

May 9, 1944.

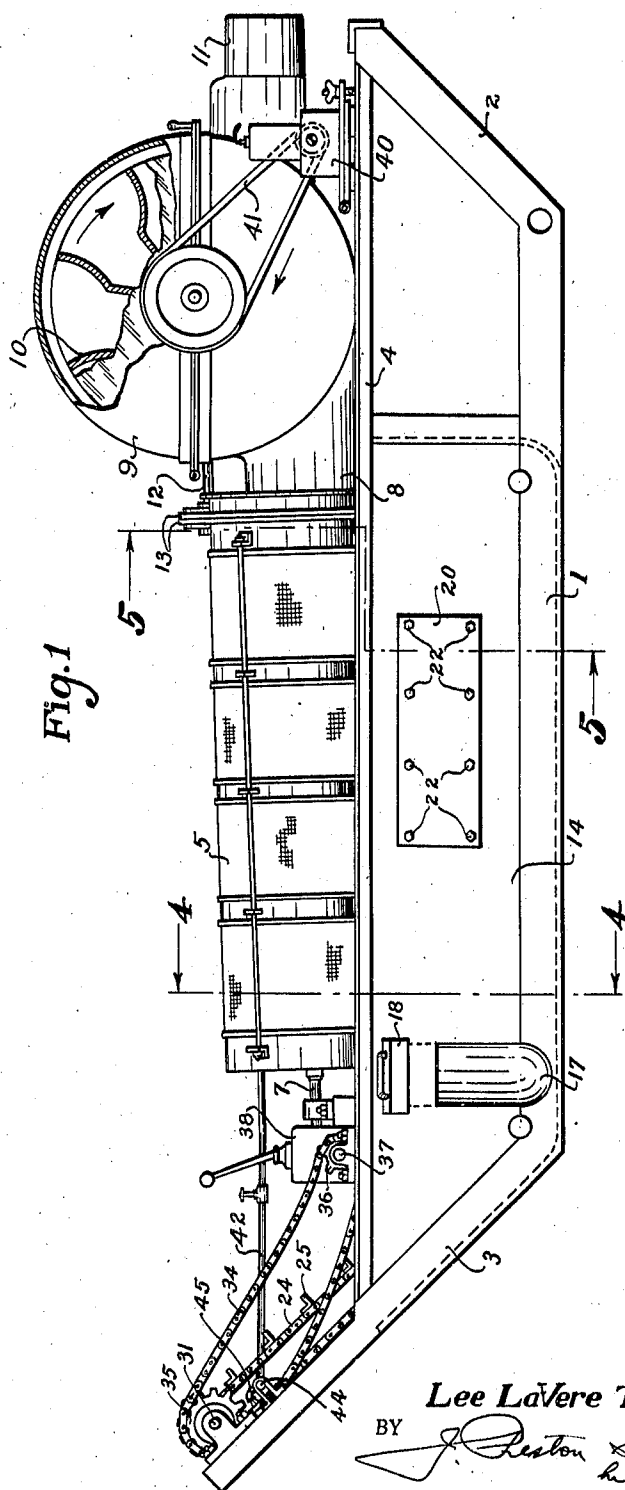
L. LA V. THOMPSON

2,348,664

CONVEYER

Filed March 17, 1941

3 Sheets-Sheet 1



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CONVEYER

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3 Sheets-Sheet 2

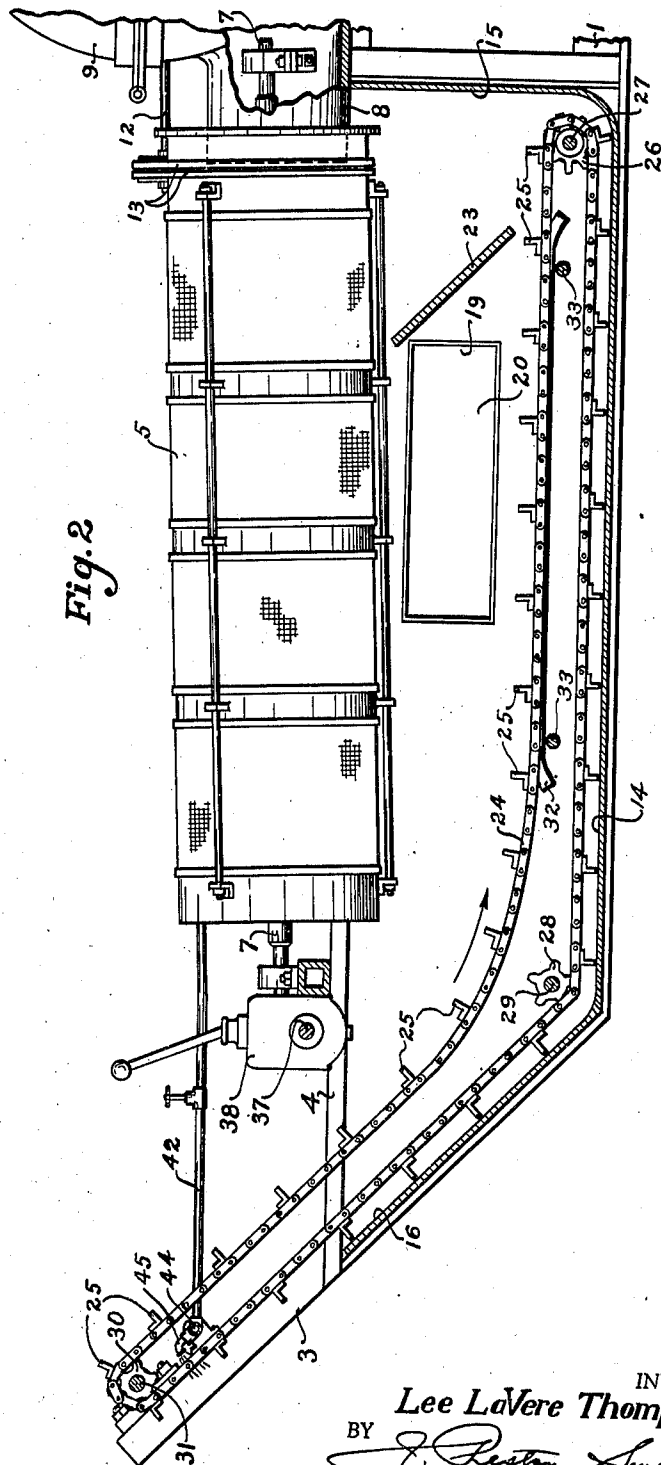


Fig. 2

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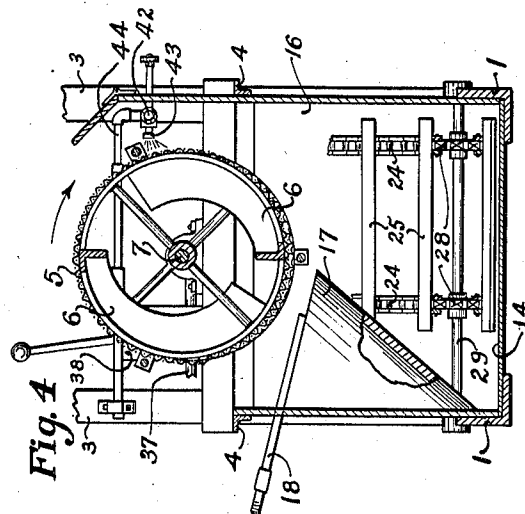
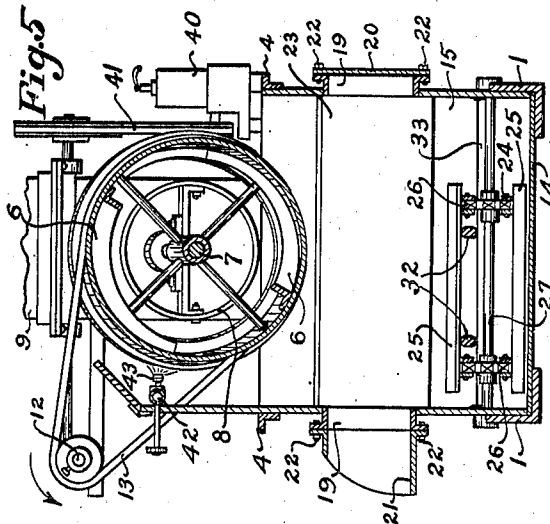
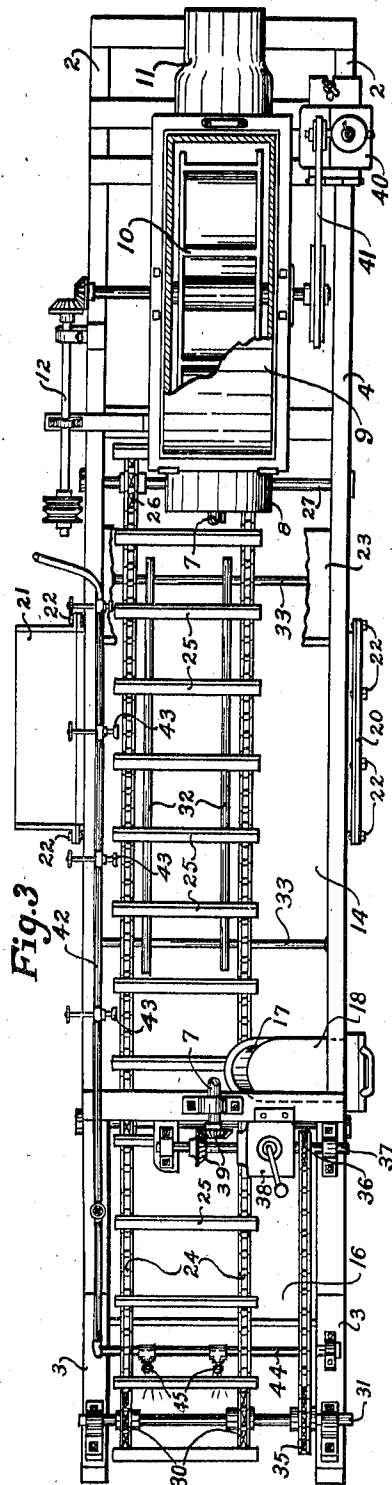
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2,348,664

CONVEYER

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,348,664

CONVEYER

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Application March 17, 1941, Serial No. 383,815

10 Claims. (Cl. 210—199)

This invention relates to an improvement in conveyers of the character used for removing small particles, granules, and the like from fluids, and more particularly to the removal of sand and other impurities from relatively viscous drilling mud, such as is used in the drilling of oil wells by the rotary method.

