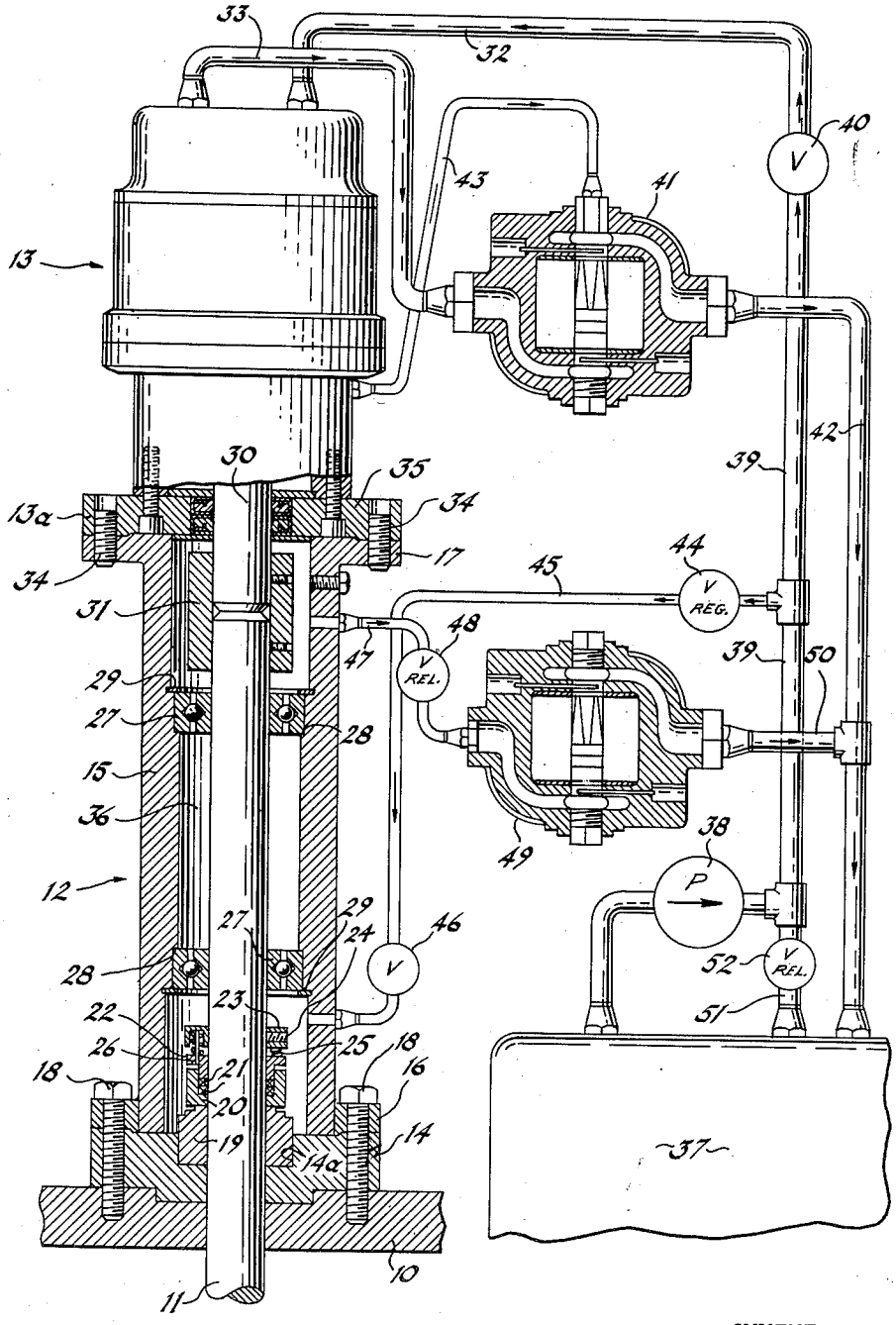
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HYDRAULIC POWER MEANS AND SEAL
FOR PRESSURE VESSEL AGITATORS
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HYDRAULIC POWER MEANS AND SEAL FOR PRESSURE VESSEL AGITATORS

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An object of the present invention is to provide improved hydraulic power means and sealing means for pressure vessel agitator shafts.

