June 9, 1964 C. F. FUNK ET AL 3,136,044

METHOD FOR REPAIR OF DEFECTIVE PUMP CASINGS

Filed March 7, 1961

Fig. 1.

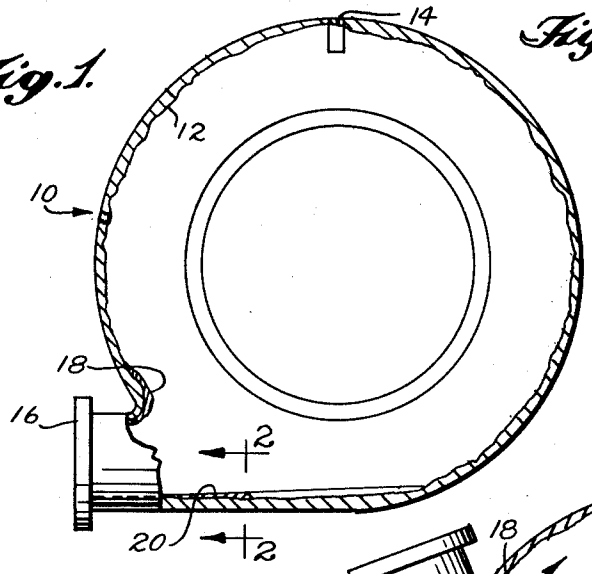


Fig. 6.

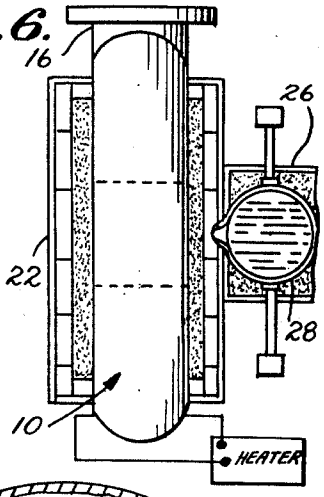


Fig. 5.

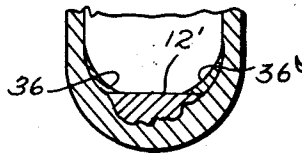


Fig. 3.

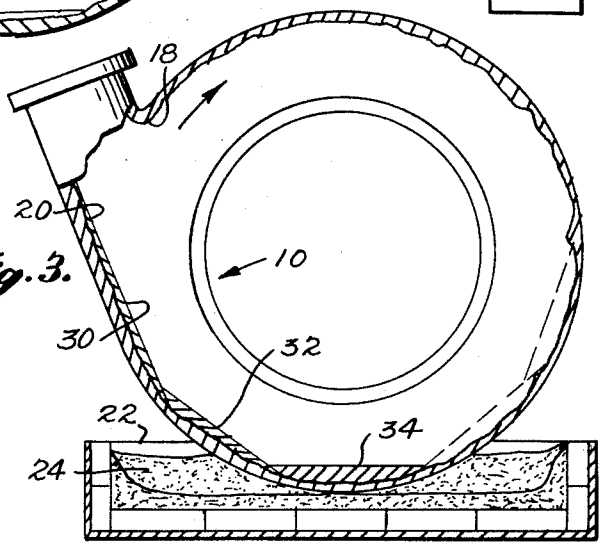


Fig. 4.

