Sept. 22, 1964 V. J. MILL 3,149,574

CERAMIC LINED PUMP

Filed Sept. 28, 1961 2 Sheets-Sheet 1

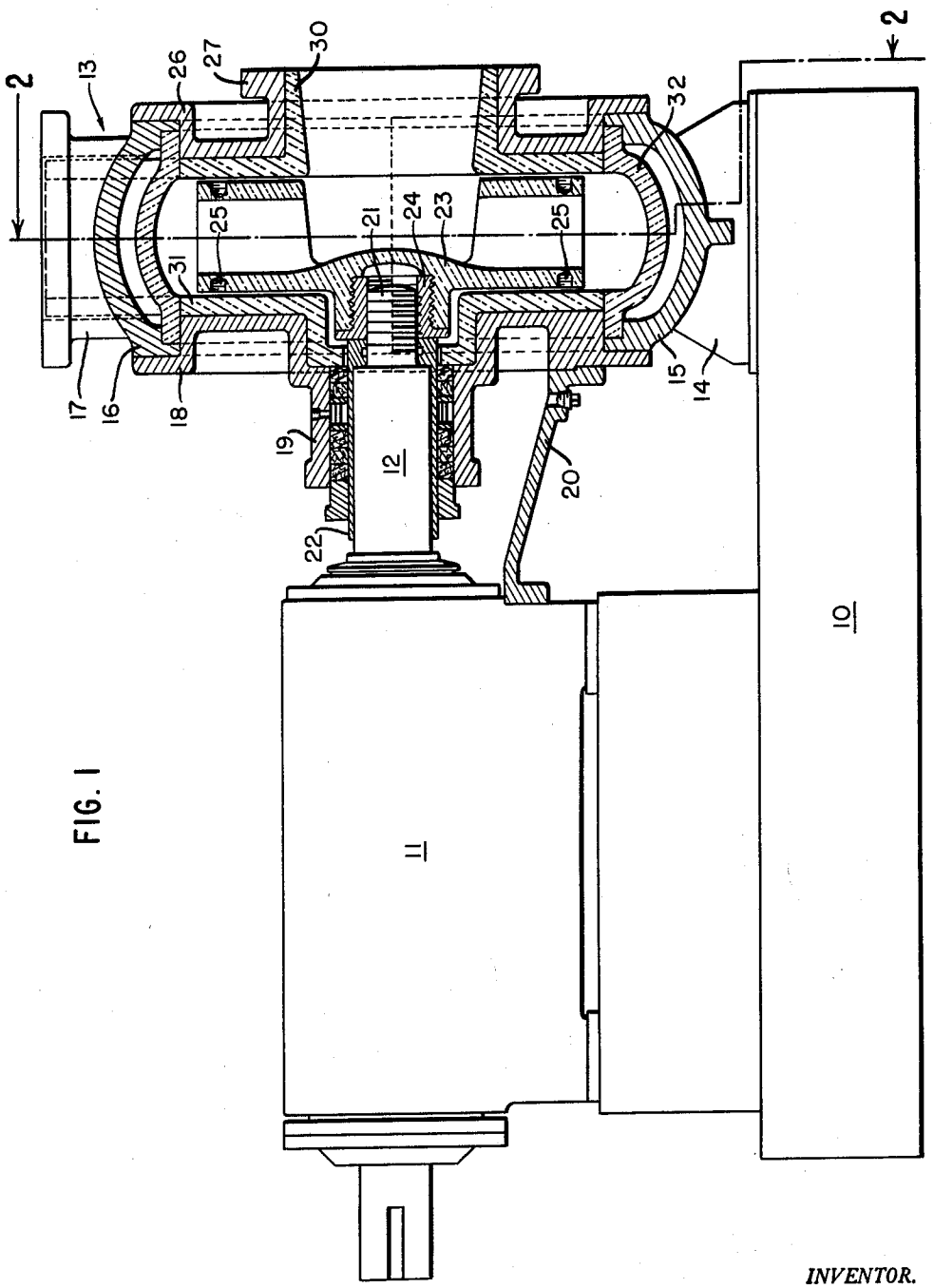


FIG. 1

INVENTOR.
VICTOR J. MILL

BY Kenway Jenney & Hildreth

ATTORNEYS

