casting to obviate the necessity of joining separate sections and thus exposing sharp corners to the flowing acid liquid. As shown in Fig. 2, the one-piece spiral casing 5 is provided at its sides with lugs 6 which rest upon pedestals 7 mounted on the base 1, the casing, pedestals and base being secured to each other by cap screws 8.

The one-piece casing 5 is provided at one side with an inlet opening 9 of diameter large enough to admit a pump runner or impeller 10 that is also formed of acid resisting chrome steel. The pump impeller 10 is supported in operating position within the casing 5 and in axial alinement therewith upon the end of a pump shaft 11, which extends through a shaft opening 12 in the side of the casing opposite from the inlet opening 9. For rotatably supporting the pump shaft 11 to turn the impeller 10 in cooperating relation with the casing 5, the shaft is provided with spaced anti-friction bearings 13 and 14 carried in the ends of a bearing housing 15 that encircles the shaft. The bearing housing and bearing are supported in axial alinement with the casing 5 and with the driving element 4 upon the supporting pedestal 3 to which the housing is secured by a bearing cap 16 held by cap screws 17.

The bearing housing 15 is disposed as near as practicable to the pump impeller 10 to rigidly support the impeller, leaving only sufficient room therebetween for a stuffing box 18 which encircles the shaft 11 and is disposed to close the shaft opening 12 in the casing 5. The stuffing box 18 has associated therewith at its inner side a stuffing box bushing 19 which encircles and supports the shaft 11 and that is further provided with an inwardly facing cylindrical bearing surface disposed to engage a wearing ring 20 on the back side of the impeller 10. A similar wearing ring 21 on the front or inlet side of the impeller is engaged by an inwardly facing bearing surface in an inlet bell or nozzle 22 which constitutes a suction cover. The inlet nozzle is secured within the inlet opening 9 of the casing 5 by bolts 23 and is adapted to be connected to inlet piping, usually an elbow section, (not shown) for conducting liquid to the pump.

The driving motor 4 is connected to drive the pump 2 by means of a coupling element 24 on the motor shaft that is adapted to cooperate with a coupling element 25 mounted on the end of the pump shaft 11 and to which it is connected by coupling bolts 26.

In order that the rotating element of the pump may be removed for inspection or repair without disturbing the alinement of the pump casing 5 with the driving motor 4 and the supporting pedestal 2, the shaft opening 12 of the casing is made sufficiently large to accommodate the bearing housing 15 and the coupling element 25. To permit withdrawal of the shaft with its bearing housing and coupling element through the shaft opening 12, the stuffing box 18 and the stuffing box bushing 19 are secured against the inner surface of the casing 5 by bolts 27 in such manner that they may be released, by unscrewing the bolts from the outside of the casing, to permit them to be withdrawn inwardly with the shaft 11 through the inlet opening 9 of the casing.

In dismantling the pump unit of its rotating element, the suction pipe elbow or other suction connection is first disconnected from the inlet nozzle 22, after which the inlet nozzle may be removed from the inlet opening 9 and the impeller 10 unfastened from the shaft 11 by unscrewing an impeller retaining screw 28 which is threaded into the end of the shaft. After the impeller 10 has been unfastened, it is withdrawn from the casing through the inlet opening 9. The shaft 11 is then released for removal by removing the coupling bolts 26 to disconnect the coupling element 25 from the motor 4, withdrawing the cap screws 17 and removing the bearing cap 16 from the bearing housing 15 and then withdrawing the bolts 27 to release the stuffing box 18 from the casing shaft opening 12. The shaft is then lifted slightly to free the bearing housing 15 from the pedestal 3 and the entire shaft assembly, including the stuffing box, bearing housing and coupling element may be withdrawn endwise through the shaft opening 12 and the inlet opening 9 of the casing.

In reassembling the unit, the reverse procedure is followed, in that the shaft and its associated elements are moved endwise through the inlet opening 9 and the shaft opening 12 into operating position. The bearing housing and the stuffing box are then secured to their respective supporting elements and the coupling element 25 joined to the coupling element 24 of the motor. The pump impeller 10 is then inserted through the inlet opening 9 and attached to the end of the

shaft by the screw 28 after which the inlet nozzle 22 is secured in the inlet opening and the inlet piping connected to it.