One of the objects of the present invention is to provide an efficient driving and sealing means for an agitator shaft in a pressure reaction vessel so arranged that no part of the shaft ever extends in the atmosphere.

Another object of the present invention is to provide in combination, a pressure reaction vessel containing liquid and subject to a predetermined pressure, a rotatable shaft in the vessel and projecting through the wall thereof, a self-contained motor for rotating the shaft and connected to the shaft spaced from the wall of the pressure vessel, this motor running in hydraulic oil or other hydraulic fluid, together with sealing means embracing the shaft where it passes through the wall of the pressure vessel, an enclosed chamber surrounding the agitator shaft and sealing means, with a seal between the chamber and the motor housing together with means maintaining a pressure liquid in the chamber at a pressure above the predetermined pressure in the agitator vessel. In this way any leakage from the chamber along the shaft toward the vessel will be into the vessel and any leakage from the chamber along the shaft in the opposite direction will be into the motor housing.

Another object of the present invention is to provide in the combination of the preceding paragraph, a single hydraulic system providing hydraulic liquid under pressure which is connected to the sealing chamber through pressure regulating means maintaining a substantially constant pressure in the chamber at all times higher than the predetermined pressure in the agitator, and so arranged that any leakage is always back into the hydraulic system.

A further object of the present invention is to provide a self-contained motor of the hydraulic type having a shaft aligned with the agitator vessel shaft and a single hydraulic system for operating the motor and for providing a pressure liquid seal along the agitator shaft. In such a combination the agitator driving shaft terminates at one end inside of the agitator vessel and at the other end terminates inside of the hydraulic system so that no leakage can ever occur to atmosphere.

Other objects and advantages of my invention will be apparent from the accompanying drawings and description and the essential features thereof will be set forth in the appended claims.

The drawing shows somewhat diagrammatically an hydraulic system embodying my invention with parts of the sealing means broken away in central sectional view to more clearly show the construction.

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In operating chemical reaction vessels wherein liquids are treated under developing pressure, it is sometimes undesirable, and other times dangerous, to have liquid leak outwardly from the reaction vessel along the agitator shaft which extends into the vessel. It is an object of the present invention to prevent such leakage along the agitator shaft. Difficulty has been found in the past in drives for such pressure vessel agitators where they exert a side thrust on the agitating shaft rendering it difficult to maintain a good seal to prevent leakage along the shaft out of the vessel. My invention is well adapted to solve this problem also.

One form of my invention is illustrated in the drawing wherein a reaction vessel is shown at 10 having a shaft 11 passing through the upper wall of the reaction vessel to the interior thereof for operating an agitator or the like. Immediately above the top wall of the reaction vessel 10 I provide a pressure hydraulic seal 12 and above this is mounted a self-contained driving motor 13.

The seal 12 comprises a base plate 14 surmounted by a tubular body 15, the interior of which provides a chamber surrounding the shaft in which liquid under pressure is provided for sealing purposes. The body 15 is provided with a bottom flange 16 and a top flange 17. Bolts 18 pass through flange 16 and base member 14 into the top wall of the reaction vessel 10 so as to hold the parts assembled. A carbon sealing ring 19 of known construction tightly embraces shaft 11 almost immediately above the top wall of the reaction vessel 10, there being just enough clearance to permit rotation of shaft 11 in the carbon ring 19. The external diameter of the carbon ring is just sufficient for a press fit into a recess 14a in the base member 14. Immediately above the carbon ring is a sealing collar 20 which is cup-shape opening upwardly and which holds two annular sealing rings 21 of compressible sealing material. A packing gland 22 presses the sealing rings 21 inside of the cup-shape member 20 so as to tightly hug the shaft 11. A compression ring 23 is secured to shaft 11 by means of a plurality of set screws 24. A plurality of short helical springs 25 are seated in recesses in ring 23 and press downwardly against the packing gland 22. Each of these springs surrounds a guide pin 26 which seats in ring 23 and gland 22 so that parts 23, 22 and 20 turn with shaft 11.

