No. 897,223.

PATENTED AUG. 25, 1908.

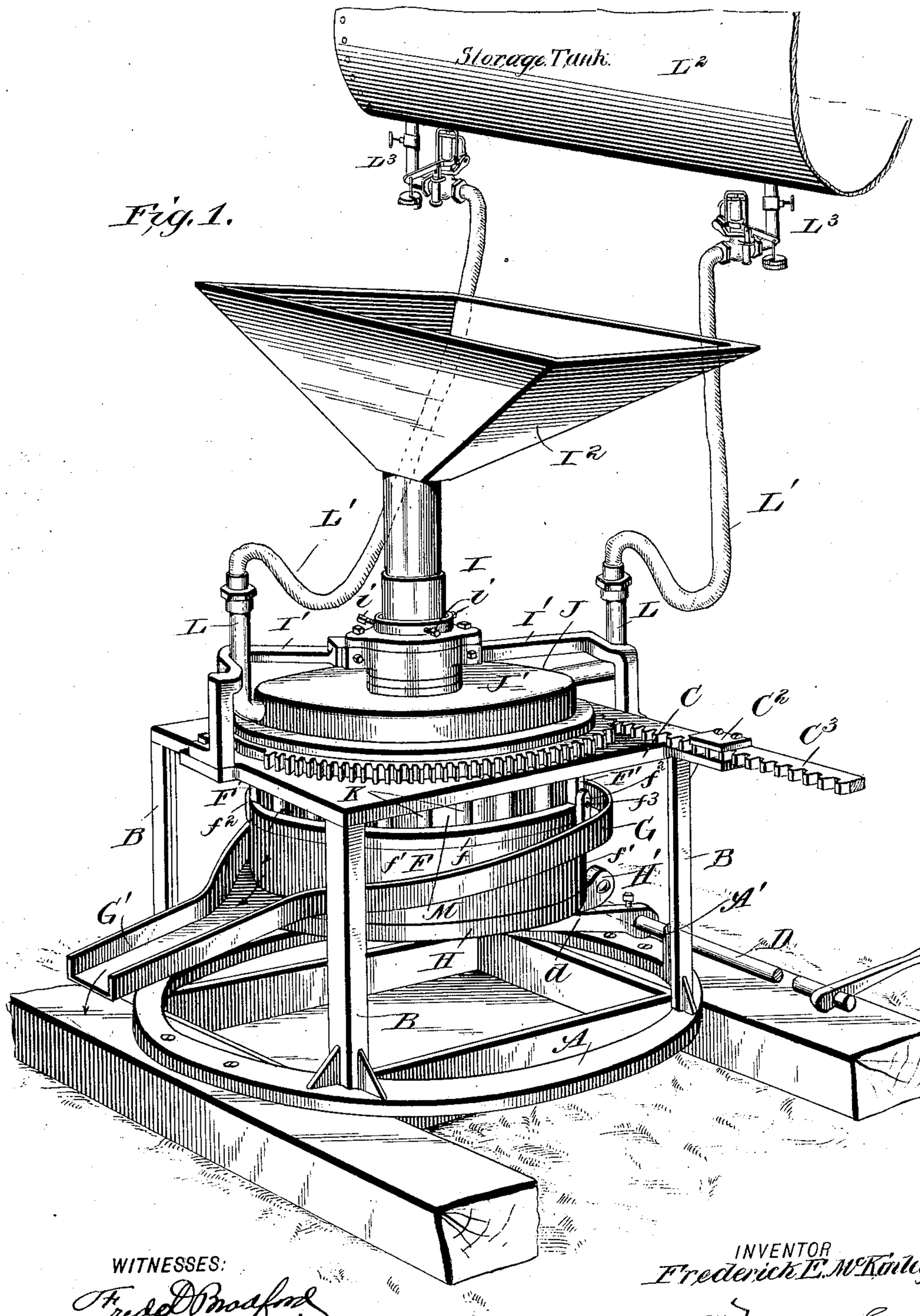
F. E. McKINLEY.

ORE CONCENTRATOR.

APPLICATION FILED MAY 7, 1904.

5 SHEETS—SHEET 1.

Fig. 1.



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5 SHEETS—SHEET 2.

Fig. 2.

