United States Patent

[11] **3,563,255**

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[54] **APPARATUS FOR COLLECTING AND WASHING WELL CUTTINGS**
20 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **134/133,** 134/183, 209/159
[51] **Int. Cl.** **B08b 3/04**
[50] **Field of Search** 134/117, 133, 182, 183, 25; 209/159

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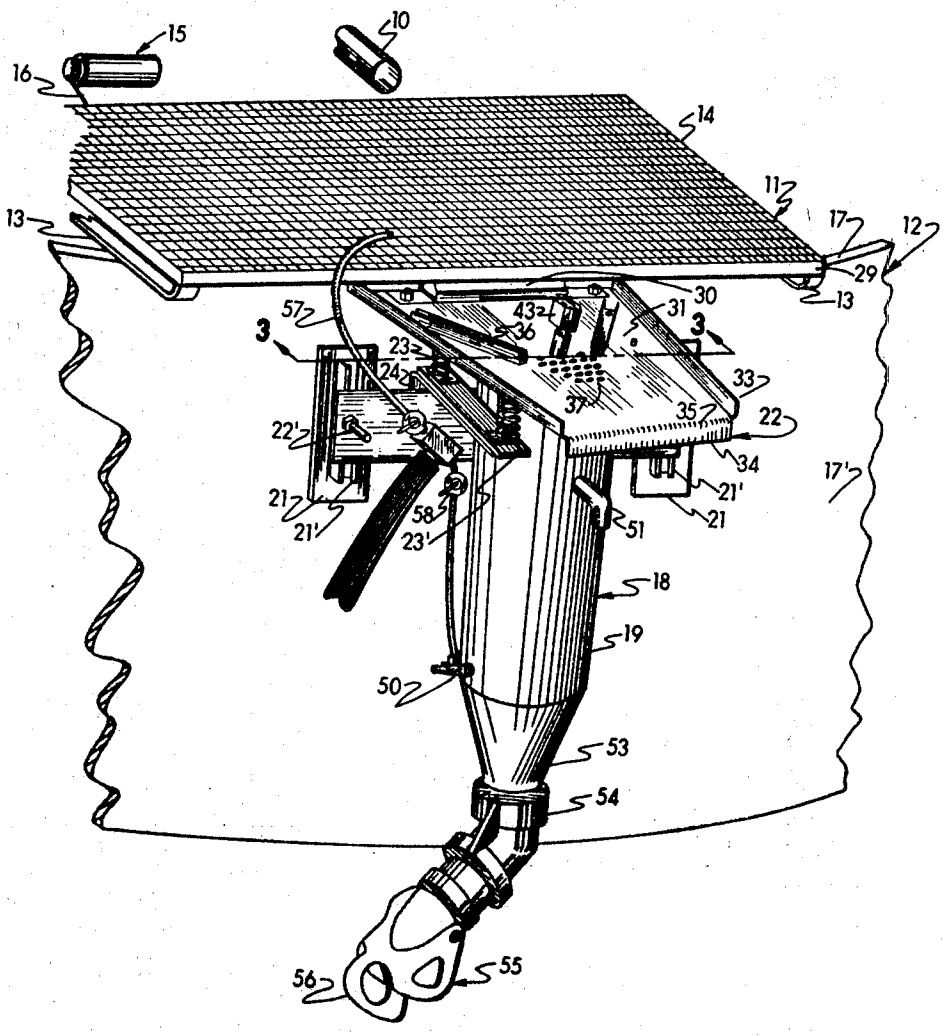
ABSTRACT: A drill cuttings sample collector and washer, which attaches to the front wall of the mud tank of a drill rig equipped with a vibrating shale shaker table. The sample collector includes a stationary outer water vessel secured to the mud tank and a cuttings collector plate and a cuttings container spring-suspended within the water vessel, taking vibratory motion from the shaker table. An adjustable stream of drill cuttings from the shale shaker is caught by the collector plate and discharged into the vibrating cuttings container, the cuttings. The washed cuttings are caught at the bottom of the washing action takes place to remove the mud from the cuttings. The washer cuttings are caught at the bottom of the water vessel and periodically removed for examination.



