No. 745,860. PATENTED DEC. 1, 1903.

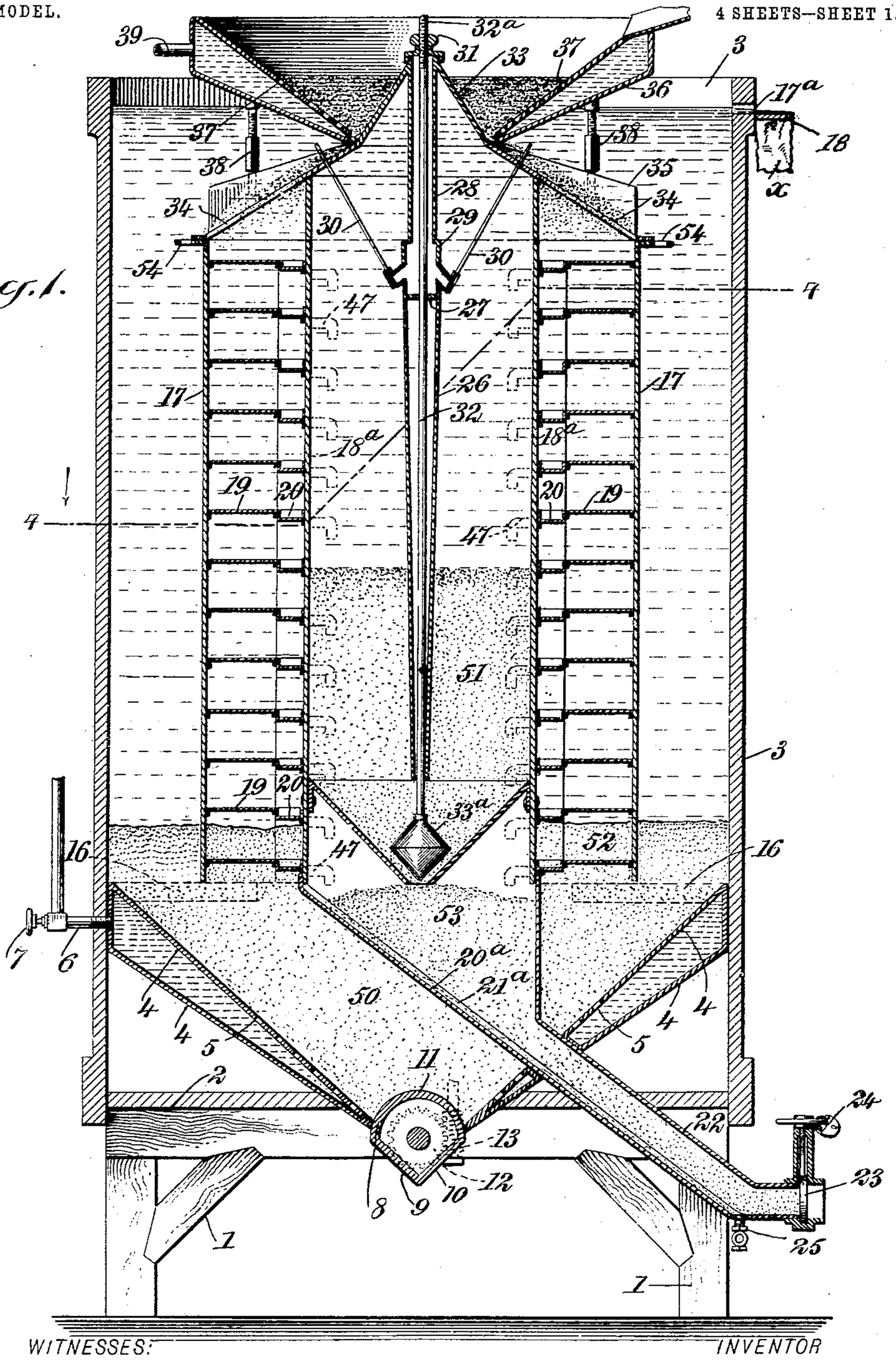
E. W. KEELER.

ORE CONCENTRATOR.

APPLICATION FILED SEPT. 5, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.