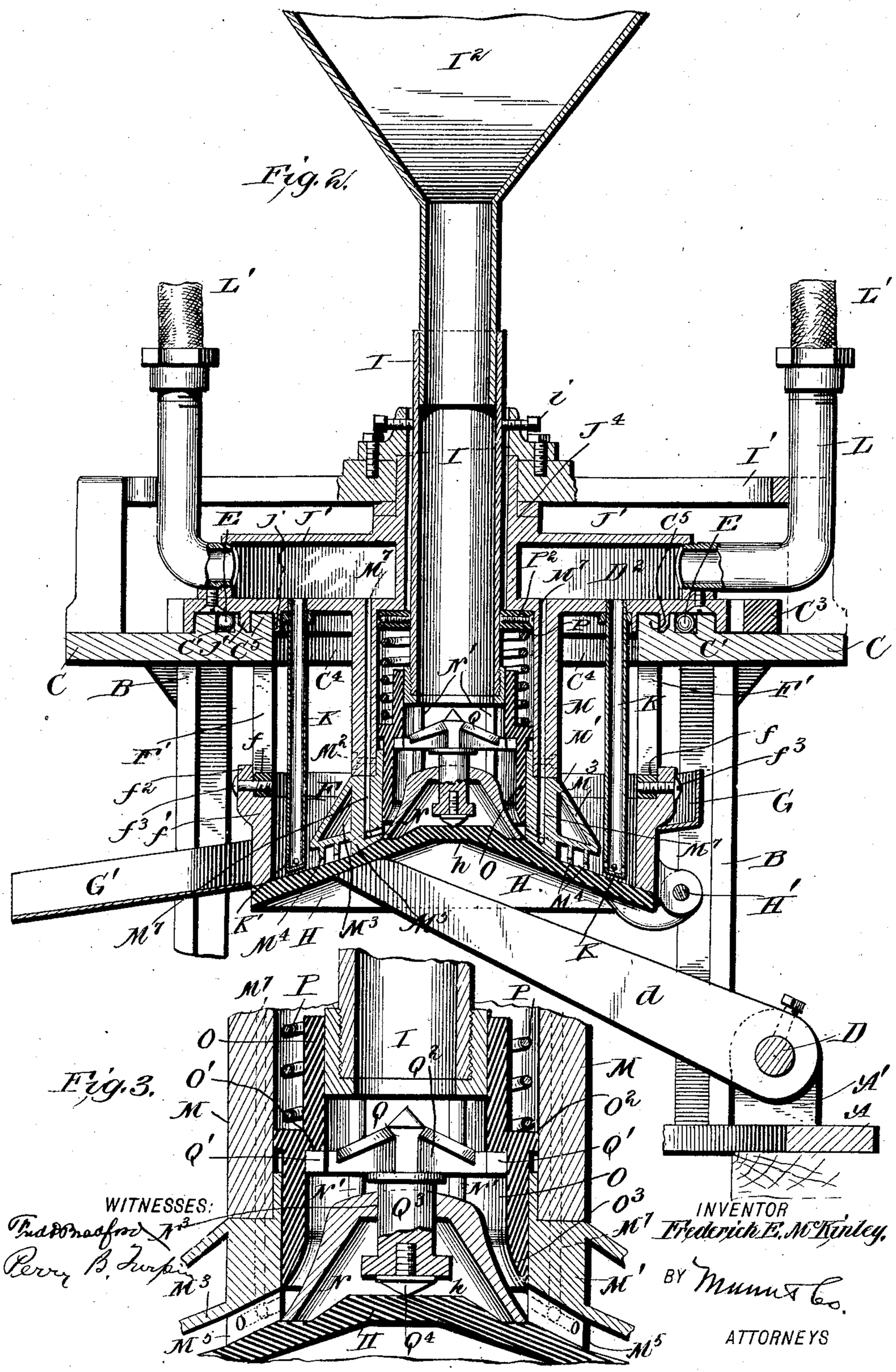

Fig. 3.

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5 SHEETS—SHEET 3.

Fig. 4.

