No. 612,742.

Patented Oct. 18, 1898.

D. D. LORD.

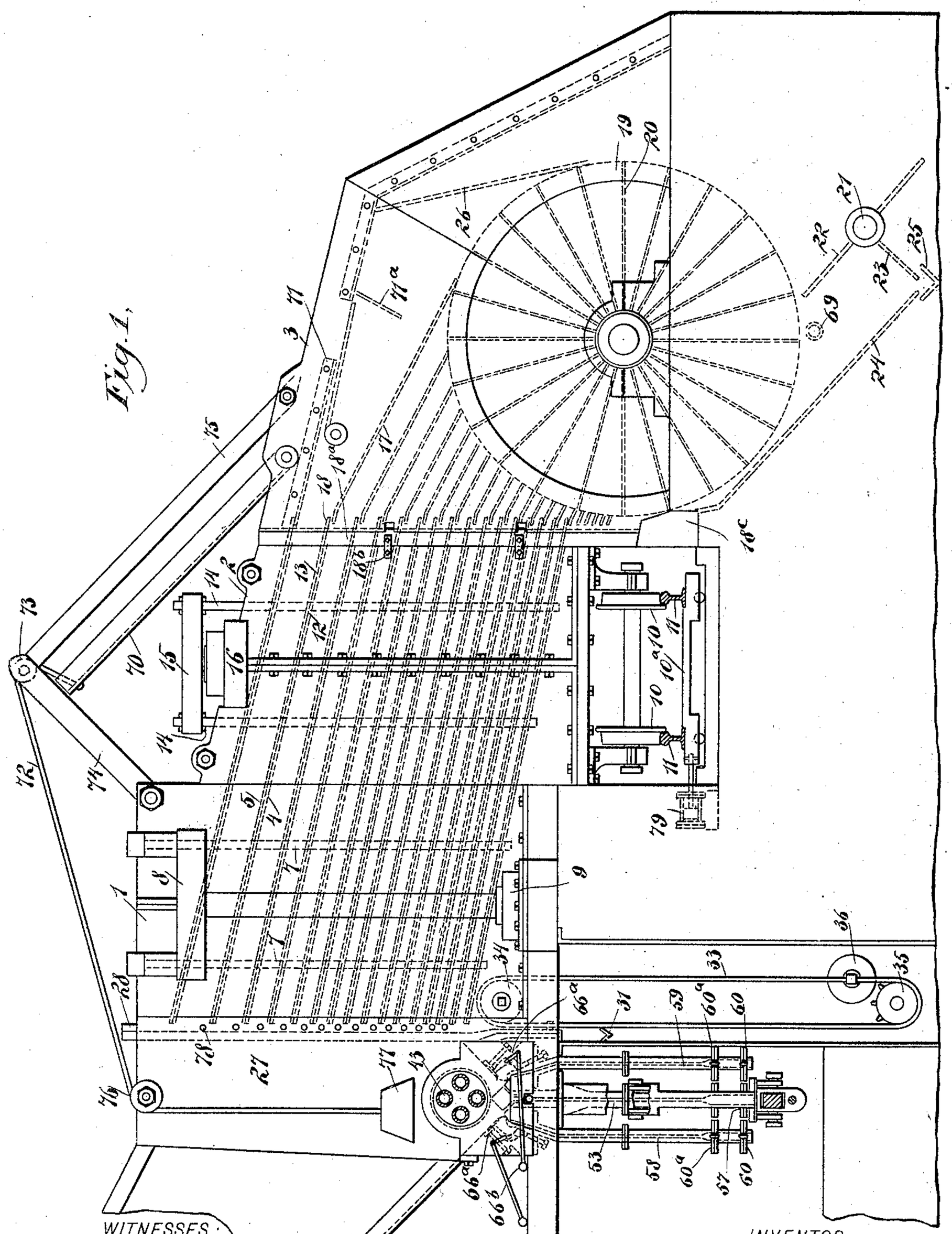
ORE CONCENTRATOR.

(Application filed Oct. 13, 1897.)

(No Model.)

5 Sheets--Sheet 1.

Fig. 1.



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5 Sheets—Sheet 2.

Fig. 2.