The lower face of the member 20 is hardened where it rubs against the carbon ring 19. This provides a very effective sealing means between the pressure reaction vessel 10 and the sealing chamber 12.

Means is provided in the sealing chamber construction to support the shaft 11 by means of two bearings 27 spaced apart along the shaft 11 so as to support it firmly against lateral movement. Each of these bearings fits on one side against a shoulder 28 in member 15 and is held on the opposite side by means of a snap ring 29 seating in the member 15.

It is commonly the practice to provide shaft 11 extending into the atmosphere and there provided with a drive means extending laterally to some driving mechanism. This causes a side thrust on shaft 11 which is disadvantageous to the seal where the shaft 11 passes through the wall of the reaction vessel 10 and sometimes causes the carbon ring 19 to lift out of place. I avoid this objectionable arrangement by providing a self-contained motor 13 having a driving shaft 30 which is either integral with or at least aligned with the shaft 11. In the present instance I have shown the two shafts in alignment and connected together for uniform rotation by a coupling 31. In this way, I provide torque without side thrust in the driving motor 13. To complete the effective sealing of shaft 11 against leakage therealong, in an upward direction, I prefer to use a self-contained motor running in hydraulic oil or other hydraulic fluid. Specifically, I have shown motor 13 as a positive displacement hydraulic motor of the type specifically shown in Fig. 1 of United States Patent No. 2,430,069, granted August 23, 1949, to Fred J. Wright. The housing of motor 13 has a bottom flange 13a which is secured by means of bolts 34 to flange 17 of the member 15. The seal 35 seals shaft 30 between chamber 36 and the interior of the housing for motor 13. This seal 35 is the sole dividing means between the hollow of motor housing 13 and chamber 36.

Means is provided for supplying hydraulic pressure fluid to chamber 36 for sealing purposes and through conduit 32 to drive motor 13. Preferably, but not necessarily, I use a single hydraulic system for this purpose. A reservoir 37 is supplied with hydraulic fluid which is moved by means of pump 38 through line 39 and control valve 40 to line 32 leading to motor 13. The discharge from motor 33 passes through a rotameter 41 which is a device for measuring the flow through line 33 and line 42 back to the reservoir 37. The pressure and temperature of this hydraulic fluid are held substantially constant and, therefore, the viscosity is substantially constant. Therefore, the rate of flow through the positive displacement motor 13 can be translated into revolutions per minute of shafts 30 and 11 and the calibration scale on the rotameter 41 can be read directly in revolutions per minute. In one form of my invention, a flow of 0.42 gallons of oil per minute is equivalent to 100 R. P. M. of the hydraulic motor 13, and tests show that this motor would deliver about 2 H. P. at 1500 R. P. M. when the oil pressure is 600 pounds per square inch. I prefer to use an oil having a viscosity of about 225 seconds on a Saybolt Universal viscosimeter at the temperature of the hydraulic system which is preferably held not greatly differing from the temperature within the reaction vessel 10. Quite commonly a lubricating oil of this viscosity is used. Some oil will leak by the pistons and rotor

of the hydraulic motor 13. A drain line 43 conducts this leakage back through a by-pass in the rotameter 41 to the line 42. This leakage oil has no effect on the movements of the rotameter 41 and does not effect the R. P. M. registered there.