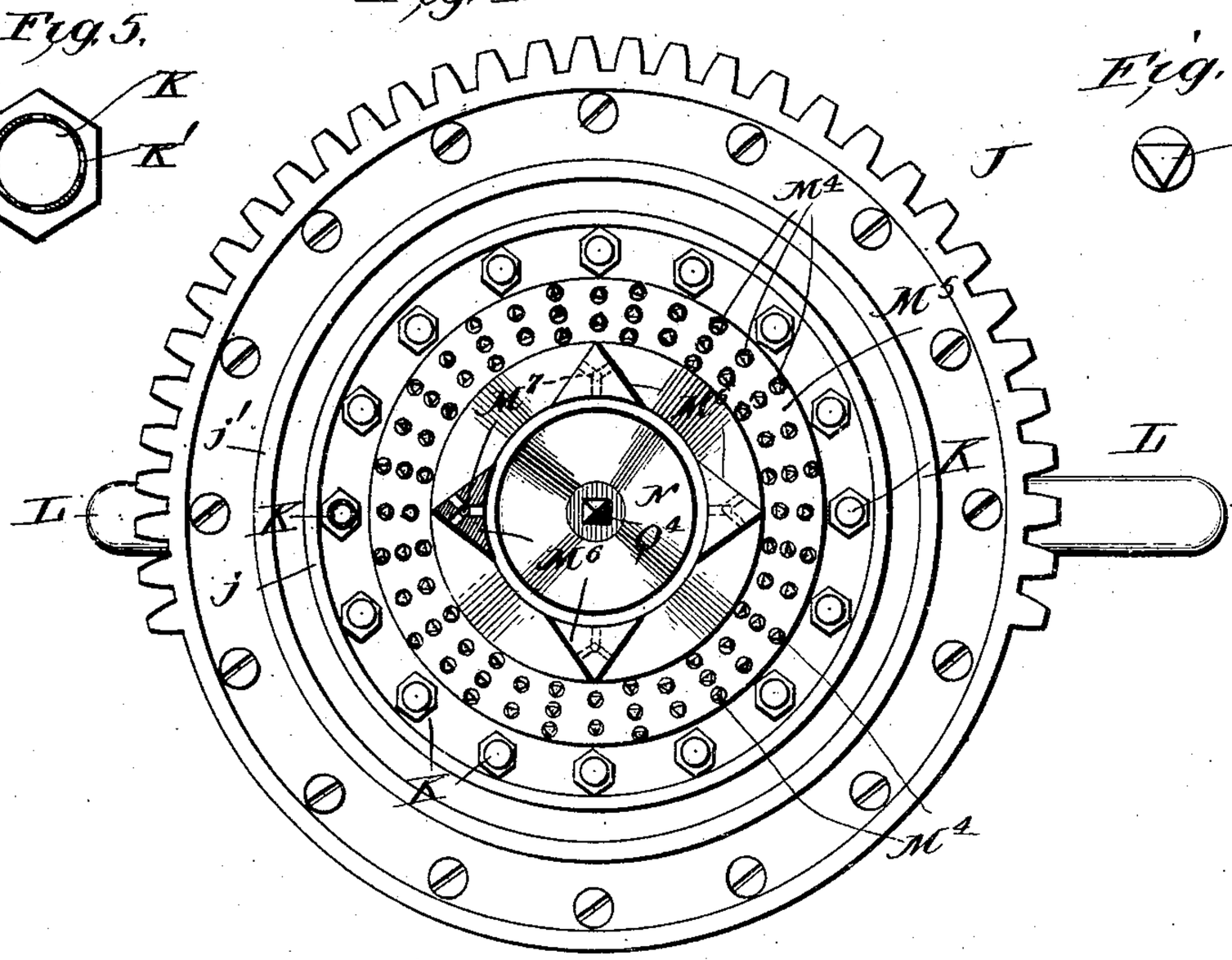
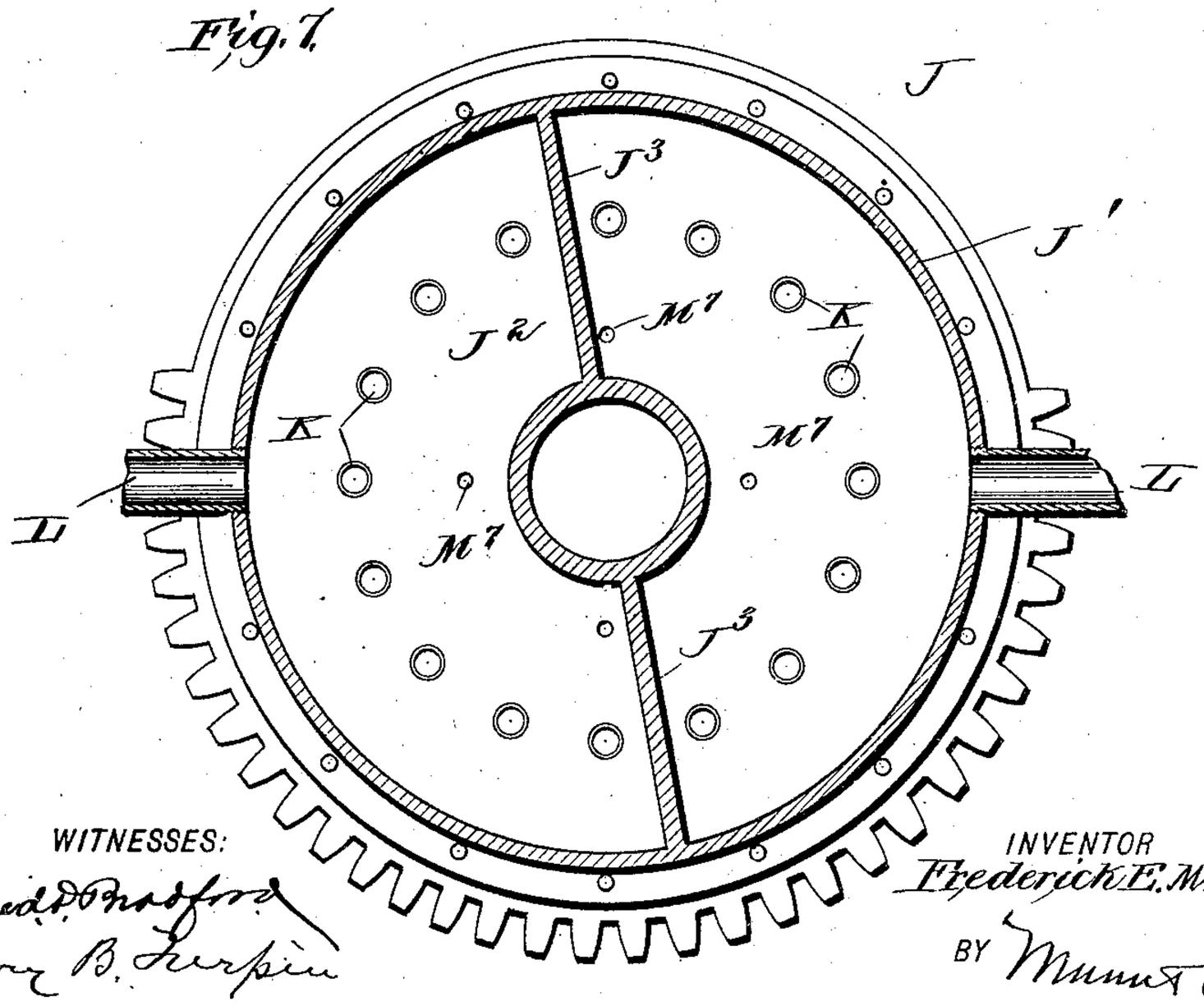


Fig. 5.

Fig. 6.

Fig. 7.



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5 SHEETS—SHEET 4.

Fig. 8.