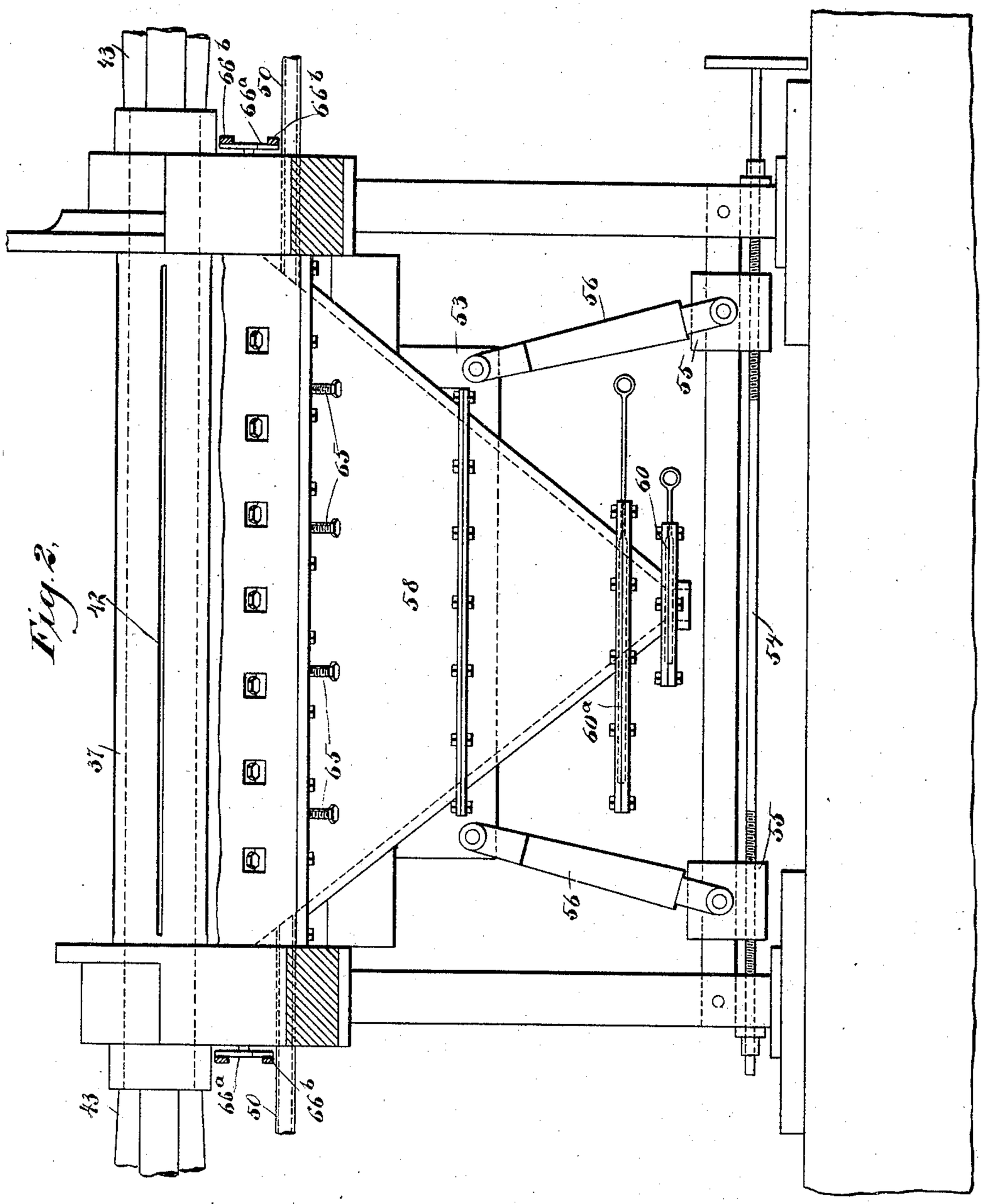

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Fig. 3,

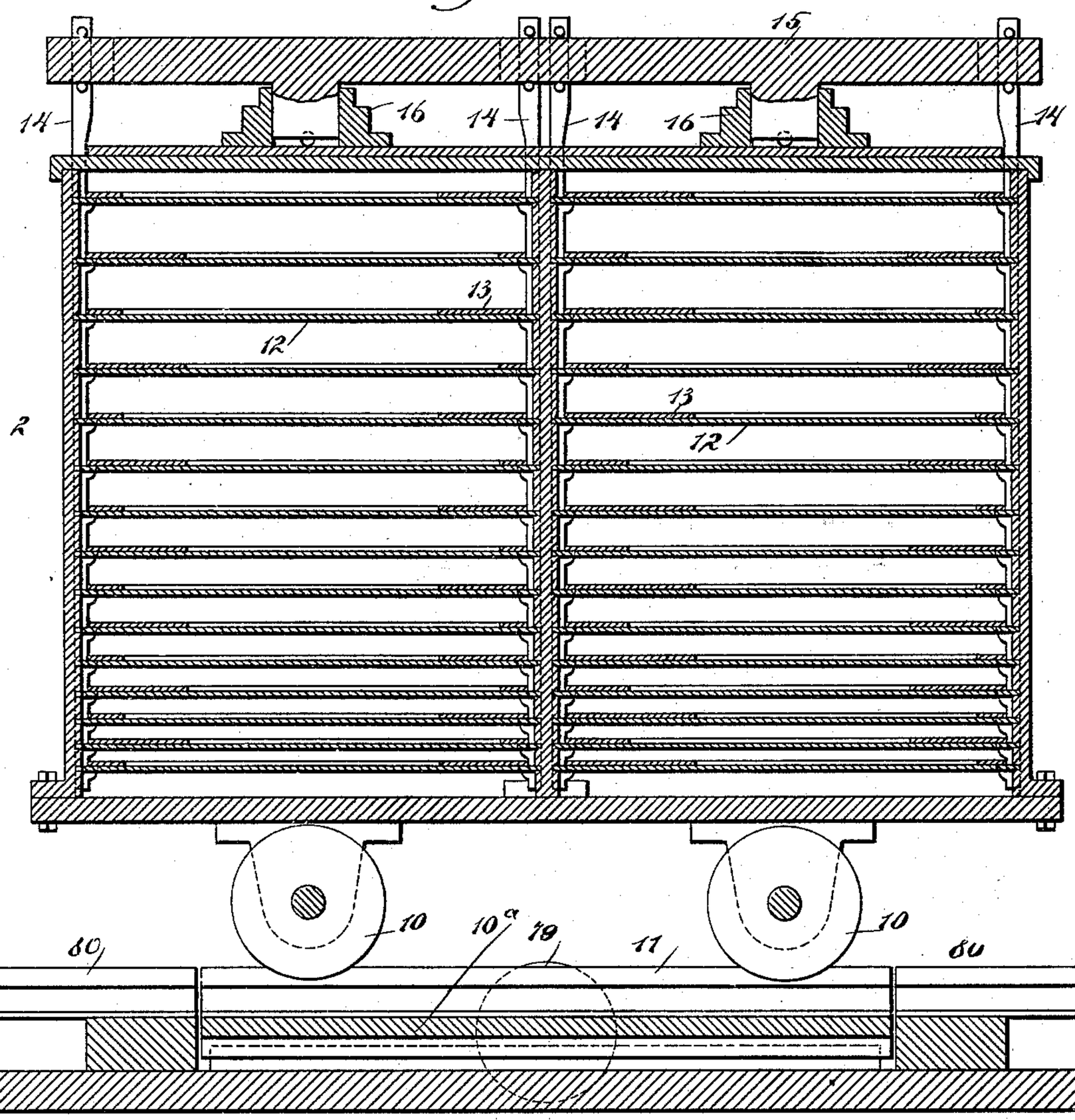


Fig. 4,

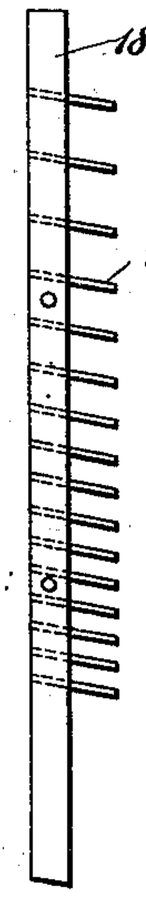
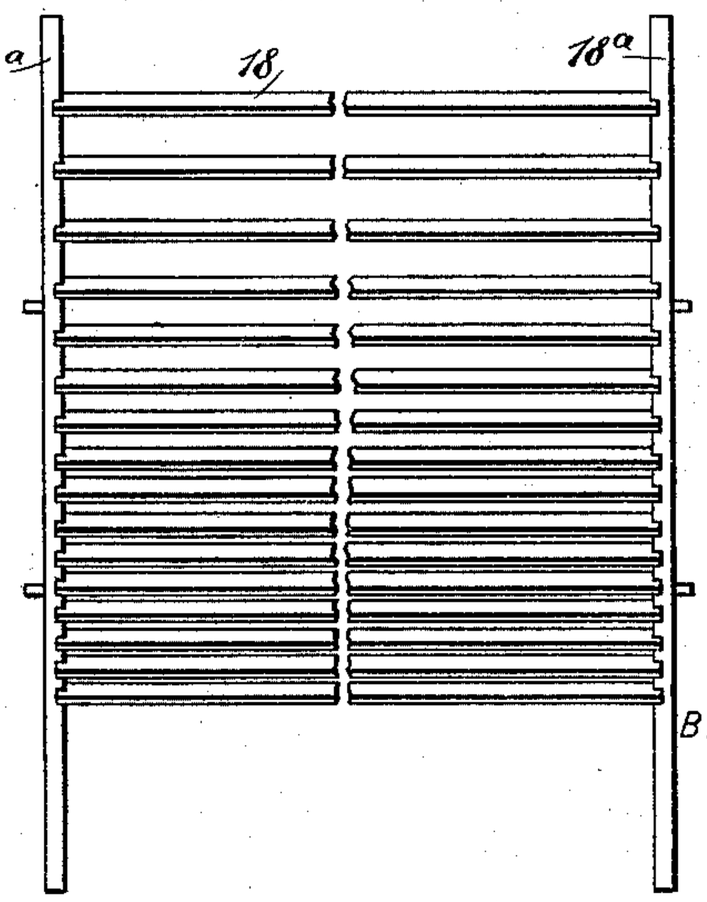


Fig. 5,



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(No Model.) 5 Sheets—Sheet 4.