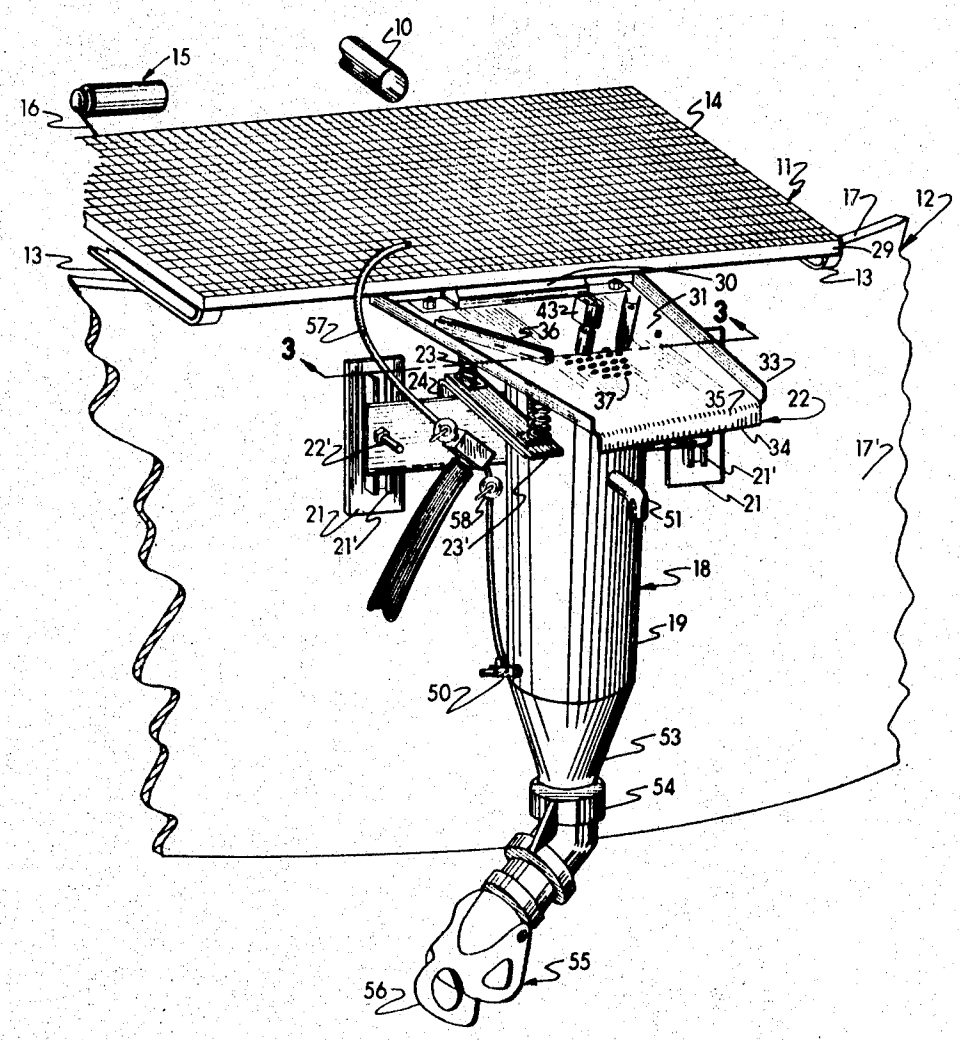


FIG. 1

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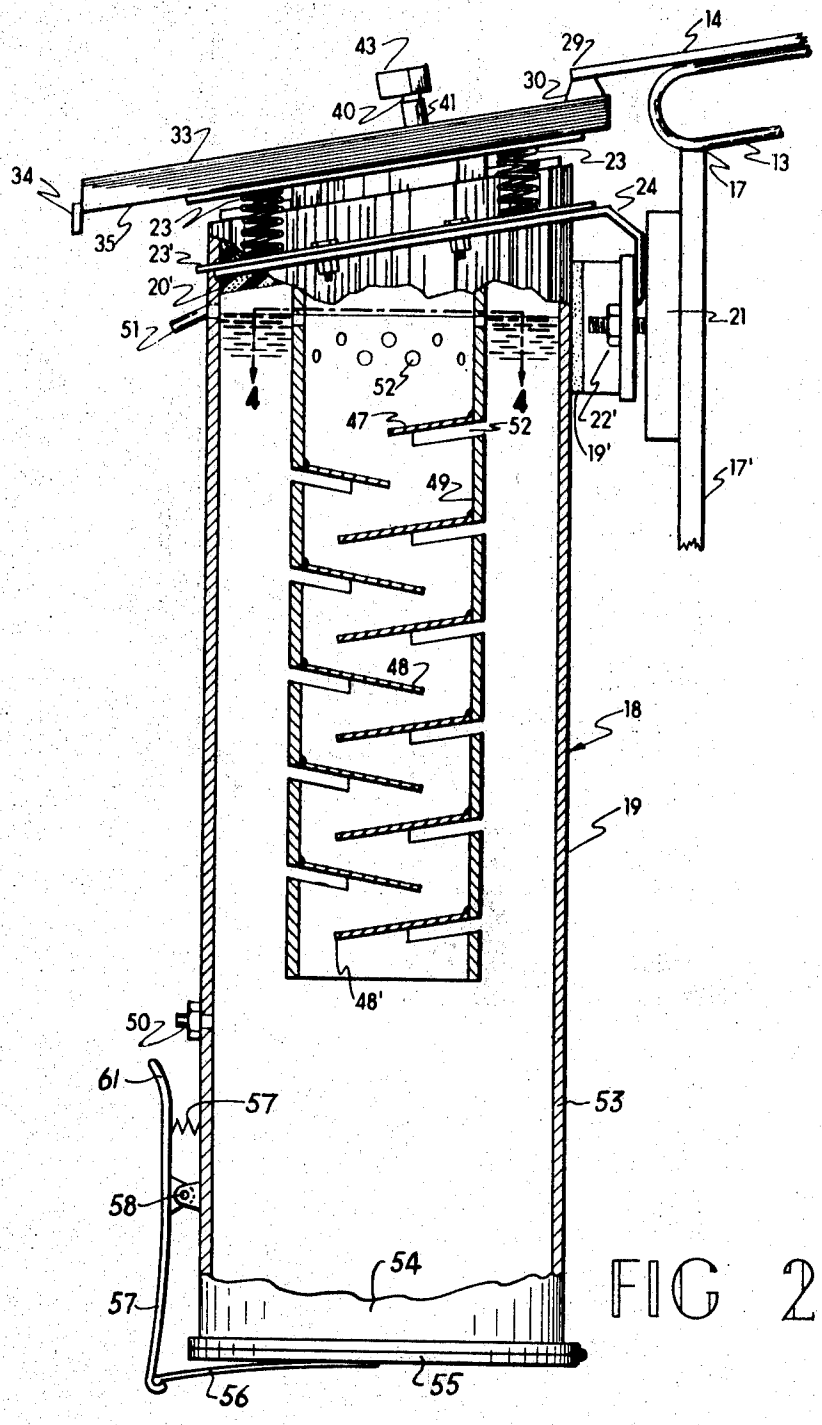

FIG 2

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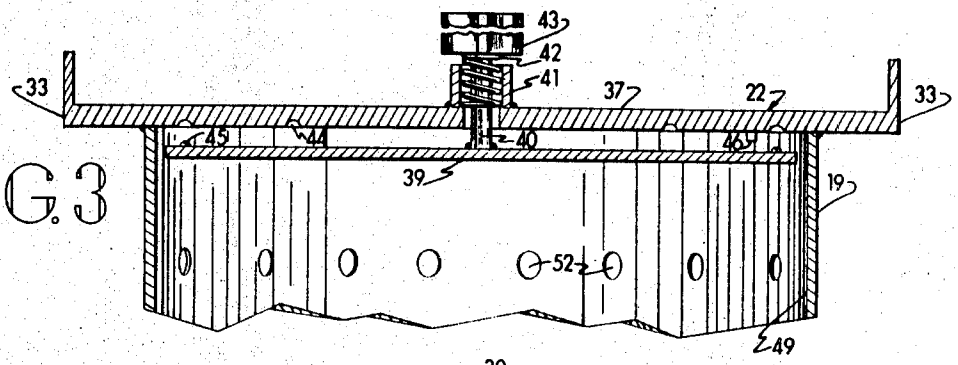
FIG. 3



