March 7, 1939. G. F. HABACH 2,149,435

PUMP IMPELLER AND METHOD OF ASSEMBLING

Filed Sept. 20, 1938

Fig. 1

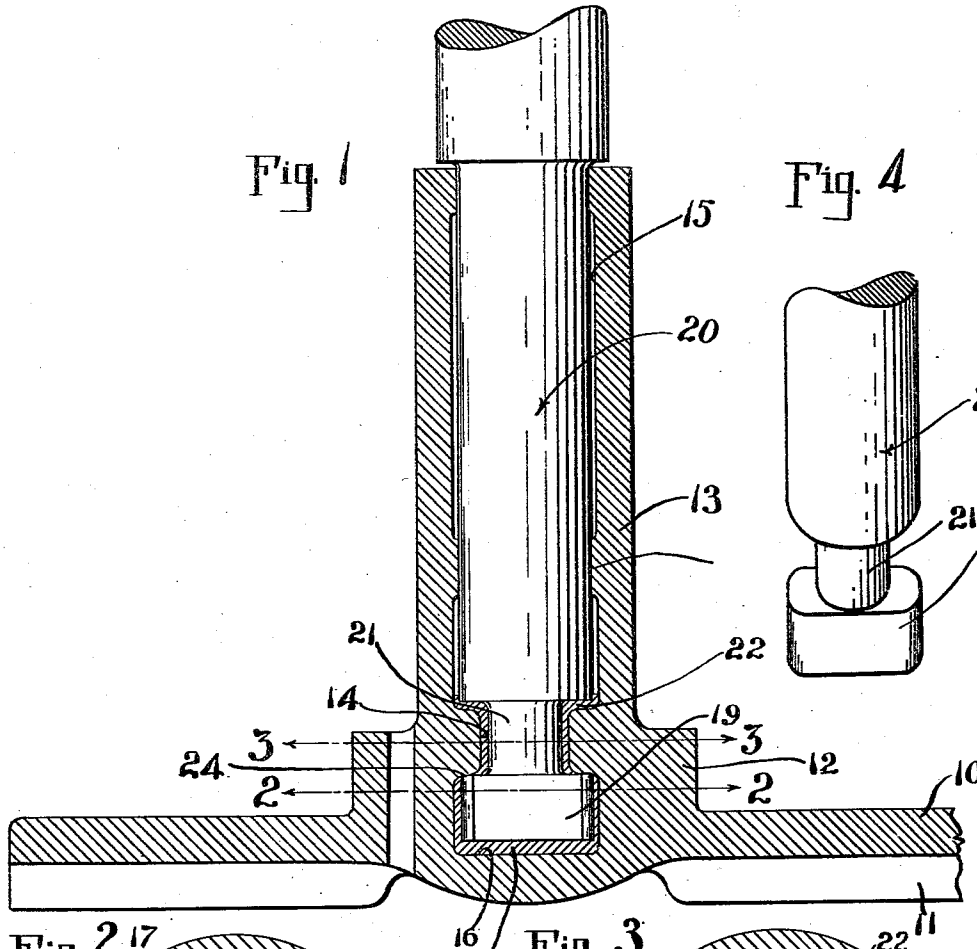


Fig. 4

Fig. 2

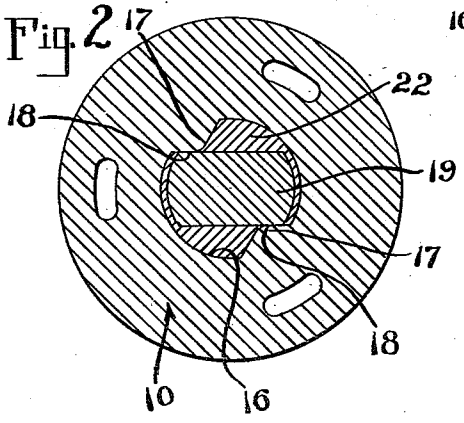
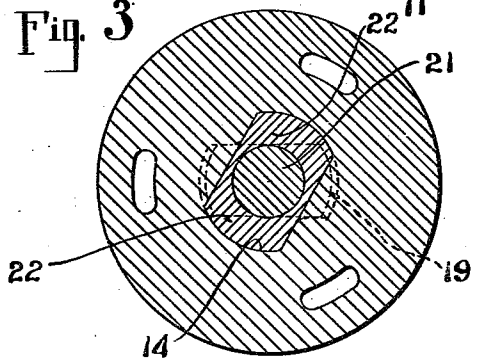


Fig. 3



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Patented Mar. 7, 1939 2,149,435

UNITED STATES PATENT OFFICE

2,149,435

PUMP IMPELLER AND METHOD OF ASSEMBLING

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Application September 20, 1938, Serial No. 230,772

3 Claims. (Cl. 287—53)

This invention relates to centrifugal pump, and more particularly to impellers therefor and a method of mounting such impellers on their driving shafts.

In pumps employed in handling various types of acids in the chemical and allied industries, corrosive and/or abrasive conditions necessitate the use of a high silicon iron or other hard, non-machinable alloy or ceramic material in the pump construction, and liquid-tight connection between the high silicon iron impeller and its steel driving shaft to prevent the acid pumped from contacting the shaft.

Various methods have been employed for connecting the impeller and shaft, such as casting a high silicon iron impeller on the shaft, as disclosed in Patent Number 2,095,055, which method, while satisfactory in the main, has certain disadvantages. One such disadvantage is fatigue failure of the impeller sleeve due to difficulty of expansion and contraction under temperature changes accentuated by the flexibility of the steel shaft, which results in cracking of the sleeve, especially when the pump is handling liquids at high temperatures.