When the pump is utilized for pumping liquid heated above atmospheric temperature, the solid pump casing 5 expands in proportion to the temperature of the liquid being pumped. To permit the casing 5 to expand freely without disturbing its cooperating relationship with the rotating impeller 10, its supporting lugs 6 and the supporting pedestals 7 are so positioned that the casing is supported upon the pedestals only at points lying in a horizontal plane passing through the aligned axes of the pump casing and the pump impeller. This arrangement of supports permits the pump casing 5 to expand upward and downward from the plane of support without causing vertical movement of the pump casing axis relative to the pump impeller axis. To prevent horizontal movement of the casing axis relative to the impeller axis, the pump is provided with a casing key block 29 disposed to engage the casing beneath the shaft opening 12 in the vertical longitudinal plane of the pump. As shown in Fig. 2 the key block 29 slidably engages the sides of a rectangular seat 30 in the casing 5 and is fitted in a similar aligned rectangular seat 31 in the bearing supporting pedestal 3 in such manner that the casing 5 may move vertically relative to the pedestal 3 but is restrained from horizontal movement relative thereto to prevent horizontal movement of the casing axis relative to the axis of the rotating impeller 10.

The pumping unit herein described is particularly well adapted for pumping hot acid liquids in that it is provided with a one-piece pump casing and a cooperating impeller both formed of acid resisting material, the casing being so mounted that expansion thereof from the heat of the liquid being pumped does not result in misalignment of the cooperating pump parts. The operations of dismantling and reassembling the pump are greatly facilitated by the arrangement of the casing openings in such manner that the parts making up the rotating element of the pump may be withdrawn through the casing without disturbing the operating alinement of the pump and its driving element.

Although a particular pumping unit has been described in detail to fully disclose a working embodiment of the invention, it is to be understood that the structure shown and described herein may be modified without departing from the spirit and scope of the invention as defined in the subjoined claims.

It is claimed and desired to secure by Letters Patent:

1. A centrifugal pump assembly, comprising a base, a bearing pedestal carried by said base, a bearing housing carried by said bearing pedestal, a shaft journaled in said bearing housing, a driving element mounted on said base in axial alinement with said shaft, a coupling joining said driving element to said shaft, a pump impeller carried by said shaft, a one-piece spiral pump casing mounted in axial alinement with said bearing pedestal and said driving element on said base in position to enclose said impeller and having an inlet opening adapted to admit said impeller and an aligned shaft opening adapted to admit said bearing housing and said shaft coupling, and a stuffing box engaging said shaft mounted in said casing in position to close said shaft opening and secured in such manner as to be removable therefrom through said inlet opening.

ing; whereby said stuffing box, together with said shaft, said bearing housing, and said coupling may be withdrawn through said inlet opening without disturbing the relative positions of said casing, said driving element, or said bearing pedestal.

2. A centrifugal pump for pumping hot acid, comprising a base, a bearing pedestal carried by said base, a bearing housing carried by said bearing pedestal, a shaft journaled in said bearing housing, a driving element mounted on said base in axial alinement with said shaft, a coupling disposed to connect said driving element to said shaft, an acid resisting chrome steel pump impeller carried by said shaft, a one-piece acid resisting chrome steel spiral pump casing disposed to enclose and cooperate with said impeller and supported upon said base solely at points lying in a horizontal plane through the axis of said shaft, said casing having an inlet opening adapted to admit said impeller and a shaft opening alined therewith and adapted to admit said bearing housing and said coupling, a stuffing box on said shaft secured within said casing to close said shaft opening and removable through said inlet opening to permit withdrawing said shaft with its bearings and coupling through said opening, and means on said casing slidably engaging said base to prevent movement of the axis of said casing along its plane of support while permitting expansion of said casing under the influence of

the hot acid being pumped to maintain said casing in concentric relation with said impeller.

3. A pumping unit for pumping hot acid comprising a spiral pump casing formed in one piece of acid resisting metal and having opposed inlet and shaft openings, a base disposed to support said casing only at points in a horizontal axial plane thereof, a pump impeller of acid resisting metal disposed within said casing in coaxial cooperating relation therewith and adapted to be withdrawn through said inlet opening, a shaft attached to said impeller for supporting and driving it and extending through said shaft opening, a bearing housing adapted to pass through said shaft opening and said inlet opening carried by said shaft and detachably secured to said base in position to rotatably support said shaft and said impeller in operating relation to said casing, a stuffing box surrounding said shaft in position to close said shaft opening in said casing and adapted to be withdrawn with said shaft through said inlet opening, a driving element mounted on said base, and a coupling disposed to connect said driving element to said shaft and adapted to be withdrawn with said shaft and said bearing housing through said shaft opening and said inlet opening of said casing.

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