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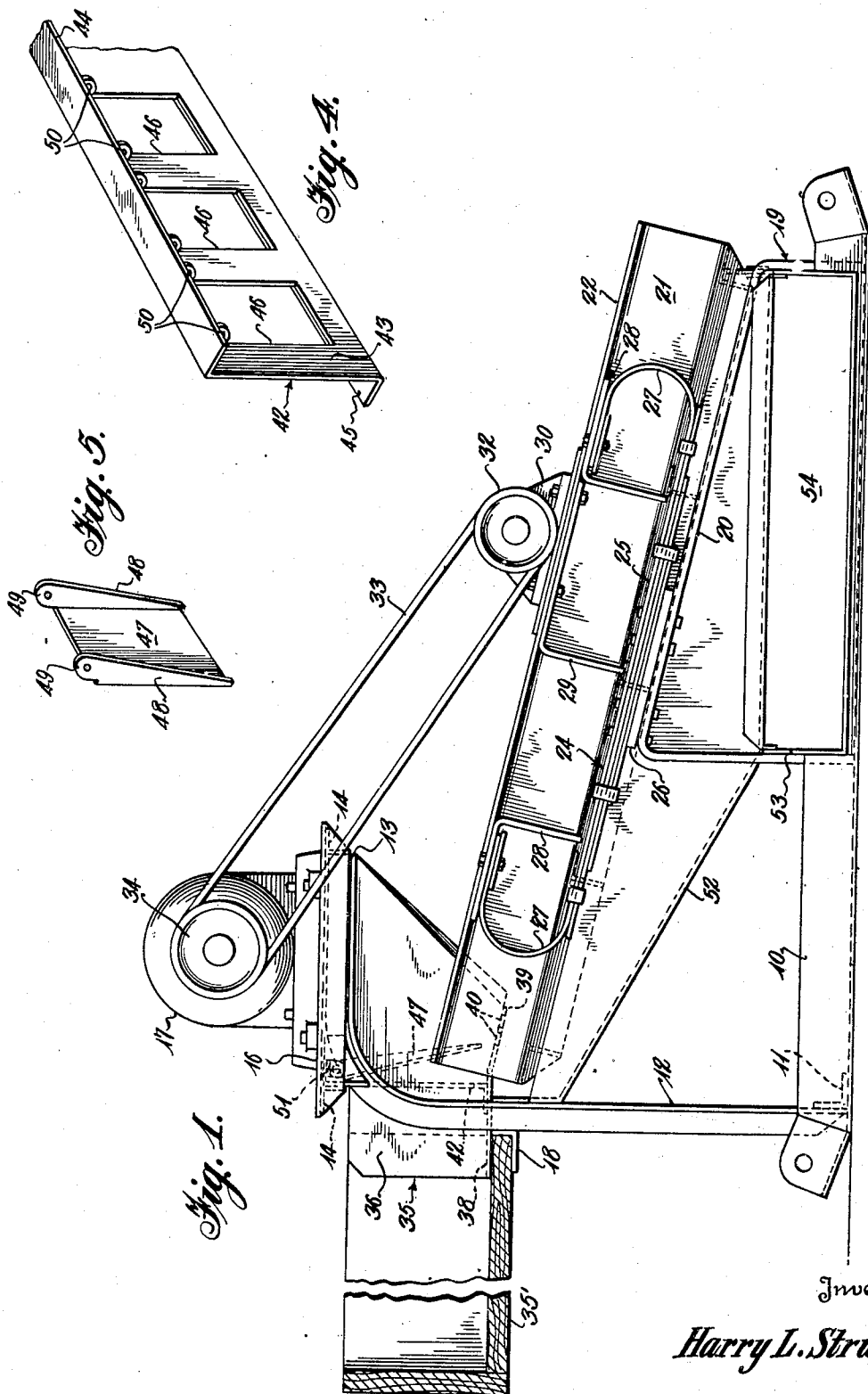
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2,298,182