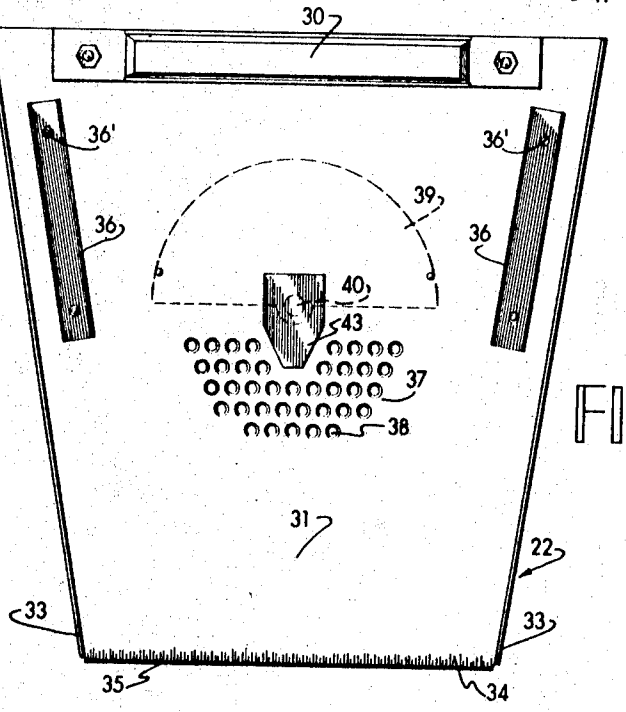


FIG. 6

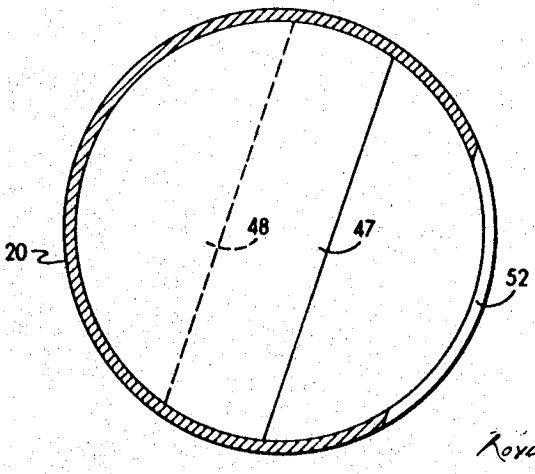


FIG. 4

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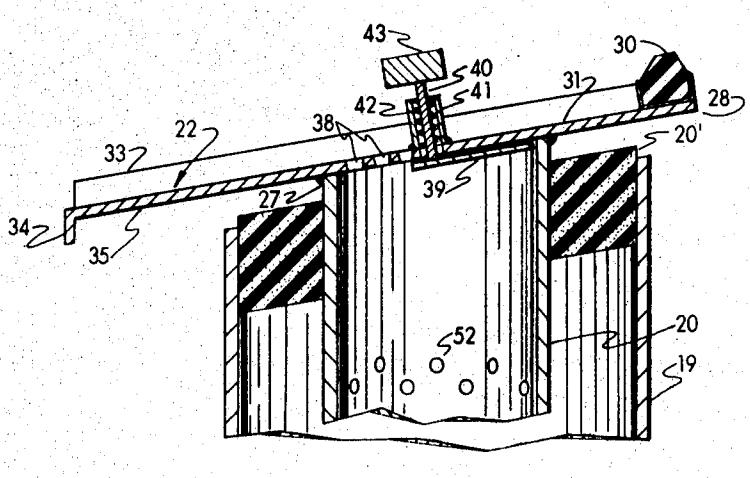

FIG. 5

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APPARATUS FOR COLLECTING AND WASHING WELL CUTTINGS

In the art of bore hole drilling through rock, it is conventional to use a drilling mud or fluid which flushes the drilling cuttings and chips to the surface.

The mixture of drilling mud, cuttings and chips are then normally separated by means of a shale shaker so that the drilling mud can be recovered and reused.

It is desirable to take periodic samples of the cuttings and chips during the drilling operation so that, by analysis, the character and composition of the rock being drilled can be ascertained.

It is conventional to collect some of the cuttings and chips from below the front of the shaker, place same in a bucket and fill the bucket with water. The sample is then agitated by hand in order to remove the traces of drilling mud therefrom, and then screened for particle sizing.

This operation is unsatisfactory for several reasons:

firstly—it is extremely tedious and time consuming;

Secondly—the sample is not representative of the drilling cuttings and chips, because said sample is taken from the shaker at one specific time, and accordingly will not be representative of the total flow of cuttings and chips.

These disadvantages have been overcome by the present device, which consists essentially of a collector plate operatively secured to the front edge of the shaker table and adapted to collect continuously a relatively small sample stream of the drilling cuttings and chips passing over the shaker table. This sample stream is prescreened as it passes through an inner container which is continuously agitated within a water bath in an outer container by the action of the shaker table. Water is continuously flushed through the device so that as the sample stream passes by gravity downwardly through the inner container, the drilling mud is washed therefrom. The movement of the drilling cuttings and chips downwardly through the inner container is impeded by means of overlapping baffles so that an efficient cleaning action is achieved. The cleaned sample is collected at the bottom of the outer container whereupon it may be removed as desired by opening a discharge valve at the bottom of the outer container.

