

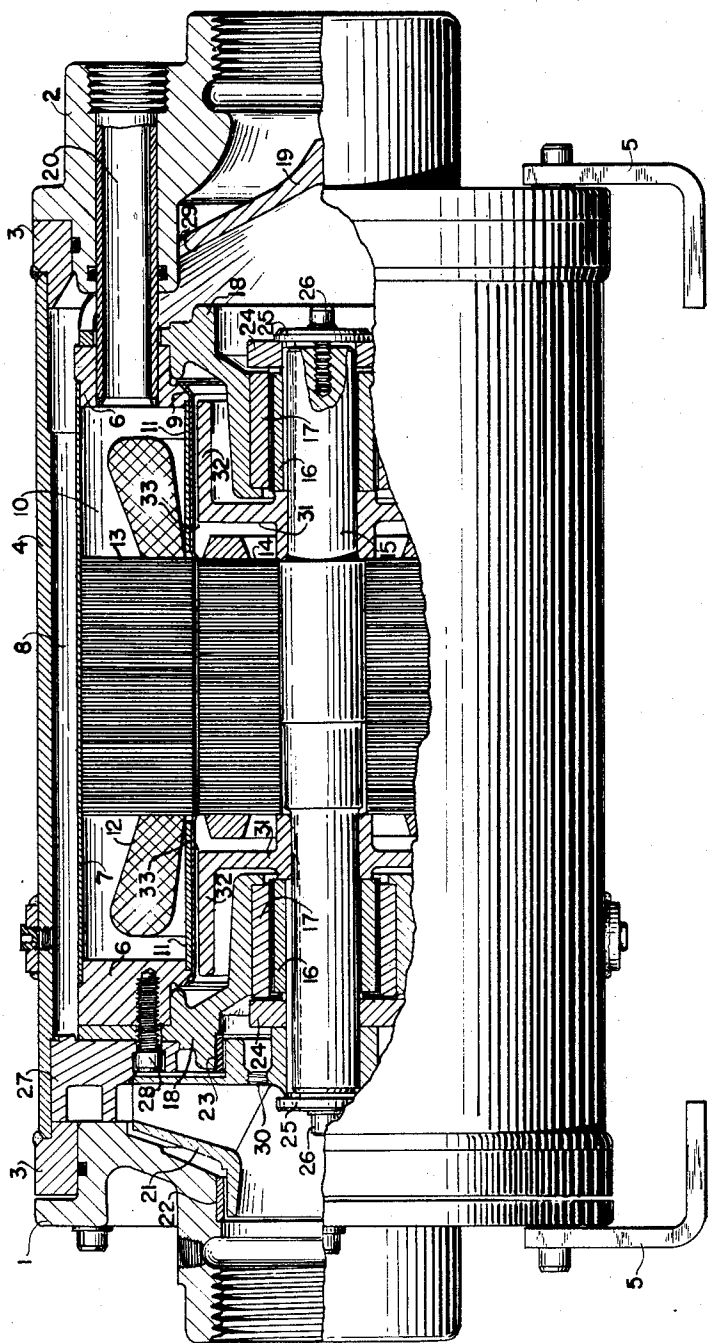
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PUMP

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This invention relates to a pump and more particularly to a sealless-type pump in which a portion of the pumped fluid is permitted to recirculate within the rotor chamber to cool the motor and lubricate the rotor shaft bearings.

In a sealless-type pump a portion of the liquid being pumped is recirculated from the discharge connection of the pump through the rotor chamber and rotor shaft bearings to cool the motor and is subsequently reintroduced into the suction end of the pump. The flow of liquid through the rotor chamber is produced by the differential in pressure between the suction end and the discharge end of the pump.

If the pumped fluid is flammable, such as oil for gasoline, and is permitted to circulate within the rotor chamber, it is essential that means be provided to prevent any flames which may arise through an explosion in the rotor chamber from entering the line. In order to confine the flame resulting from the explosion to the rotor chamber, it has been proposed in the patent of H. T. White, 2,741,990, to provide a restricted opening of substantial axial length at the ends of the rotor chamber so that the liquid and vapor within the passage will not ignite and therefore the flame will not be propagated outside of the rotor chamber.

