

Sept. 22, 1959

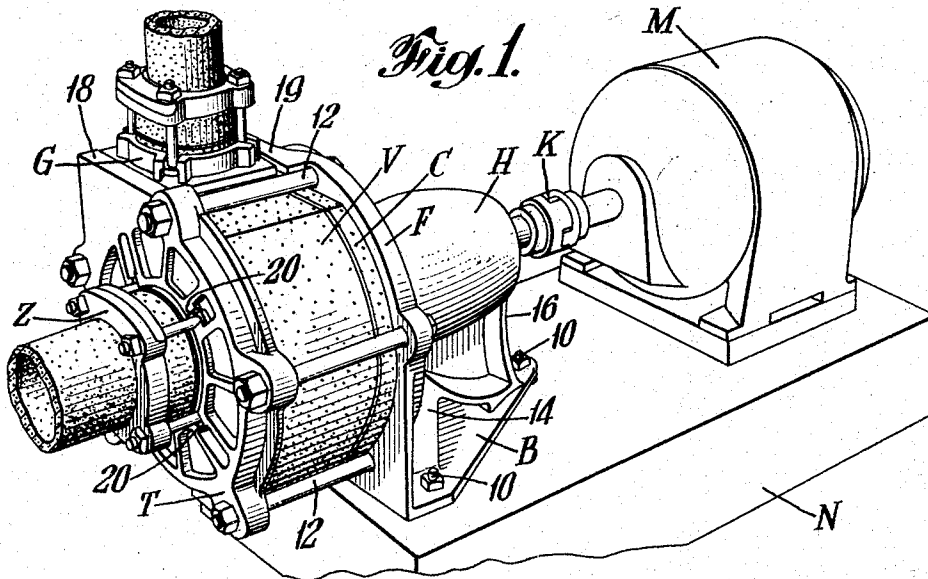
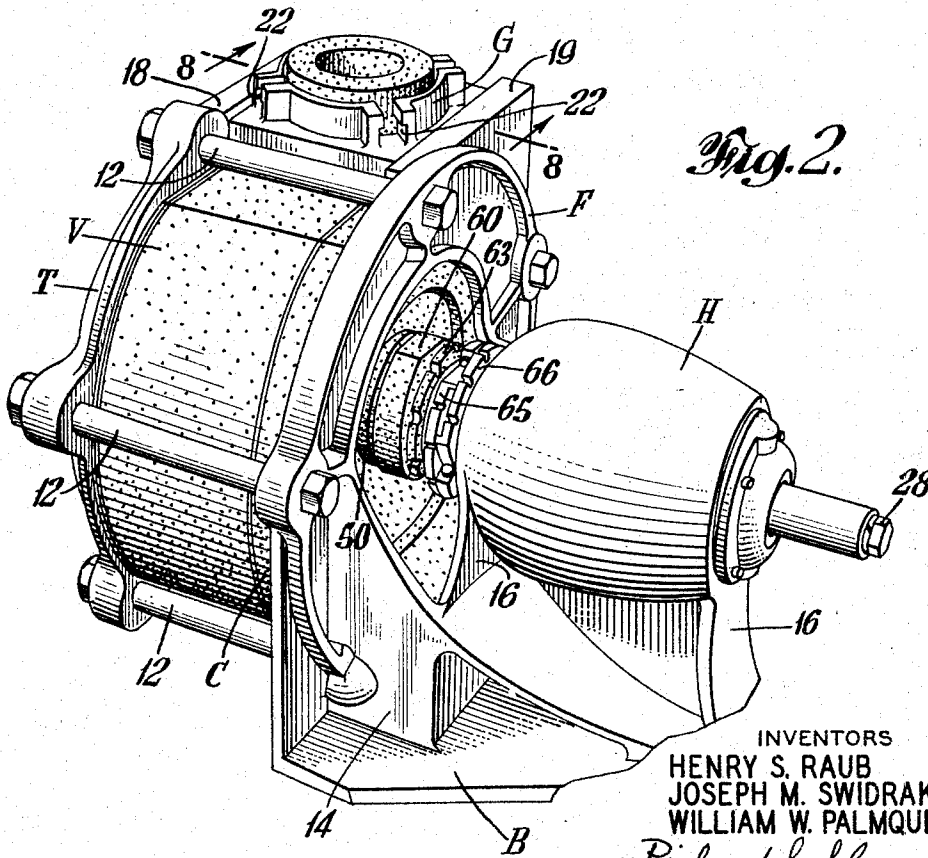
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2,905,093