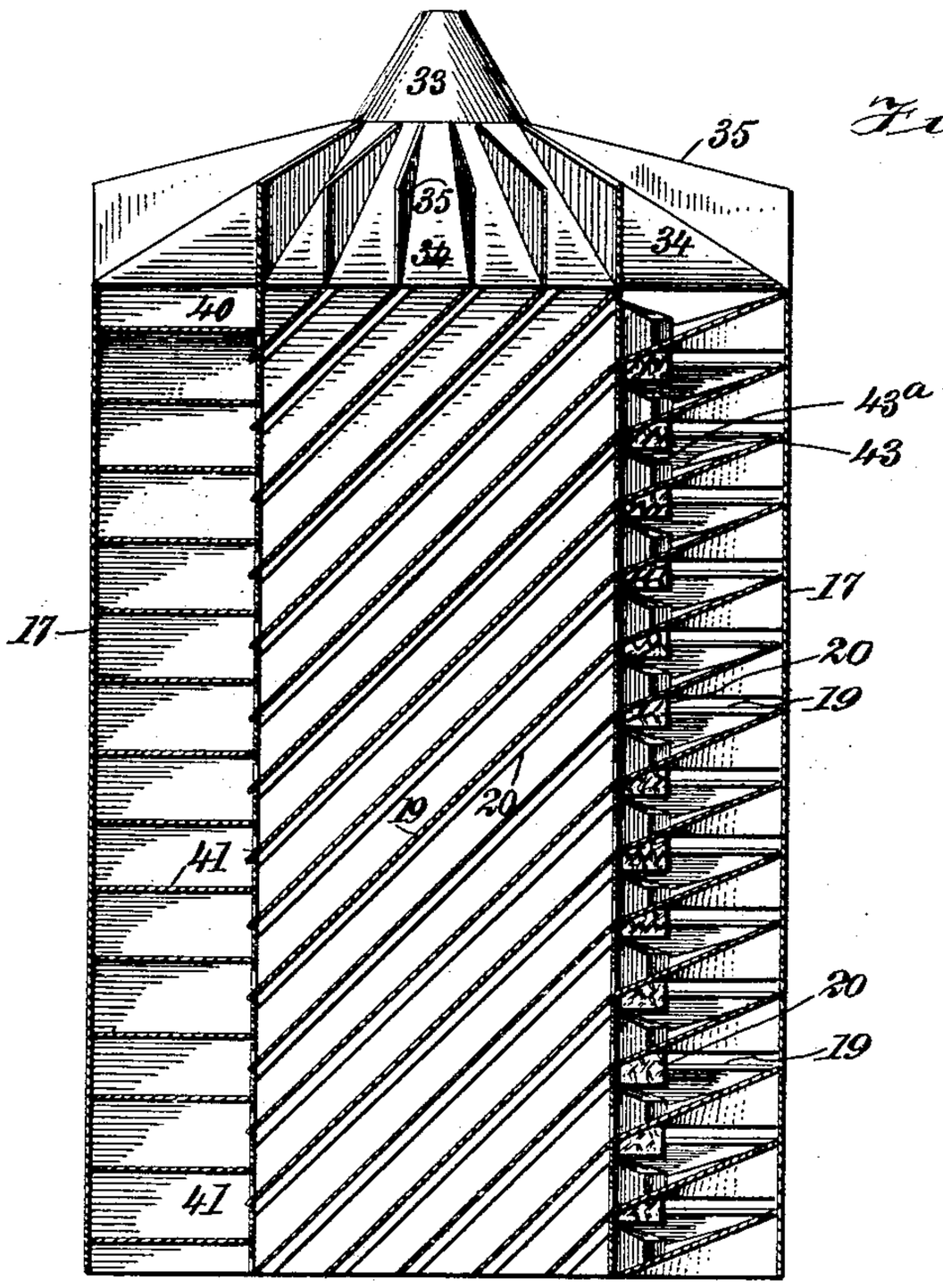
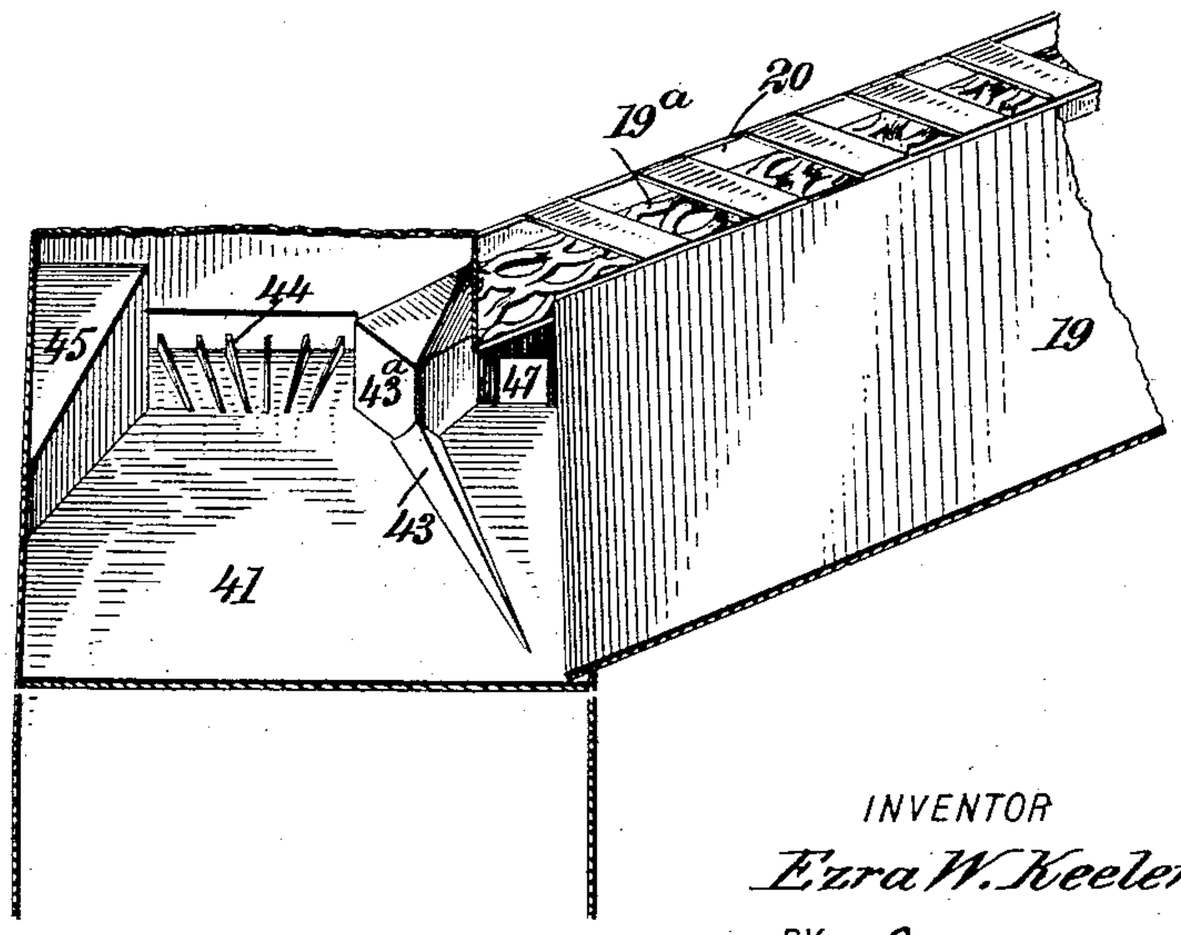


Fig. 7.