VIBRATING SCREEN

Filed Nov. 25, 1939

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

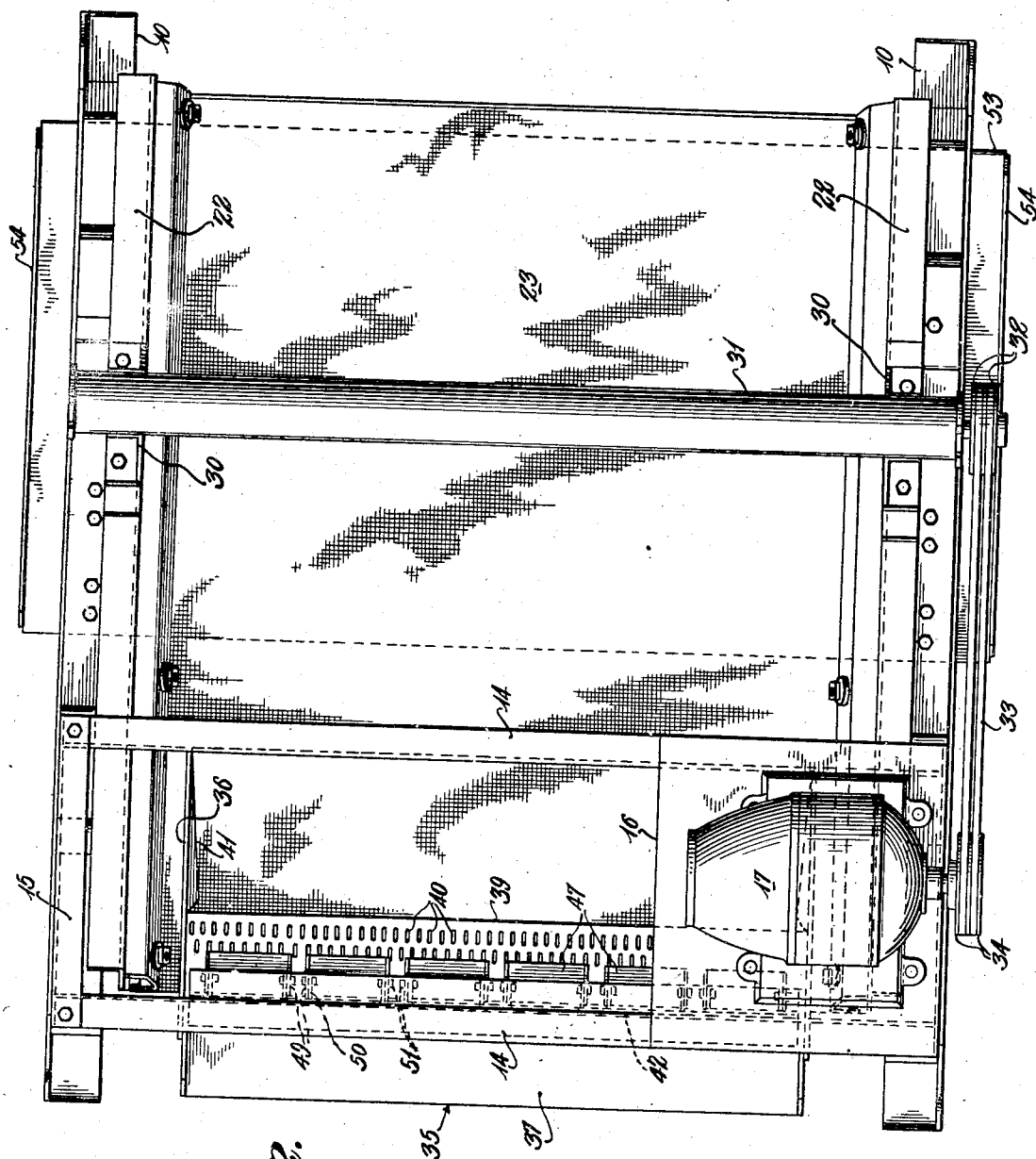


Fig. 2.

