April 15, 1952 D. M. JACKSON 2,592,904

HYDRAULIC AGITATOR

Filed April 10, 1950

Fig. 1.

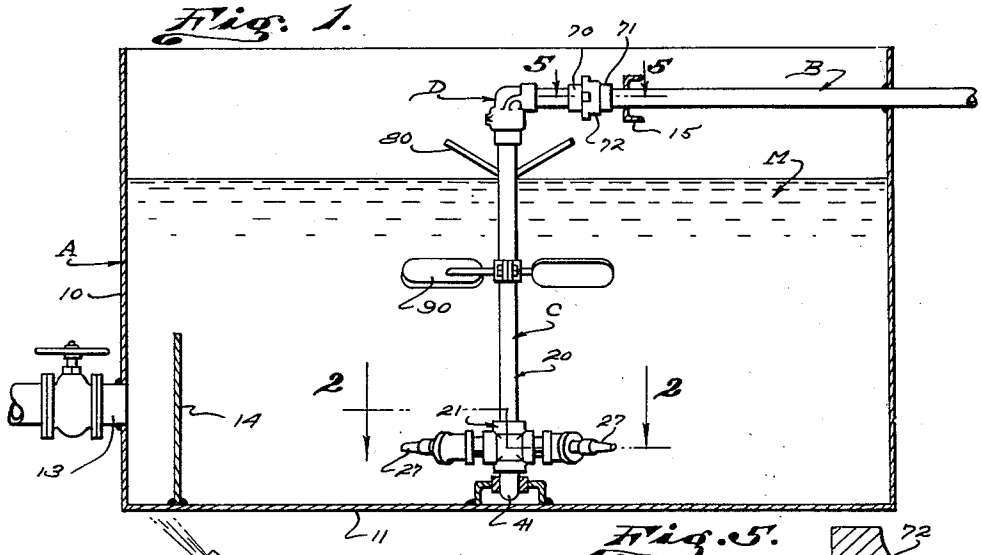


Fig. 5.

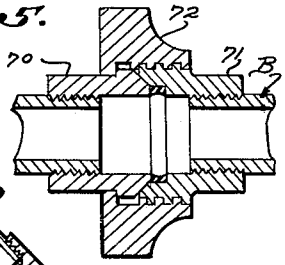


Fig. 2.

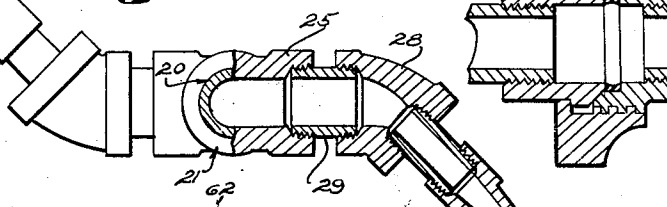


Fig. 3.

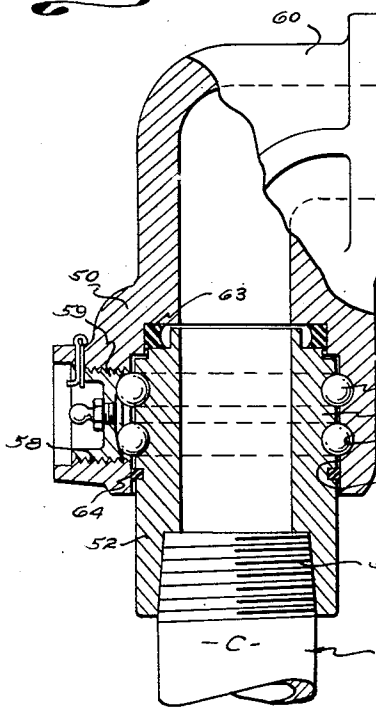
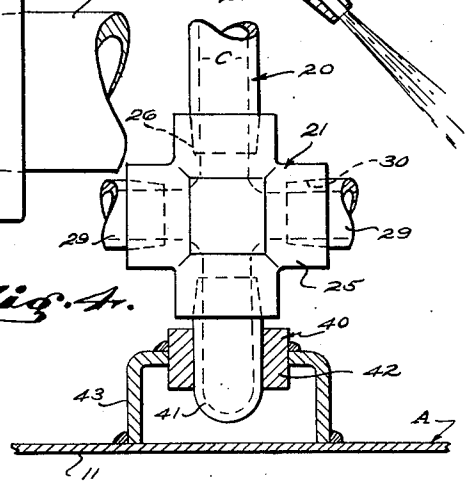


Fig. 4.