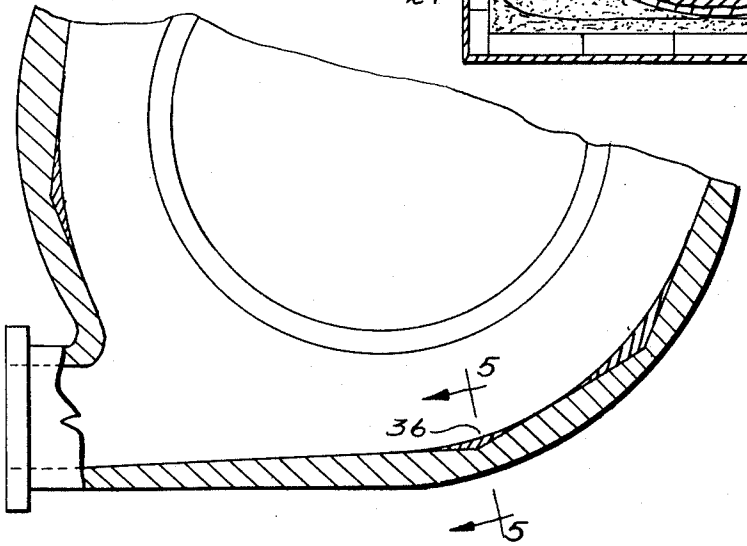
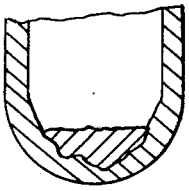


Fig. 2.



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METHOD FOR REPAIR OF DEFECTIVE PUMP CASINGS

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6 Claims. (Cl. 29—401)

This invention relates to a new and improved method of repairing the worn interior shroud portions of centrifugal pumps and the like, and has particular reference to a method for fusing Thermit metal thereto in a sequential series of pouring steps.

Due to the adverse conditions imposed on centrifugal pumps, such as by foreign matter in the fluid and cavitation, the interior peripheral casing walls in the area surrounding the impeller are subjected to continual abuse, and this shroud portion of a centrifugal pump casing accordingly is subjected to relatively rapid wear while the remainer of the pump casing remains in generally good condition. The life of a centrifugal pump casing is thereby determined, to a great extent, by the condition of the shroud portion of the casing adjacent the tips of the pump impeller blades.

In applicants' co-pending application Serial No. 87,872, filed February 8, 1961, there is disclosed a method of repairing the defective shroud portions of the centrifugal pumps and the like wherein a consumable liner is mounted on the interior peripheral pump casing surface and the Thermit metal is introduced into the area of the consumable liner to provide a repaired surface of Thermit metal which is fused with the consumable liner and the defective shroud.

In accordance with this invention, a centrifugal pump casing having a defective shroud portion is mounted vertically, reacted Thermit metal is poured into the interior thereof, and the casing is then axially rotated through a sequence of positions in a vertical plane and Thermit metal is again introduced therein the Thermit metal providing a built up interior shroud surface, by virtue of this series of pouring steps. The built up surface is then finished as by welding, to provide a smoothly finished interior shroud of proper dimensions.

It is accordingly, an object of this invention to provide a new and improved method of repairing the defective shroud portion of a centrifugal pump casing wherein the Thermit metal is sequentially poured into the interior of the casing, as the casing is rotated through a vertical plane such that a built-up shroud surface is provided.

Another object of this invention is to provide a method of repairing the defective shroud portion of centrifugal pump casings and the like which obviates the requirement for extensive preparation such as sand packing and the like prior to the actual molding operation. Accordingly, the pump casing may be repaired in a considerably shortened period of time due to the simple and reliable techniques provided.

Still further objects and advantages of this invention will become apparent in the specification, claims and accompanying drawings wherein;

FIGURE 1 is an elevation section view of a defective pump casing which has been partially repaired according to this invention;

FIGURE 2 is a view taken along line 2—2 of FIGURE 1;

FIGURE 3 is a view similar to FIGURE 1 showing the pump casing during a subsequent position of repair;

FIGURE 4 is a view of the pump casing showing a subsequent operation to the pump casing in the final stages of repair;

FIGURE 5 is a view taken substantially along line 5—5 of FIGURE 4; and

FIGURE 6 is a diagrammatic plan view showing the arrangement of the casing during a stage of repair.

Referring now to the drawings wherein like numerals refer to similar elements, there is shown in FIGURE 1 a centrifugal pump casing **10** having a defective interior shroud portion **12** which is to be repaired in accordance with the teachings of this invention.