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5 Sheets-Sheet 3

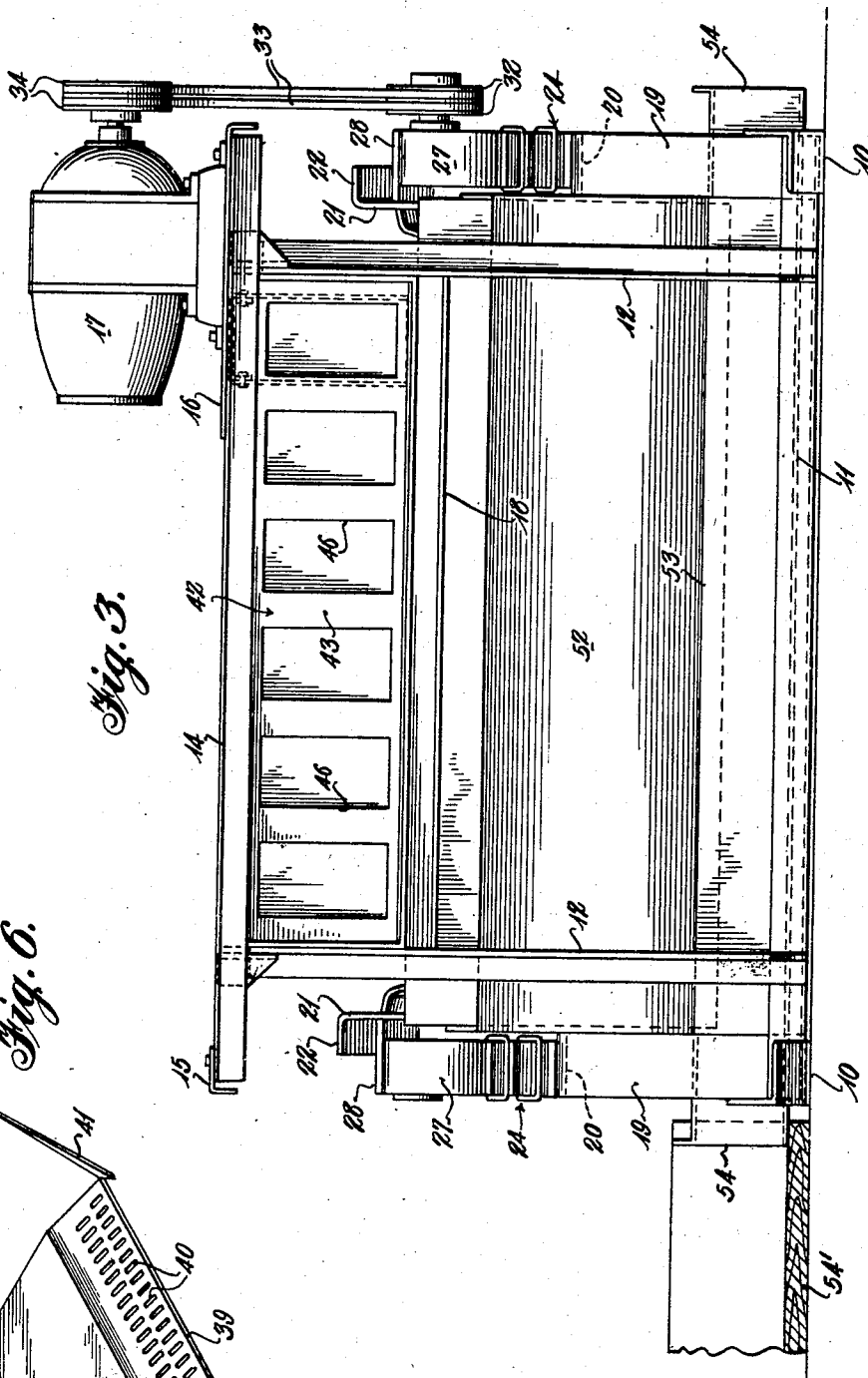


Fig. 3.

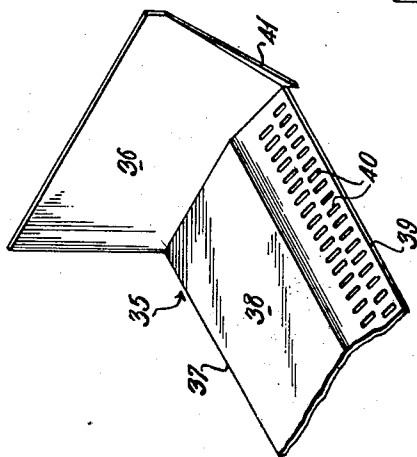


Fig. 6.

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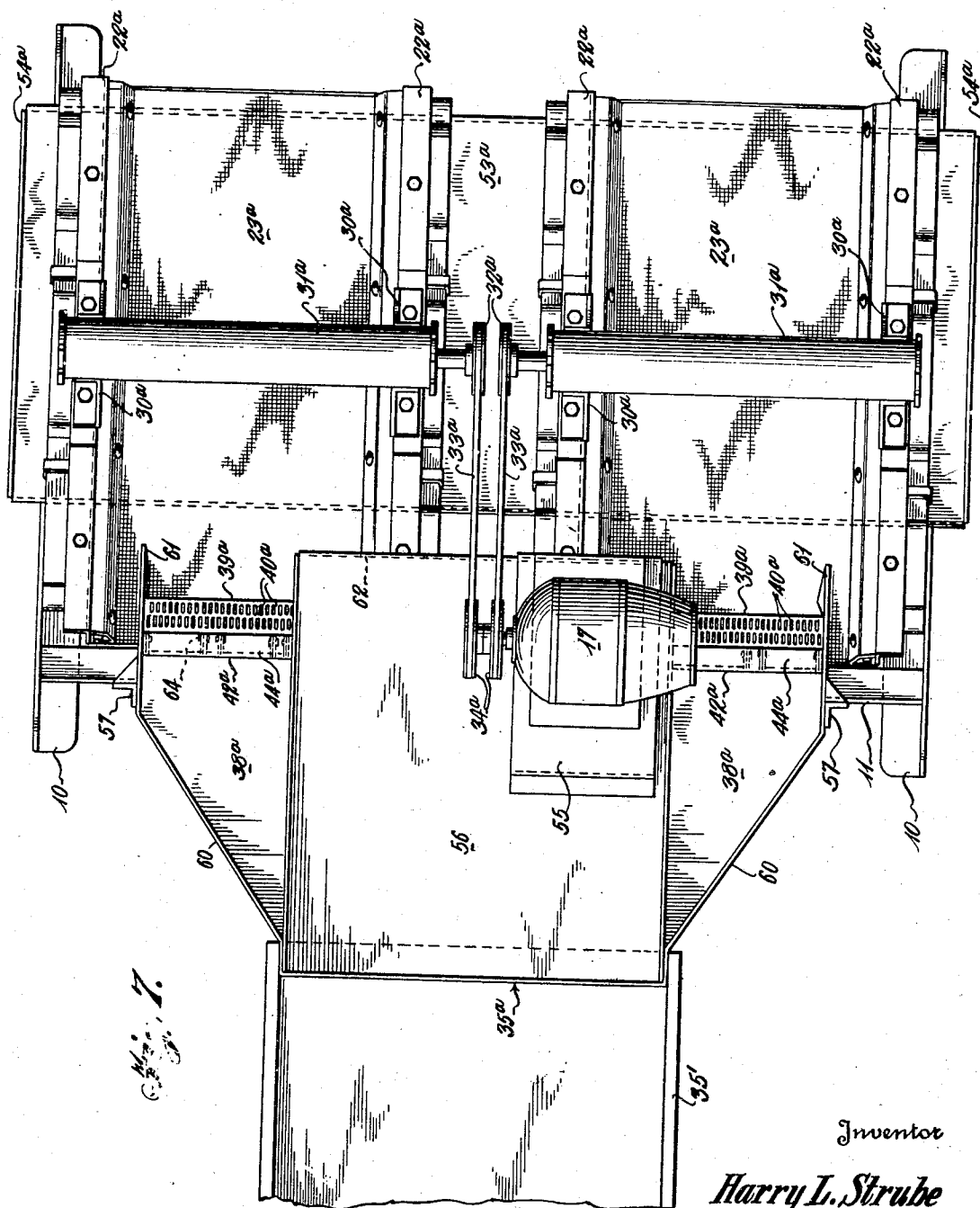
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5 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,298,182

VIBRATING SCREEN

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Application November 25, 1939, Serial No. 306,171

7 Claims. (Cl. 209—243)

This invention relates to new and useful improvements in vibrating screens which, although not necessarily so limited, are particularly adapted for use in reclaiming "rotary mud" employed in oil well drilling operations.