Also incorporated in the device is an adjustable plate which controls the volume of the sample stream passing into the device so that within limits, a constant size of sample can be obtained regardless of the amount of material passing over the shaker table.

Another advantage of the device of the invention is the method of the drive, by which the connection between the reciprocating shaker table and the collector plate is frictional, thus making it extremely simple to attach and remove the device from the conventional shaker table assemblies.

The use of the device of the invention enables the operator to take a continuous sample stream of the drilling cuttings and chips which are collected and held within the device until it is desired to remove some for examination and analysis.

Furthermore, the device is relatively simple in construction, economical in manufacture, and otherwise well suited to the purpose for which it is designed.

With the foregoing in view, and all those objects, purposes or advantages which may become apparent from consideration of this disclosure and specification, the present invention consists of the inventive concept embodied in the method, process, construction, arrangement of parts, or new use of the same, as herein particularly exemplified in one or more specific embodiments of such concept, reference being had to the accompanying FIGS. in which:

FIG. 1 is an isometric view (partially schematic) of a conventional shaker table and mud tank assembly with the device of the invention secured thereto.

FIG. 2 is a partial cross-sectional view of the device also depicting the method of connection between the shaker table and the device of the invention.

FIG. 3 is an enlarged fragmentary cross-sectional view of the collector plate taken along the line 3—3 of FIG. 1, 3–3 of FIG. 1, showing the means for adjusting the size of the sample passing therethrough.

FIG. 4 is a lateral cross-sectional view of the inner cylinder, taken along the line 4– of FIG. 2, showing the arrangement of the interim baffle plates.

FIG. 5 is a longitudinal cross-sectional view of the upper portion of the device, depicting the means of suspending the inner cylinder within the outer cylindrical water container.

FIG. 6 is a top plan view of the collector plate.

In the drawings like characters of reference indicate corresponding parts in the different FIGS.

Proceeding therefore to describe the arrangement of the invention and the associated well drilling equipment in detail, reference should first be made to FIG. 1 which shows schematically a conventional shaker table and mud tank.

The drilling mud or fluid together with the drilling cuttings and chips are discharged from the drill assembly (not illustrated) through a conduit 10 onto a shaker table assembly generally designated 11 in FIG. 1, situated above a collecting mud tank 12.

The shaker table 11 is normally mounted upon springs 13 or other resilient mounting means connected to the mud tank 12, and itself comprises the planar table 14, the surface of which is constructed of a relatively fine mesh screen. A source of power 15 such as a fractional horsepower electric motor operates an eccentric drive 16, schematically depicted in FIG. 1, and imparts oscillating movement to the shaker table 14 mounted upon the resilient spring mounts 13. The shaker table surface 14 is inclined downwardly from the discharge conduit 10 towards the outer edge 17 of the mud tank 12 so that the drilling mud or fluid passes through the screen and the drilling cuttings and chips are gradually urged downwardly by the inclination of the shaker table and the oscillating movement imparted thereto, to be discharged over the side of the mud tank.

The device of the invention, collectively designated 18, consists essentially of an outer cylindrical water container 19 mounted rigidly to the front wall 17′ of the mud tank 12, a cuttings collector plate 22 resiliently spring mounted upon mounting brackets secured to the front wall 17′ of the mud tank 12 and in frictional contact with the oscillating shaker table 11 and thereby deriving oscillating motion therefrom, and an inner container 20, rigidly mounted under the cuttings collector plate 22 and suspended coaxially within the outer cylindrical water container 19 and oscillating with the cuttings collector plate 22. A water bath is maintained in the water container 19, and the inner container 20 is continuously agitated within the water bath. A controlled portion of the cuttings stream, which is normally discharged over the side of the mud tank 12, falls onto the cuttings collector plate generally designated 22, and is diverted and screened into the inner container 20, where it passes downwardly over a series of overlapping baffle plates 48 located within the inner container 20, which is continuously agitated therein by the derived oscillating motion from the shaker table 11. The washed cuttings stream passes longitudinally downwards through the inner container 19, from which the washed cuttings are withdrawn as required.

Proceeding then to describe the device of the invention in further detail, the substantially cylindrical water container 19 is rigidly mounted substantially vertically on the outer wall 17′ of the mud tank 12 with the bracket 19′ secured to the side of the water container 19 as clearly shown in the drawings. The upper end of the water container 19 is inclined from the horizontal, at an angle substantially equal to the angle of inclination of the shale shaker table 14, as will be hereinafter explained.

