Nov. 15, 1966 W. R. WILEY 3,285,422

SAND TRAP

Original Filed Jan. 3, 1963 2 Sheets-Sheet 1

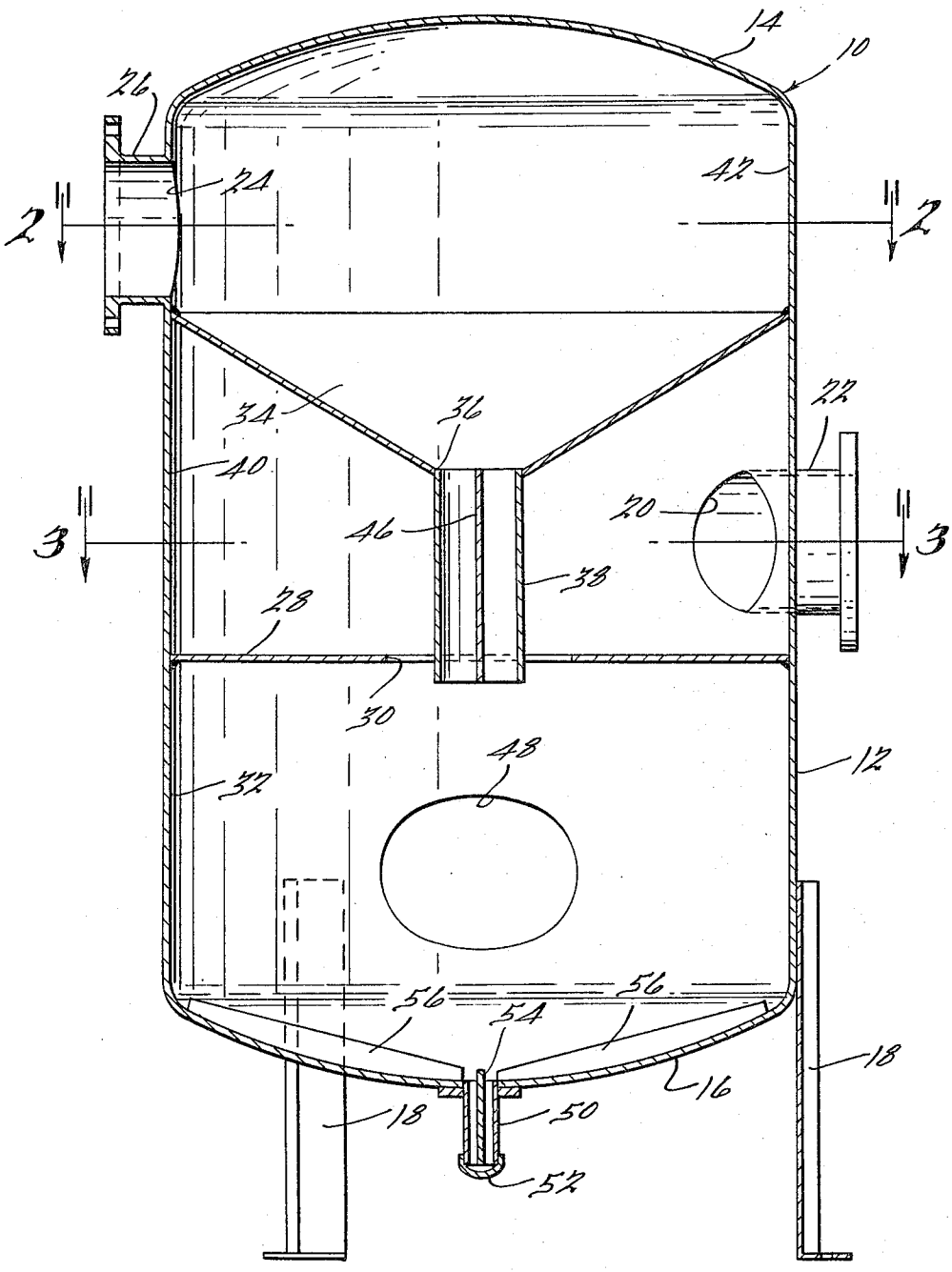


Fig. 1.