Vibrating screens have been found to be extremely valuable in separating the "rotary mud" from the sand, shale, borings, etc., which are carried by the mud to the top of the well. Prior to the use of such screens, it was the practice to discharge the mud with its foreign matter from the top of the well casings into ditches and large storage ponds to permit the sand, shale, borings, etc., to settle out of the mud. This old method required the use of a considerable quantity of expensive special mud, much of which could not be reclaimed for reuse. Also, large pieces of solids and the like would not always settle and consequently were pumped back through the drill pipe into the well, causing rapid wear of the pump parts, etc., and frequent jamming of the drill bit.

The use of vibrating screens for reclaiming the "rotary mud" eliminates practically all of the above mentioned disadvantages because:

(1) It quickly and completely removes from the mud all of the sand, shale, boring, etc., particles which are not small enough to pass through the mesh of the screen and permits the mud to be immediately recirculated for use.

(2) It avoids much wearing of the pump parts and jamming of the drill bits.

(3) It reduces the amount of costly "rotary mud" required for drilling a well to about one-half of that which was needed when settling ponds were relied upon to effect separation.

(4) It speeds up the sinking of the well by materially reducing the number of shut down periods during drilling operations, thereby greatly reducing the costs.

Of course, there have been some refinements and structural modifications incorporated in conventional vibrating screen structures to adapt them to this use of reclaiming "rotary mud". Such revamped screens, however, are not capable of performing in the most efficient and economical manner under all of the different working conditions encountered in different oil fields, under different hook-up arrangements, and during the drilling of a complete hole on any installation. For example, prior screens are inadequate to fully and effectively take care of or provide for:

(a) Fluctuations in the volume of mud delivered to the screen during a complete drilling operation, or as a result of unusual operating re-

quirements during certain periods. The volume of mud will vary considerably, depending upon the depth of the hole and the speed of operation of the pumps. Near the surface, where the pressures are not great, the volume is large, while at the lower levels, where the pressures are high, the volume decreases considerably.

(b) High surges, when the mud is likely to spurt out beyond the discharge end of the screen and become lost in the tailings of sand, borings, shale, etc.

(c) Completely shutting off the flow of mud to the screen when it becomes necessary to make repairs, etc.

(d) Properly distributing the flow of mud evenly across the entire width and throughout the entire length of the screen so as to take full advantage of the available screening area.

(e) Hook-ups where the mud is delivered to the feed chute of the screen at an angle instead of head on.

(f) Relieving or protecting the expensive screen cloth from excessive and rapid wear at the zone where the mud, with its highly abrasive foreign matter, is delivered to the screen.

It is a primary object of this invention to provide self-contained or unitized vibrating screen structures which are particularly adapted for reclaiming "rotary mud" for immediate reuse and which will perform in an extremely efficient manner under all the working conditions encountered in the different oil fields.

A further important object is to provide vibrating screen structures which will adequately take care of all fluctuations, from maximums to minimums, in the volume of mud delivered thereto during complete rotary drilling operations.

Another object of the invention is to provide simple, compact, and effective means for regulating the volume of mud delivered to the screen cloth; for completely stopping the flow when repairs are needed; for distributing the mud, either uniformly or at different volumes, to the entire width of the screen cloth, regardless of the angle at which the mud is delivered to the feed chute of the screen, and for controlling the portion or point in the length of the screen cloth at which the mud will be delivered, regardless of the volume of mud being fed to the screen.

Still another object of the invention is to provide a vibrating screen structure having means for protecting the expensive screen cloth from excessive and rapid wear at the point or points where the mud, with the highly abrasive foreign matter mixed therewith, is discharged onto the

cloth and which will additionally make available for use a greater portion of the length of the screening area than has been possible heretofore.

A still further object of the invention is the provision of a completely unitized vibrating screen structure which will provide for maximum economy of performance during a complete drilling operation because of the possibility of employing either the entire available screening area of the unit, when the volume of mud is high, or only a fractional portion of said area to the complete exclusion of the remainder, when the volume is low.

It must be understood that although the vibrating screen structures embodying this invention have for their primary object the reclaiming of "rotary mud," they also are capable of reclaiming other liquids, or semi-liquids, which must be screened before being reused.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevational view of one form of vibrating screen unit embodying this invention,

Figure 2 is a top plan view of the unit disclosed in Fig. 1,

Figure 3 is an end elevational view of the unit shown in Figs. 1 and 2, taken at the inlet or receiving end of the device,

Figure 4 is a detail perspective view of a plate which functions as a support and closure seat for a plurality of inlet gates embodying this invention,

Figure 5 is a detail perspective view of one inlet gate to be associated with the plate of Fig. 4,

Figure 6 is a fragmentary, detail perspective view of a perforated feed plate and its associated feed chute,

Figure 7 is a top plan view of a modified form of vibrating screen unit embodying this invention,

Figure 8 is an end elevational view of the unit disclosed in Fig. 7 and taken at the inlet end of the unit, and

Figure 9 is a fragmentary, side elevational view of the inlet portion of the unit disclosed in Figs. 7 and 8.