A pair of mud tank brackets 21 secured, as by welding, to the front wall 17′ of the mud tank 12, enable the apparatus to be readily attached to conventional drill rigs. A pair of adjustment bolts 22′, operating in vertical adjustment slots 21′

formed in each of the mud tank brackets 21, permit the entire apparatus to be moved vertically relative to the mud tank 12, over a limited range, the purpose of which will become hereinafter apparent.

The water container 19 is open at the upper end thereof to receive the substantially cylindrical inner container 20 which is positioned concentrically therewithin by a resilient annular sleeve 20' desirably constructed of soft rubber, as depicted in FIG. 5, thus providing an annular space 20'' between the inner container 20 and the outer water container 19.

The inner container 20 is rigidly secured at its upper open end 27 to the underside of the cuttings collector plate 22, in substantially vertical depending relationship thereto, as depicted in FIG. 5. The upper open end 27 of the inner container 20 is inclined from the horizontal by the same angle as the upper end of the water container 19, as depicted in FIG. 5, so that when the inner container 20 is suspended with the water container 19 and may be positioned parallel with, and in spaced relationship to the upper open end thereof.

Resilient suspension of the cuttings collector plate 22 and the inner container 20 is provided by spring members, such as the four helical springs 23, which are secured to the cantilevered spring-mounting arms 23' of a pair of mounting brackets 24, disposed at each side of the outer container 19. It will therefore be apparent the both the cuttings collector plate 22 and the inner container 20 are resiliently mounted in relation to the fixed and stationery outer water container 19. Additionally, it will be apparent that the orientation of the cuttings collector plate 22 relative to the inner container 20 is such that although the inner container is positioned substantially vertically, the collector plate 22 inclines downwardly and outwardly from the mud tank 12 at an angle of inclination similar to the angle of inclination of the shaker table 14, so that in effect, it becomes an extension thereof.

The upper edge 28 of the collector plate 22 underlies the front edge 29 of the shaker table 14; a friction pad 30 is secured to the upper surface 31 of the collector plate and engages the under surface 32 of the front edge of the shaker table 14 so that by upwardly adjusting the entire assembly 18 on the mounting brackets 21 relative to the front wall 17' of the mud tank, pressure is applied between the friction pad 30 and the underside 32 of the shaker table 14 against the resilient mounting of the coil spring members 23 so that the oscillatory movement of the shake table 14 is thereby transferred to the collector plate 22 and the inner container 20, thus operatively connecting the device of the invention to the shaker table 14.

The collector plate 22, depicted in detail in FIG. 6, is substantially planar, and is provided with up-turned flanged side edges 33 which converge downwardly towards a discharge lip 34 located at the front edge 35 of the collector plate. Cuttings guide means are formed upon the upper surface of the collector plate 22 and desirably take the form of a pair of adjustable cuttings guide ribs 36, pivoted about a spring-loaded pivot pin 36' which ribs direct the drilling cuttings and chips towards a screen 37 formed in the collector plate 22. It will be apparent that altering the angle of the cuttings guide ribs 36 will vary the size of the sample stream delivered to the screen 37, by controlling the amount of cuttings which will bypass the screen 37 for discharge to waste from the discharge lip 34.

The screen 37 of the collector plate 22 is depicted in detail in FIG. 6 and it will be understood that this area overlies the inner container 20.

The screen 37 is provided with a plurality of apertures 38 communicating with said inner container 20 so that the cuttings sample stream directed towards the screen 37 by the guide ribs 36 will pass through the apertures 38 and into the inner container 20

Additionally, means are provided to further control the quantity of cuttings passing into the inner container 20, said means taking the form of a semicircular plate 39 mounted for rotation centrally under the screen 37, by means of shaft 40 mounted for rotation in a relatively short sleeve 41 extending upwardly from the collector plate 22.

A spring 42 reacts between the collector plate 22 and the adjustment knob 43, thus normally maintaining the plate 39 in interfacial spring-biased contact with the underside of the collector plate 22.

It will therefore be appreciated that the plate 39 can be adjusted for any position between the extremes where all of the apertures 38 are fully open or, alternatively, where all of the apertures 38 are closed off by the plate 39. It is, of course, desirable to provide indexing means permitting the operator to set the plate 39 in a plurality of predetermined positions. I have therefore provided a plurality of drilled recesses 44 upon the underside of the collector plate 22 selectively engageable by upstanding rounded pins 45 provided upon the adjusting plate 39 as shown in FIG. 3.