Prior to the repair of the pump casing **10**, the shroud portion **12** is cleaned to remove dirt, rust, grease and other foreign matter. In this regard, carbon tetrachloride, air pressure, and other well known expedients may be used to clean the pump casing and otherwise prepare it for repair.

Any holes in the pump casing are closed as by welding. Additionally, a primer hole plug is mounted in the primer hole **14** which extends radially through the shroud portion of the pump casing **10** to close off the hole.

The pump casing **10** is then vertically mounted by any suitable means (not shown) such that the pump casing may be rotated through a vertical plane during the sequence of repair steps as will become apparent.

The region of the pump casing **10** in the area of the discharge port **16** is manually built up as designated at **18** and **20**. In this regard, the areas **18** and **20** in the region of the discharge port **16** are preferably built up in the order of one foot in length from the port **16** within about 1/16 of the designated thickness with a filler metal containing 12 to 14% manganese, depending of course, on the size of the casing **10**.

The areas **18** and **20** are then surfaced with a filler metal to the proper shroud size, the metal preferably having a hardness of 40 to 60 Rockwell C. The casing **10** is then preheated preferably at least to 300° F. by suitable means such as an induction coil heater diagrammatically shown in FIGURE 6.

Referring to FIGURE 3, a box **22** filled with molders sand is placed on a hydraulic lift or the like (not shown) under the casing **10** and raised until there is the full load of sand backing up the area to be welded. The sand **24** is firmly tamped around the outside of the pump casing **10** to prevent burn throughs, as is apparent. A sand catch basin **26** is placed in front of the casing **10** (FIGURE 6) and heated to approximately 200° F. as by an induction heater, also shown in FIGURE 6.

As is shown in the art, the properties of Thermit metal particularly lend themselves to the repair of metal structures. The metal fuses to the surface of the wall of the defective structure and thereby provides a notably satisfactory fusion therebetween.

The crucible **28** is charged with a predetermined amount of Thermit metal and the crucible **28** is moved over the area to be poured by suitable means (not shown). A magnesium starter is then added to the Thermit metal within the crucible to initiate the exothermic reaction of the metallic oxide and aluminum, as will be understood. After the temperature of the metal within the crucible **28** has been elevated by the chemical reaction therein, the crucible **28** is moved into a position for pouring into the bottom portion of the structure **12** and tapped. When the predetermined amount of the metal has run from the crusible to the bottom interior of the casing **10**, the boom is moved away, placing the crucible **28** over the sand catch basin **26**. After the slag has emptied from the crucible into the basin **26** the boom is lifted into an open area, the crucible **28** is removed and prepared for another charge.

As shown in FIGURE 3, the pump casing **10** has been

rotated through three positions, the Thermit metal having been fused to the casing 10 by three sequential pouring steps, providing portions 30, 32 and 34. In this regard, the pump casing 10 is shown in FIGURE 3 just after completion of pouring the charge 34 in the casing. The view in FIGURE 2 would generally show the configuration of the shroud in any representative view taken therethrough at this stage of repair.

This sequence of steps is continued until charges of Thermit metal have been fused to substantially the entire shroud portion 12 of the casing 10. Thus, when this sequence of pouring operations has been completed, the interior surface of the shroud portion 12 comprises a series of intersecting planar surfaces and thereby must be subsequently modified to provide a smooth shroud portion which is dimensionally accurate. To this end, after the planar surfaces have been formed, and the pump shell has cooled to approximately 200° F. the regions 36 of the casing 10 adjacent the planar surface are arc welded to complete the properly designed curvature of the prepared shroud portion 12'. This step may be done by automatic, semiautomatic, or manual arc welding processes, preferably with a filler metal with 12–14% manganese and a lower percentage of nickel. Thus, the configuration of the repaired shroud portion 12' is provided, and the life of the pump casing 10 has been extended by the repair. The primer plug 14 is then removed and the casing 10 is cleaned again. The interior sides of the casing 10 are laced preferably a half inch away from the top to the bottom radius by welding, this operation being provided for both sides.