Another connection from line 39 leads through a pressure regulating valve 44 and line 45, through a control valve 46 to the lower end of chamber 36. The discharge from chamber 36 is through line 47 and relief valve 48 to rotameter 49 and thence through line 50 back to line 42 for return to the reservoir 37. The flow through the sealing chamber 36 may be regulated by valve 46 and in one form of my invention is adjusted to about ⅛ of a gallon per minute. To insure that no leakage will occur from the reaction vessel 10 outwardly along shaft 11, the pressure in chamber 36 is constantly held at pressure greater than that in the reaction vessel 10. In one form of my invention, the regulating valve 44 is set to hold a constant pressure in line 45 approximately 75 pounds per square inch higher than the highest pressure expected in the vessel 10. The relief valve 48 is then set for 25 to 50 pounds higher than the pressure in vessel 10 so as to constantly hold a pressure in chamber 36 greater than the pressure inside of vessel 10.

Since valve 44 is a regulating valve and opens only to permit flow in the direction of the arrows when the pressure in line 45 is less than that in line 39; and since valve 48 is a relief valve and opens to permit flow in the direction of the arrow only when the pressure in line 47 is above a predetermined minimum, valves 44 and 48 serve to hold liquid under pressure in sealing chamber 12 if for any reason the pressure should fail in the system 37—38—39.

In one form of my invention the pump 38 delivers hydraulic fluid at a pressure of about 600 pounds per square inch through line 39, valve 40 and line 32 for the operation of motor 13. By regulating valve 40, the speed of motor 13 may be controlled. Excess oil moving through the pump 38 may flow through line 51 and relief valve 52 back into reservoir 37.

In cases where even small quantities of oil used in sealing chamber 36 might have a deleterious effect on the chemical reaction of the charge in the vessel 10, the sealing chamber 36 may be provided with a separate pressure liquid supply system using silicone oil or grease, a medicinal grade of white oil, specially refined petrolatum, or any other lubricant which is chemically inert.

It will be noted that any leakage from the pressure sealing chamber 36 toward the reaction vessel will in any case be very slight and no deleterious chemical can escape from the reaction vessel. The seal 35 creates barrier against free flow between chamber 36 and the interior of the motor 13. However, if any leakage does occur in this direction along shaft 30 upwardly, such leakage returns to the hydraulic system and cannot escape into the room.

Prior constructions known to me have utilized an agitator drive shaft such as that shown in United States Patent No. 2,398,944, granted April 23, 1946, to George E. Kopetz. This Kopetz construction provides a sealing chamber somewhat similar to my sealing chamber 36 for preventing leakage from the reaction vessel outwardly along shaft 11. However, the Kopetz shaft extends into atmosphere and any leakage from chamber 36 will cause a messy or even dangerous condition. In contrast to this, it will be noted that my drive shaft 11, 30 ends within the hydraulic system itself

and no leakage outside to atmosphere is possible.

What I claim is:

1. In combination, a pressure reaction vessel containing liquid and subject to a predetermined pressure, a rotatable shaft in said vessel and projecting through the wall thereof, a self-contained motor for rotating said shaft and connected to said shaft spaced from said wall, said motor being a hydraulic motor having a shaft aligned with said first-named shaft, sealing means embracing said shaft where it passes through said wall, and an enclosed chamber surrounding said shaft and sealing means, a seal between said chamber and said motor and providing the only dividing means between them, an hydraulic system including a source of hydraulic pressure fluid connected with said motor for operating it, and means connecting said hydraulic pressure fluid in said chamber, said last named means providing means maintaining pressure in said chamber above said predetermined pressure, whereby said shaft terminates at one end inside of said vessel and at the other end inside of said hydraulic system.

2. The combination of claim 1 including valves in said hydrauliic system isolating said chamber from the rest of said system when pressure in the rest of said system falls below said predetermined pressure, whereby if said system falls below said predetermined pressure or if said hydraulic motor fails to maintain rotation of said shaft in said reaction vessel, the pressure liquid in said chamber maintains a seal there.

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2,250,714	LaBour	July 29, 1941
2,398,944	Kopetz	Apr. 23, 1946