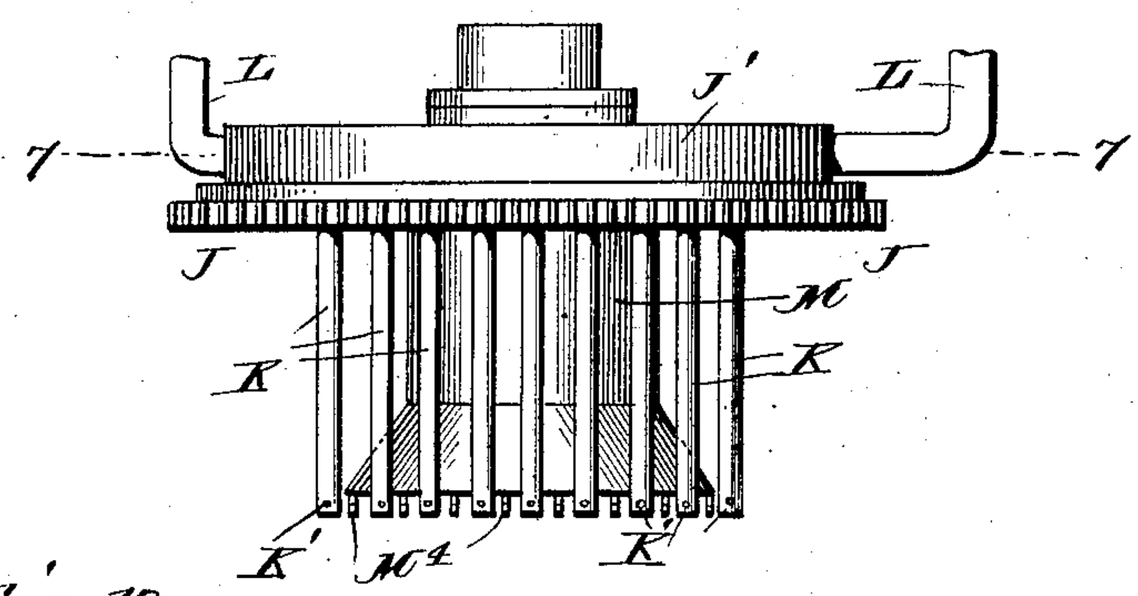


Fig. 13.