The correctness of the configuration of the shroud portion 12' can be suitably checked by templates and the like and any excessive metal may be ground out as necessary to provide the necessary dimensional accuracy.

It will thus be seen that there has been provided by this invention a method of repairing defective pump casings in which the objects of this invention, together with many practical advantages, are successfully achieved.

As various possible embodiments may be made of the mechanical features of this invention, all without departing from the scope thereof, it is to be understood that all matters herein set forth or shown in the accompanying drawings is to be interpreted in an illustrative and not a limiting sense.

What is claimed is:

1. Method of repairing the defective interior shroud surface of a pump casing comprising the steps of: mounting the pump casing for rotation in a substantially vertical plane; placing the bottom of the casing in a sand base to prevent burn throughs and preheating the casing; introducing a predetermined charge of reacted Thermit metal into the bottom interior portion of the casing; rotating the pump casing while in said base to consecutive angularly displaced positions in the vertical plane and introducing additional charges of Thermit metal into the bottom of the casing at each of the angularly displaced positions whereby the circumferential interior of the casing is fused with the Thermit metal to provide a built-up casing shroud.

2. Method according to claim 1 including the step of depositing weld metal to the shroud region of the casing adjacent the discharge port thereof prior to introducing Thermit metal.

3. Method of repairing the defective interior shroud surface of a pump casing comprising the steps of: depositing weld metal to the shroud portion of the casing adjacent the discharge port thereof to build up the same; mounting the casing for rotation in a substantially vertical plane and placing the bottom of the casing in a sand base; preheating the casing; introducing a predetermined charge of reacted Thermit metal into the bottom interior portion of the casing; rotating the pump casing in said base to consecutive angularly displaced positions in the vertical plane and introducing additional charges of Thermit metal into the bottom of the casing at each of the angularly displaced positions so that the circumferential surface of the casing between said built up portions is provided with a plurality of intersecting generally planar surfaces of fused Thermit metal; and depositing weld metal to the regions of said surfaces to provide a smoothly curved circumferential built-up surface throughout the interior shroud portion of the casing.

4. Method of repairing the defective interior shroud surface of a pump casing comprising the steps of mounting the pump casing for rotation in a substantially vertical plane, placing the bottom of the casing in a sand base; introducing a predetermined charge of weld metal into the bottom interior portion of the casing; rotating the pump casing to consecutive angularly displaced positions in the substantially vertical plane and in contact with said base, and introducing additional charges of weld metal into the bottom of the casing at each of the angularly displaced positions whereby the circumferential interior of the casing is built-up.

5. Method of repairing the defective interior shroud surface of a pump casing comprising the steps of: mounting the pump casing for rotation in a substantially vertical plane; placing the bottom of the casing in a sand base and preheating the casing; introducing a predetermined charge of reacted Thermit metal into the bottom interior portion of the casing; rotating the pump casing while in said base to consecutive angularly displaced positions in the vertical plane, introducing additional charges of Thermit metal into the bottom of the casing at each of the angularly displaced positions whereby the circumferential interior of the casing is fused with the Thermit metal to provide a built-up casing shroud and subsequently forming the shroud portion by depositing weld metal to the regions of the poured metal adjacent the casing to provide the desired built-up curvature of the repaired shroud portion.

6. Method of repairing the defective interior shroud surface of a pump casing comprising the steps of: mounting the pump casing for rotation in a substantially vertical plane; placing the bottom of the casing in a sand base and preheating the casing; introducing a predetermined charge of reacted Thermit metal into the bottom interior portion of the casing; rotating the pump casing while in said base to consecutive angularly displaced positions in the vertical plane, introducing additional charges of Thermit metal into the bottom of the casing at each of the angularly displaced positions whereby the circumferential interior of the casing is fused with the Thermit metal to provide a built-up casing shroud, the consecutive poured charges of metal provide generally planar intersecting surfaces and the regions adjacent the intersecting surfaces being subsequently built up by depositing weld metal to provide smoothly curved circumferential surface.

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