In the shale separator of the character set forth in the patent of Lonnie L. Thompson, No. 2,228,185, granted January 7, 1941, there was provision for screening sand and other particles from the drilling fluid, as it is pumped out of the well, but small particles of sand and foreign substances frequently pass through the meshes of the screen and remain entrapped in the mud, and are not entirely separated therefrom. The presence of such fine sand and foreign particles destroys the usefulness of the mud unless they can be removed effectively, because such mud is pumped into the well and the presence of sand would destroy the action of the pump by injury thereto and to the drill stem through which it passes. This mud is conditioned frequently by chemical action to provide the desired weight and viscosity, which is destroyed by the presence of foreign substances, unless these can be removed entirely.

The Thompson patent on shale separators referred to above, had provision for screening sand and foreign particles from the drilling mud, while allowing the latter to pass through the screen into a trough or receptacle therebeneath, thence to the tank or slush pit for the settling out of the foreign particles therefrom, to some extent at least.

The object of this invention is to improve the separating action, by providing for a settling action directly in the shale separator trough or receptacle, and removing such foreign substances therefrom, providing a continuous separating action of the solids from the liquid. A conveyer operates lengthwise of the trough to scrape out and remove the solids that collect or accumulate in the trough, which conveyer is operated preferably directly from the rotary screen of the shale separator.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevation of the shale separator and conveyer, with parts broken away and in section;

Fig. 2 is an enlarged longitudinal section through the conveyer structure with the separator shown in elevation;

Fig. 3 is a top plan view of the conveyer structure and portion of the separator structure, the rotatable screen being removed, and parts being broken away and in section;

Fig. 4 is a cross section on the line 4—4 of Fig. 1; and

Fig. 5 is a similar view on the line 5—5 thereof.