In the drawings, wherein for the purpose of illustration are shown the preferred embodiments of this invention, and particularly referring to Figs. 1 to 3, inclusive, the screen structure of these figures is entirely self-contained or unitized and is adapted to be moved readily from place to place. For that reason, the base of the unit includes a pair of skids 10 which are formed of angle iron stock. These skids are braced relative to each other and are interconnected at one end by an angle iron 11. Extending perpendicularly from this angle iron bracing member 11 are the angle iron bracket members 12 which are of inverted L-shape in side elevation. Extending between and secured to the horizontally arranged arm portions 13, formed by the upper parts of these bracket members 12, are horizontally extending angle irons 14. These angle irons 14 extend laterally in opposite directions from the bracket arms 12 and are interconnected at their outer, parallel ends by the brace members 15 and 16. The bracing member 16 takes the form of a square or rectangular plate which acts

as a supporting base for an electric motor 17 which is bolted thereto. An additional angle iron cross brace 18 interconnects the bracket arms 12 between their upper and lower extremities. This upstanding frame structure functions as a support for certain portions of the vibrating screen mechanism, which will be described in detail at a later point.

At the discharge end portion of the skids 10, each one of the same is provided with an upstanding, inverted, substantially U-shaped bracket 19, which is formed with sides of unequal length, to provide an inclined top portion 20. These brackets 19 function as supports for the vibrating screen box which is mounted on the inclined top portions 20.

The screen box consists of the side frame members 21 which are suitably braced relative to each other by any desired, conventional form of transverse bracing means, not disclosed. Each one of these side frame members 21 is provided with a laterally outwardly projecting top flange 22 which act as mounting flanges for the screen box. A screen cloth 23 is stretched between these side frame members 21 and is secured thereto in any desired, conventional manner, such as by means of the usual removable clamping plates.

Each side of the screen box is yieldably supported by a leaf spring member, generally designated by the reference character 24. The construction and mode of operation of these supporting leaf spring members is fully disclosed and described in my Patent No. 2,141,320, issued December 27, 1938. It will be unnecessary, therefore, to describe these members in detail. It should be sufficient to state that the generally horizontally extending bottom portion 25 of each spring is bolted to the inclined top portion 20 of a bracket 19 with a spacer plate 26 interposed therebetween. One of the leaves of the spring, in the illustrated example the top leaf, is provided with upstanding, bowed end portions 27 which have their extremities bolted to brackets 28 which are attached to and extend laterally of the side frame members 21 of the screen box. These brackets provide a substantial anchorage for securing the springs to the side frame members of the screen box.

Each side frame member 21 also has secured thereto, such as by welding, a bracket 29 which extends laterally outwardly thereof and underlies the top flange 22 to brace and support the same.

This bracing and supporting of the top flanges 22 of the side frame members 21 is found to be desirable to provide means for attaching the mounting brackets 30 which support the opposite end portions of an out-of-balance vibratory device 31 which functions to produce the desired vibrating movement of the screen box. This vibratory device has a double-grooved pulley 32 mounted on one end of its shaft. This pulley has trained thereover the V-belts 33 which extend to and are trained over the double-grooved pulley 34 mounted on the shaft of the electric motor 17. Figs. 1, 2, and 3 disclose the motor and vibratory device drive being located at one side of the entire vibrating screen unit. It is to be understood, however, that this drive mechanism may be located at either side of the unit, depending upon the particular requirements of any installation.

Supported from the transverse brace members 14 is a feed chute which is designated in its entirety by the reference character 35 and is best illustrated in detail in Figs. 1, 2, and 6. This

feed chute receives the mud to be treated from a suitable wooden sluice 35', see Fig. 1, and includes upstanding end plates 36 which are joined at their lower edges by a bottom plate 37. This plate includes a blank portion 38 and a perforated portion 39 having elongated perforations 40 formed therein. It will be appreciated that other kinds and arrangements of perforations than those disclosed in the drawings may be employed as desired. The bottom portion 38 and the end plates 36 function as a feed chute for the screen. The perforated portion 39 is of novel construction and overlies the receiving end portion of the screen cloth. These perforations permit a limited portion of the mud, etc., to pass therethrough and be delivered to the receiving end portion of the screen cloth or from the end of the screen to and including the area where the main part of the mud strikes the screen cloth. The mud delivered to the screen cloth in this manner spreads over the cloth and acts as a protective, cushioning layer where the main portion of the mud, containing the coarse, heavy, and abrasive particles, is delivered to the screen cloth from the discharge end of the feed chute. Figs. 2 and 6 clearly illustrate the side plates 36 of the feed chute as having inwardly bent flanges 41 at their discharge edges to deflect the mud inwardly onto the screening surface and to prevent the mud from splashing over the sides of the screen box.

Another extremely novel feature of construction incorporated in this improved vibrating screen unit consists of a distributing and flow or volume controlling arrangement which is best illustrated in Figs. 1 to 5, inclusive. This mechanism includes a plate 42 of substantially Z-shape in end elevation or vertical section. This plate includes a vertically arranged main body portion 43 having oppositely extending top and bottom flanges 44 and 45, respectively. The top flange 44 is suitably secured, as by welding, to the adjacent transverse bracing member 14, see Figs. 1 and 2. The bottom flange 45 is suitably secured, as by welding, to the bottom plate portion 38 of the feed chute 35, see Fig. 1. The main body portion 43 of this plate is provided with a suitable number of substantially rectangularly shaped inlet openings 46.