Fig. 6,

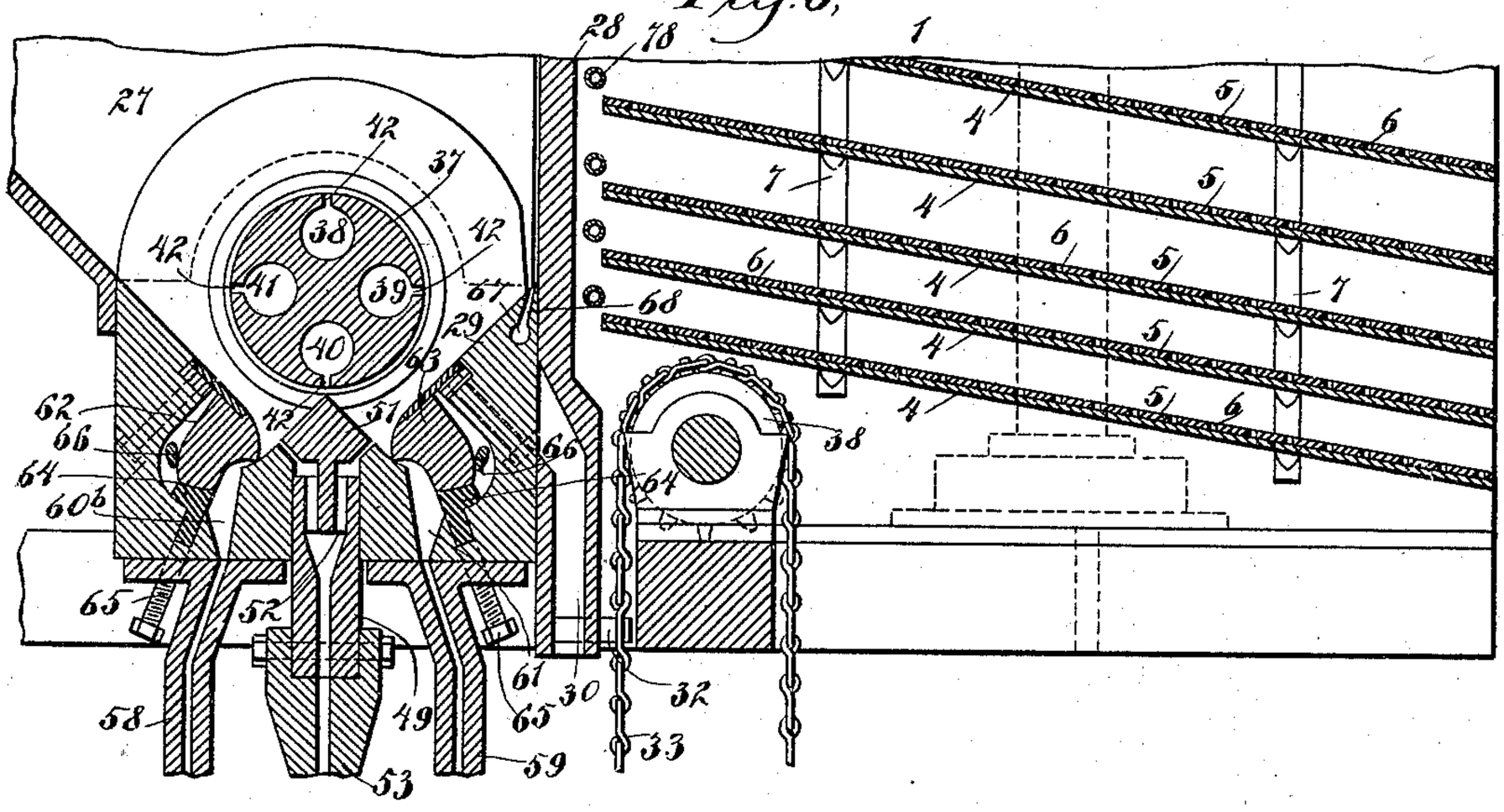

Fig. 7,

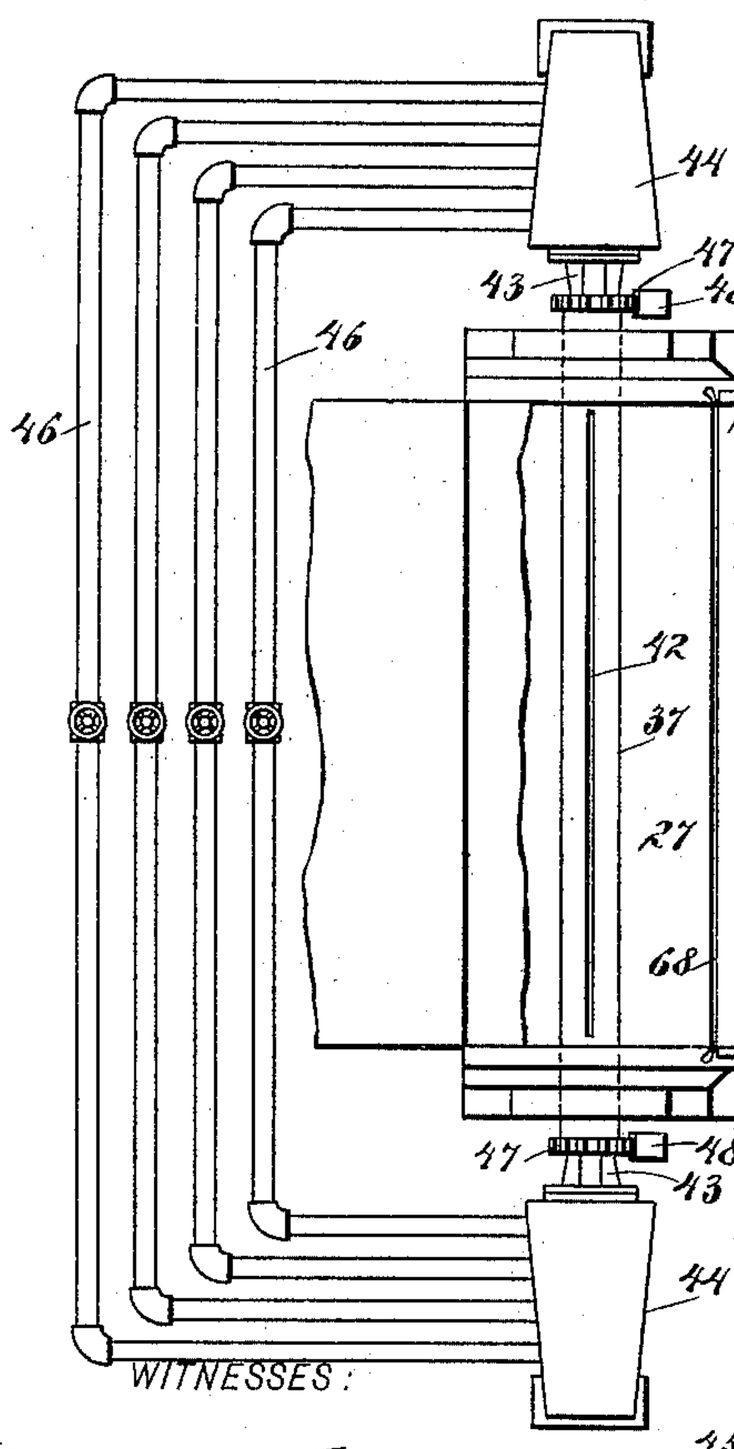

Fig. 8.