The invention is shown in connection with a shale separator of the type generally as illustrated in the above-mentioned Thompson Patent, No. 2,228,185, but in which the separator structure is modified to accommodate the present invention.

The combined structure includes frame side bars 1, the opposite end portions of which are turned upward, as shown at 2 and 3, and connected together by a super-structure comprising a frame 4, which supports the operating mechanism of the machine.

In the form shown, this operating mechanism includes a rotary screen 5 formed in sections and suitably braced for unitary rotation. The screen 5 is provided with an internal spiral conveyer screw 6 (Fig. 4) and is journaled on a shaft 7 for rotary movement. The shaft 7 is supported in journals at its opposite ends carried by the super-structure 4. The axis of the screen 5 is inclined slightly toward its inlet end (at the right in the drawings) so that the fluid admitted at said inlet end will flow lengthwise within the screen and the foreign particles will be discharged from the screen at the opposite end thereof, after passage of the filtrate through the meshes of the screen during the rotation of the latter. The conveyer screw 6 rotates with the screen 5 and increases the tendency to flow along the screen.

The inlet end of the screen 5 receives therein a tubular duct 8 connected with a housing 9 that encloses an impeller wheel 10 journaled in the housing. Said impeller wheel is constructed and arranged in the path of fluid flow through the housing 9 from an inlet pipe 11 at the opposite side thereof, so as to be rotated by the force of the fluid being pumped through the housing, as said fluid is discharged from the oil well. The force of the fluid in passing through the impeller housing 9 is utilized to rotate the screen 5, for which purpose the impeller wheel 10 is geared to a shaft 12 that has driving relation through a belt or belts 13 with the rotary screen 5, turning the latter as the fluid is forced against the impeller wheel 10.

This structure of the screen and impeller generally described above are set forth more in detail in the above-mentioned Patent, No. 2,228,185.

Supported within the frame structure 1-3, beneath the screen 5, is a receptacle or trough 14, extending lengthwise thereof, and having an upright end wall 15 at one end and an inclined end wall 16 at the opposite end, the latter end wall corresponding substantially with the inclination of the frame end portion 3 and supported directly thereon. The trough or receptacle 14 receives the lower portion of the rotary screen 5, and is adapted to receive therefrom the filtrate passing through the screen. The coarse particles that are screened from the mud are discharged through the open end of the screen, at the left in the drawings, into a receiving spout 17 (Fig. 4) which spout extends laterally from a side wall of the trough 14 in position beneath the open end of the screen to receive the larger solid particles therefrom and to direct these particles laterally away from the machine. Under some circumstances, it may be desirable to regulate the portion of the solid particles that is discharged through the spout 17, the remainder being directed into the trough 14, for which purpose, a slide door 18 is guided in a side of the trough 14 and movable therein over the open top of the spout 17 to regulate the degree of opening thereof, or to close the spout altogether.

The trough or receptacle 14 is provided with openings 19 on opposite sides thereof, as shown in Figs. 2 and 5, one of which is closed by a door 20, while the other has a spout 21 connected therewith for directing the filtrate from within the trough to any desired external point. This door and spout are secured to the trough about the openings 19 by bolts or other detachable fastenings designated generally by the numeral 22 and adapted to secure these parts to the trough but capable of ready removal therefrom for interchangeability whenever desired. Frequently it is required that the direction of discharge from the trough be changed due to the placement of the separator or the location of the slush pit relative to the well, which makes it desirable for such discharge openings to be provided in opposite sides and for interchangeability of the door and spout. To prevent the filtrate from passing directly from the first section of the screen through the discharge opening 19 without adequate opportunity for settlement of any fine particles therefrom, a baffle 23 extends from side to side in the trough 14 beneath said first section of the screen as shown in Fig. 2.

As the mud is filtered through the screen, it flows into the bottom portion of the trough 14, where it accumulates in substantial quantity before it rises in said trough high enough to flow out of the discharge opening 19. This allows sufficient time for some settling action to take place in the trough to remove from the viscous materials fine particles of sand or other foreign substances that may have passed through the screen with the filtrate. Provision is made for removing such sand or foreign substance from within the trough as it accumulates therein, allowing a continuation of the settling action and permitting only relatively clean mud to flow through the discharge spout 21, capable of reuse when desired.