The present invention is directed to a pump structure having an improved flame guard construction. According to the invention, the flame guard is provided by a restricted axial passage of substantial length which is provided between the cylindrical liner separating the rotor and stator chambers and the outer surface of a flange of a cup-shaped flame guard. With this construction a single flame trap is provided for the rotor chamber which will effectively prevent flames from passing out of the rotor chamber and into the pipe line. The flame guard is of simple construction and eliminates a portion of the expensive machine operations which accompany flame traps of conventional design.

Other objects and advantages of the invention will appear in the course of the following description.

The drawing is a side elevation of a pump embodying the present invention with parts broken away and sectioned.

The drawing illustrates a motor driven, in-line centrifugal pump comprising a pair of end connections 1 and 2, each of which carries a ring 3, and a cylindrical sleeve 4 welded at its ends to the rings 3 to provide a housing for the unit. The pump is supported by a plurality of legs 5 which are suitably connected to the end connections 1 and 2.

The motor assembly employed to drive the pump comprises a pair of motor end bells 6 which are connected together by a cylindrical sleeve 7. The sleeve 7 is spaced radially inward from the outer sleeve 4 to provide an annular chamber 8 therebetween which serves to conduct the pumped fluid from the suction end connection 1 to the outlet connection 2.

A thin metal cylindrical liner 9 made of stainless steel or the like is secured by welding to the inner edges of

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the motor end bells 6 and is spaced from the sleeve 7 to define a stator chamber 10 therebetween. The liner 9 is suitably reinforced by a pair of backing rings 11 supported by the respective motor end bells 6.

The stator is of conventional construction and comprises field windings 12 which are disposed within the laminated core 13. The windings 12 are adapted to be energized by a suitable source of alternating current which is connected to the windings by leads, not shown.

A laminated squirrel-cage rotor 14 is secured to a rotor shaft 15 and is also of conventional construction. A pair of sleeves 16 are keyed to the end portions of shaft 15 and the sleeves are journaled within bearings 17 which are supported within bearing support housing 18.

To direct the pumped fluid from annular chamber 8 to outlet connection 2 a generally conical bearing cap 19 is secured to the bearing support 18 at the discharge end of the pump. The electrical leads are introduced into the stator chamber through a conduit 20 which is secured within suitable aligned openings in the discharge connection 2, cap 19, bearing support 18 and motor end bell 6.

To move the fluid through the unit, an impeller 21 is secured to and driven by rotor shaft 15. The impeller 21 is disposed within suction end connection 1 and is suitably journaled for rotation within wear rings 22 and 23 which are mounted in connection 1 and housing 18, respectively, for the purpose of reducing back leakage of the pumped fluid.

Thrust collars 24 are secured to shaft 15 outwardly of bearings 17, by thrust washers 25 and lock screws 26, and bear against the end of bearings 17.

A diffuser ring 27 is disposed radially outwardly of impeller 21 and is formed with a series of spiral passages which serve to diffuse and direct the liquid from the impeller into the annular chamber 8 between the sleeves 4 and 7. The diffuser ring 27 is secured to the motor assembly by bolts 28 which are threaded into the motor end bell 6 at the suction side of the motor assembly.

In operation of the pump, fluid is drawn into the impeller through suction connection 1 and thrown outwardly into the diffuser ring 27. The fluid then passes from the diffuser ring through the annular clearance 8 to the outlet connection 2. In order to cool the motor and lubricate the rotor shaft bearings a portion of the pumped fluid is recirculated through the bearings and the rotor chamber. This is accomplished by providing an opening 29 in the bearing cap 19 through which the conduit 20 passes without contact. The pumped fluid is drawn inwardly through opening 29 and then through the annular space between bearing 17 and adjacent the discharge end of the unit, to the rotor chamber. After passing through the rotor chamber the fluid again passes between bearing 17 and the other sleeve 16, adjacent the suction end of the unit, and enters the impeller through openings 30 formed in the hub thereof.

The fluid flow through the motor chamber is produced by the differential in pressure between the inlet and outlet ends of the unit, and is limited to that necessary for lubrication and cooling by the clearance in passages involved.

As the fluid being pumped is recirculated through the rotor chamber to cool the motor and lubricate the bearings, it is essential that any explosion which may occur in the rotor chamber be confined to that chamber and not be permitted to pass into the pipe line containing the flammable liquid.