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UNITED STATES PATENT OFFICE

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HYDRAULIC AGITATOR

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6 Claims. (Cl. 259—96)

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This invention has to do with a hydraulic agitator and it is a general object of the invention to provide a simple, practical, dependable structure for agitating a body of material such as a fluid located or carried in a suitable container.

There are various situations where materials are to be mixed or agitated while in a container, or the like. As an example, reference will be made to drilling fluid such as is used in oil wells, in which case a mid-laden fluid is provided for circulation and such fluid requires mixing and after being mixed requires agitation to keep it at the proper consistency.

A general object of the present invention is to provide a structure applicable to or combined with a container such as a tank, or the like, which is operated by means of a fluid supplied at high pressure so that it rotates and delivers high velocity jets or streams of fluid in the mass to be mixed or agitated and in such manner as to effectively and uniformly mix and agitate.

A further object of the invention is to provide a structure of the general character referred to which involves few, simple parts, one of which is a rotor supplied with fluid at a suitable pressure, which rotor operates in the material to be mixed or agitated by reason of reactionary forces developed as a result of the fluid being discharged from the rotor.

A further object of the invention is to provide a structure of the general character referred to which involves few simple parts, one of which is a rotor supplied with fluid at a suitable pressure, which rotor operates in the material to be mixed or agitated by reason of reactionary forces developed as a result of the fluid being discharged from the rotor.

A further object of the invention is to provide a structure of the general character referred to which is mounted in or applied to a container through a simple, inexpensive, dependable means which permits of the working parts being removed at will for purpose of repair, replacement, or servicing, etc.

The structure provided by or in which the present invention is incorporated involves, generally, a container such as an open top tank, a supply line that extends to the container to deliver operating fluid thereto, preferably at a high pressure, a rotor operable in the container, and coupling means connecting the rotor to the supply line so that the rotor is free to revolve in the container as the high pressure fluid issues from the rotor. In a typical arrangement the

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supply line extends horizontally into the upper portion of the container to a point near the center of the container and the rotor is located in the container, preferably centrally thereof. The rotor involves a vertical tubular stem and a head on the lower end portion of the stem and preferably made up of a body receiving fluid from the stem and propeller units carried by the body and projecting therefrom.

In a typical arrangement there are two diametrically opposite propeller units and each involves a tangentially disposed nozzle and suitable mounting or coupling means connecting the nozzle to the body. A bearing means preferably supports the head in the container and may involve a bull plug depending from the body in line with the stem and supported in a bearing carried in the container, as for instance by a bracket secured to the bottom of the container. The coupling means joins the upper end of the stem to the supply line and preferably involves a swivel coupling in which male and female sections are rotatably coupled by anti-friction bearing means. One of the sections is fixed on or joined to the upper end of the stem while the other is releasably connected or joined to the discharge end of the supply line, as by a union type connection.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a vertical sectional view of a typical structure equipped with the present invention. Fig. 2 is an enlarged plan section taken substantially as indicated by line 2—2 on Fig. 1. Fig. 3 is an enlarged view of the coupling means showing the manner in which the stem of the rotor is held for rotation. Fig. 4 is an enlarged view taken at the lower end portion of the rotor showing the manner in which it may be mounted or held for rotation, and Fig. 5 is an enlarged sectional view taken as indicated by line 5—5 on Fig. 1.

In the construction illustrated in the drawings there is a container A in the form of an open top tank and a supply line B supplies a suitable fluid under pressure to the upper portion of the tank. A rotor C is located in the tank A and a coupling means D connects the supply line B and the rotor C so that the rotor is free to operate or rotate and is supplied with fluid under high pressure from the line B.

The container A shown as an open top tank has a vertical side wall 10 and a bottom 11. The particular tank illustrated in the drawings has a suitable valve controlled outlet 13 in one side and a baffle 14 is located in the container in front of the outlet to somewhat shield the outlet.

The supply line B is shown as a horizontally disposed line entering the upper end portion of the container A and where the rotor C is located centrally in the container, as shown in the drawings, the supply line extends to a point near the center of the container. In the particular case illustrated the supply line B is supported by a wall of the container where the line enters the container and its inner end portion is supported in the container by a suitable transverse beam 15 extending between side walls of the container.