Fig. 5 discloses in detail a form of inlet gate which is provided for each one of the openings 46. This gate includes a main body portion 47, which is of greater area than the area of the opening 46 with which it is to be associated. Each perpendicular edge of the body portion 47 is provided with a right angularly arranged flange 48. Each flange is formed to provide an apertured ear 49 at its upper end. Fig. 4 discloses the inlet plate 42 as having a pair of ears 50 arranged at the side of each inlet opening 46. Hinge pins, or the like, 51, see Fig. 1, are employed for securing the apertured ears 49 of the gates to the pairs of apertured ears 50 of the mounting plate 42. This type of mounting for the gates permits them to be moved into any desired angular relationship over an arc of approximately 90 degrees. When these gates are in their truly vertical position, they engage the main body 43 of the mounting plate 42 and completely close off or cover their respective inlet openings 46.

It will be appreciated that these inlet gates 47 provide extremely effective means for controlling the volume of mud being discharged onto the screen cloth as a whole and each section thereof; the distribution of the mud across the width of

the cloth and the point at which the main body of the mud is delivered onto the screening surface. These inlet gates are capable of effecting this desired distribution and control of the flow of the mud regardless of whether the mud is delivered to the feed chute 35 head on or at any angle up to 90 degrees. By varying the extent of opening of the different gates, the mud may be either uniformly or differentially distributed to different portions of the screening surface. If the mud is delivered at an angle to the feed chute, it will tend to strike an end plate 36 of this chute and be concentrated at that end of the chute. To effect uniform distribution of the mud with this type of delivery, the inlet gates should be opened to different degrees transversely of the screen with the greater amount of opening being provided at the side of the feed chute opposite the side at which the mud is concentrated.

Due to the downwardly inclined arrangement of the inlet gates, they will function to direct the mud downwardly onto the screen. They, therefore, will prevent the mud from spurting out beyond the discharge end of the screen when a large volume of mud is being delivered to the feed chute, or during high surges of delivery. Of course, all of the inlet gates can be completely closed or seated against their supporting plate 42 for entirely shutting off the feeding of mud to the screening surface. This will enable repairs to be made to the screen when necessary.

Arranged beneath the screen box is a mud collecting tank or hopper 52 which is of proper size and shape to receive and collect all of the mud passing through the screen cloth 23. This tank terminates in a trough portion 53 which is clearly illustrated in Figs. 2 and 3 as being adapted to discharge to either or both sides of the vibrating screen unit. Discharge at one side of the unit is accomplished by closing the remaining opening 54 by means of a cover, or the like, not shown. Fig. 3 discloses a wooden chute 54' for carrying off the screened mud.

Figs. 7, 8, and 9 disclose a modified form of vibrating screen unit from that disclosed in Figs. 1 to 6, inclusive. This unit of Figs. 7 to 9 differs from the previously described unit principally by having its screen box arrangement divided into separate and distinct parts which are independently vibrated and for that reason are capable of being entirely independently operated. Because of this fact, the unit of Figs. 7 to 9, inclusive, may be operated in its entirety and have a capacity equal to that of the unit disclosed in Figs. 1 to 6, inclusive, or its capacity may be reduced to that of one section or part of this unit as one section or part may be operated while the remaining section or part remains idle. When operating in this manner, the unit will have a capacity which is only one-half that of the first described unit, or only one-half of its own complete capacity. Notwithstanding these two screen boxes, this unit employs only one feed chute, one mud collecting tank with its two-way discharge trough, and one prime mover or electric motor. As many features of construction of this modified unit are the same as those disclosed and described in detail in connection with the unit illustrated in Figs. 1 to 6, inclusive, the same reference characters will be applied to identical elements. New reference characters will be applied to and a detail description will be given for only such elements as differ structurally from those of the first described unit.

In this dual screen arrangement, the screen

boxes are each provided with the side frame members 21a which have their top mounting flanges 22a. Brackets 28a extend laterally from each side of both of the screen members and have connected thereto the upper extremities of the bowed end portions 27 of the several springs 24. It will be appreciated that four springs 24 are required for the two screen boxes, as is clearly illustrated in Fig. 8. These leaf spring members 24 are mounted on the four brackets 19 by being connected to the top portions 20 of these brackets. Out-of-balance vibratory units 31a are arranged one on each screen box and are secured to the top flanges 22a of the screen side frame members by mounting brackets 30a. The shaft of each vibratory unit 31a projects at the inner end of the unit and is provided with a pulley 32a over which is trained a belt 33a. These two belts are trained over pulleys 34a mounted on the shaft of the motor 17 which is carried by a base plate 55 suitably secured to the top wall 56 of the feed chute 35a. Although Figs. 7 and 8 disclose the motor 17 as being arranged at one side of the center line of the complete vibrating screen unit, it will be understood that the motor may be shifted to the other side of the center line if so desired. By disengaging either one of the belts 33a from its pulleys 32a and 34a, the vibratory unit 31a driven by this belt will be rendered inoperative and its associated screen box will remain stationary. It will be appreciated, therefore, that a considerable saving in power, wear, and tear may be obtained when the volume of mud being fed to the securing unit is such that one screen section will be capable of handling the same.