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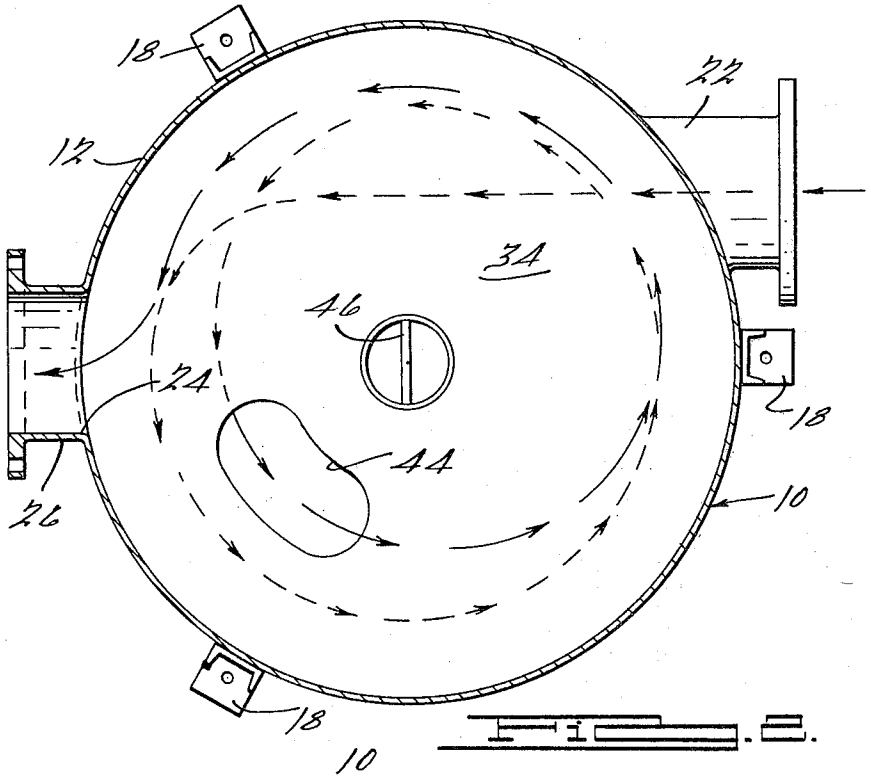


Fig. 1.

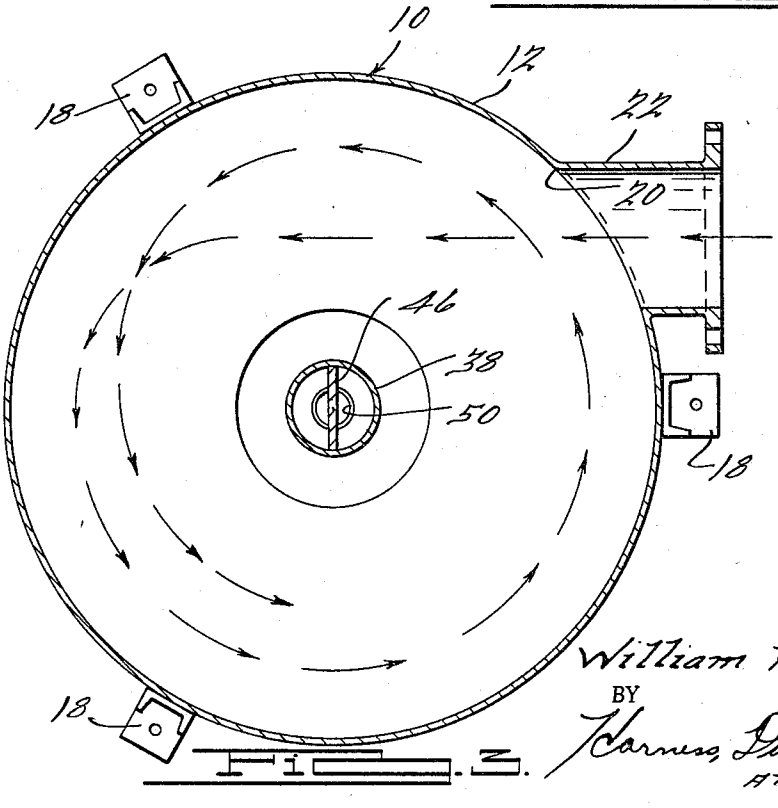


Fig. 2.

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3,285,422

SAND TRAP

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Continuation of application Ser. No. 249,280, Jan. 3, 1963. This application Aug. 10, 1965, Ser. No. 482,995
4 Claims. (Cl. 210—512)

This application is a continuation of my copending application, Serial No. 249,280, filed January 3, 1963, and now abandoned.

This invention relates to sand traps and particularly to a device for separating sand or the like from water in water pumping and delivery systems.

It is an object of the present invention to provide a sand trap having a high degree of effectiveness in removing sand and other similar particles from water being pumped.

It is another object of the present invention to provide a sand trap of the centrifugal separator type which is effective to direct the water in a manner obtaining controlled rotational velocity of the water and causing the sand and other heavy particles to accumulate at the center of the trap.

It is still another object of the present invention to provide a sand trap having means for directing the separated sand to a special repository, where it is stored apart from the clean water flowing through the device.

