MUD MIXING DEVICE

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A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more clearly understood from a reading of the following specification and by reference to the accompanying drawings, wherein examples of the invention are shown, and wherein:

Fig. 1 is a view in elevation of the front of a mud mixing device constructed in accordance with this invention,

Fig. 2 is an end elevation taken from the left-hand end of Fig. 1,

Fig. 3 is a vertical, sectional view taken along the axis of the right hand hopper as viewed in Fig. 1,

Fig. 4 is a perspective view, partly broken away, of the driving motor,

Fig. 5 is a fragmentary plan view of the lower ends of the hoppers, and

Fig. 6 is an enlarged, fragmentary, vertical, sectional view of the aspirator structure.

In the drawings, the numeral 10 designates a rectangular support upon which a pair of elongate mud hoppers 11 are carried in spaced parallel relation. The support includes a rectangular base 12 adapted to rest upon the ground at the site adjacent the mud line A. The base 12 is provided with a pair of elongate tubular side members 13 joined in spaced parallel relation by transverse, tubular end members 14 which are secured between the side members and at each end thereof.

Each of the hoppers 11 is formed of an elongate, cylindrical drum having one end 15 open and the opposite closed end 16 pierced by an axial opening 17. An integral, hollow, cylindrical sleeve or neck 18 extends axially from the closed end of each of the hoppers and is aligned with the opening 17 so that its bore forms a continuation of the latter. The sleeves 18 are surrounded by flanged, cylindrical bearing sleeves 19 formed of brass or bronze, or some other suitable bearing material, the annular flanges 20 of said bearing sleeves abutting the outer surfaces of the closed bottoms 16. Each of the bearing sleeves is in turn received within a cylindrical supporting sleeve or collar 21 having an annular flange 22 abutting the outer surface of the flange 20 and being co-extensive therewith in a radial direction.

The hoppers 11 are supported upon the base 10 at an angle so that the open upper ends 15 of the hoppers are positioned at an elevation a sizable distance above the closed lower ends 16 of said hoppers. This structure causes mud...
compound introduced through the open ends to pass to the lower end of the hoppers and be carried upon the bottoms thereof. For supporting the lower ends of the hoppers, a pair of legs 23 are secured to the longitudinal base 13 adjacent said lower ends and extend upwardly therefrom at an angle to the periphery of the supporting sleeves 21. Each pair of legs have their upper ends welded, or otherwise suitably secured to the sleeve 21 so as to support the same immovably with respect to the base or frame member 10. While the sleeves 21 are thus securely held, the bearing sleeves 18 permit the necks 18 of the hoppers to rotate therein, and at the same time the provision of the flanges 20 and 22 permits the sleeves 21 to carry a considerable portion of the endwise thrust of the hoppers.

For supporting the upper end of the hoppers, each hopper carries an annular bearing band 24 in circling its outer periphery at a point adjacent the upper end thereof. A pair of posts 28 extend upwardly at an angle from the longitudinal frame member 13 upwardly supporting the upper ends of the hoppers, one pair of said posts being disposed beneath each of the hoppers. Suitable rollers 26 are carried upon the upper ends of the posts and the bearing bands 24 rest thereon. In this manner the hoppers are adequately supported at their upper ends, but still are free to undergo rotation or revolution with respect to the frame 10. Each hopper carries a transverse screen or perforated disk 27 extending transversely of its interior adjacent the position of the bearing band 24. The screen disks 27 serve to exclude humus or foreign material which may be present in the mud compounds being added, and also serve as abrasive surfaces which disintegrate and comminute such humus as the hoppers are rotated whereby the material may pass downwardly through the disks.