The feed chute 35a, receiving mud from a wooden sluice 35', is supported by upstanding angle irons 57 which extend upwardly from the transverse brace member 11 which extends between the two skids 10. Additional braces 58 are provided for supporting the overhanging portion of the chute 35a, see Figs. 8 and 9. A platform 59 is illustrated in Fig. 9 in side elevation and in Fig. 8 in end elevation as underlying the feed chute 35a for supporting the same. The top or platform 56 of the feed chute is attached at its rear end to the flared side walls 60 of the feed chute. The forward portion of this motor platform or chute top 56 is supported by elements which will be specifically described at a later point.

It will be noted by inspecting Figs. 7 and 8 that the feed chute 35a flares out from a comparatively narrow inlet end to a discharge end which includes both of the screen boxes. This spreading out or flaring of the feed chute is provided by the side walls 60 which diverge relative to each other and terminate in truly parallel side wall sections 61, see Fig. 7. Fig. 8 discloses a perpendicular plate 62 which bridges the space between the two screen boxes. This imperforate plate in effect closes a portion of the discharge end of the feed chute 35a. The bottom of this chute is formed by a feed plate which includes a blank portion 38a. This feed plate portion terminates in two perforated portions 39a which overlie the respective screening surfaces and are provided with perforations 40a. This structure functions in the same manner as the perforated portion 39 of the feed plate disclosed and described in connection with the preceding figures.

Extending between each outer side wall portion 61 of the feed chute and the adjacent ver-

tical edge of the bridge plate 62 is an inlet gate mounting plate 42a. Each one of these inlet gate mounting plates 42a is of identical construction with the mounting plate 42 disclosed in Fig. 4 but is of reduced length and has a smaller number of inlet openings 46a formed therein. The bottom flange of each one of these inlet plates is secured to the bottom wall portion 38a of the inlet chute. The top flanges 44a of these plates 42a and a top flange 63 of the bridge plate 62 provide the aforementioned transverse support for the forward portion of the motor platform 56.

The inlet gate plates 42a have mounted thereon the inlet gates 64, see Figs. 7 and 9, which are of identical construction with the inlet gates disclosed in detail in Fig. 5. These inlet gates 64, therefore, will not be described in detail. It is to be understood that the inlet gates 64 perform the same functions for their respective screen boxes as the inlet gates 47 of the screening unit illustrated and described in connection with Figs. 1 to 3, inclusive. These inlet gates for the dual screen units will function to uniformly distribute the mud throughout the width of their respective screen cloths and will direct the mud down onto these cloths so that it will not spurt beyond the discharge ends of the screens. By shutting or closing all of the inlet gates for one of the screen units of this dual arrangement, that particular screen box will not receive any of the mud delivered to the complete vibrating screen assembly and the screen box which remains in communication with the feed chute will receive all of the mud delivered to the complete assembly.

A single mud collecting tank or hopper 52a is provided and is of proper size and shape to receive the reconditioned or reclaimed mud from both of the screens. This collecting tank or hopper terminates in a single discharge trough 53a which has its opposite ends left open at 54a for discharge to either side of the vibrating screen unit into a discharge chute 54', see Fig. 8. Either outlet opening may be closed by means of a cover, not shown, so that discharge of the reclaimed mud will occur at only one side of the complete unit. Of course, screened mud may be discharged from both outlets by leaving them both open.

Although the drawings and the specification only disclose and describe the use of electric motors 17 for driving the vibrating devices for the screen boxes, steam turbines, gasoline engines, and other types of prime movers may be and frequently are used instead of electric motors where they are found to be more practical on certain installations. Also, I do not desire to have the novel structural features and their very desirable operations limited in use to screen boxes which are mounted for vibratory movement on leaf springs for other kinds of mounting may be employed. My invention, furthermore, contemplates the use of other types of vibrating devices for the screen boxes than the unbalanced shaft units which are disclosed. For example, the screen boxes may as readily be vibrated by eccentrics, differential motions, electric solenoids, etc.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without

departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:

1. A vibrating screen comprising a screen box mounted for vibratory movement and including a screening surface, a feed chute for delivering the material to be treated partially overlying the receiving end of the screening surface, means formed in the bottom of the chute for delivering a portion of the material onto the part of the screening surface underlying the feed chute to utilize said underlying surface and also to provide a cushioning layer of material serving to protect the portion of the screening surface arranged beyond the chute from the abrasive action of the remaining major portion of the material which is discharged from the end of the chute, and means in the feed chute and positioned with respect to the said delivery means in the bottom of the chute and the discharge end of the chute for either completely stopping or controlling the volume of flow of material through both the delivery means and from the discharge end of the chute and for deflecting the material that flows from the discharge end of the chute downwardly onto the aforesaid portion of the screening surface which is provided with said protective cushioning layer of material.

2. A vibrating screen comprising a screen box, including a screening surface, mounted for vibratory movement, a feed chute for delivering the material to be treated partially overlying the receiving end of the screening surface and having its bottom plate apertured for delivering a portion of the material onto the part of the screening surface underlying the feed chute to utilize said underlying surface and also to provide a cushioning layer of material serving to protect the portion of the screening surface arranged beyond the chute from the abrasive action of the remaining major portion of the material which is discharged from the end of the chute, and means in the feed chute and positioned with respect to the said delivery apertures in the bottom of the chute and the discharge end of the chute for either completely stopping or controlling the volume of flow of material through both the said delivery apertures and from the discharge end of the chute and for deflecting the material that flows from the discharge end of the chute downwardly onto the aforesaid portion of the screening surface which is provided with said protective cushioning layer of material.