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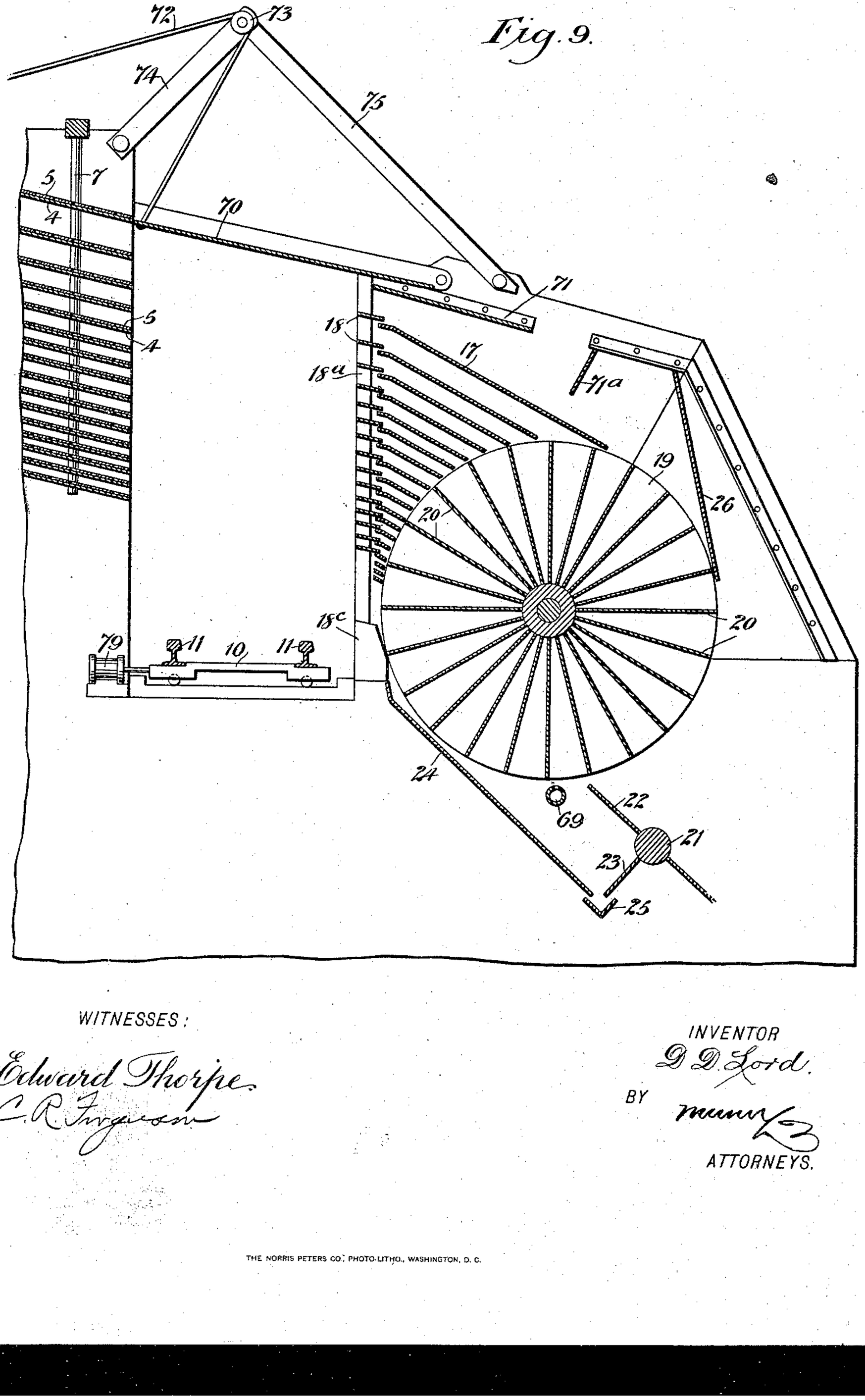
(No Model.)