CORROSION RESISTANT PUMP

Filed Aug. 12, 1954

3 Sheets-Sheet 1



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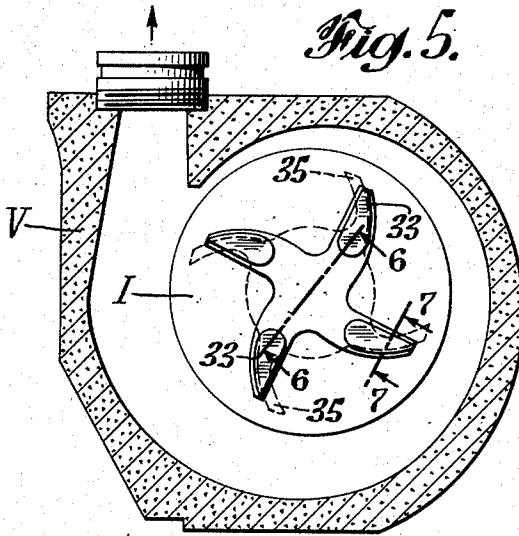
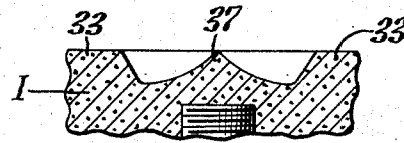
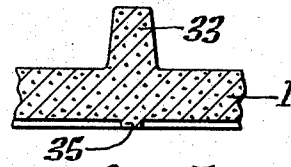
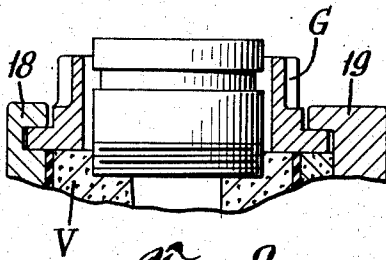
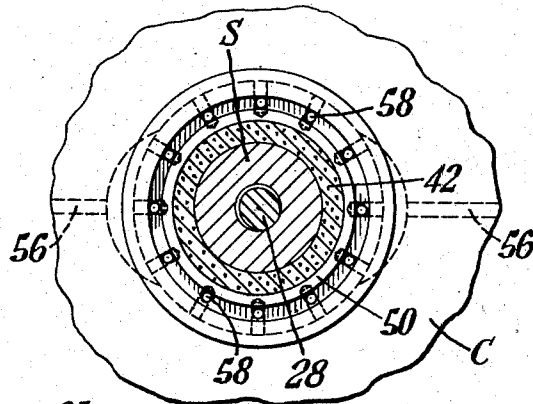
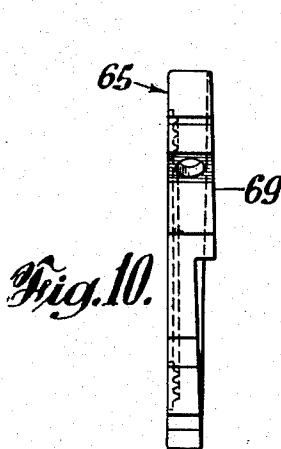
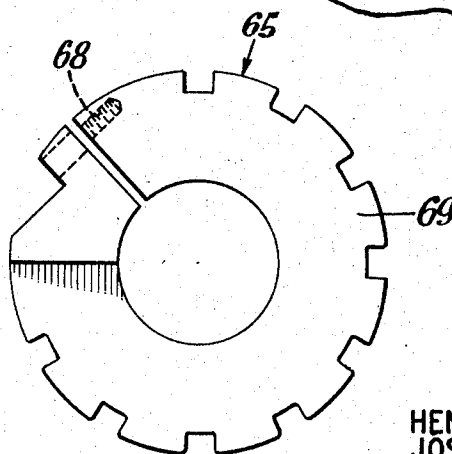
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2,905,093

CORROSION RESISTANT PUMP

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Application August 12, 1954, Serial No. 449,390

10 Claims. (Cl. 103—114)

This invention relates to impervious graphite and/or carbon centrifugal pumps for corrosion resistant purposes, and has for its main object to simplify and improve the construction and operation of pumps of this character.

The wet end parts are rugged sections of impervious graphite mounted in an integral cast iron bearing housing and volute case support frame. This housing and the suction cover casting enclose the impervious graphite sections, providing protection against mechanical damage. Bolt slots for the armored section are cast in. The impeller and impeller shaft assembly can be removed without disturbing the main pump shaft, the ball bearings or the pump alignment. The rotary seal coolant which must be supplied from an external source, is handled within closed passages. All major pump parts, except the volute case, suction cover flange and impeller assembly, are interchangeable for several different sizes. All connections to graphite stress the graphite only in compression. The pump shaft exposed to possible corrosive spray in rotary seal area is stainless steel. This shaft is unmarked by set screws or like devices. Seal pressure is closely adjustable by mating spiral cam faced split rings, and the rotary seal gasket comprises two conical faced Teflon rings. The position of the impeller with respect to the case and cover is held within narrow limits by means of close manufacturing tolerances.