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APPLICATION FILED SEPT. 6, 1902.

NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.

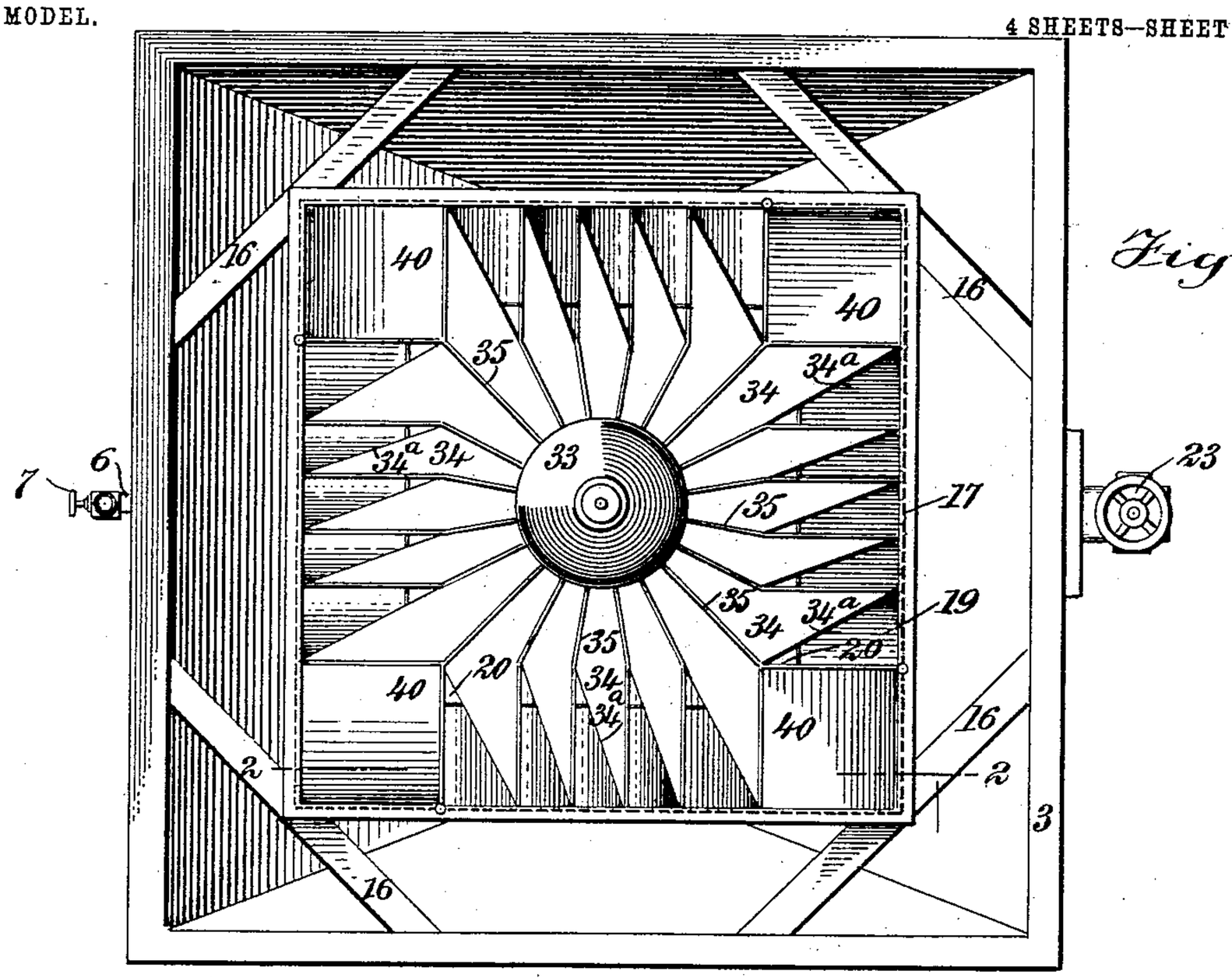
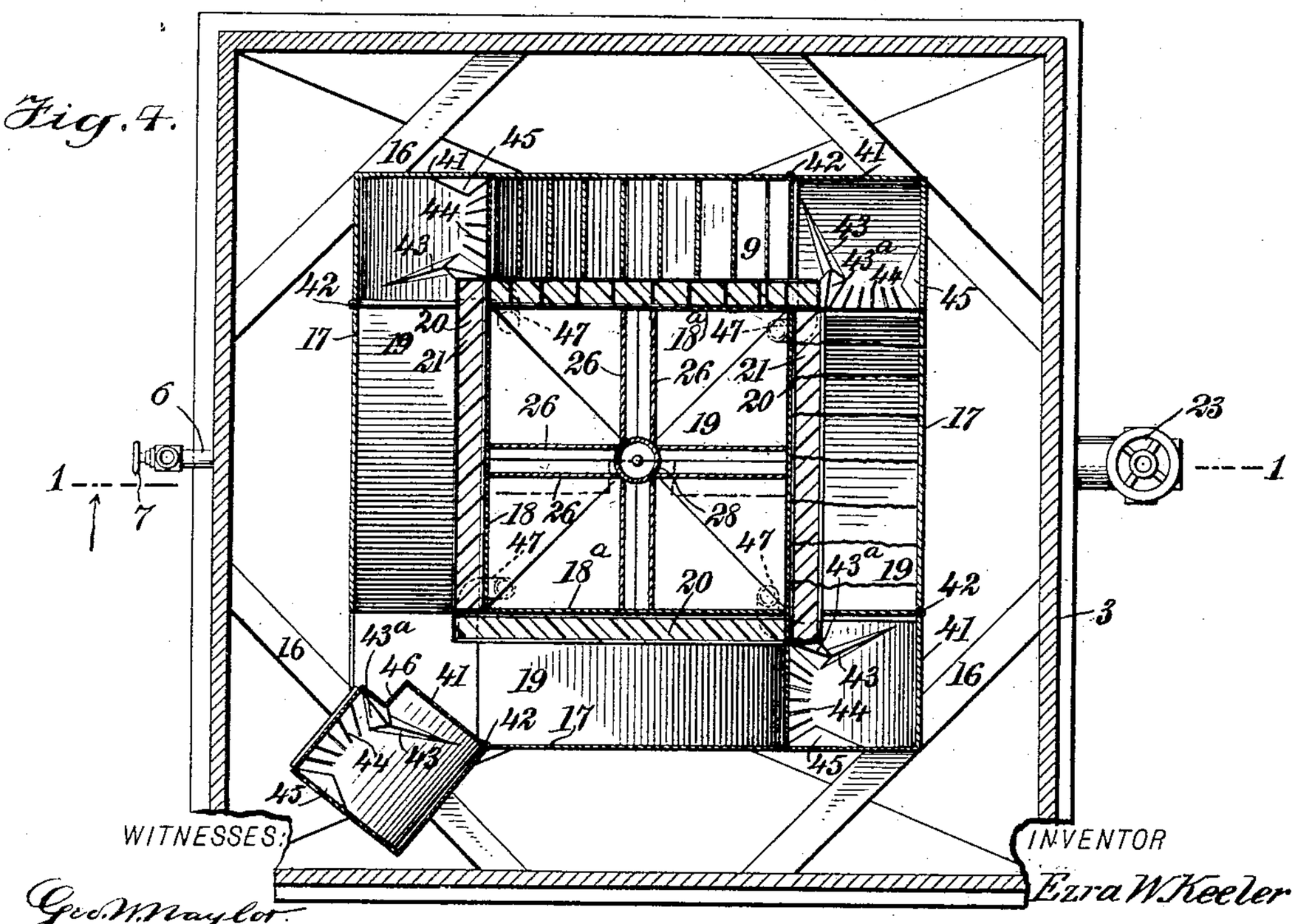