To provide for this removal of the accumulated sand and foreign particles, I have provided a conveyer structure in the bottom of the trough 14 and extending upward along the end wall 16 and the frame end 3. This conveyer structure is shown in the form of endless sprocket chains 24 spaced apart laterally substantially on oppo-

site sides of the trough 14 and connected together by flight bars 25. The sprocket chains 24 are guided over sprockets 26 mounted on a shaft 27 at one end of the conveyer and over sprockets 28 on a shaft 29 at an intermediate point adjacent the juncture between the bottom and the end wall 16 of the trough 14. The sprockets 28 engage only the lower runs of the sprocket chains. The upper runs of the sprocket chains 24 pass over sprockets 30 on a shaft 31, journaled adjacent the upper end of the inclined frame portion 3 at a point substantially above the upper end of said end wall 16, as shown in Fig. 2.

The flight bars 25 are adapted to ride along the bottom and end wall 16 of the trough 14 and act as scrapers thereon to move along any accumulation of fine sand or foreign particles that may settle out of the mud in the trough 14, and discharge it therefrom over the top of the end wall 16. The upper run of the conveyer is supported intermediate the ends of the trough 14 on guide bars 32 extending lengthwise between the chains 24 and mounted on transverse bars 33.

The endless conveyer is operated by the shaft 31, which is driven by means of a sprocket chain 34 passing over a sprocket wheel 35 on the shaft 31 and over a second sprocket wheel 36, on a sectional drive shaft 37. The sections of the drive shaft 37 are connected together by means of a change speed transmission 38, preferably of the shift gear type, to provide for variable speeds of operation of the shaft 31. The drive shaft 37 is driven from the shaft 1, being geared therewith through bevel pinions 39, as shown in Fig. 3.

Thus during normal operation of the shale separator, the rotation of the screen 5 will be imparted to the shaft 31, which in turn operates the endless conveyer, scraping out of the bottom of the trough 14 any accumulation of fine sand or foreign particles that may settle out of the mud that is filtered or screened into the trough. The relative speeds of the screen and conveyer may be varied by the transmission 38 which is also capable of entirely disconnecting the sections of the drive shaft 37, so as to allow rotation of the screen 5 without operation of the conveyer, if desired.

The impeller wheel 10 has sufficient power, ordinarily, due to the pressure of the mud forced into the impeller housing 9, for rotating the screen 5 and also operating the endless conveyer that removes foreign particles from the trough, but under some conditions, it may be found desirable to provide an auxiliary power unit to supplement the driving force of the impeller wheel 10. For this purpose, I have provided a small gasoline engine 40 which is connected through pulleys and a belt 41 with the shaft of the impeller wheel, as shown in Figs. 1 and 3.

To prevent an accumulation of mud in the screen 5 and to keep the meshes of the screen open, I have provided a spray pipe 42 extending lengthwise of the screen as shown in Fig. 3, and provided at intervals with sprays 43 arranged to be directed onto the sections of the screen. This spray pipe 42 is extended with a transverse section 44 adjacent the upper end of the conveyer and provided with sprays 45, so arranged as to act on the chains and flight bars to wash these free of any sediment or foreign particles collecting thereon.

I claim:

1. In a separator of the character described,

the combination of a receptacle, a hollow rotary cylindrical screen mounted over said receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof outside the receptacle, an impeller wheel in the path of the fluid flow to the receptacle and operatively connected with the rotary screen for turning said screen, an endless conveyer operatively mounted in the bottom of the receptacle and extending to a discharge point externally thereof, said conveyer being arranged to remove sediment from the bottom of the receptacle, power driving means for said conveyer connected with the discharge end portion of said conveyer, and means for connecting said power driving means with the impeller for operation of the conveyer therefrom.

2. In a separator of the character described, the combination of a receptacle, a hollow rotary cylindrical screen mounted over said receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof outside the receptacle, an impeller wheel in the path of the fluid flow to the receptacle and operatively connected with the rotary screen for turning said screen, said rotary screen including an axial shaft, an endless conveyer operatively mounted in the bottom of the receptacle in position to remove sediment therefrom, and driving means for said conveyer operatively connected with the screen shaft at the discharge end of said screen.