5 Sheets—Sheet 5

Fig. 9.



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UNITED STATES PATENT OFFICE.

DAVID D. LORD, OF COLORADO SPRINGS, COLORADO.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 612,742, dated October 18, 1898.

Application filed October 13, 1897. Serial No. 655,062. (No model.)

To all whom it may concern:

Be it known that I, DAVID D. LORD, of Colorado Springs, in the county of El Paso and State of Colorado, have invented a new and Improved Ore-Concentrator, of which the following is a full, clear, and exact description.

This invention relates to concentrators for separating precious metals or other metals from ore or other foreign matter; and the object is to provide a device of this character in which the separation may be quickly and thoroughly done at a comparatively small expense for operation.

I will describe an ore-concentrator embodying my invention, and then point out the novel features in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of a concentrator embodying my invention. Fig. 2 is a front end view thereof. Fig. 3 is a section, on the line 3 3 of Fig. 7, of a concentrator-plate-carrying car used in the apparatus. Fig. 4 is an edge view of certain connecting-plates employed. Fig. 5 is a front view thereof. Fig. 6 is a sectional elevation of the forward portion of the concentrator. Fig. 7 is a plan view thereof. Fig. 8 is a side elevation of a distributing-head employed, and Fig. 9 is a sectional elevation of the rear portion of the concentrator with the intermediate section removed and the trough connecting the upper section with the lower section in operative position.

The body portion of the concentrator comprises a receiving-section 1, a removable section 2, and a distributing-section 3.

The receiving-section 1 has a number of concentrating-plates 4, rigidly attached to the side walls and inclined downward from the receiving end, and it also has a series of plates 5, movable vertically with relation to the plates 4 and adapted to rest on the upper surfaces thereof at a certain time. The movable plates 5 are provided with transverse slots 6, which extend entirely through said plates. As a means for lifting these plates 5 relatively to the plates 4 the said plates 5 are connected at opposite sides with vertical lifting-bars 7, which are connected to a cross-head 8, attached to the pistons of hydraulic jacks 9.

The removable section 2 is made in the form of a car—that is, it is mounted on wheels 10, which run on tracks 11 on a truck 10^a—designed to be moved lengthwise of the concentrator, as will be hereinafter explained. This removable section has inclined fixed plates 12, designed to register at their upper ends with the fixed plates 4, and it also has vertically-movable plates 13, provided with slots similar to the slots in the plates 5. These plates 13 are connected at the sides to lifting-bars 14, attached to a cross-head 15, operated by hydraulic jacks 16.

The section 3 has a series of fixed plates 17 for receiving material from the plates 13, and between the plates 17 and 13 are narrow plates 18, that may be moved upon the plates 17, so as to disengage them from the removable section, whereby said removable section may be disconnected from the apparatus. The narrow plates 18 are secured at their ends to vertical bars 18^a, which, with the plates, form a frame designed to slide between the side boards of the section 3. When in operative position, the plates 18 are locked to the movable section by clips 18^b. The bars 18^a are supported on a base 18^c, which has its top inclined.

Mounted to rotate in the section 3 is a drum 19, closed at its ends and having a series of plates 20 extended from its shaft to its periphery and from end to end, whereby radial pockets are formed in said drum.

Mounted on a shaft 21 below the drum 19 are deflector-plates 22 and 23, designed, in conjunction with a stop-plate 24, extending below the drum, to direct the heavier and more valuable particles discharged from the drum to a suitable receptacle by means of a trough 25.

Extended downward from the upper portion of the section 3 and against the forward side of the drum 19 is a stop-plate 26, against which material that may be thrown with considerable force from the upper plates 17 will strike and be directed into the pockets in the drum.

It will be noted that the plates of the several sections 1, 2, and 3 are arranged progress-

ively closer to each other from the top downward.

Forward of the section 1 is an ore-receiver 27, separated from said section 1 by means of a vertically-movable gate 28. This movable gate at its lower end engages against the outer side of a trough-shaped base 29 at the bottom of the receiver 27, and the said gate is provided with a passage 30 for the discharge of the heavier particles in large quantities from the receiver 27. (See Fig. 6.) Said discharge will be received by a trough 31 (see Fig. 1) and conveyed to any suitable place. The gate 28 may be raised or lowered by means of a connection 32, (see Fig. 6,) with a sprocket-chain 33 extended over sprocket-wheels 34 and 35, and to facilitate an easy operation of said gate the stretch of the chain 33 opposite the connection 32 will be provided with a counterweight 36. (See Fig. 1.)