The present invention provides a novel structure of pump impeller assembly wherein the high silicon iron impeller is rigidly and securely attached to the steel shaft in such manner as to permit replacement of the impeller when it becomes worn, without requiring an entirely new shaft and impeller assembly. The present structure also effectively prevents the liquid being pumped from contacting the steel shaft and provides a rigid, solid connection between the impeller and shaft.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawing, showing a pump impeller and method of assembly embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawing:

Figure 1 is a longitudinal section through the improved impeller assembly.

Figure 2 is a cross-section through the impeller assembly taken on the line 2—2 of Figure 1.

Figure 3 is a cross-section taken on the line 3—3 of Figure 1.

Figure 4 is an isometric view of the shaft.

Referring more particularly to the drawing, the impeller proper comprises the disk 10 having the pumping blades 11 formed thereon, the hub 12, and a sleeve 13 which is formed integrally with the hub 12 and projects axially therefrom. The sleeve 13 is made longer than the pump casing (not shown) so that the end of the sleeve will project out of the casing to prevent the liquid being pumped from entering the sleeve.

The impeller hub 12 is provided with a bore 14 which is smaller in diameter than the bore 15 of the sleeve 13. The bore 14 opens into the bore 15 of the sleeve 13, and into a recess 16 formed in the hub. The recess 16 has its circular contour interrupted by two abutment forming projections 17 formed in the hub 12. The abutment forming projections 17 form abutments or contact surfaces 18 against which the opposite sides, at opposite ends, of the head 19 which is formed on the shaft 20 engage when the shaft is properly inserted in the hub 12 and sleeve 13. The head 19 is substantially rectangular in shape except that its ends are rounded to conform to the curvature of the inner wall of the recess 16. The width of the head 19 is equal to the width of the elongated bore 14 formed in the hub so that in assembling the shaft and impeller the head 19 will pass through the elongated bore 14 in the hub and thus into the recess 16, after which the shaft is rotated to bring the sides of the head 19 at opposite ends thereof into engagement with the abutment surfaces 18, to provide a firm solid metal to metal contact between the head 19 on the shaft and the impeller abutment surfaces 17. The abutment surfaces 17 are positioned so that the metal contact between the head 19 on the shaft and the impeller is in the direction of rotation of the shaft and impeller, whereby transmission of the driving torque is provided in the direction of pumping rotation of the impeller.

The elongated opening 14 in the hub 12 has the same contour as the recess 16, as illustrated by Figures 2 and 3, except that it is displaced angularly by a suitable amount so that when the shaft 20 is inserted in the impeller bore and rotated by a corresponding amount the head 19 moves under the projecting shoulders 24 formed by the elongated opening 14 and locks the impeller against axial movement. Thus any axial thrust due to the operation of the pump is transmitted directly by metal to metal contact from the impeller to the shaft. Thus none of the operating forces are transmitted through the cement or bonding agent.

The shaft 20 is cemented in the impeller by the filling of the spaces around the head 19 in

the recess 16 and around the neck 21 of the shaft which serves to connect the head 19 to the main body of the shaft 20. Such cement is shown at 22. By particular reference to Figures 1 and 3 of the drawing, it will be noted that the diameter of the neck 21 is less than the width of the elongated opening 14 in the hub 12, and also that the head 19 is smaller than the recess 16, so as to provide ample space for receiving a sufficient quantity of cement to thoroughly and securely connect the shaft 20 and impeller 10 in a rigid structure practically the equivalent of a unitary structure.

The cement employed may be any suitable type of cement or lead alloy to provide a sufficient and secure bond between the shaft 20 and impeller 10. If an alloy is used, a suitable amount of the alloy can be placed in the recess 16 and the impeller heated until the alloy is molten. The shaft can then be inserted and turned as described above. On cooling the alloy will solidify and firmly bond the impeller to the shaft.

In assembly, a sufficient quantity of this cement or bonding agent, in liquid form, is poured into the recess 16, after which the shaft is inserted into the sleeve 13, with the head 19 extending into the recess 16. This forces the cement upwardly, filling all of the spaces about the head 19 and neck 21. The cement or bonding agent is then allowed to harden, after which the impeller is ready for service.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a pump structure, an impeller, a shaft therefor, a coupling head on said shaft, said impeller provided with a recess receiving said coupling head, said recess shaped to provide abutment surfaces and shoulders for engagement with the head to prevent withdrawal of the head from the recess after the shaft has been turned a partial turn subsequent to the insertion of said coupling head in said recess, and a bonding agent in said recess about said head for securely connecting said shaft and impeller.

2. In a pump structure, an impeller, a shaft therefor, a coupling head on said shaft, said impeller provided with a recess receiving said coupling head, a bonding agent in said recess about said head for securely connecting said shaft and impeller, driving surfaces on said head, abutments formed in said recess for engagement with said driving surfaces to provide metal to metal contact between the shaft and impeller for transmission of driving torque in the direction of pumping rotation of the impeller.

3. In a pump structure, a pump impeller, a shaft therefor, a sleeve on the impeller for receiving the shaft, a section of the shaft near its impeller engaging end having a reduced diameter, a coupling head formed on the end of the reduced portion of the shaft, said sleeve having an interior diameter greater than the diameter of the shaft, and a reduced section corresponding to the reduced section of the shaft shaped to allow passage of the coupling head therethrough, said impeller having an enlarged recess opening into said reduced section to receive said coupling head and allow the shaft to be turned therein to a locked position, and a bonding agent about the coupling head and filling the space surrounding said coupling head for holding the shaft and impeller rigidly connected.

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