It is a still further object of the present invention to provide a sand trap which is relatively inexpensive to fabricate, which is of simple, rugged construction, which is easy to maintain and clean, and which possesses a long, useful life.

These and other objects of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a vertical sectional view of a sand trap made in accordance with the present invention; and

FIGS. 2 and 3 are sectional views of the structure illustrated in FIG. 1, taken along the lines 2—2 and 3—3 thereof, respectively.

Referring now to the drawings, the sand trap will be seen to include a sheet metal casing **10** having an enclosing circular cylindrical side wall **12** integrally joined to a top wall **14** and a bottom wall **16**. A plurality of depending legs **18** are fastened to the exterior of the side wall **12** adjacent to the bottom thereof and serve to support the casing **10** on a suitable supporting surface with the axis of the enclosing side wall **12** disposed in a vertical attitude.

The sidewall **12** has an inlet opening **20** at approximately the middle thereof, through which water is admitted to the interior of the casing **10** from an inlet conduit or pipe **22**. The inlet pipe **22** is of circular cross section and is arranged to direct incoming water in a path spaced radially inwardly from the side wall **12** and transversely between the side wall **12** and the axis about which the side wall is generated. Water is discharged from the casing **10** through an outlet opening **24** formed in the side wall **12** and communicating with an outlet pipe **26** integrally formed with the side wall **12**. The outlet opening **24** is located at the upper end of the side wall **12** adjacent the top wall **14** and is spaced above the level of the inlet opening **20**.

Within the casing **10** are arranged a pair of baffles dividing the casing **10** into separate chambers or compartments. A lower baffle **28** extends radially inwardly from the side wall **12** in a plane transverse to the axis of the side wall **12** and spaced slightly below the inlet opening **20**. The baffle **28** is of annular shape to define a large central opening **30** providing communication to a storage chamber or sand respository **32** located between the lower

baffle **28** and the bottom wall **16**. An upper baffle **34** is supportingly connected at its large diameter end to the interior of the side wall **12** on a plane above the inlet opening **20** and below the outlet opening **24**. The baffle **34** extends radially inwardly and downwardly from the side wall **12** toward the axis of the casing side wall and terminates at its small diameter end in a central opening **36**. A drainage conduit or pipe **38** is welded at one end thereof to the portion of the baffle **34** defining the opening **36** and depends from the baffle **34** through the opening **30** in the lower baffle **28**. It will be seen that the drainage pipe **38** is disposed at a level opposite from the inlet opening **20** and its of a diameter less than the lower baffle opening **30** to define an annular space between the opening **30** and the outside of the pipe **38**.

The space between the upper baffle **34** and the lower baffle **28** subdivides the casing **10** into a first or lower separation chamber **40**, whereas the portion of the casing **10** between the upper baffle **34** and the top wall **14** forms a second or upper separation chamber **42**. The flow of water from the lower chamber **40** to the upper chamber **42** is through an opening **44** formed in the upper baffle **34**. A center plate **46** extending the entire length of and diametrically across the drainage pipe **38** subdivides the drainage pipe **38** into two paths and serves to restrain rotation of water and sand therein. Access to the sand storage repository **32** for maintenance purposes is provided by a normally closed manhole **48** formed in the casing side wall **12**. However, sand is normally removed from the repository **32** through a clean-out pipe **50** connected to the bottom wall **16** and closed by any suitable means such as a cap **52**. A center plate **54** extends diametrically across the clean-out pipe **50** and along the length thereof to limit swirling of sand in the pipe **50**. A pair of upstanding ribs **56** on the bottom wall **16** extends radially outwardly from opposite sides of the pipe **50** to a position closely adjacent the side wall **12**. The ribs **56** serve to trap the sand and limit its rotation in the repository **32**.

In operation, water entering the casing **10** through the inlet pipe **22** flows in the path indicated by the arrows of FIGS. 2 and 3 until it finally emerges from the casing **10** through the outlet pipe **26**. It will be seen that in entering the chamber **40** incoming water flows in a direction generally coincident with the axis of the cylindrical inlet pipe **22**. This axis extends in a path spaced between the vertical axis of the casing **10** and the side wall **12**. As the incoming water continues its course, it is directed in a generally circular path rotating about the axis of the side wall **12** until it flows upwardly through the upper baffle opening **44** into the upper chamber **42**, where it will continue rotating until it flows out of the casing **10** through the outlet pipe **26**. In rotating within the chambers **40** and **42**, the sand that is carried by the water tends to move at a lower speed, due to its heavier weight. As a result, the faster traveling water is thrown to the outside of the tank and the heavier material is forced to the center. In prior sand traps, water has been introduced in a path tangential to the side wall **12** and it is believed that the arrangement of the present construction, in which the water is introduced in a direction away from the side wall **12** (that is, nontangentially to the side wall **12**), increases the tendency of the sand to drop out of the water and to be forced to the center of the casing **10**. In understanding why the sand tends to move toward the center, it is important to appreciate the fact that the lighter, faster-moving water possesses a greater centrifugal force, this resulting from the fact that the formula for centrifugal force equals weight × radius in feet × revolutions in minutes squared×.00034, or .00034WRN^2. It will therefore be seen that the centrifugal force diminishes