According to the present invention any explosion which may occur is confined to the rotor chamber by providing a flame trap at each end of the rotor chamber. This is accomplished by means of a pair of flame guards 31 which are keyed to the rotor shaft 15 at each end of the

rotor. Each flame guard is of a generally cup-shape and the peripheral flange 32 of the guard is provided with a substantial axial length. The outer surface of the flange 32 is spaced a slight distance from the inner surface of liner 9 to provide a restricted annular passage 33 through which the flames will not propagate. Generally, flange 32 has a length of approximately one and one-half inches and the opening or clearance between the flange and the liner is usually about .0125 inch maximum. Due to the restricted size of the passage 33, any liquid or vapor within the passage will not ignite and therefore flames resulting from an explosion in the rotor chamber will not be propagated to the flammable liquid in the line.

With the use of the flame guard 31, the pumped fluid after passing inwardly between the sleeve 16 and bearing 17 at the discharge end of the housing then passes outwardly from flange 32 and through passage 33 to the rotor chamber. The path of travel at the suction end of the housing is similar with the liquid passing through passage 33 between sleeve 16 and bearing 17 to impeller 21. With this flow of fluid, any liquid or vapor within passages 33 will not ignite due to the small size of the passage which causes an adiabatic expansion of any gases passing therethrough.

The present invention provides a simple and effective flame trap which will prevent flames from passing out of the rotor chamber. As the liner 9 is a dimensioned member, it is only necessary to machine the outer surface of the flange 32 of the flame guard in order to provide the proper tolerance for the flame trap. This eliminates a substantial portion of the machining which is necessary if the flame trap, for example, was disposed between the inner surface of flange 32 and the bearing housing 18.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a motor-driven centrifugal pump adapted to pump flammable fluids, a stator, a rotor disposed radially inward of the stator, a metallic cylindrical liner separating said stator and rotor and defining a rotor chamber, a drive shaft secured to the rotor and disposed to carry an impeller, and flame guard means disposed within an end of the rotor chamber and having a peripheral surface of substantial axial length, said peripheral surface being spaced radially inward of said liner to provide a passage therebetween having a radial width and axial length sufficient to prevent the propagation of flame therethrough from the rotor chamber to the exterior.

2. In a motor-driven centrifugal pump adapted to pump flammable fluids, a housing, a stator disposed within the housing, a rotor spaced radially inwardly of

the stator, a generally cylindrical liner disposed between the stator and rotor and defining a rotor chamber, a drive shaft secured to the rotor and disposed to carry an impeller on one end thereof, and a flame guard secured to the shaft and disposed to close an end of the rotor chamber and having a peripheral edge of substantial axial length, said edge being spaced radially inwardly of said liner to provide an annular passage therebetween of sufficient radial width and axial length to prevent ignition of flammable media therein.

3. In a motor-driven centrifugal pump adapted to pump flammable liquids, a housing, a stator disposed within the housing, a rotor spaced radially inwardly of the stator, a generally cylindrical liner disposed between the stator and rotor and defining a rotor chamber, a drive shaft secured to the rotor, an impeller secured to one end portion of the shaft and disposed to draw in the liquid to be pumped through an inlet in said housing and discharge the liquid through an outlet in said housing, means for recirculating a portion of the liquid from the outlet through the rotor chamber to said impeller, and a pair of flame guards secured to the shaft on opposite sides of said rotor, each of said flame guards having a generally cylindrical peripheral surface of substantial axial length, said peripheral surfaces being spaced radially inwardly of said liner to provide annular passages therebetween of sufficient radial width and axial length to prevent ignition of flammable media therein.

4. In a motor-driven centrifugal pump adapted to pump flammable liquids, a housing, a stator disposed within the housing, a rotor spaced radially inwardly of the stator, a generally cylindrical liner disposed between the stator and rotor and defining a rotor chamber, a drive shaft secured to the rotor, centrifugal pumping means secured to said shaft and disposed to draw in the liquid to be pumped through an inlet in said housing and discharge the liquid through an outlet in said housing, means for recirculating a portion of the liquid from the outlet through the rotor chamber to said pumping means, and a flame guard disposed within an end of said rotor chamber and having a generally cylindrical peripheral surface of substantial axial length, said peripheral surface being spaced radially inwardly of said liner to provide an annular passage therebetween of sufficient radial width and axial length to prevent ignition of flammable media therein.

References Cited in the file of this patent

UNITED STATES PATENTS

2,741,990 White ----- Apr. 17, 1956

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