Fig. 4.



No. 745,860. PATENTED DEC. 1, 1903.

E. W. KEELER.

ORE CONCENTRATOR.

APPLICATION FILED SEPT. 5, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5.

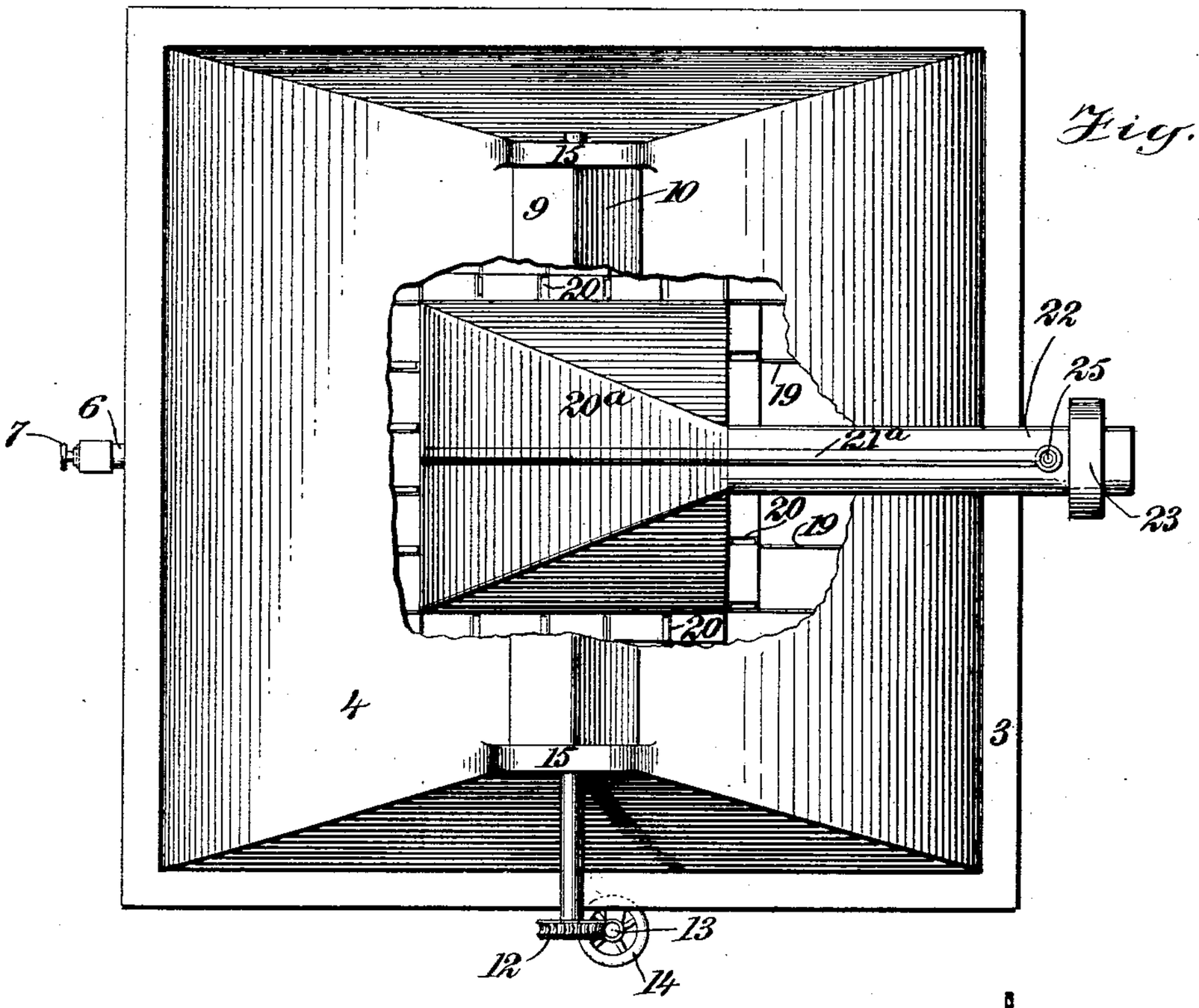
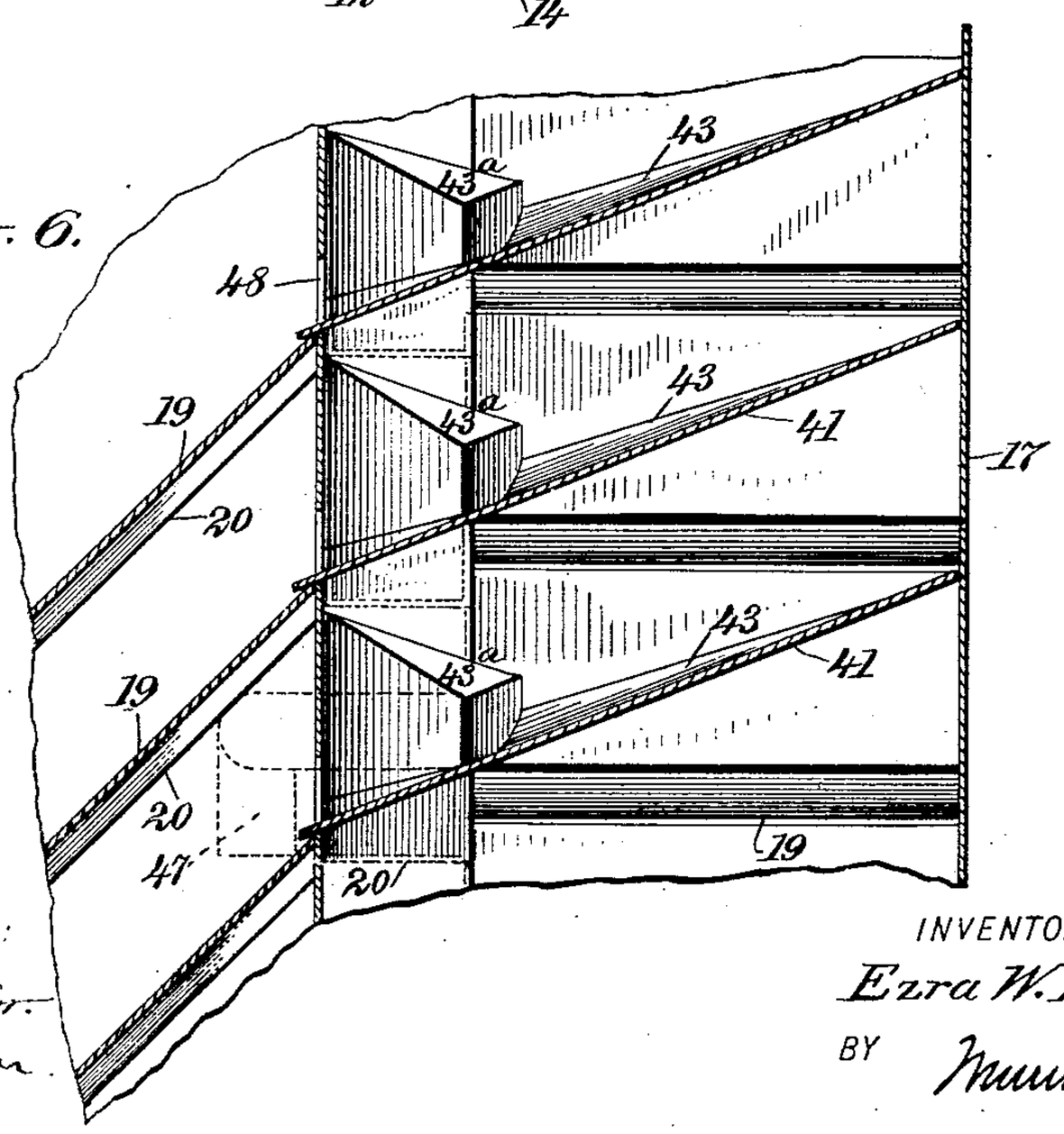


Fig. 6.



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No. 745,860. Patented December 1, 1903.

UNITED STATES PATENT OFFICE.

EZRA W. KEELER, OF NEW YORK, N. Y.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 745,860, dated December 1, 1903.

Application filed September 5, 1902. Serial No. 122,189. (No model.)

To all whom it may concern:

Be it known that I, EZRA W. KEELER, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county of New York and State of New York, have invented a new and Improved Ore-Concentrator, of which the following is a full, clear, and exact description.

My invention relates to ore-concentrators, my idea being more particularly to produce a simple, compact, efficient, and reliable apparatus which has quite a number of important functions, as hereinafter described.

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 figures.

Figure 1 is a substantially central section through the concentrator upon the line 1 1 of Fig. 4. Fig. 2 is a section of the interior vessel upon the line 2 2 of Fig. 3. Fig. 3 is a plan of the concentrator complete. Fig. 4 is a fragmentary section upon the line 4 4 of Fig. 1. Fig. 5 is an inverted plan of the concentrator, certain parts being broken away. Fig. 6 is an enlarged fragmentary section, showing the relative arrangement of the chutes and redistributing-pans; and Fig. 7 is a perspective view of one of the redistributing-pans and adjacent parts.