According to the present invention, the corrosion resistant pump comprises a metal casting including a pedestal bearing housing and a volute support flange integral therewith, the bearing housing having a bore aligned with an aperture in said volute support flange, an impervious graphite casing and cover therefor, and a metal cover flange casting, said volute casing and cover being bolted between said casting flanges. Preferably a base is cast integral with said pedestal bearing housing and said volute support flange, with brackets connecting said housing and flange with said base. A metal discharge flange is preferably held between said bolted flanges, and a suction nozzle is clamped to said metal cover flange casting. A drive shaft is journaled in said bearing housing, a corrosion resistant impeller shaft is sleeved onto said drive shaft, and an impervious graphite impeller is secured to said impeller shaft and rotatable in said volute casing. Preferably an impervious carbon sleeve is mounted on said impeller shaft and has a threaded end of larger diameter threaded into said impeller. Preferably the drive shaft is hollow, and a tension rod passing therethrough is screwed into said impeller shaft. Preferably an impervious carbon stationary sealing ring is gasketed into the volute casing cover, and an impervious carbon rotary sealing ring is cinched onto said impeller shaft and bears against said stationary ring. The stationary ring preferably has passages leading to the mating face of said rotary sealing ring, and the graphite cover has passages in communication therewith for conducting cooling medium to and from said mating face.

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In the drawings:

Fig. 1 is a perspective front view of the impervious graphite centrifugal pump according to the preferred embodiment of the present invention as coupled to a motor;

Fig. 2 is a larger perspective rear view of the pump shown in Fig. 1 without the motor;

Fig. 3 is a vertical axial section through the pump shown in Figs. 1 and 2;

Fig. 4 is an enlarged section of a portion of Fig. 3;

Fig. 5 is a section taken along the line 5—5 of Fig. 3;

Fig. 6 is a section taken along the line 6—6 of Fig. 5;

Fig. 7 is a section taken along the line 7—7 of Fig. 5;

Fig. 8 is a section taken along the line 8—8 of Fig. 2;

Fig. 9 is a section taken along the line 9—9 of Fig. 4;

Fig. 10 is a side elevation of a seal adjusting ring; and

Fig. 11 is a front elevation of the ring shown in Fig. 10.

The apparatus shown in the drawing comprises a volute casing V and a cover C both of impervious graphite. These graphite parts are supported by a unitary metal casting, preferably iron, comprising a base B, a bearing housing H, and a volute supporting flange F. The base B is secured to a foundation N, and the graphite parts are bolted between the flange F and a metal cover flange casting T. A discharge flange G is secured between the metal flanges F and T, and suction piping Z is secured to the cover casting T.

The bearing housing H has journaled therein a drive shaft D, on which is sleeved an impeller shaft S of stainless steel. The impeller shaft S passes through registering central apertures in the flange F and cover C and has secured thereto an impervious graphite impeller I, which rotates inside the volute casing V. The drive shaft D is driven through a coupling K by a motor M mounted on the foundation N.

The base B is preferably generally triangular, and provided with three holes for holddown bolts 10, forming a tripod base which is easily leveled on the foundation N at assembly. The flange F is provided with hexagonal sockets for heads of three bolts 12 so that the tightening of nuts on these bolts requires only one wrench.

The inside diameters of the bearing housing H and of the bore of the volute mounting flange F are bored in line to insure permanent interchangeable concentricity of the impervious graphite parts and the shaft mounted parts, avoiding shimming and adjusting. The flange F is bracketed to the base B by brackets 14 which leave more than 180° of arc of mechanical seal free of struts or other obstructions which would interfere with ease of seal adjustments or maintenance. The box formed by brackets 14, flange F and pedestals 16 of bearing housing H around the mechanical seal area is open at the bottom for unobstructed run-off of any leakage, and is kept free of any bolts or struts passing through it.

The cover flange T has cast holes for the bolts 12, and a ledge 18 matching a corresponding ledge 19 on the flange F for retaining the discharge flange G. The cover flange T has T-slots 20 receiving standard square head bolts around the suction nozzle Z. The discharge flange G has similar slots 22 for the discharge nozzle.