For revolving the hoppers 11, a fluid motor 28 is provided. The motor includes a relatively narrow upright housing 29 having an open top closed by a lid 30. A suitable reaction type bucket wheel 31 is rotatably supported within the housing 29 upon a shaft 32 journaled in the side walls of said housing. A fluid inlet conductor 33 is carried in the upper portion of one end wall and extends downwardly at an angle therethrough so as to direct incoming fluid upon the buckets or paddles 34 of the wheel 31. An outlet or drain 35 is provided in the lower portion of the opposite end wall for permitting the fluid to drain or pass from the housing. Any suitable or desirable means may be provided for supplying fluid under pressure to the inlet 33, it being preferable to employ a by-pass line (not shown) extending from the drilling mud pressure line A for this purpose. Of course, the outlet 35 is normally connected to the mud pits so as to conserve the drilling fluid passing through the fluid motor 28.

The portion of the shaft 32 extending through the outer side wall of the housing 29 projects laterally therefrom and carries a suitable pulley or gear pinion 36. A somewhat larger pinion or pulley 37 is aligned with the pulley 36 and carried upon a shaft 38 journaled upon the inlet end wall of the housing. An endless belt or chain 39 passes around the pulley 36 and 37 so as to transmit rotative motion therebetween. A ring gear housing 40 has its marginal portion secured to the housing 29 and is provided with a ring gear (not shown) from which a shaft 41 extends in parallel relation with respect to the hoppers 11. The upper end of the shaft 41 is carried in a suitable pillow block bearing 42 supported upon an arm 43 extending laterally from the inner side wall of the housing 29. The shaft 38 extends into the housing 40 and carries a beveled pinion (not shown) which meshes with the beveled outer end of the housing 29. With this structure, the shaft 38 revolves the shaft 41 through the reduction gearing in the housing 40.

The shaft 41 carries a plurality of relatively small pulleys 44, and a plurality of endless flexible belts 45 pass around said pulleys and also around the inner end of the pulley 37, as viewed in Figure 1. Rotation of the shaft 41 is thus transmitted to the hopper 11. For rotating the right-hand hopper, as viewed in Figure 1, each of the hoppers is provided with an integral, grooved ring 46 formed upon the outer side of the bottoms 18 of the hoppers and positioned eccentrically with respect to the projecting necks 18. The inner periphery of the rings 46 are engaged by the flanges 20 and 22 and thus serve as additional retaining means for the bearing sleeves 18 and the supporting 11 of the hoppers. The outer peripheries of the rings 46 are provided with a series of helical grooves 47, and an endless flexible belt 48 engages in said grooves and extends between the lower ends of the hoppers as shown in Figure 1. An idler pulley 49 is carried upon a post 50 extending vertically upward from the housing 29, with the belt 48 so as to maintain tension therein. By means of a belt 50, rotation of the left-hand hopper 11 results in rotation of the right-hand hopper so that the fluid motor 28 may drive both.

It is to be noted that the speed of revolution of the various elements providing the motion to the hopper is continuously stepped down with the resultant increase in mechanical advantage. The shaft 38 is driven at a somewhat lower speed than the shaft 32, and the shaft 41 is driven at a considerably lesser speed than the shaft 32. An additional speed reduction is obtained in the connection between the left-hand hopper 11 and the pulleys 44 by means of the belt 48, so that the total overall reduction of speed of revolution as between the paddle wheel 31 and the hopper 11 is of considerable magnitude. In accordance with well-known laws of mechanics, the mechanical advantage achieved is inversely proportional to the degree of speed reduction so that a relatively small amount of power applied by the paddle wheel 31 so as to revolve said wheel at a moderate to high speed will carry a quite considerable load as represented by the revolution of the hoppers 11, it being kept in mind that said hoppers are revolved at a much lesser speed than said paddle wheel.

For the purpose of metering the flow of mud compound from the hoppers, a valve arrangement is provided within each of the necks 18. The arrangement includes a cylindrical valve plug 51 having a sliding fit within the bore of the neck 18 and being formed with an operating rod 52 which is received in the lower end thereof. The lower end of each of the plugs 51 is cut at an angle so that as said plugs are moved upwardly within the necks 18, an increasingly larger opening or gap is exposed between the upper end of the necks and the lower end of the valve plug which is cut at an angle. A guide sleeve 53 encircles the medial portion of the operating rod 52 and is carried upon an angular bracket 54 depending from the upper portion of the supporting sleeve 21.