Upon the framework 1 is placed the platform 2, supporting the casing 3. Within this casing is a substantially funnel-shaped hopper 4, made with double walls, as shown, the inner wall being provided with water-ducts 5. The pipe 6, provided with the valve 7, is used for supplying water between the walls 4 4 of the funnel-shaped hopper. The bottom of the hopper is provided with a valve 8, having the general form of a prismoidal cylinder and provided with flat faces 9 10 and with a curved face 11. This valve is operated by means of the worm-wheel 12, which engages the worm 13, the worm in turn being operated by the hand-wheel 14. The valve is pivoted directly upon the bearings 15, as indicated more particularly in Fig. 5.

Disposed within the casing, near the bottom thereof, are supporting-beams 16, upon which the inner vessel 17 normally rests. The casing 3 is provided with an overflow 17^a, adjacent to which is a shelf 18 for the purpose of spreading the overflowing water in the form of a sheet. Gold-gathering blankets *x* may be laid upon this shelf and are used for the purpose of collecting any floating particles of gold which may be carried off in the overflow.

A casing 18^a is disposed inside of the casing 17, as shown more particularly in Fig. 4.

Mounted between the casings 17 and 18^a are a number of chutes consisting of flat metallic plates 19 and the troughs 20, sunken relatively thereto. Both the plates 19 and the troughs 20 are inclined for the purpose of drifting material downward. The casing 18^a is provided with an inclined bottom 20^a (shown more particularly in Fig. 5) and with a mercury-trough 21^a, as shown in Figs. 1 and 5. A discharge-chute 22 (shown more particularly in Fig. 1) serves the purpose of leading the ore downwardly to the valve 23, from whence it may be allowed to flow out as desired. A lock 24 prevents unauthorized persons from removing the riffle-treated ore, and the valve 25 is used for the purpose of removing mercury which may drift downward in the trough 21^a. The casing 18^a is provided with partitions 26, whereby it is divided into into four equal compartments. The partitions 26 are not parallel, but are somewhat inclined relatively to each other, as indicated in Fig. 1. This is for the purpose of making the exit of the ore easier than would otherwise be the case. In other words, the inclination of the partitions 26 prevents the ore from packing in the receptacle 18^a.

A tube 28 is mounted upon and is connected with the partitions 26. The lower end of the tube is provided with a mercury-cup 29, the bottom of the cup being formed by a partition 27, as indicated more particularly in Fig. 1. A number of movable spade-like members 30 are provided for the purpose of discharging the mercury from the cup 29 in any quantity desired. The upper end of the tube 28 is closed by a screw-cap 31, which engages the thread 32^a upon the vertical rod 32. The lower end of this rod is provided with a conical valve 33^a. Rigidly connected with the tube 28 and mounted within the up-

per portion of the casing 3 is a conical member 33, divided into sections 34, each section terminating in a mutilated edge 34ª, as indicated more particularly in Fig. 3. The triangular partitions 35 are employed for the purpose of dividing the sections 34 each from the other. By this arrangement when ores and water are placed upon the conical member 33 they are distributed into the sections formed between the walls 35.

A double-walled conical hopper 36 is provided with water-ducts 37, as shown in Fig. 1. This hopper is adjusted by means of the screw adjustments 38 and is supplied with water by means of the pipe 39. The object of this arrangement is that when the water is forced through the pipe 39 into the interior of the double-walled hopper it makes its escape through the water-ducts 37, thereby rendering the internal surface of the hopper somewhat slippery and facilitating the discharge of the ores from the hopper The arrangement thus described is substantially the same as the arrangement above described with reference to discharging the ores from the double-walled hopper 4 at the bottom of the casing 3.

Situated at the four corners of the inner vessel are a number of square pans 40 41, rigidly connected in one body, all of which are hinged at the corner 42, and are thus enabled to swing outward, as indicated in Fig. 4. These pans are disposed in the forms of distinct columns, as indicated more particularly in Fig. 2. The pans in each corner are swung in a group. These pans are provided with riffles 43 43ª and a wall 45, between which are partitions 44. Each pan is provided with mutilations 46, as indicated at the lower left-hand corner of Fig. 4, whereby the pan is enabled to fit against the end of the channel 20 immediately adjacent thereto, and thus make a new and equal distribution. The disposition of the pans relatively to the channels 20 and the plates 19 is such as to form a series of continuous spiral channels extending from the top of the inner vessel to the bottom thereof. A passage-way 47 leads from a point immediately adjacent to each of the pans 41 through the inner casing 18ª, as indicated more particularly in Figs. 4 and 7. The lower portion of each pan 41 terminates immediately adjacent to the upper end of a plate 19 and a channel 20, the opening 48 being provided for the purpose of discharging ore settling in this special riffle from each pan 41, as indicated more particularly in Fig. 6.

The coarser and lighter portion of the sand or worthless material is shown at 50, the concentrated ore at 51, and the portion of the sand passing downward through the channels and from the concentrates which have been removed is shown at 52. Concentrated ore after passing down from the inner receptacle is shown at 53. Roughened plates 19ª may be placed within the channels, as indicated in Fig. 7, for the purpose of causing the ore and water passing downward through the channels to pursue a more sinuous route, forming an obstructed retarding path. The inner vessel may be lifted bodily out of the outer vessel by means of the ears or handles 54, as indicated at the top of Fig. 1.