Arranged in the lower portion of the receiver 27 is a cylinder 37, (see Fig. 6,) having a series of longitudinal chambers 38, 39, 40, and 41. Each of these chambers has an outlet consisting of a slot 42, extended the full length of the cylinder within the concentrator. The several chambers 38 to 41, inclusive, receive in their opposite ends short pipes 43, and these several short pipes 43 connect with ports extending through distributing-heads 44, mounted to rock on pillow-blocks 45. The ports through the distributing-heads each communicate with a water-pipe 46, and each of these pipes 46 is provided with a valve, so that water may be discharged into one, two, three, or all of the chambers in the cylinder 37. The distributing-heads 44 have swinging connection with said pipes. Rocking motion may be imparted to the cylinder 37 in any desired manner. I have here shown it as provided at its ends with gear-wheels 47, with which racks 48 engage. (See Figs. 7 and 8.) The said racks may be operated by hydraulic or any other desired power.

The base 29 of the receiver 27 (see Fig. 6) has an opening extended lengthwise of it at its center, and movable vertically in this opening is a hollow bar 49, having feed-pipes 50 (see Fig. 2) for supplying water thereto. Supported by this hollow bar 49 is a valve 51, (see Fig. 6,) having its stem portion extended downward into said bar, and at the side of said stem portion are ports 52, through which water may be discharged into the receiver when the valve is raised. This valve 51 has its opposite side edges at the lower side beveled downward and inward to engage upon the inclined wall of the base of the receiver. The hollow bar 49 and the ports 52 communicate with a hollow boxing 53, and the said bar and valve are raised and lowered by means of a screw-shaft 54, (see Fig. 2,) having bearings through the supporting-legs of the concentrator. This screw-shaft 54 is provided with right-and-left threads engaging with blocks 55, from which links 56 extend to a swiveled connection with the boxing 53.

The hollow boxing 53 at its lower portion is provided with a slide-valve 57. (See Fig. 1.) At the front and rear of the hollow boxing 53 are other hollow boxings 58 and 59, each provided with a slide-valve 60 at its lower portion, and above the valves 57 and 60 are slide-valves 60^a. These several slide-valves may be opened when it is desired to discharge material received in the hollow boxings. The hollow boxings 58 and 59 communicate, respectively, with ports 60^b and 61, (see Fig. 6,) leading through the base 29 at the sides of the ports 52, and these ports 60^b and 61 are controlled by swinging valves 62 and 63. These valves 62 and 63 are rounded at their lower sides and are seated on movable bars 64, with which screw-rods 65 engage, these screw-rods being extended through tapped holes in the base 29, and by manipulating these screw-rods 65 the valves 62 and 63 may be adjusted. The upper inner edges of the valves 62 and 63 are designed to engage an inclined portion of the base 29 at the upper ends of the ports 60^b and 61, the said inclined portions forming valve-seats. The valves may be raised and lowered relatively to the valve-seat by means of eccentric-rods 66, passing longitudinally through the base portion of the receiver. The eccentric-rods have cranks 66^a on their outwardly-extended ends, and from these cranks operating-rods 66^b extend. (See Figs. 1 and 2.)

Extended longitudinally through the side of the base 29, against which the gate 28 slides, is a waterway 67, having an upwardly-inclined opening 68, (see Figs. 6 and 7,) through which water may be discharged to prevent sand from entering between the outer surface of the base 29 and the surface of the gate 28, engaging therewith, thus preventing any undue friction, and the same method will be adopted as to the other similar surfaces and joints in the receiver 27, where the sand would otherwise enter.

Referring now to Fig. 1, arranged underneath the drum 19 is a water-pipe 69, having a longitudinal slot at its upper side. This water-pipe 69 is mounted to oscillate back and forth, so that water forced through the slot may wash the plates 20 of the drum. The oscillating movement of this pipe, which may be produced by any suitable means, will facilitate the washing, as the water will be evenly distributed by such motion.

Pivotally connected to the side walls of the section 3 at its top is a trough 70, designed to connect the top plate of the section 1 with an overflow-chute 71. This trough 70 is designed to be used when the section 2 is removed for cleaning or for giving free access to the plates of the other sections. The overflow from the receiver will be directed to the drum 19 by a deflector-board 71^a. The upper end of the trough 70 is attached to chains or ropes 72, extending over pulleys 73, mounted to rotate on a shaft supported by a frame consisting of sections 74, extended from the cas-

ing 1, and a section 75, extended from the section 3. These chains or ropes 72 extend over pulleys 76 and have counterbalance-weights 77 at their ends.

In operation the receiver 27 will be about half filled with water, and then the ore—say from five to ten tons—in a crushed state will be placed in the receiver. Water is then injected into any one or all of the chambers in the cylinder 37 and is forced out of said chambers through the slots 42. This water will be forced up through the descending sand, forcing back the lighter particles, the heavier particles dropping down to the lowest point in the base of the receiver, and by lifting or lowering the valves 62 63 the same will descend still farther, to be caught above the valves 60^a, where the values may be obtained. The valves 62 63 may be slightly open during the whole time of the operation to expedite the catching of the values. By raising the valve 51 water will be discharged into the receiver 27. The amount of foreign particles caught at the base of the valve 51 with the metallic sand will govern the operator as to the amount and force of water to be used. These manipulations may be varied to suit the operations. Instead of forcing the water up through the sand the sand may be allowed to settle on the bottom of the receiver. When it all settles, water is then discharged in the chambers of the cylinder 37, at first with greater pressure in the lower chambers, which will force the lighter particles and, if desired, the heavier particles upward, or the cylinder 37 may be dispensed with, the sand being forced back and up by raising the valve 51 to allow the water to enter the receiver 27 at any desired pressure. By rocking the cylinder 37 back and forth the water will be evenly distributed. The valves 51, 62, and 63 may be all raised at the same time, so that the heavier sand may drop into the boxings 53, 58, and 59. When all the valuable particles that can in a reasonable time be precipitated have been deposited in the bottom of the receiver 27, then the gate 28 is to be lowered by means of the chain 33 and a mixture of light sand and water flows over the top of said gate and over the several plates to the drum 19. The heavier particles of the sand that passes over the plates will fall through the slots of the upper plates to the plates below. At different intervals the top plates 5 and 13 will be raised by means of the hydraulic jacks, so that the plates below them may be flushed with water. This flushing may be done by a series of water-pipes connected together at one end and extended through holes 78 and entirely across the section 1 of the apparatus.