It is, of course, desirable to regulate the rate of flow of mud compound from the hoppers, and
often to set each of the hoppers so as to deliver its particular mud compound at a rate differing from that of the other hopper. For this reason, individual adjusting means are provided for the two valve plugs $41$, so that each hopper may be adjusted to deliver mud compound at the desired rate independently of the adjustment of the opposite hopper. For this adjusting purpose, an elongate rod $65$ is disposed adjacent to and parallel to each of the hoppers $11$. The lower ends of the rods $65$ are supported for revolution by bearings $66$ carried upon posts $67$ extending upwardly from the frame $10$. The rearward portion or upper portion of the rods $65$ are screw-threaded and are received within screw-threaded sleeves $68$ supported upon arms $69$ extending laterally and upwardly from the posts $32$. A handle $66$ is formed upon the upper end of each of the rods $65$. With this structure, the rods may be revolved by means of the handles $66$ and caused to move longitudinally by reason of their engagement in the screw-threaded sleeve $68$. The lower ends of the rods are bent inwardly at almost a 90 degree angle to form inwardly directed arms $61$, the inner ends of the inwardly projecting arms being pivotally connected to the lower ends of the operating rods $62$. The arms $61$ are rigid with the rods $65$ so that longitudinal movement of said rods causes the valve operating rods $62$ to move longitudinally within the bores of the necks $18$. In this manner, the valve plugs $61$ are caused to shift longitudinally or axially with respect to the necks and regulate the rate at which mud compound flows from each of the hoppers $11$. If desired, suitable lock nuts $62$ may be provided upon the screw-threaded portions of the rods $65$ and moved into engagement with the sleeves $68$ to lock the rods in the desired position.

As the hoppers are revolved, the mud compound contained therein is tumbled and agitated and caused to flow outwardly through the bores of the necks $18$ in accordance with the adjustment of the valve plugs $61$. The metered flows of mud compounds pass from the open lower ends of the hoppers and drop into angular troughs $63$ carried by the frame $18$ immediately below the open lower ends of the necks $18$. The mud line $18$ is provided with a nozzle fitting $64$ connected therein, said fitting having an internal aspirator nozzle $65$ through which the drilling fluid or mud flows under pressure. A branch pipe or conductor $66$ extends laterally from the fitting $64$ and communicates with the annular space surrounding the nozzle $65$. By reason of the aspirator structure and action achieved by the nozzle, a certain degree of suction is exerted within the branch pipe or conductor $66$. The pipe $66$ extends vertically from the fitting $64$ and the mud line $18$ is provided with an open upper end as shown in Figure 6. The troughs $63$ are inclined downwardly from the lower ends of the hoppers, and each have their lower end overlying the open upper end of the branch pipe $66$. Mud compound flowing from the hoppers thus slides by gravity downwardly in the troughs $63$ into the branch pipe $66$. The outlet in this branch conductor facilitates the entry of the mud compound thereinto so that the latter passes into the drilling fluid or mud stream flowing through the mud line $18$. Because of the turbulence and agitation created by the nozzle $65$, the mud compound is thoroughly mixed into the drilling fluid which passes onwardly to be returned to the aid pits or to be conducted directly into the bore of the well being drilled.

It is to be noted that the provision of two hoppers allows the addition of two different types of mud compound at the same time, and this addition may be accomplished in very definite quantities and proportions by the proper adjustment of the valve plugs $61$. The desired types of mud compounds are thus added in the desired proportions and quantities so that the nature and consistency of the drilling fluid may be carefully controlled and regulated. Of course, it is not essential that the fluid passing through the line $A$ be drilling fluid since it may just as well be ordinary water to which mud compound is being added for the purpose of making up a quantity of drilling fluid.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. A mud mixing device including, a supporting base, a mud hopper rotatably mounted on the base, a valve in the lower end of the hopper through which mud is discharged, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, means for conducting to the aspirator structure mud discharged from the hopper, a fluid motor operated by the fluid under pressure, and a driving connection between the motor and the hopper for revolving the latter.