The general operation of my device is as follows: The several parts being placed in position indicated in Fig. 1, the screws 38 are properly adjusted and the ores to be concentrated—say beach or placer sand or ores in any finely-divided state—are thrown upon the cone 33, being distributed as equally as possible upon the different sides thereof. Water is slowly supplied, if necessary, through the pipe 39 and enables the ores to pass downward through the passages formed by the partitions 35, the ore thus spreading out radially in thin layers. The water oozes slowly through the ducts 37 and enables the ore to slide slowly, but easily, out of the hopper and onto the cone-surface. The function of this part of the apparatus therefore is to feed the ore in the form of a plurality of fan-like sheets which gradually taper in thickness, being thinnest at the outer edges. The inclination of descent is such that the lighter and coarser particles passing over the casing 17 fall below, whereas the heavier particles containing the gold are concentrated along with a considerable admixture of the ore over the edges 34ª of the plates 34 and also into the pans 40, whence it passes down upon the plates 19 and the channels 20. The operation is conducted somewhat slowly, and each operative soon finds a rate of feed which is productive of the best results for a given class of ore, the material falling by its own gravity over the inclined surfaces.

When a portion of the ore in passing down the inclined plate 19 and channel 20 reaches one of the four corners of the inner vessel, the larger proportion of it passes over the riffle 43. The heavier particles, however, containing the largest percentage of gold, are unable as they fall from the lower edge of the silvered plate 19 to go over the riffle 43 and are diverted laterally, passing through the channel 47 and settling into the central receptacle 18ª. The sand and ore passing over the riffle 43 are immediately redistributed and pass between the partitions 44 downward upon another plate 19 and through another channel 20 to another corner, where the same operation is repeated.

The metallic plates 19, coated with quicksilver, are at intervals removed and cleaned for the purpose of extracting the gold adhering thereto by amalgamation, the swinging of the pans 40 and 41 permitting the plates 19 to be removed. Each plate is removed by drawing it out endwise.

I find that a good plan is to slowly feed the material, meanwhile obstructing the discharge thereof at the bottom of the concentrated ore, so that the riffles are all filled loosely with the ore, and then to so regulate

the influx and efflux of the ore and water that the descent of the ore is a gradual creeping or settling of a series of continuous unbroken chains of ore. Whether the process be conducted in the manner just mentioned or more rapidly is largely a matter of experience different to some extent with different characters of ore. The sand-valve 8 may be turned in the position indicated in Fig. 1, in which event it effects a total obstruction of the sand and water. By rotating the sand-valve, however, so as to bring one of the faces 9 10 at a different angle relatively to the hopper, more or less of the sand 50 may be discharged. If desired, the valve 8 may be adjusted to such a position that the sand 50 will be carried off as rapidly as possible, or the sand may be caused to fill the outer vessel to any desired height. The sand 52, coming downward from the spiral chutes, is of course deposited upon the sand 50 and as a general proposition has approximately the same height as that of the sand 50. The gradual removal of the sand 50 allows the sand 52 to descend, the line of demarcation between the two kinds of sand not being distinct. It will be observed that every possible chance is afforded the particles of gold in order to induce them to enter the inner receptacle or to amalgamate with the silvered plates 19.

Mercury is poured into the tube 28 and the screw-cap 31 placed in position to prevent the entrance of grit into the tube. The mercury occupies the cup 29. By means of the spade-like hand-valves 30 the mercury is allowed to trickle downward at a predetermined rate into the concentrates 51, through which it gradually percolates, thus amalgamating with any gold therein contained. The cone-shaped sand-valve 33[a] being adjusted by means of the rod 32 acts as a disturber to prevent clogging, as above described, and the concentrates pass slowly around it and bank up at 53, as indicated in Fig. 1. The concentrated ore 53 is removed by adjusting the valve 23 to an easy flow. The valve is normally secured by means of the lock 24. This sand may be subsequently treated in any desired manner for the purpose of removing any gold which it may contain. The free mercury passes into the shallow trough 20[a] and may be removed by means of the valve 25. The mercury after being freed in any desired manner from the gold which it holds by amalgamation may be recharged in the tube 28 and used over and over again.

It will be understood, of course, that the more freely the sand is allowed to pass through the sand-valve 8 the greater will be the admixture of water contained in the escaping sand. So, also, the supply of water escaping through this valve can be regulated in a measure by controlling the supply of water through the pipes 6 and 39 or upper discharge 17[a] and keeping a uniform depth of solid sand above the valve, discharging no faster than it is replaced. Normally, however, the greater bulk of the inflowing water escapes through the aperture 17[a], and as this water may contain gold in solution or floating particles of metallic gold, or both, there is of course nothing to prevent the recovery of this gold in any desired manner.

I do not limit myself, however, to the practical methods above described for employing my machine. It may be employed in other relations more or less analogous to those described. The matter of adjusting the several valves and the supply of mercury and the water-supply is clearly a matter of individual judgment and may be changed with each kind of ore to be treated and with different-sized machines for treating the same ore. In regions where water is scarce my machine offers the great advantage that the water is economically used and that the machine has no effect upon the water which prevents the subsequent reuse thereof. The operation of the machine may of course be continuous.

Among the several advantages presented by this machine may be mentioned the fact that a given quantity of ore is operated upon in several different ways and is thoroughly worked before being finally released; also, that the several resulting products—such as waste sand, concentrated ore, amalgamated mercury, and amalgam upon the silvered plates—are so arranged as to be readily accessible and capable of being operated upon independently of each other by subsequent treatment, if desired. All parts of the machinery being submerged practically in a tank of water, permits the gold-carrying sands to be equally distributed and so segregated that any particles of gold may easily fall by their own gravity on a silvered surface and the ordinary friction and water be avoided on the plates while forcibly pushed, as in any other devices. The free mercury also has no opportunity to become floured in its purely gravitating and percolating path, and so is entirely under control, and preservation of every particle is insured.