In order to more quickly draw off the heavy particles from the receiver 27 and also to empty said receiver of all particles not intended to pass into the boxings 53, 58, and 59 and over the plates, the gate 28 may be raised until the opening 30 through the same has its upper end above the wall of the base 29. The material may then discharge into the trough 31.

When gold ores are to be concentrated, the plates 5, 13, and 17 will be amalgamated on their upper surfaces, but the plates 20 will be amalgamated on both sides for the purpose of catching the flour-gold in the tailings that would otherwise be lost. The top plates 5 and 13 are to be amalgamated on the side which the mixture strikes.

When it is desired to remove the movable section, water will be admitted to the hydraulic jack 79 (shown in Fig. 1) and which has its piston-rod connected to the truck 10^a. The truck will be moved lengthwise of the amalgamator, carrying the movable section and moving the plates 18 over and upon the plates 17. Then by releasing the clips 18^b the truck may be moved back and the movable section may be rolled out on either of the side tracks 80. (See Fig. 3.)

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a receiver, of a plurality of connected water-chambers mounted to rock in the receiver, and having outlets discharging into the receiver, and rocking water-distributing heads connected with the ends of the water-chambers, substantially as described.

2. The combination with a receiver, of a cylinder mounted to rock in the receiver and provided with a plurality of longitudinal water-chambers having outlets discharging into the receiver, and rocking water-distributing heads connected with the ends of the said water-chambers, substantially as described.

3. The combination with a receiver, of a cylinder mounted to rock in the receiver and provided with a plurality of longitudinal water-chambers having outlets discharging in the receiver, rocking water-distributing heads connected with the ends of the said water-chambers, and a plurality of water-pipes having a loose connection with the said distributing-heads, substantially as described.

4. The combination with a receiver having an outlet in its bottom, of a vertically-movable hollow support with which a water-supply is connected, and a valve carried by the support for closing the outlet, the valve being provided with ports through which water may enter the receiver when the valve is raised, substantially as described.

5. The combination with a receiver having an outlet in its bottom, of a hollow movable support below the outlet and with which a water-supply is connected, a valve carried by the support at the upper end thereof and provided with ports, and means for raising and lowering the support, to raise and lower the valve to permit water to enter the receiver through the ports of the valve, substantially as described.

6. The combination with a receiver having

a central valve-controlled outlet in its bottom and an outlet one on each side of the central outlet, of valves for controlling the said side outlets, substantially as described.

7. The combination with a receiver having a central valve-controlled outlet in its bottom, and an outlet at each side of the central outlet, of swinging and adjustable valves for the said side outlets, substantially as and for the purpose set forth.

8. The combination with a receiver having outlets in its bottom, of adjustable supports, valves in the outlets and having their lower ends loosely mounted on the supports, and means for raising and lowering said valves, substantially as described.

9. In a concentrator, a receptacle having an outlet near the bottom for the withdrawal of material, concentrating-surfaces to which the material may pass from the receptacle independent of the outlet, a gate controlling communication between the receptacle and concentrating-surfaces, and means for directing water adjacent to said gate to clear it of material.

10. The combination with a receiver, and concentrating-surfaces at one side of the receiver, of a vertically-sliding gate between the receiver and concentrating-surfaces, said gate being provided with an outlet, whereby the gate is made to serve a twofold purpose viz: controlling the flow of material to the concentrating-surfaces and conveying the contents of the receiver to a trough, substantially as described.

11. In a concentrator, a receptacle having means for agitating material therein, concentrating-surfaces to which material may pass from the receptacle, and a gate controlling the admission of material to the said surfaces, the gate having an outlet-passage at its lower end, whereby the gate may direct the material to a trough or the like.

12. In a concentrator, the combination with a fixed section having concentrating-surfaces, of a bodily and laterally movable section having concentrating-surfaces, which register with and form continuations of the concentrating-surfaces of the fixed section when in position, substantially as described.

13. In a concentrator, the combination with a fixed section having concentrating-surfaces, of a movable section having concentrating-surfaces which register with the concentrating-surfaces of the fixed section when in place, said movable section being mounted on a transversely-traveling wheel-supported frame, substantially as described.

14. In a concentrator, the combination with a fixed section having concentrating-surfaces, of a movable section having concentrating-surfaces which register with the concentrating-surfaces of the fixed section, when in place, a wheel-supported frame carrying the movable section, and a longitudinally-movable track upon which the wheel-supported frame travels, substantially as described.

15. In a concentrator, the combination with stationary sections having concentrating-surfaces spaced apart, of removable sections arranged between the stationary sections and having concentrating-surfaces receiving the material from the concentrating-surfaces of one stationary section and delivering it onto the concentrating-surfaces of the other stationary section, substantially as described.

16. In a concentrator, the combination with stationary concentrating-surfaces spaced apart, of removable concentrating-surfaces arranged between the stationary concentrating-surfaces and registering with the upper stationary concentrating-surfaces, and a frame arranged between the removable concentrating-surfaces and the lower fixed concentrating-surfaces and having short plates overlapping the said lower fixed concentrating-surfaces, substantially as described.

17. In a concentrator, the combination with a plurality of fixed concentrating-plates arranged one above the other, of a movable plate arranged above each of the fixed plates and normally resting thereon, vertical lifting-bars to which the opposite sides of the movable plates are secured, cross-heads secured to the lifting-bars and means for operating the cross-heads, substantially as described.

18. In a concentrator, the combination with a plurality of fixed concentrating-plates arranged one above the other, of an apertured movable plate arranged above each of the fixed plates and normally resting thereon, lifting-bars to which the opposite sides of the movable plates are secured, cross-heads connecting the lifting-bars, and hydraulic jacks having their pistons connected with said cross-heads, substantially as described.