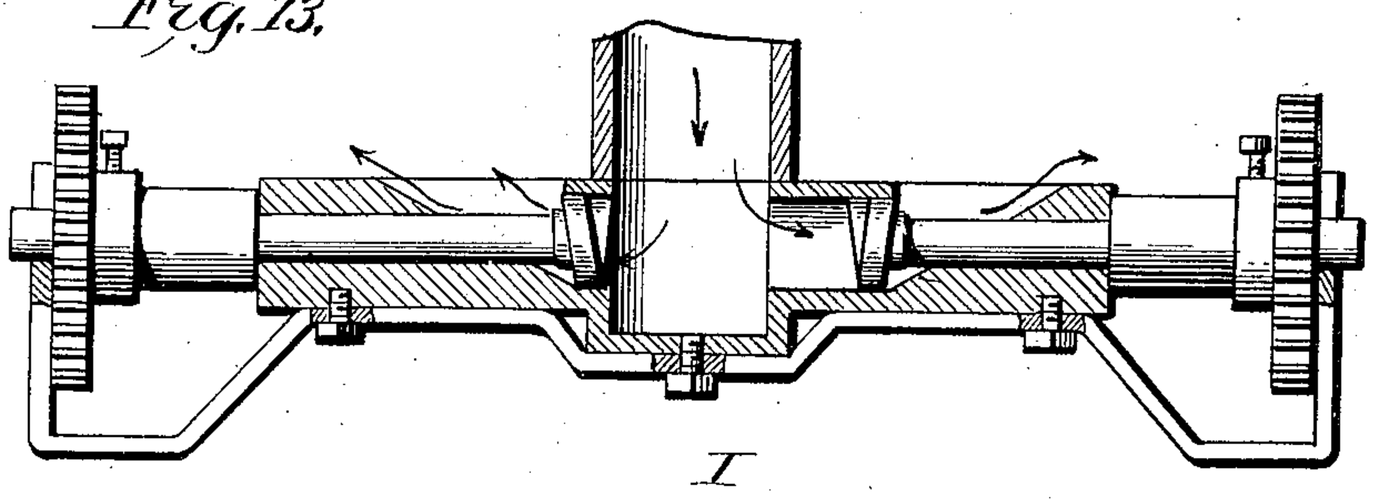
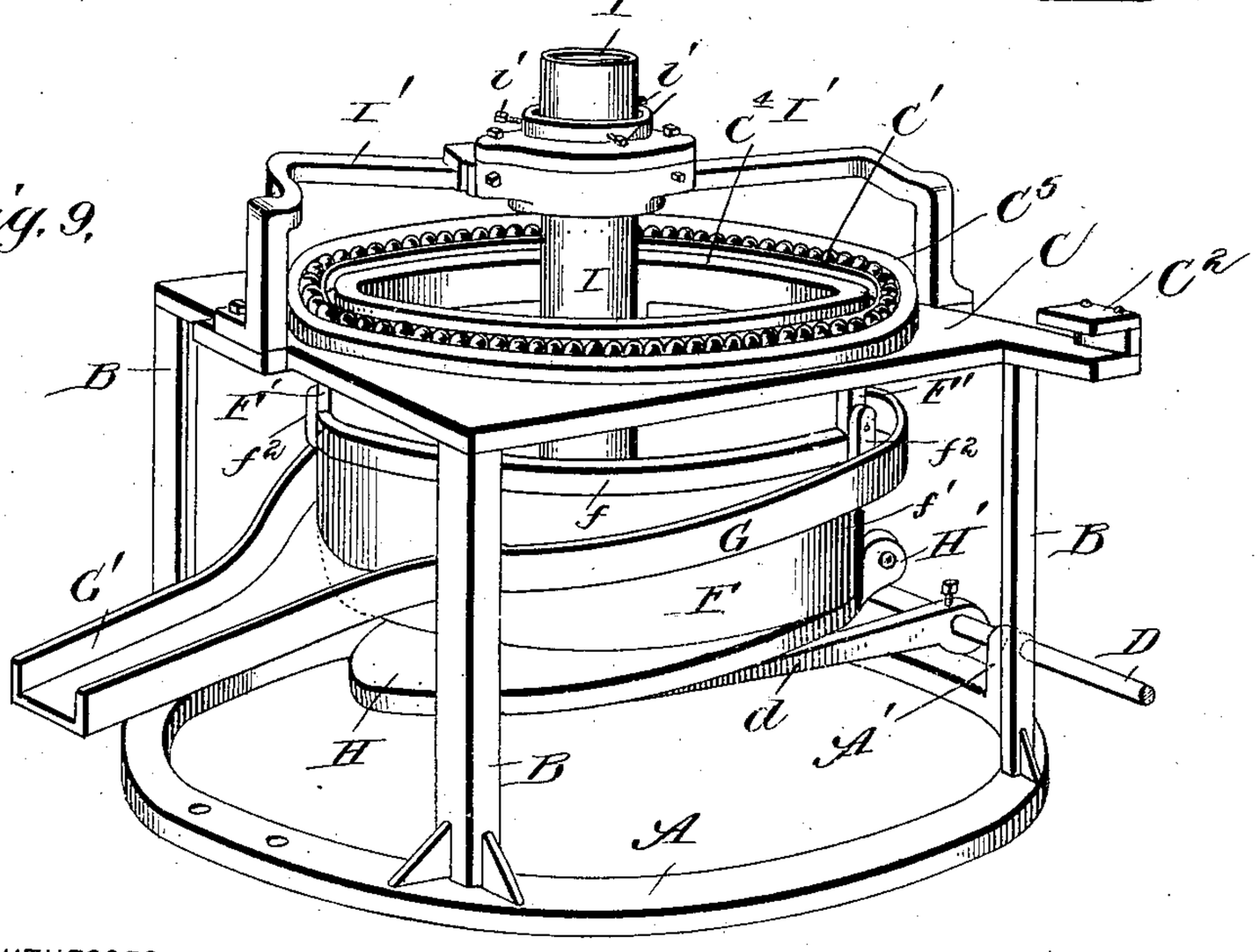