3. In a separator of the character described, the combination of a receptacle, a hollow rotary cylindrical screen mounted over said receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof outside the receptacle, an impeller wheel in the path of the fluid flow to the receptacle and operatively connected with the rotary screen for turning said screen, said screen including an axial shaft, an endless conveyer operatively mounted in the bottom of the receptacle for removing sediment therefrom, and power driving means for said conveyer having geared connection with the screen shaft adjacent the discharge end of the screen for operation of the conveyer thereby.

4. In a separator of the character described, the combination of a receptacle, a hollow rotary cylindrical screen mounted over said receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof outside the receptacle, an impeller wheel in the path of the fluid flow to the receptacle and operatively connected with the rotary screen for turning said screen, said screen including an axial shaft, an endless conveyer operatively mounted in the bottom of the receptacle for removing sediment therefrom, and power driving means for said conveyer having geared connection with the screen shaft adjacent the discharge end of the screen for operation of the conveyer thereby, and said power driving means including means for varying the speed of the conveyer relative to the screen shaft.

5. In a separator of the character described, the combination of an elongated receptacle, a hollow rotary cylindrical screen mounted over said receptacle in position to receive fluid in one

end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof outside the receptacle, said screen having the last-mentioned end thereof spaced from the adjacent end of the receptacle, a conveyer operatively mounted in the receptacle beneath the screen and extending from beneath the screen beyond the last-mentioned end thereof substantially to the adjacent end of the receptacle, and a spout extending laterally from a side of the receptacle intermediate the length of the conveyer to a point adjacent the last-mentioned end of the screen to receive the screenings therefrom.

6. In a separator of the character described, the combination of a receptacle, a hollow rotary cylindrical screen mounted over said receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof outside the receptacle, an impeller wheel in the path of the fluid flow to the receptacle and operatively connected with the rotary screen for turning said screen, said receptacle having a discharge opening in a side thereof intermediate the ends of the screen, and a baffle extending transversely of the receptacle between said discharge opening and the inlet end of the screen for directing a portion of the filtrate from the screen away from said discharge opening.

7. In a separator of the character described, the combination of an elongated receptacle, a rotatable cylindrical screen mounted over said receptacle with the axis thereof extending lengthwise of the receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof, a conveyer operatively mounted in the bottom of the receptacle and constructed to discharge sediment from the receptacle, said conveyer having the longitudinal center thereof displaced laterally of the receptacle from a vertical plane through the center axis of the screen, and a chute at the opposite side of said receptacle in position to receive the screenings from the screen to direct said screenings outside the receptacle.

8. In a separator of the character described, the combination of an elongated receptacle, a rotatable cylindrical screen mounted over said receptacle with the axis thereof extending lengthwise of the receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle and to direct screenings from the opposite end thereof, an endless conveyer operatively mounted in the bottom of the receptacle and extending to a point externally thereof to discharge sediment from the receptacle, said endless conveyer having the longitudinal center thereof displaced laterally of the receptacle from a vertical plane through the center axis of the screen, a chute at the opposite side of said receptacle in position to receive the screenings from the screen to direct said screenings outside the receptacle, and power means for operating said screen and endless conveyer.

9. In a separator of the character described, the combination of a receptacle, a rotatable cylindrical screen mounted over said receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle, said receptacle having a discharge opening in a side thereof intermediate

the ends of the screen, and a baffle mounted in the receptacle between the discharge opening and the inlet end of the screen, said baffle extending substantially from side-to-side of the receptacle beneath the same in position for directing a portion of the filtrate from the screen away from the discharge opening.

10. In a separator of the character described, the combination of a receptacle, a rotatable cylindrical screen mounted over said receptacle in position to receive fluid in one end thereof for the passage of filtrate through the screen into the receptacle, said receptacle having a discharge

opening in a side thereof intermediate the ends of the screen, a baffle mounted in the receptacle between the discharge opening and the inlet end of the screen, said baffle extending from side-to-side of the receptacle beneath the same in position for directing a portion of the filtrate from the screen away from the discharge opening, sediment removing means mounted in the bottom of said receptacle, and power means for operating said screen and sediment removing means.

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