The float-gold can be controlled as it passes out on the surface of water at the top of the tank and handled in various satisfactory ways, the bulk of water used, if so desired, practically passing out of the top of the tank in which the ore or sand is being treated, so that the sand or waste is flowed from the bottom and water at the top at slight pressure, so that small particles of float-gold can be reclaimed.

In starting the machine the concentrating-chamber and riffles will fill up at once with sand, but later as the moving material passes on the riffles will catch the heavy gold, which upon starting at the bottom a small opening, the bottom of these riffles being on an incline, will slide into the inner chamber, and after a little time the mercury has only to act upon a limited portion instead of a mass that has no gold at all.

Under some conditions the machine can be

located so the waste can be sluiced by surplus water at some distance. In other cases a car can be filled underneath and sent to the dump.

The machine may be effectually used upon dredges where the waste materials are easily disposed of.

The capacity of this machine is very great, for the reason that the waste material, which carries a limited quantity of ore, is easily disposed of.

No power is required to operate this machine aside from the work of depositing the material into the hopper and of maintaining a water-supply.

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

1. An ore-concentrator, comprising a vessel for containing concentrates, a plurality of chutes provided with side passages leading into said vessel, plates coated with mercury and disposed within said chutes, a conical member, a plurality of radially-disposed channels mounted upon said conical member and connected with said chutes, and means for discharging ores and water upon said conical member.

2. An ore-concentrator, comprising a central vessel to hold concentrates, an outer vessel to hold waste material, and a number of chutes connected with said central vessel and provided with by-passages leading into said central vessel, said chutes being in part composed of plates coated with quicksilver, and being provided with swinging members to allow the removal of said plates.

3. An ore-concentrator, comprising an outer containing vessel, an inner vessel for holding concentrates, sinuous channels provided with riffles and connected with both of said vessels, means for feeding mercury to said inner vessel, a gravitational feed-outlet for discharging said concentrates from said inner vessel, and adjustable mechanism for regulating the capacity of said outlet.

4. An ore-concentrator, comprising an inner vessel for holding concentrates, an outer vessel provided with channels and riffles for separating said concentrates from ores, and also provided with side passages leading from said channels into said inner vessel for discharging said concentrates into said inner vessel, and means for supplying mercury to said concentrates within said inner vessel.

5. An ore-concentrator, comprising an inner vessel for holding concentrates, an outer vessel provided with channels and with riffles for separating said concentrates from ores, and also provided with side passages leading into said inner vessel for discharging said concentrates into said inner vessel, means for supplying mercury to said concentrates within said inner vessel, a conical discharge for said inner vessel, and a conical valve disposed within said conical discharge for bringing said concentrates more closely into contact with the mercury as said concentrates and said mercury are discharged.

6. An ore-concentrator, comprising an inner vessel for holding concentrates and provided with an outlet, an outer vessel provided with channels and with riffles for separating said concentrates from ores, and also provided with supply-passages leading into said inner vessel for discharging said concentrates into said inner vessel, and a chute disposed adjacent to the outlet of said inner vessel, said chute being provided with a passage to allow the gradual accumulation of concentrated material, and with a trough to facilitate the collection of mercury, said chute being further provided with means for allowing the removal of said mercury, independently of said concentrates.

7. An ore-concentrator, comprising an inner vessel for holding concentrates, and an outer vessel provided with channels and riffles for separating said concentrates from ores and provided with side passages leading into said inner vessel for discharging said concentrates thereinto, said channels being of such conformity as to present a succession of abrupt bends disposed adjacent to said side passages respectively, so as to make a succession of separate distributions of the ore.

8. In an ore-concentrator, the combination of an outer vessel provided with channels and with riffles, and also provided with an overflow at the top thereof, an inner vessel connected with said outer vessel by a succession of passages disposed adjacent to said channels, means for directing the flow of ores and water into said outer vessel, a chute connected with said inner vessel for discharging the concentrates therefrom, and a valve mounted within said chute and controllable at will for governing the outflow of said concentrates from said inner vessel, thereby allowing the concentrates accumulated within said inner vessel to drop gradually downward.

9. An ore-concentrator, comprising an inner vessel for holding concentrates and water, an outer vessel provided with an overflow disposed adjacent to its upper level and with channels and riffles for separating said concentrates from ores, said outer vessel being further provided with side passages leading into said inner vessel for discharging said concentrates thereinto, an educt for discharging said concentrates from said inner vessel, and means, controllable at will, for governing the capacity of said educt.

10. In an ore-concentrator, the combination of an outer vessel of substantially cubical form provided near its top with an overflow, a plurality of channels mounted within said outer vessel and so connected together as to make a plurality of abrupt angular bends for the purpose of effecting repeated redistributions of the ore, riffles connected with said channels at points adjacent to said bends, and an inner vessel for holding concentrates, said inner vessel being connected with said

outer vessel by a plurality of side passages disposed adjacent to said abrupt bends.

11. In an ore-concentrator, the combination of an outer vessel of substantially cubical form provided near its top with an overflow, a plurality of channels mounted within said outer vessel and so connected together as to make a plurality of abrupt angular bends, riffles connected with said channels at points adjacent to said bends, an inner vessel for holding concentrates, said inner vessel being connected with said outer vessel by a plurality of side passages disposed adjacent to said abrupt bends for the purpose of drawing concentrates laterally from said abrupt bends into said inner vessel, and means controllable at will for governing the discharge of concentrates from said inner vessel for the purpose of allowing the upper level of said concentrates within said inner vessel to drop gradually downward.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EZRA W. KEELER.

Witnesses:

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EVERARD BOLTON MARSHALL.