Fig. 9.



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APPLICATION FILED MAY 7, 1904.

5 SHEETS—SHEET 5.

Fig. 10.

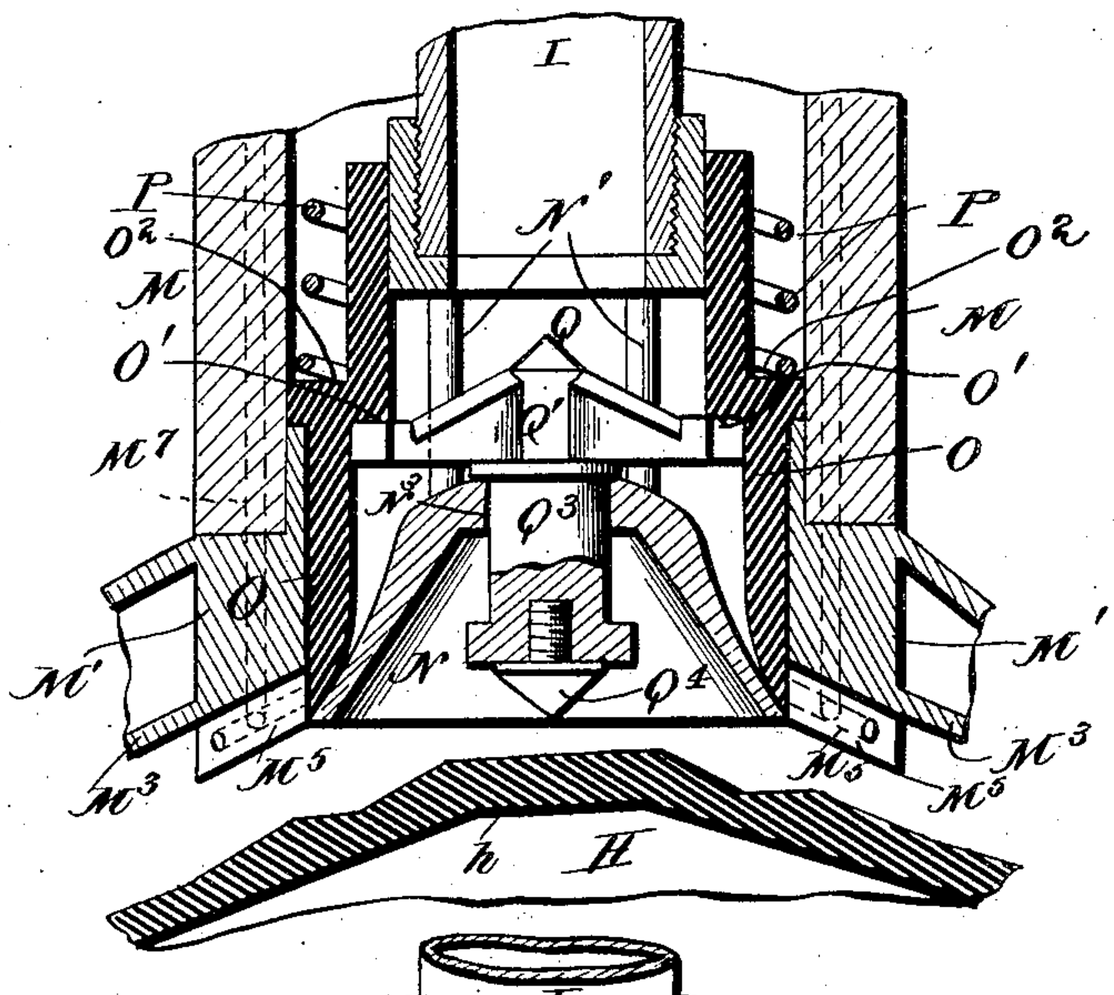


Fig. 11.

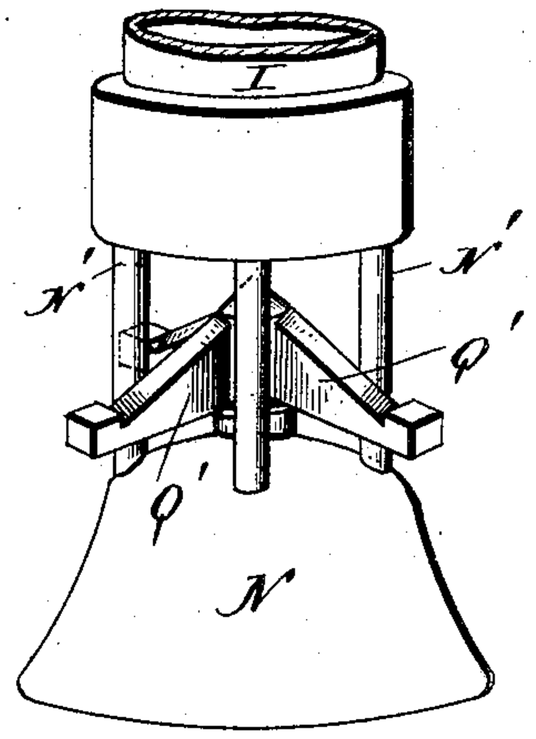
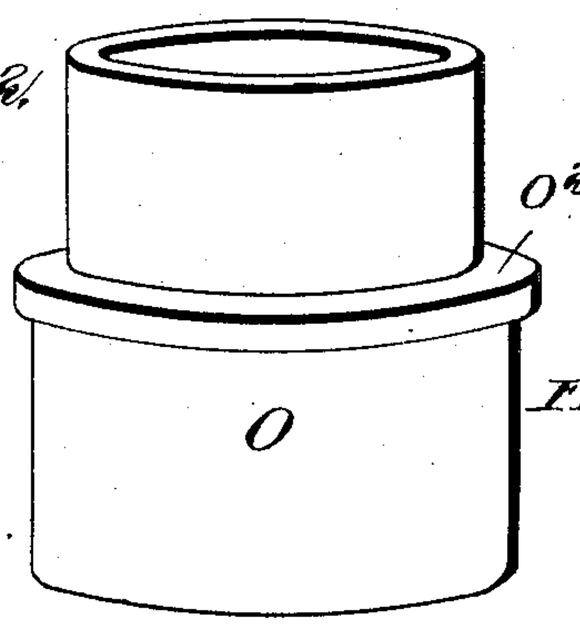


Fig. 12.



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UNITED STATES PATENT OFFICE.

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ORE-CONCENTRATOR.

No. 897,223. Specification of Letters Patent. Patented Aug. 25, 1908.

Application filed May 7, 1904. Serial No. 206,870.

To all whom it may concern:

Be it known that I, FREDERICK E. McKINLEY, a citizen of the United States, and resident of Guthrie, in the county of Logan, Oklahoma, have made certain new and useful Improvements in Ore-Concentrators, of which the following is a specification.

My invention is an improvement in concentrators for precious metals and for other metals and minerals and is especially designed for use in placer mining and for concentrating gold from dry, or almost dry material by the application of air under pressure to said material; or, if desired, water under pressure may be substituted for air; and the invention consists in certain novel constructions and combinations of parts as will be hereinafter described and claimed.

In the drawings, Figure 1 is a perspective view of an apparatus embodying my invention. Fig. 2 is a vertical longitudinal section thereof. Fig. 3 is a detail vertical section showing the feed from the lower end of the inlet tube to the bottom of the chamber. Fig. 4 is a bottom plan view of the operating head. Fig. 5 is a detail cross section showing the discharge openings in the fluid discharge pipes. Fig. 6 is a detail view of the lower end of one of the agitating feeding pins. Fig. 7 is a detail horizontal section on about line 7—7 of Fig. 8. Fig. 8 is a detail side elevation of the operating head, and Fig. 9 is a detail perspective view of the main frame. Fig. 10 is a detail section showing the outlet tube of the feed controlling devices closed. Fig. 11 is a detail view of the lower end of the inlet tube showing the valve plate it supports and the slide for operating the outlet tube. Fig. 12 is a detail view of the outlet tube, and Fig. 13 shows a somewhat different construction of feed mechanism.