The rotor C may, in practice, vary widely in form, size and arrangement. In the drawings I have illustrated a centrally located rotor and have shown a rotor suitable for mixing or agitating mud, or the like. In accordance with the present invention the rotor C has a vertically disposed tubular stem 20 and a head 21 on the stem, preferably at the lower end portion thereof. The particular stem illustrated is a simple, straight, tubular element of such length as to extend from the upper portion of the container A downwardly into a body of material M in the container so that the head 21 located on the lower end of the stem is in the lower portion of the container, as clearly shown in Fig. 1 of the drawings.

The head is shown as involving a body portion 25 joined to the lower end of the stem 20 as by a threaded connection 26 and it is such as to receive fluid from the stem. Propeller units are carried by and project from the body 25. In the case illustrated there are two propeller units located diametrically opposite each other and each of these units involves a suitable nozzle 27 suitably coupled to the body to be tangentially disposed relative to the body which is concentric with the stem. In the particular case illustrated each nozzle is shown as a simple jet-forming device joined to the body 25 by suitable fittings, such as fitting 28 and a nipple 29. The particular body illustrated in the drawings has threaded openings 30 which are located diametrically opposite each other and receive the nipples 29. The fittings 28 are carried by the nipples and are angle fittings which, in turn, carry the nozzles 27 so that they are pitched or angularly related to the head in the desired manner, as shown in Fig. 2 of the drawings. By angularly relating the nozzles 27 to the body 25 from which they are supported, or by arranging the nozzles so that they are tangentially disposed, as shown in Fig. 2, reactionary forces set up when fluid is discharged from the nozzles at a high velocity results in rotation of the head and the stem which is joined thereto.

The rotor C formed by the stem 20 and the head 21 constructed as above described is supported for free rotation about a vertical axis or about the axis of the stem through the coupling means D and a bearing 40 located at the lower end of the rotor. In the particular case illustrated in the drawings a bull plug 41 is joined to the body 25 so that it is opposite the lower end of the stem and depends from the body to be rotatably carried in a suitable bearing 42. The bearing 42 as shown in the drawings, may be carried by a suitable bracket 43 secured to the bottom 11 of the container A.

The coupling means D involves a suitable swivel connection or coupling carrying the stem 20 of the rotor and a releasable joint or connection making connection with the discharge end of the supply line B.

The swivel coupling carrying the stem 20 rotatably supports the upper end portion of the stem and delivers fluid thereto. The swivel coupling preferably involves, generally, a female section 50 with a socket opening 51, a male section 52 with an inner end portion 53 entered in the socket 51, and anti-friction bearing means 54 retaining the portion 53 in the socket 41 for free rotation. In the particular case illustrated the male section is joined to the upper end of stem 20 as by a threaded connection 56 and it projects upwardly therefrom to enter the female section 50. The anti-friction bearing means 54 retaining the portion 53 of the male section in the socket 51 of the female section preferably involves two or more annular rows of balls carried in registering grooves 57 in the connected parts. An access opening 58 is provided for inserting the balls into operating position and is normally closed by a suitable plug closure 59. In practice suitable packing or sealing means are provided in connection with the sections 50 and 52 to prevent leakage of fluid. In the case illustrated a packing ring 63 is provided between the bottom of the socket 51 and the inner end of male portion 53 and a packing ring 64 is provided in the outer portion of the socket 51 to engage around the portion 53 where it enters the socket. This arrangement of packing rings or members retains lubricant in the bearing or anti-friction elements and prevents leakage of fluid being handled by the structure.

The female section 50 may vary in shape and extent depending upon the manner in which the stem 20 and the supply line B are related. In a case where the stem 20 is vertically disposed and the supply line B is horizontally disposed it is desirable to form the female section 50 as an L-shaped tubular fitting with a receiving end portion 60 which is horizontally disposed. In the particular case illustrated an extension 61 of the female section 50 is joined to the part 60 by a suitable threaded connection 62.

The releasable joint provided for connecting the section 50 of the swivel coupling with the supply line B preferably connects the extension 61 to the end of the line B. In the case illustrated the releasable joint is in the form of a union type coupling or connection involving sections 70 and 71 on the extension 61 and supply line B, respectively, and a threaded collar 72 carried by one of the sections and engaging the other joins the sections 70 and 71 so that they are normally clamped together but can be released when desired.

In the preferred form of the invention handles 80 are provided on the stem 20 at or near the upper end portion thereof and in the case illustrated the handles extend radially and upward from points where they are joined to the stem so that they are in the upper portion of the container A where they are readily accessible and make it possible to turn the rotor manually if desired. Manual operation may be required or desirable to initiate operation of the rotor after heavy material has been allowed to stand in the container in such manner as to pack on or behind the rotor. Further, in practice it may be desirable to provide suitable agitators or paddles 90 on the stem 20 of the rotor at suitable points

along the rotor, which agitators may involve vanes or blades which cause material to circulate in the desired direction in the vicinity of the stand.