Sept. 22, 1964 V. J. MILL 3,149,574

CERAMIC LINED PUMP

Filed Sept. 28, 1961 2 Sheets-Sheet 2

FIG. 4

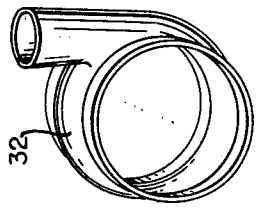


FIG. 2

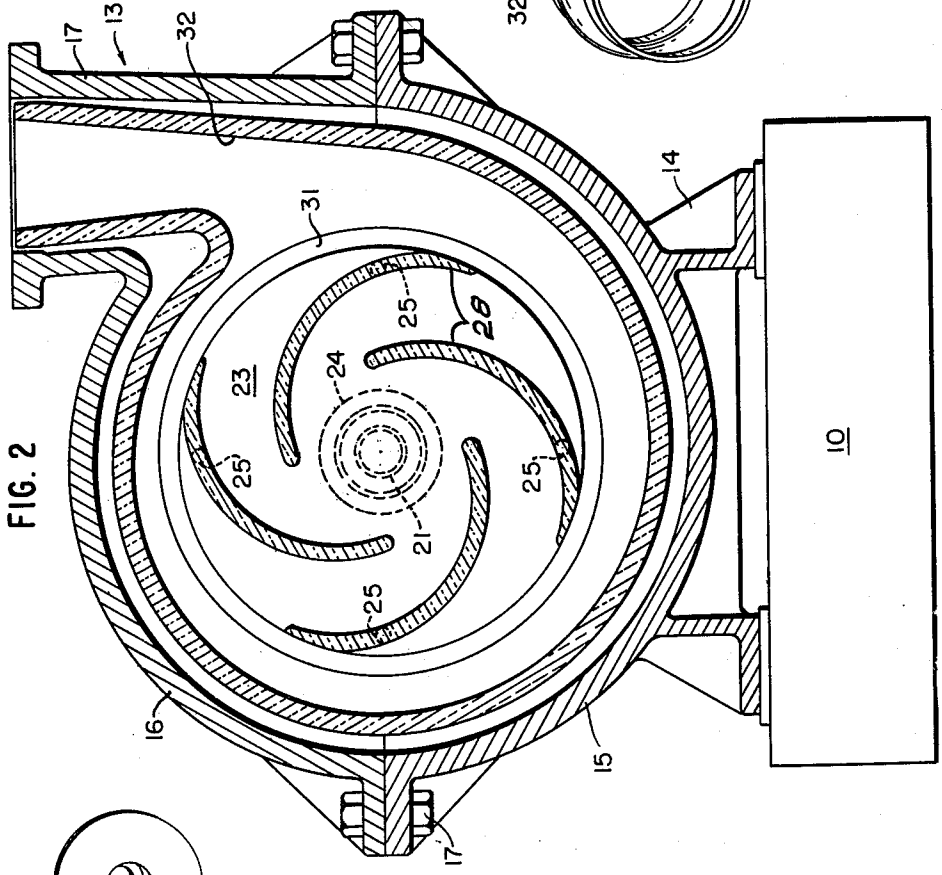
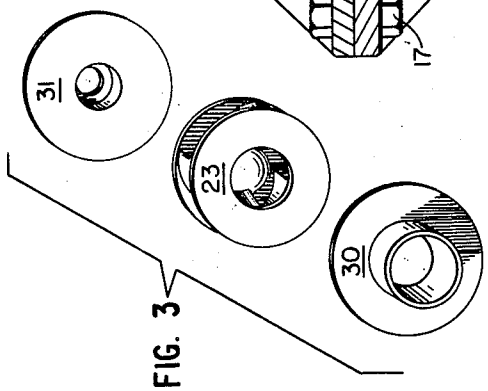