19. In a concentrator the combination with stationary sections having concentrating-surfaces and spaced apart, of a removable intermediate section having concentrating-surfaces, and means for connecting the stationary sections when the intermediate section is removed, substantially as described.

20. In a concentrator the combination with stationary sections having concentrating-surfaces and spaced apart, of a removable intermediate section having concentrating-surfaces, and a swinging trough for connecting the stationary spaced sections when the intermediate section is removed, substantially as described.

21. In a concentrator, a receptacle for the material, two spaced sections one adjacent to the receptacle, said sections having concentrating-surfaces, a gate controlling the entrance to said adjacent section, but permitting overflow from the receptacle, a removable section fitting between the spaced sections and having concentrating-surfaces, and a trough for connecting the spaced sections at the top, when the removable section is removed.

22. In a concentrator, the combination with a rotating drum having radial concentrating-

plates, of an inclined stop-plate extending below the drum, a shaft below the drum and in front of the stop-plate, and deflector-plates 22 and 23 mounted on the shaft, and serving with the stop-plate to direct the heavier and more valuable particles discharged from the drum to a suitable receptacle, substantially as described.

23. In a concentrator, two fixed sections, concentrating-plates in each of said sections, a movable section between the fixed sections, concentrating-plates in said movable section, and a series of narrow plates movable with the movable section.

24. In a concentrator, two fixed sections, concentrating-plates in said fixed sections, a movable section between the fixed sections, concentrating-plates in said movable section, movable plates for connecting the plates of the movable section with the plates of the lower fixed section, and means for moving the movable section and movable plates together.

25. In a concentrator, two fixed sections, concentrating-plates in the fixed sections, a movable section having plates to connect with the fixed plates, a truck having a track on which wheels on the movable section bear, and means for moving the truck lengthwise of the concentrator.

26. An ore-concentrator, comprising two fixed sections, a removable section between the fixed sections, each of said sections having a series of inclined plates, the plates of one section registering with the plates of the other sections, the upper of the fixed sections and the removable section having plates provided with slots and designed to rest on the fixed plates in said sections and to be moved vertically therefrom, means for causing the vertical movements of said slotted plates, a receiver for ore and water at the forward end of the upper section, a vertically-movable gate between said upper section and receiver, and means for injecting water into the lower portion of said receiver.

27. An ore-concentrator, comprising two fixed sections and a removable section between the fixed sections, fixed inclined plates in the several sections, vertically-movable slotted plates in the upper of said fixed sections and in the removable section, means for moving said plates upward and downward, a drum having radial plates forming walls of pockets for receiving material from the plates in the lower fixed section, a receiver at the forward end of the upper fixed section, a vertically-movable gate between the upper fixed section and the receiver, and means for injecting water into the lower portion of the receiver.

28. An ore-concentrator, consisting of two fixed sections having inclined plates, a section between said two fixed sections, mounted on wheels, inclined plates in said section designed to register with inclined plates in the fixed sections, a rotary drum having radial plates forming pockets to receive material from the plates in the lower fixed section, a receiver forward of the upper fixed section, a vertically-movable gate between said upper section and the receiver, the said gate having a discharge-opening in its lower portion, means for injecting water into the lower portion of the receiver, and valve-controlled outlets at the bottom of the receiver.

29. An ore-concentrator, comprising a series of inclined plates, a drum having pockets to receive material from said plates, a receiver forward of the upper end plates, a vertically-movable gate between said receiver and plates, a cylinder mounted to rotate in the lower portion of the receiver and having a series of chambers extended through it, the said chambers having outward openings into the receiver, independent pipe connections with said chambers, and valve-controlled outlets leading into boxings at the lower portion of the receiver.

30. An ore-concentrator, comprising a series of inclined plates, a rotary drum having plates forming the walls of pockets for receiving material from the lower ends of the plates, a receiver for material at the upper ends of the plates, a vertically-movable gate between the said upper ends of the plates and the receiver, a cylinder mounted to rotate in the lower portion of the receiver and having a series of chambers, the said chambers having outward openings into the receiver, means for supplying water to said chambers one independently of another, a base for said receiver having an opening at its central portion, a hollow bar movable in said opening, water-pipes leading into said hollow bar, a valve carried by said hollow bar and having its stem portion extended into the bar, but spaced from the sides thereof so as to form ports, a hollow boxing having communication with the hollow bar, a slide-valve at the bottom of said boxing, means for raising and lowering the valve, hollow boxings forward and rearward of the first-named boxing and having valves at their lower portion, ports through the base of the receiver communicating with said front and rear hollow boxings, and valves for controlling said ports.

31. An ore-concentrator, comprising a series of inclined plates, a receiver for material at the upper end of said inclined plates, a vertically-movable gate between said receiver and plates, the said gate having an outlet in its lower portion, a base at the lower portion of the receiver, against one side of which the lower portion of the gate engages, the said base having a waterway in its wall adjacent to the gate, the said waterway opening outward so as to discharge water upon the gate, means for injecting water into the lower portion of the receiver, and valve-controlled outlets in the base of the receiver.

32. An ore-concentrator, comprising a series of inclined plates, a rotary receiver for receiving material from the lower ends of said inclined plates, a receiver for material at the

upper ends of said inclined plates, a vertically-movable gate between said upper ends of the plates and the receiver, a cylinder mounted to rotate in the lower portion of the receiver, the said cylinder having a series of independent chambers extended longitudinally of it within the receiver, the said chambers having outlets for discharging water into the receiver, valve-controlled pipes connecting with said chambers, the said pipes being independent one of another, a central longitudinal opening through the bottom of said receiver, a hollow bar movable vertically in said opening, a boxing with the interior of which the said hollow bar communicates, a screw-shaft and link connections for raising and lowering the boxings and the hollow bar, a valve carried by the hollow bar for controlling communication between said hollow bar and the interior of the receiver, hollow boxings forward and rearward of the first-named boxing and having communication with the interior of the receiver, and valves for controlling said communication.

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