By my invention I provide in connection with a main frame having a concentrating chamber open at its upper end and the movable bottom which may be opened to discharge the concentrates, an oscillating operating head which projects at its lower end into the material within the concentrating chamber and operates upon such material to cause the tailings to rise and discharge outwardly over the top of said concentrating chamber to any suitable receptacle surrounding the concentrating chamber and the concentrates of gold or other minerals to remain or settle on the movable bottom which may be opened to discharge such concentrates whenever in the operation of the apparatus a sufficient quantity of concentrates has been accumulated.

In the operation of my machine successful concentration is accomplished by the following steps in the operation in the order given. First: The feeding of the properly prepared gold or mineral bearing material centrally to the conical shaped bottom of the concentrating chamber, upon and around the apex of said bottom, through a central feeding tube. Second: The feeding of the material outwardly from the central feeding tube by means of agitating feeding devices holding the said material upon and close to the bottom of the concentrating chamber, an important part of said feeding devices being the delivery of air under pressure to the material being fed at or near the point where said material passes from the central feeding tube to and under the feeding devices; the result of said feeding devices being to constantly feed the material outwardly along the bottom of said concentrating chamber to and under the mass of material in the open area or space beyond and surrounding the central feeding devices and between the said feeding devices and the wall or side of the concentrating chamber. Third: The agitating of the mineral bearing material within the open area between the feeding devices and the wall of the concentrating chamber by means of depending agitators that extend into close proximity to the bottom of said concentrating chamber, and by the delivery of air under pressure at and into the bottom part of the material within said area, loosening and lightening it and causing the parts of said material of the greater specific gravity to remain at and near the bottom and those of the lesser specific gravity to pass upward, thus producing a gravity separation of the valuable parts of the material from the waste parts. Fourth: The exhaust or discharge of the "tailings" or waste material upwardly and outwardly over the sides or walls of the concentrating chamber.

As shown, the framing comprises a base A having uprights B, which support the top plate C, and the base is also provided with

upwardly projecting lugs A′ having bearings for the shaft D to which is fixed the lever *d* for opening and closing the hinged bottom of the concentrating chamber presently described.

The top plate C is provided with a ball race C′ receiving the balls on which turns the operating head presently described, and such plate C is also provided with guides C^2 in which slides the rack C^3 which is given a reciprocating motion by any suitable means and is geared with the operating head presently described, and serves to oscillate such head in the operation of the concentrator.

The top plate C is provided with a central opening C^4 through which the depending portions of the operating head are placed to the position shown in Figs. 1 and 2, a forwardly projecting annular rib C^5 surrounding such opening C^4 forming a rail which aids in guiding the oscillating movements of the head, the head resting upon the balls E in the ball race C′ as best shown in Fig. 2 of the drawings.

The concentrating chamber F is supported below the plate C by the hangers F′, is open at its upper end and discharges at such end to the tailings trough G which encircles the concentrating chamber and inclines toward one side and communicates at such side with the discharge spout G′ as best shown in Figs. 1, 2 and 9 of the drawings.

As shown, the hangers F′ are integral with a ring *f* which forms the top of the concentrating chamber, the lower or cylindrical portion *f′* of the concentrating chamber being provided at its upper end with lugs f^2 overlapping the ring *f* and bolted thereto at f^3. This construction may be preferred as it enables me to use cylindrical portions *f′* of different lengths on the same machine and thus adapt the concentrating chamber to a construction having walls of a greater or less height from the bottom of said chamber as will be understood from Figs. 1 and 2 of the drawings.

The concentrating chamber is normally closed during the concentrating operation by the bottom H which is hinged at H′ so it can be lowered at its other side as shown in Fig. 9 to discharge the concentrates and such bottom is held normally closed by the lever *d* on the shaft D. This bottom H is conical, sloping downwardly from its center or apex *h* toward its outer edges so the material being treated will have a tendency to move down the tapered surfaces of the bottom H to the outer edges thereof, being aided in such movement by the movements of the operating head as well as by the special form of the agitating feeding devices thereon and air under pressure, as will be more fully described hereinafter.

The main frame is provided with the central inlet tube I which is held adjustably by the screws *i* in the top frame I′ mounted on the main frame, the screws *i* securing the frame I so the latter can be raised and lowered to any desired extent. A hopper I^2 discharges to the inlet tube I and the material passes from the lower end of the said tube to the feed devices which will be more fully described hereinafter.

The operating head J is shown in side elevation in Fig. 8 and applied to the main frame in Figs. 1 and 2 and is formed with the hollow upper portion J′ which is divided into the separate chambers J^2 separated by the partition J^3 and with which communicate the depending agitating air discharge devices K presently described. The lower side of the top portion J′ is provided with the inner and outer depending flanges *j* and *j′* which fit on opposite sides of the annular rib C^5 of the top plate C of the main frame and guide the operating head as the same is turned in the operation of the invention. The chambers J^2 are supplied with air under pressure by means of the independent pipes L having flexible branches L′ connecting them with a pressure tank L^2 which may be supplied in any suitable manner, pressure regulators L^3, which may be of any approved construction, being provided between the tank L^2 and the chambers J′ to regulate pressure when air is employed, as will be understood from Fig. 1 of the drawings.