In order to adjust the plate 39 in relation to the screen 37 of the collector plate, it is merely necessary to push downwardly upon the knob 43 against the pressure of spring 42 thus disengaging the pins 45 from the registering recess 44, and then rotate the plate to the desired position and release the knob 43, whereupon the pins 45 will engage the next registering recess 44 and lock the plate 39 into the desired position.

Also provided is a stop member 46, depicted in FIG. 3, engageable by one of the pins 45, to assist in the initial positioning of the plate 39.

The sample stream passing downwardly through the apertures 38 in the collector plate 22 is discharged into the upper end of the inner cylinder 20 which is open at both the upper and the lower ends thereof.

There is provided a plurality of spaced apart, partially overlapping and downwardly inclining baffle plates 48 secured to the inner surface of the wall 49 of the inner container 20 in mutually successively opposed relationships, as is clearly illustrated.

These baffle plates 48 restrict the downward movement by gravity of the sample stream, thus increasing the path of travel of the sample stream through the water bath, and thereby increasing the effectiveness of the washing.

In this connection there is provided a water inlet 50 adjacent the base of the water container 19 and connected to a source of water. A water outlet 51 is provided adjacent the upper end of the water container 19 and is connected to a suitable disposal. Thus, the water is in counterflow to the downwardly falling sample stream.

The wall 49 of the inner container 20 is perforate or provided with a plurality of drillings or slots 52 so that water continuously passes laterally through the inner container 20, washing the sample moving downwardly therethrough free of drilling mud residue and the like. These perforations or wash ports 52 are desirably positioned immediately under each baffle 48 so that sample particles being agitated in their downward path cannot escape prematurely through the ports, and must travel the full course of the inner cylinder 20.

When the sample stream passes over the lowermost baffles specifically designated 48' in FIG. 2, it falls downwardly through the lower portion 53 of the water container 19 to a sump 54 defined by the base of the water container 19.

A hinged base 55 seals the lower end of the water container 19, and is maintained in closed position by a spring catch 56, secured to the base 55, engaging with a stop member 57, pivotally secured to the water container 19 by pivot means 58, as indicated in FIG. 2. Spring bias is applied to the stop member 57 by a coil spring 59, urging the stop member 57 into engagement with the spring catch 56. Thus, when the operator desires to withdraw the cleaned sample, hand pressure applied against the upper end 61 of the stop member 57 will release the catch 56 thereby discharging the cleaned sample into a storage container.

If the drilling conditions require a heavy mud, it may become necessary to supplement the water content of the shale sample stream as it falls from the shaker table 11 onto the collector plate 22, and for this purpose a flexible water line 57 may be added, as depicted in FIG. 1, tapped to the water inlet 50, and regulated as by the valve 58.

It will therefore be appreciated that a sample of drilling cuttings and chips can be collected continuously, cleaned, screened and withdrawn when desired for analysis and examination.

Since various modifications can be made to the invention herein described within the scope of the inventive concept disclosed, it is not intended that protection of the said invention should be interpreted as restricted to the modification or modifications or known parts of such concept as have been particularly described, defined, or exemplified, since this disclosure is intended to explain the construction and operation of such concept, and not for the purpose of limiting protection to any specific embodiment or details thereof.

I claim:

1. A drill cuttings sample collector and washer securable to the front wall of a conventional mud tank of a drill rig equipped with a vibrating shale shaker table and operable by the shale shaker table of said drill rig, comprising in combination: a stationary water container; means for fixedly mounting said water container to the front wall of said mud tank adjacent said shale shaker table; an open ended inner container moveably disposed within said water container; a shale sample collector plate rigidly secured to the upper open end of said inner container; means on said collector plate adapted to collect plate adapted to collect a continuous sample of rock cuttings from said shale shaker table and to transfer said sample into said inner container; suspension means resiliently connecting said collector plate and said inner container to said water container adapted to permit oscillating movement of said collector plate and said inner container relative to said water container; means operatively connecting said collector plate to said vibrating shaker table and adapted to transmit the oscillating motion of said shaker table to said collector plate and said inner container; water inlet and outlet means connected to and communicating with the said water container adapted to produce a circulation of wash water therein; means within said inner container to increase the path of travel of said rock cuttings samples therethrough; and rock cuttings collecting and discharge means positioned at the lower end of said water container.

2. The device according to claim 1 in which said suspension means resiliently connecting said collector plate to said water container comprise: spring-mounting means fixedly secured to said water container; a plurality of helix coil spring members each having an upper end and a lower end, the lower end of each of said coil spring members being fixedly secured to said spring-mounting means, the upper end of each of said coil spring members being fixedly secured to said collector plate, said suspension means being adapted to position said collector plate to incline downwardly and outwardly from said shaker table at an angle of inclination substantially equal to the angle in inclination of said shaker table.