FIG. 3



INVENTOR.
VICTOR J. MILL

BY Kenway, Jenney & Hildreth

ATTORNEYS

United States Patent Office 3,149,574 Patented Sept. 22, 1964

3,149,574

CERAMIC LINED PUMP

Victor J. Mill, Andover, Mass., assignor to Lawrence Pump's Inc., Lawrence, Mass., a corporation of Massachusetts

Filed Sept. 28, 1961, Ser. No. 141,429
2 Claims. (Cl. 103—114)

This invention relates to centrifugal pumps and comprises a new and improved pump of that type adapted by the provision of a ceramic lining and impeller for pumping fluid mixtures containing abrasive solids in suspension, such as cement slurry, tailings in ore reduction plants, grinding and cutting sand in quarries, acid slurries, soda ash and the like. While centrifugal pumps have heretofore been provided with linings and impellers of hard metal and rubber, the results have not been entirely satisfactory from the standpoint of expense of manufacture and wear in use. The present invention eliminates these difficulties and presents additional advantages.

Going more into detail the pump of my invention comprises all or several of the following elements, viz. an outer metal casing or shell lined on the inside with a ceramic liner, a metal suction disk lined on the inside with a ceramic liner, a metal hub disk lined on the inside with a ceramic liner, a ceramic impeller fitted with a metal bushing in the hub for securing it on the shaft and conventional shaft, bearings and base.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawings, in which:

FIG. 1 is a view of the pump unit, the bearing frame being shown in elevation and the pump in longitudinal section,

FIG. 2 is a view of the pump in cross section,

FIG. 3 is a diagrammatic view of the ceramic impeller and adjacent ceramic disk liners, and

FIG. 4 is a view in perspective of the ceramic shell liner.

As shown in FIG. 1, the bearing frame **11** and pump **13** are mounted on a common base **10**, the shaft **12** carrying a ceramic impeller **23**. The outer casing of the pump is supported from the base **10** by legs or brackets **14** and comprises a fixed bottom section **15** and a detachable upper section **16**. These members form a substantially volute metal casing having a tangential outlet **17**. The removable section **16** is secured to the fixed section **15** by bolts **17'** as shown in FIG. 2.

The metal casing also includes an inner or hub disk **18** having a tubular hub **19** containing a stuffing box and gland for the shaft **12** and a peripheral flange, also an outer or suction disk **26** having a flanged inlet passage **27** and an outwardly directed peripheral flange. The metal casing also includes a bracket **20** connecting the bearing frame **11** to the casing of the pump.

The inboard end **21** of the shaft **12** is shouldered, reduced in diameter and threaded. A flanged sleeve **22** surrounds the shaft and engages its shoulder.

The outboard end of the shaft may be fitted either with flexible coupling for direct connection to motor or engine or with pulley for belt drive.

The impeller **23** is formed as a single ceramic unit having a tubular hub formed with an internal thread and in this is fitted a metal bushing **24** externally threaded for connection with the hub of the impeller and having a flange for engaging the end of its hub. In addition to the threaded connection between the bushing and the hub of the impeller, epoxy cement is applied to the contacting surfaces for the purpose of making a permanent union between the bushing and the impeller. Epoxy

cement has been found particularly effective in maintaining a permanent bond at this point. The bushing **24** is also internally threaded to take the thread of the reduced end **21** of the driving shaft. The impeller is also formed with several threaded recesses for the reception of metal plugs **25**. These may be inserted or removed or varied in weight in order to secure a static and dynamic balance of the impeller.

The impeller **23** may be of conventional design including circular side walls and a series of interposed vanes **28** symmetrically located to produce a balanced rotating unit. The vanes form peripheral outlets for fluid entering by the inlet opening opposite the center of the rotating impeller.

The ceramic shell liner **32** which is in one piece is held in place within the outer metal casing **15** and **16** by projecting circumferential flanges as shown in FIG. 1.

The space between shell liner **32** and outer shell **15** and **16** is allowed to fill with the liquid being pumped through vairous clearances so that the internal and external pressure on the shell liner is equalized and it is not subjected to any bursting pressure.