The pump shaft D is journaled in bearings 24 in the housing H, and the impeller shaft S is keyed thereto by a key 26. The pump shaft D is hollow, and a drawbolt 28 having a head outside the pump shaft, passes therethrough and is screwed into threads 30 inside the head of the impeller shaft S. This draws up the sleeve portion of the impeller shaft to seat against the inner race of the adjacent bearing 24. This forms one continuous surface of stainless steel to any corrosives in the rotary seal area, with the joint to the pump shaft D protected by a non-metallic grease seal 32.

The front of the impervious graphite impeller I has streamlined vanes 33 on its front face as shown in Fig. 5,

for increased efficiency and higher head at all speeds. Relief vanes 35 on the back of the impeller plate I reduce the pressure on the mechanical seal. The impeller I also has a flow splitter hub 37 which adds to the streamlining through the pump.

The inner end of the impeller shaft S, for assembling to the impeller I, is of reduced diameter forming a shoulder 34 and threaded as at 36, with a relief groove 38 adjacent the shoulder, and slabbed off on two sides forming flats 40. The threads, flats and cement relief groove are full of cement and free of voids but not under initial pressure from trapped cement which might burst impeller hub as cement expands slightly under heat. The sealing of the shoulder 34 against the impeller makes the joint twice as strong as when the end of the shaft seats on the bottom of the socket.

Mounted on the impeller shaft hub is an impervious carbon sleeve 42, which has a threaded joint 44 to the impeller of larger diameter than the neck of the sleeve. The stock is smoothly curved down as at 46 to eliminate this section as a point of breakage in cantilever. The other end of the sleeve 42 is recessed to receive an O-ring 48 seal to the shaft S, which also provides resilient support without rigid restraint. There is a clearance between the inside diameter of the sleeve and the outside diameter of the shaft to prevent sleeve breakage due to shaft expansion, bending or vibration.

The impervious graphite cover C is bored and threaded to receive a stationary seal ring 50 of impervious carbon, which is removable and interchangeable. A gasket 52 at the bottom inside the threads retains the corrosive fluids being pumped and separates them from the cooling water flowing through the seal, which is retained by an outer gasket 54 at the top of the threads.

Cooling water is supplied from an external source through a pipe 55 threaded into the flange F, and a passage 56 in the graphite cover C, with an O-ring seal 57 therebetween. Drilled holes 58 in the ring 50 in conjunction with the passage 56 in the cover C convey cooling water to the rubbing faces of the seal 50 and a rotary seal ring 60. A lower passage 71 in the cover is connected to an external drain pipe 72.

The seal face of the stationary seal ring 50 has a specification of four light band flatness to obtain sealing action. The rotary seal ring 60 has a two piece or double cone Teflon packing 61 and 62, which is compressed or tightened by a threaded ring 63 of Synthane.

The mechanical seal is also provided with seal adjusting rings 65 and 66, and a rubber compression member 67 bearing against the ring 63. The rings 65 and 66 are shown in Figs. 10 and 11 and comprise split rings having threaded sockets 68 for clamping screws, and spiral faces 69 on their mating sides. Pressure against rubber compression member 67 is obtained by bringing both rings up snug against the rubber member 67, tightening plain ring 66 to the shaft by a screw in its socket 68, rotating ring 65 with respect to plain ring 66 so that the spiral faces 69 in contact force the two rings apart, and then tightening ring 65 to the shaft by the screw in its socket 68. The grip to the shaft is by cinching action rather than a set screw which might mark the shaft so that it becomes locked thereto. Further if corrosion builds up the rings can be pried open and removed without sawing or breaking.

What is claimed is:

1. In a corrosion resistant pump, a metal casting comprising a pedestal bearing housing and a volute support flange integral therewith, said bearing housing having a bore aligned with an aperture in said volute support flange, an impervious graphite volute casing and cover therefor, and a metal cover flange casting, said volute casing and cover being bolted between said casting flanges, said volute casing having a suction end facing said cover flange and a discharge nozzle between said bolted flanges, and said graphite cover facing said volute support flange and

recessed therein and having a removable stationary seal member in axially aligned relation therewith and with said pedestal bearing housing.

2. In a corrosion resistant pump, a metal casting comprising a pedestal bearing housing and a volute support flange integral therewith, said bearing housing having a bore aligned with a central aperture in said volute support flange, an impervious graphite volute casing, a graphite cover for said volute casing, a metal cover flange casting, said graphite parts being bolted between said castings, a drive shaft journaled in said bearing housing, an impervious graphite impeller rotatable in said volute casing, and a corrosion resistant impeller shaft secured to said impeller and passing through the central aperture in said volute support flange and sleeved onto said drive shaft, said volute casing having a suction end facing said cover flange and a discharge nozzle between said bolted flanges, and said graphite cover facing said volute support flange and recessed therein and having a removable stationary seal in axially aligned relation therewith and with said pedestal bearing housing to permit removal of said impeller and shaft without disturbing said stationary seal member.