3. The device according to claim 2 in which said means on said collector plate to collect a sample of rock cuttings from said shale shaker table and to transfer said sample into said inner container includes a pair of cuttings guide ribs adjustably mounted on the upper surface of said collector plate, and perforate means formed through said collector plate above said inner container, said pair of cuttings guide ribs adapted to direct said rock cuttings sample towards said perforate means.

4. The device according to claim 3 which includes additional control means on said collector plate adjustably controlling the quantity of rock cuttings passing through said perforate means.

5. The device according to claim 4 in which said additional control means comprises an adjustable shutoff plate mounted for rotation upon the underside of said collector plate and adapted to be moved across said perforate means from a position whereby all of said perforate means are open to a position whereby all of said perforate means are closed, and to any intermediate position.

6. The device according to claim 5 in which said means in said inner container to increase the path of travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping, opposed relationship one with the other, and secured to the inner surface of the walls of said inner container, said walls being perforate to permit the flow of water therethrough.

7. The device according to claim 4 in which said means in said inner container to increase the path of travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping opposed relationship one with the other, and secured to the inner surface of the walls of said inner container, said walls being perforate to permit the flow of water therethrough.

8. The device according to claim 3 in which said means in said inner container to increase the path of travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping, opposed relationship one with the other, and secured to the inner surface of the walls of said inner container, said walls being perforate to permit the flow of water therethrough.

9. The device according to claim 2 in which said means in said inner container to increase the path of travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping, opposed relationship one with the other, and secured to the inner surface of the walls of said inner container, said walls being perforate to permit the flow of water therethrough.

10. The device according to claim 1 in which said means on said collector plate to collect a sample of rock cuttings from said shale shaker table and to transfer said sample into said inner container includes a pair of cuttings guide ribs adjustably mounted on the upper surface of said collector plate, and perforate means formed through said collector plate above said inner container, said pair of cuttings guide ribs adapted to direct said rock cuttings sample towards said perforate means.

11. The device according to claim 10 which includes additional control means on said collector plate adjustably controlling the quantity of rock cuttings passing through said perforate means.

12. The device according to claim 11 in which said additional control means comprises an adjustable shutoff plate mounted for rotation upon the underside of said collector plate and adapted to be moved across said perforate means from a position whereby all of said perforate means are open to a position whereby all of said perforate means are closed, and to any intermediate position.

13. The device according to claim 12 in which said means in said inner container to increase the path of travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping, opposed relationship one with the other, and secured to the inner surface of the walls of said inner container, said walls being perforate to permit the flow of water therethrough.

14. The device according to claim 12 in which said means operatively connecting said collector plate to said shaker table comprises at least one friction pad secured to said collector plate adjacent said shaker table and frictionally engaging the underside of said shaker table thereby transmitting movement of said shaker table to said collector plate and said inner container.

15. The device according to claim 11 in which said means in said inner container to increase the path of travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping, opposed relationship with the other, and secured to the inner surface of the walls of said inner con-

tainer, said walls being perforate to permit the flow of water therethrough.

16. The device according to claim 10 in which said means in said inner container to increase the path of travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping, opposed relationship one with the other and secured to the inner surface of the walls of said inner container, said walls being perforate to permit the flow of water therethrough.

17. The device according to claim 10 in which said means operatively connecting said collector plate to said shaker table comprises at least one friction pad secured to said collector plate adjacent said shaker table and frictionally engaging the underside of said shaker table thereby transmitting movement of said shaker table to said collector plate and said inner container.

18. The device according to claim 1 in which said means in said inner container to increase the path to travel of said rock cuttings sample therethrough comprises a plurality of downwardly inclining baffle plates situated in spaced apart, partially overlapping, opposed relationship one with the other, and secured to the inner surface of the walls of said inner container, said walls being perforate to permit the flow of water therethrough.

19. The device according to claim 18 in which said means operatively connecting said collector plate to said shaker table comprises at least one friction pad secured to said collector plate adjacent said shaker table and frictionally engaging the underside of said shaker table thereby transmitting movement of said shaker table to said collector plate and said inner container.

20. The device according to claim 1 in which said means operatively connecting said collector plate to said shaker comprises at least one friction pad secured to said collector plate adjacent said shaker table and frictionally engaging the underside of said shaker table thereby transmitting movement of said shaker table to said collector plate and said inner container.