3. A vibrating screen comprising a screen box, including a screening surface, mounted for vibratory movement, a feed chute for delivering the material to be treated partially overlying the receiving end of the screening surface, means formed in the bottom of the chute for delivering a portion of the material onto the part of the screening surface underlying the feed chute to utilize said underlying surface and also to provide a cushioning layer of material serving to protect the portion of the screening surface arranged beyond the chute from the abrasive action of the remaining major portion of the material which is discharged from the end of the chute, a vertical plate extending transversely of the feed chute upstream of the delivery means and having a plurality of outlet openings formed therein, and a control gate for each outlet opening mounted on said plate for pivotal movement about a transverse axis, each gate being of proper size to close its outlet opening when lying flatly

against the plate to completely stop the flow of material through the delivery means and from the end of the feed chute and being swingable into different inclined positions relative to the plane of the plate for varying the volume of material flowing through its opening below the said pivotal axis, for varying the head of the material flowing past the said delivery means in the bottom of the chute to control the amount of material passed through said delivery means, and for deflecting the material that flows from the discharge end of the chute downwardly onto the aforesaid portion of the screening surface which is provided with said protective cushioning layer of material.

4. A vibrating screen comprising a screen box, including a screening surface, mounted for vibratory movement, a feed chute for delivering the material to be treated partially overlying the receiving end of the screening surface and having its bottom plate apertured for delivering a portion of the material onto the part of the screening surface underlying the feed chute to utilize said underlying surface and also to provide a cushioning layer of material serving to protect the portion of the screening surface arranged beyond the chute from the abrasive action of the remaining major portion of the material which is discharged from the end of the chute, a vertical plate extending transversely of the feed chute upstream of the delivery apertures and having a plurality of outlet openings formed therein, and a control gate for each outlet opening mounted on said plate for pivotal movement about a transverse axis, each gate being of proper size to close its outlet opening when lying flatly against the plate to completely stop the flow of material through the delivery means and from the end of the feed chute and being swingable into different inclined positions relative to the plane of the plate for varying the volume of material flowing through its opening below the said pivotal axis, for varying the head of the material flowing past the said delivery apertures in the bottom of the chute to control the amount of material passing through said delivery apertures, and for deflecting the material that flows from the discharge end of the chute downwardly onto the aforesaid portion of the screening surface which is provided with said protective cushioning layer of material.

5. A vibrating screen comprising a frame, including a base portion and an upstanding portion at one end of the base portion, said upstanding portion being provided with vertical side members and a horizontally arranged top portion between the side members, a screen box, having a screening surface, supported for vibratory movement on the base portion and arranged to have its receiving end underlie the said horizontal top portion, a feed chute mounted on and reinforced by the vertical side members and the horizontal top portion of the frame, said feed chute being arranged to partially overlie and deliver material to be treated to the receiving end of the screening surface and having its bottom plate apertured for delivering a portion of the material onto the part of the screening surface underlying the feed chute to utilize said underlying surface and also to provide a cushioning layer of material serving to protect the portion of the screening surface lying beyond the discharge end of the chute from the abrasive action of the remaining major portion of the material which is discharged from the end of the chute,

a vertical plate extending transversely of the feed chute upstream of the delivery apertures and having a plurality of outlet openings formed therein, and a control gate for each outlet opening mounted on said plate for pivotal movement about a transverse axis, each gate being of proper size to close its outlet opening when lying flatly against the plate to completely stop the flow of material through the delivery means and from the end of the feed chute and being swingable into different inclined positions relative to the plane of the plate for varying the volume of material flowing through its opening below the said pivotal axis, for varying the head of the material flowing past the said delivery apertures in the bottom of the chute to control the amount of material passing through said delivery apertures, and for deflecting the material that flows from the discharge end of the chute downwardly onto the aforesaid portion of the screening surface which is provided with said protective cushioning layer of material.

6. A material feeding device adapted to be associated with a vibrating screen surface for delivering material to said surface, said device comprising a chute having a bottom plate and two upstanding side plates cooperating with the bottom plate to define an outlet end, said bottom plate having means formed therein and arranged to discharge a portion of the material passing through the chute downwardly in advance of and in a substantially parallel relation to the outlet end edge of the bottom plate, and means in the feed chute and including a plurality of independently pivotal gates for either completely

stopping or varying the volume of flow of material passing through different transverse portions of the discharge means and the end of the chute and for controlling the distance to which the material may be discharged beyond the outlet end edge of the bottom plate to take care of variations in volume and velocity of flow of the material.

7. A material feeding device adapted to be associated with a vibrating screening surface for delivering material to said surface, said device comprising a chute having a bottom plate and two upstanding side plates cooperating with the bottom plate to define an outlet end, said bottom plate having apertures formed therein and arranged to discharge a portion of the material passing through the chute downwardly in advance of and in a substantially parallel relation to the outlet end edge of the bottom plate, a vertical plate extending transversely of the feed chute upstream of the delivery apertures and having a plurality of outlet openings formed therein, and a control gate for each outlet opening independently mounted on said plate for pivotal movement about a transverse axis, said gates and transverse vertical plate cooperating to either completely stop or vary the volume of flow of material passing through different transverse sections of the chute below the said pivotal axis and for controlling the distance to which the material may be discharged beyond the outlet end of the bottom plate to take care of variations in volume and velocity of flow.

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