3. In a corrosion resistant pump, a metal casting comprising a pedestal bearing housing and a volute support flange integral therewith, said bearing housing and said volute support flange having aligned bores, an impervious graphite volute casing, a graphite cover for said volute casing, a metal cover flange, said graphite parts being bolted between said metal flanges, a hollow pump shaft journaled in said bearing housing, a corrosion resistant impeller shaft sleeved onto said pump shaft, an impervious graphite impeller cemented onto said impeller shaft, and rotatable in said volute casing, and a tension rod passing through said hollow pump shaft and screwed into said impeller shaft, said volute casing having a suction end facing said cover flange and a discharge nozzle between said bolted flanges, and said graphite cover facing said volute support flange and recessed therein and having a removable stationary seal in axially aligned relation therewith and with said pedestal bearing housing to permit removal of said impeller and shaft without disturbing said stationary seal member.

4. In a corrosion resistant pump, a metal casting comprising a volute support flange, an impervious graphite volute casing, a graphite cover for said volute casing, a metal cover flange casting, said graphite parts being bolted between said castings, said volute casing having a suction end facing said cover flange and a discharge nozzle between said bolted flanges, said graphite volute casing cover facing said volute support flange and recessed therein, an impeller shaft passing through said volute support flange, an impervious graphite impeller cemented onto said impeller shaft and rotatable in said volute casing, an impervious carbon stationary seal ring gasketed into the volute casing cover, and an impervious carbon rotary seal ring cinched onto said impeller shaft and bearing against said stationary ring.

5. In a corrosion resistant pump as claimed in claim 4, said stationary ring having passages leading to the mating face of said rotary seal ring, and said graphite cover having passages in communication with said ring passages, for conducting cooling medium to and from said mating face.

6. In a corrosion resistant pump as claimed in claim 4, said rotary sealing ring being adjusted by a pair of adjusting rings having mating spiral faces, said adjusting rings being split and cinched to the shaft by clamping screws.

7. In a corrosion resistant pump as claimed in claim 4, in which an impervious carbon sleeve is mounted on said impeller shaft, and said rotary sealing ring has a threaded socket receiving mating conical gasket rings compressed against said carbon sleeve by a threaded ring screwed into said socket.

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8. In a corrosion resistant pump, a metal casting comprising a base, a pedestal bearing housing, a volute support flange, and brackets integrally connecting said pedestal and flange with said base, said bearing housing having a bore aligned with an aperture in said volute support flange, an impervious graphite volute casing having a suction end, a graphite cover for said volute casing, and a metal cover flange casting, said volute casing and cover being bolted between said casting flanges with said suction end facing said cover flange, said volute support flange and cover flange casting being substantially flat and spaced apart by said graphite parts, said substantially flat metal parts being bolted together across said graphite parts and outside thereof, and a discharge flange secured between said bolted flanges outside of said graphite parts.

9. In a corrosion resistant pump, a metal casting comprising a pedestal bearing housing and a volute support flange integral therewith, said bearing housing having a bore aligned with an aperture in said volute support flange, an impervious graphite volute casing having a suction end, a graphite cover for said volute casing, and a metal cover flange casting, said volute casing and cover being bolted between said casting flanges, said volute support flange and cover flange casting being substantially flat and spaced apart by said graphite parts, said substantially flat metal parts being bolted together across said graphite parts and outside thereof, a discharge flange held in compression between said bolted flanges, and suction piping clamped under compression to said metal cover flange casting aligned with the suction end of said volute casing.

10. In a corrosion resistant pump, a metal casting comprising a pedestal bearing housing and a volute support flange integral therewith, said bearing housing having a bore aligned with a central aperture in said volute support flange, an impervious graphite volute casing having a suction end, a graphite cover for said volute casing, a metal cover flange casting, said graphite parts being bolted between said castings with said suction end facing said cover flange, a drive shaft journaled in said bearing housing, an impervious graphite impeller rotatable in said volute casing, a corrosion resistant impeller shaft

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secured to said impeller and passing through the central aperture in said volute support flange and sleeved onto said drive shaft, and an impervious carbon sleeve mounted on said impeller shaft and having a threaded end of large diameter threaded into said impeller and smoothly curved down to eliminate this section as a point of breakage, said volute cover carrying a removable stationary seal member in axially aligned relation therewith which permits removal of the impeller and impeller shaft without disturbing the alignment of the seal member.

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