From the foregoing description it will be apparent that the present invention provides a rotor of very simple, yet dependable, construction and the rotor, being joined to the supply line B by the coupling means D, can be readily detached from the supply line B when desired for removal or repair. In practice various fluids may be handled by the line B and supplied at suitable pressures to cause the desired operation of the rotor and as fluids issue from the nozzles 27 at high velocities the rotor is suitably operated, causing mixing or agitation of material in container A by reason of movement of the rotor itself and by reason of the mixing and agitating effect of the fluid discharged from the nozzles.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. In combination, a container, a fluid supply line extending to the upper portion of the container, means fixing the supply line to the container at the upper end thereof, a rotor in the container, and coupling means rotatably coupling the rotor and line so fluid from the line is delivered to the rotor, the rotor including, a tubular flow conducting stem with its upper end rotatably held by the coupling means and a head on the lower end of the stem with an angularly disposed nozzle discharging fluid into the container so reactionary forces cause operation of the rotor, the coupling means including a fluid handling swivel connection in the upper end portion of the container and carrying the stem and a releasable fluid handling union joining the swivel connection to the supply line.

2. In combination, a container, a fluid supply line extending horizontally into the upper portion of the container, means supporting the line in fixed position in the container at the top thereof, a rotor in the container, and coupling means rotatably coupling the rotor and line so fluid from the line is delivered to the rotor, the rotor including, a vertically disposed tubular fluid handling stem having its upper end rotatably held by the coupling means and a head on the lower end of the stem with an angularly disposed nozzle discharging fluid into the container so reactionary forces cause operation of the rotor, the coupling means including, two fluid handling sections one L-shaped and having a horizontal portion and a depending portion and the other a straight tubular part carrying the stem and engaged in said depending portion, means coupling the sections for relative rotation, and a releasable fluid handling union joining said horizontal portion to the said line, the said section being angular in form.

3. In combination, a container, a fluid supply line extending to the upper portion of the container, a rotor in the container, coupling means rotatably coupling the rotor and line so fluid from the line is delivered to the rotor, the rotor including, a tubular flow handling stem having its upper end engaged with the coupling means, the coupling means including a tubular section fixed on the upper end of the stem, an L-section with a depending portion receiving the tubular section and having a horizontally disposed portion, an anti-friction bearing rotatably retaining the tubular section in the depending portion of the L-section, and a flow handling union releasably connecting the supply line and said horizontal portion of the L-section, a body on the lower end of the stem receiving fluid therefrom, and a reactionary nozzle on the body receiving fluid therefrom, and bearing means supporting the body including a depending projection on the body and a bearing supported in the container and carrying the projection.

4. In combination, a container, a fluid supply line extending to the upper portion of the container, a rotor in the container, coupling means in the upper portion of the container rotatably coupling the rotor and line so fluid from the line is delivered to the rotor, the rotor including, a tubular flow handling stem having its upper end rotatably held by the coupling means, a body on the lower end of the stem receiving fluid therefrom, and a plurality of circumferentially spaced tangentially disposed nozzles projecting from the body and supplied with fluid therefrom, and bearing means supporting the body including a bull plug depending from the body in line with and open to the stem and a bearing supported in the container and rotatably carrying the plug.

5. A structure applicable to a container having a fluid supply line extending into the upper end portion thereof including, a rotor including, a vertical tubular flow handling stem and a body on the lower end of the stem receiving fluid therefrom and carrying a reactionary nozzle, and coupling means connecting the supply line and the stem of the rotor for free rotation of the stem and conducting fluid to the stem, the coupling means including a releasable flow handling union joined to the supply line and an anti-friction fluid handling swivel joint carrying the upper end of the stem and passing fluid thereto.

6. A structure applicable to a container having a fluid supply line extending to the upper end thereof including, a rotor including, a vertical tubular flow handling stem, a body on the lower end of the stem receiving fluid therefrom and having a lateral fluid outlet opening, and a reactionary nozzle carried by the body and supplied with fluid through said opening, releasable coupling means connecting the supply line and the stem of the rotor for free rotation of the stem and conducting fluid to the stem, and a bearing rotatably supporting the rotor body on the container and including a bull plug depending from the body in line with and open to the stem and a bearing mounted in the container and rotatably supporting the bull plug.

DONALD M. JACKSON.

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