It will be apparent that in assembling the pump the lower half of the outer casing **15** will first be put in place then the shell liner **32** will be inserted inside and then the upper half **16** inserted over the liner. The two halves will then be bolted together with bolts **17'**.

The ceramic disk liner **30** has a tubular outlet which lines the inlet passage of the pump and it is cemented to disk **26** with epoxy cement with its circumferential edge in flush relation with the peripheral flange of the metal hub disk.

The ceramic hub disk liner **31** has a tubular hub which encloses the hub on the impeller **23** and it is cemened to the metal disk **18** with epoxy cement with its circumferential edge in flush relation to the peripheral flange of the hub disk.

The cementing of liners to disks with epoxy cement reinforces the liners and has been found particularly effective in maintaining a bond between the disks and the liners. It also permits of renewing the liners readily by application of heat which releases the bond.

Shaft **12** is supported by ball or roller bearings within the bearing frame **11**, the bearings being lubricated either with grease or oil.

The pump **13** and bearing frame **11** are mounted on suitable base **10** for maintaining alignment.

In assembling the pump, the outer casing with liner is first assembled and secured in place as described above.

After that, hub disk **18** with liner **31** is secured to the outer casing with suitable studs. Then the impeller **23** is mounted on the threaded end of the shaft. Then the suction disk **26** with liner **30** of the inlet opening is secured to the outer casing with suitable studs.

In disassembling, a reversed process will be followed.

The ceramic impeller and the parts of the ceramic lining may be formed of porcelain or other abrasion resistant ceramics such as "Refrax" which is a dense bonded silicon carbide especially hard, practically impervious to oxidation or other chemical attack.

The four ceramic members **23**, **30**, **31** and **32** as shown in FIGS. 3 and 4 may be formed or cast as separate integral units capable of manufacture at moderate cost and inherently rugged in their construction.

No bolts or studs are used for holding the ceramic lining in place which is particularly advantageous because of the fragile character of ceramic materials.

It is also contemplated as part of this invention to utilize these features in different combinations with metal parts such as metal impeller with ceramic lined casing and disks, metal impeller and metal outer casing with ceramic lined disks, etc.

Having thus disclosed my invention and described in

detail an illustrative embodiment thereof, what I claim as new and desire to secure by Letters Patent is:

1. In a ceramic lined pump for handling abrasive mixtures, a ceramic impeller having circular side disks and curved intermediate vanes forming peripheral discharge openings in the impeller, the said side disks having smooth inner faces and recesses in their outer faces containing balancing plugs.

2. A ceramic lined pump for handling abrasive mixtures, comprising an outer end disk of metal having an outwardly directed flanged inlet opening and an inwardly directed peripheral shoulder, a corresponding hub disk of metal having a flanged opening for a driving shaft and a peripheral shoulder, flanged ceramic liners for said metal outer end disk and hub disk coinciding in diameter with the peripheral shoulder of its adjacent disk and adhesively secured by cement to the disk with its circumferential edge in flush relation therewith, the flanges on said liners fitting within said openings, an integral ceramic liner of volute shape having flanges that rest directly upon the peripheral shoulders of the end disks and upon

the flush circumferential edge of the ceramic liners of the end disks, thus supporting the ceramic volute liner as a unit, and a sectional metal casing of volute form having flanges fitting upon the flanges of the ceramic volute liner, and engaging the peripheral shoulders of said end disc.

References Cited in the file of this patent

UNITED STATES PATENTS

304,809	Esplin	Sept. 19, 1884
914,283	Jackson	Mar. 2, 1909
1,172,947	Coppage	Feb. 22, 1916
1,897,947	Howell	Feb. 14, 1933
1,952,488	Blunt	Mar. 27, 1934
1,958,108	Milkowski	May 8, 1934
1,970,435	Sharp	Aug. 14, 1934
2,029,333	Miller	Feb. 14, 1936
2,107,260	Ihara	Feb. 1, 1938
2,433,589	Adams	Dec. 30, 1947
2,658,454	Greene	Nov. 10, 1953
2,868,441	Reutt	Jan. 13, 1959