2. A mud mixing device including, a supporting base, a mud hopper rotatably mounted on the base, a valve carried by the supporting base in the lower end of the hopper through which mud is discharged, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, means for conducting to the aspirator structure mud discharged from the hopper, a fluid motor operated by the fluid under pressure, and a driving connection between the motor and the hopper for revolving the latter.

3. A mud mixing device including, a supporting base, a mud hopper rotatably mounted on the base, a metering type valve communicating with the lower end of the hopper through which mud is discharged, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, means for conducting to the aspirator structure mud discharged from the hopper, a fluid motor operated by the fluid under pressure, and a driving connection between the motor and the hopper for revolving the latter.

4. A mud mixing device including, a supporting base, a plurality of mud hoppers rotatably mounted on the base, valves communicating with the lower ends of the hoppers through which mud is discharged, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, means for conducting to the aspirator structure mud discharged from the hoppers, a fluid motor operated by the fluid under
pressure, and a driving connection between the motor and the hoppers for revolving the latter.

5. A mud mixing device including, a supporting base, a mud hopper rotatably mounted upon the base in an inclined position, a sleeve communicating with the lower end of the hopper, a metering type valve plug in the sleeve, adjusting means extending from the opposite end of the hopper and carried by the base externally of the hopper for adjusting the position of the valve plug and the rate of mud discharge from the hopper, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, means for conducting to the aspirator structure mud discharged from the hopper, and means for revolving the hopper.

6. A mud mixing device as set forth in claim 5 wherein the means for revolving the hopper is a fluid motor operated by the fluid under pressure.

7. A mud mixing device including, a supporting base, a mud hopper rotatably mounted upon the base in an inclined position, a sleeve communicating with the lower end of the hopper, a metering type valve plug rotatable in the sleeve, an operating rod carried by the valve plug extending from the lower end of the sleeve, adjusting means extending from the opposite end of the hopper and carried by the base externally of the hopper, the adjusting means being connected to the operating rod for adjusting the position of the valve plug and the rate of mud discharge from the hopper, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, means for conducting to the aspirator structure mud discharged from the hopper, and means for revolving the hopper.

8. A mud mixing device as set forth in claim 7 wherein the means for revolving the hopper is a reaction type fluid motor operated by the fluid under pressure, and a compound speed-reducing driving connection between the motor and the hopper.

9. A mud mixing device including, a supporting base, a mud hopper rotatably mounted upon the base in an inclined position, a sleeve secured to the lower end of the hopper, a metering type valve plug in the sleeve, means holding the valve plug against rotation, adjusting means extending from the opposite end of the hopper and carried by the base externally of the hopper for adjusting the position of the valve plug and the rate of mud discharge from the hopper, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, means for conducting to the aspirator structure mud discharged from the hopper, and means for revolving the hopper.

10. A mud mixing device, including, a supporting base, a plurality of mud hoppers rotatably mounted upon the base in an inclined position, sleeves secured to the lower ends of the hoppers, a metering type valve plug in each sleeve, means holding the valve plugs against rotation, adjusting means extending from the opposite ends of the hoppers and carried by the base externally of the hoppers for adjusting the positions of the valve plugs and the rates of mud discharge from the hoppers, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hoppers, means for conducting to the aspirator structure mud discharged from the hoppers, and means for revolving the hoppers.

11. A mud mixing device including, a supporting base, a mud hopper rotatably mounted on the base, a valve communicating with the lower end of the hopper through which mud is discharged, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hopper, a chute extending between the aspirator structure and the discharge end of the hopper for conducting mud, and a fluid motor operated by the fluid under pressure for revolving the hopper.

12. A mud mixing device including, a supporting base, a plurality of mud hoppers rotatably mounted on the base, valves communicating with the lower ends of the hoppers through which mud is discharged, a conductor carrying a fluid under pressure, an aspirator structure in the conductor responsive to the flow of fluid through the conductor to draw into said fluid the mud discharged from the hoppers, a chute extending between the aspirator structure and the discharge end of the hopper for conducting mud, and a fluid motor operated by the fluid under pressure for revolving the hoppers.

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