quite rapidly as the speed is reduced, inasmuch as the square of the speed of rotation is a factor in determining centrifugal force. Therefore, slight changes in the speed of rotation will have a marked effect upon the centrifugal force. The pressures existing in the water at the outer diameter of the chambers **40** and **42** are greater, thereby tending to force the sand inwardly. The upper baffle **34** is effective to guide the sand inwardly so that it will fall through the opening **30** into the sand repository **32**. Additionally, the upper baffle **34** provides a controlled path for the flow of fluid, permitting the fluid to freely rotate within the chambers **40** and **42** and providing an opening **44** by which the water may flow from the chamber **40** to the chamber **42** with a minimum of obstruction. The rotation of fluid in the upper chamber **42** also tends to force the sand inwardly and such sand as settles on the upper baffle **34** in the chamber **42** will be free to fall down the baffle **34** through the drainage pipe **38** into the sand repository **32**. Thus, sand separated in the upper chamber **42** will not be commingled with clean water circulated in this chamber.

In one embodiment of the present invention, a casing **10** was built having a ten-inch diameter inlet pipe **22** and 1250 gallons of water per minute were pumped through the unit. This produces a velocity of 350 feet per minute at the inlet and outlet with about 167 feet per minute average at the mid-radius (the velocity at the center of the casing being zero). In computing the formula $.00034WRN^2$ to determine the centrifugal force of the water and sand, it will be noted that water weighs approximately 60 pounds per cubic foot and sand approximately 100 pounds per cubic foot. Assuming that N equals 25 revolutions per minute for water, it is believed that a slower rate of about 15 revolutions per minute would be correct for sand. On this basis, WN^2 equals 60×625 or 37,500 for water and 100×225 or 22,500 for sand. It will thus be seen that the centrifugal force of water is substantially greater than that of the sand in the device of the present invention and the pressure of the water at the outside of the casing chambers will force the sand to the middle. A sand trap made in accordance with the present invention has been found to remove approximately 99.75% of all sand in the water pumped through the device.

While it will be apparent that the preferred embodiment herein illustrated is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. A device for separating sand from water, including a casing having a generally cylindrical enclosing side wall formed about a substantially vertical central axis, a bottom wall and a top wall, an inlet in said side wall arranged to direct sand bearing water therefrom into said casing along a path offset from said axis and spaced from said side wall and thereby produce rotation of water about said axis, a baffle extending radially inwardly from said wall

substantially perpendicularly to said axis and located above said bottom wall and beneath said inlet, a sand storage chamber in said casing between said baffle and said bottom wall, means including rib means in said storage chamber for retarding the rotation of sand and water therein, said baffle having a central opening for the passage of sand from a location above said baffle to said storage chamber, said baffle being otherwise substantially imperforate, and a water outlet in said side wall located above said inlet and baffle means disposed between said inlet and said outlet for preventing the direct flow of water from said inlet to said outlet without preventing the direct flow of sand from said inlet to said central opening.

2. A device for separating sand from water including a casing having a generally cylindrical enclosing side wall disposed about a substantially vertical central axis, an inlet in said side wall arranged to direct sand-bearing water therefrom into said casing in a path offset from said axis and spaced from said side wall and thereby produce rotation of water about a lower baffle extending inwardly from said side wall at a location beneath said inlet, said lower baffle having a central opening therethrough, a generally conical upper baffle extending radially inwardly and downwardly from said side wall at a level above said inlet, a conduit depending from said upper baffle at the center thereof for directing sand from above said upper baffle to a location beneath said lower baffle, said conduit being of a diameter smaller than the opening in said lower baffle to provide space for the downward flow of sand from space between said baffles through the opening in said lower baffle, said upper baffle having an opening therethrough in a location spaced radially outwardly from said conduit for the upward flow of water therethrough, and a water outlet in said casing disposed above said upper baffle.

3. The structure set forth in claim **1** including means depending from said baffle means through said central opening for communicating sand from a location above said baffle means to said sand storage chamber.

4. The structure set forth in claim **1** wherein said baffle means comprises a generally conical wall extending from said side wall in a radially inward and downward direction, said conical wall having an opening therein in a location spaced from its center for the flow of water from said inlet to said outlet.

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