By dividing the pressure chamber of the operating head into two sections J^2, J^2, as shown in Fig. 7, I aim to prevent all of the pressure passing out through one section of pipes K, and am able to equalize the pressure to the different pipes as will be understood from Figs. 2, 4 and 7 of the drawings. The flexible sections L′ of the pipes supplying air under pressure to the operating head, permit the oscillations of said head without interfering with the supply of pressure. The agitating air discharge pipes K are also agitating devices and are arranged in a circular series as shown in Fig. 4, depend from the pressure chamber of the operating head and communicate at their upper ends with the pressure chamber of said head as shown in Fig. 2 of the drawings, and are arranged near the walls of the concentrating chamber, and are provided at their lower ends with outlet openings K′ through which air under pressure is discharged to the material in the concentrating chamber as shown in Figs. 2 and 8, in such manner as to lighten up the said material, separate the divided particles thereof and permit the gold or other minerals to remain on or settle to the bottom of the concentrating chamber as desired. These agitating air discharge pipes it will be noticed are located near the sides of the concentrating chamber and outside of the laterally projecting portions on the central tube of the operating head and act directly upon

the mineral bearing material before the tailings rise in the concentrating chamber.

The operating head has a central depending tubular portion M surrounding the central opening J^4 in the top portion of the head, said tube M having a detachable lower portion M′ secured by bolts M^2—see Fig. 2—and provided near its lower end with a laterally projecting flange M^3 and at its lower end with the depending agitating feeding pins M^4 and with the agitating feeding feet M^5 within the circle of the pins M^4 and made approximately triangular in plan view with the bases of the triangles facing toward the center of the head as best shown in Fig. 4 of the drawings, and provided with air outlets or discharge openings M^6 leading to their different sides, as shown in Fig. 4, and supplied through a channel M^7 leading downwardly from the pressure chambers J^2 so air under pressure may be discharged through the triangular feet M^5 to all sides of the latter immediately adjacent to the feed of the material to the bottom of the concentrating chamber. The depending tubular portion M and the agitating air discharge pipes K are carried by the oscillating top portion of the head and are so formed as to rest at their lower ends close to the upper surface of the bottom H when the latter is closed as shown in Fig. 2. The lower ends of the agitating feeding feet M^5 are preferably sloped and rest closely adjacent to the inclined upper surface of the bottom H as the head is oscillated as best shown in Fig. 2, the said figure also showing the agitating feeding pins as resting in close proximity to the upper surface of the said bottom H. These agitating feeding pins M^4 are also made triangular in plan view, as best shown in Fig. 4 with the bases of the triangles like the bases of the triangular feet M^5 toward the center of the head, so that as the said oscillating head is operated the tendency of the agitating feeding feet M^5 and of the agitating feeding pins M^4 will be to cause the material on the bottom of the concentrating chamber and between such bottom and the laterally projecting flange M^3 to travel outwardly toward the outer portion of the chamber as will be understood from Figs. 2 and 4 of the drawings, the air under pressure supplied through the agitating feeding feet lightening up the material in such manner as to permit the same to be operated upon efficiently by the said feet M^5 and the agitating feeding pins M^4 in the use of the invention. While the pins M^4 may operate in a measure as agitators it should be understood that they serve an important purpose in carrying the fed material from the inlet tube outwardly under the flange to the open space between the flange and the side or wall of the concentrating chamber where the depending tubes discharging the air under pressure agitate and lighten up the mass so that the particles of greater specific gravity constantly displace the lighter ones which as new material is constantly fed in must necessarily rise.

In operation the material is fed directly to the bottom of the concentrating chamber at the center of same, and passes outwardly between the agitating feeding feet M^5 and thence between the agitating feeding pins M^4 to the outer portion of the concentrating chamber in which portion operate the air discharge and agitating pipes K as shown in Fig. 2. In securing this feed of material to the center and bottom of the concentrating chamber and also in effecting a closure of the feed opening to the concentrating chamber when the movable bottom H is open, I prefer to provide the feed construction arranged to be opened by the movement of the bottom H to the closed position shown in Fig. 2 to permit the discharge of the material to the concentrating chamber and to close automatically when said bottom is opened, and which feed construction I will now describe. The feed devices operate within the central depending tubular portion M of the head and comprise the bell-shaped valve plate N which is carried by the rods N′ from the lower end of the inlet tube I, and the outlet sleeve O which encircles the lower end of the inlet tube I and may be raised to the position shown in Figs. 2 and 3 to permit the escape of the material on to the bottom H when the latter is closed as shown in Figs. 2 and 3, or may be forced down by the action of the spring P to shut off the passage of the material from the inlet tube to the concentrating chamber when the bottom is open, as shown in Fig. 10. At its upper end the spring P bears beneath a ring P^2, which is secured to the inlet tube by screws as shown or any other suitable manner, so the action of the spring P will not be against any oscillating portion of the head, it being understood that the feed controlling devices at the lower end of the inlet tube are like the inlet tube stationary as regards any rotary or oscillating motion with the operating head. As shown, the rods N′ which carry the valve plate N, connect with a collar N^2 screwed on the lower end of the inlet tube for convenience in constructing the valve plate N and for attaching and detaching the same at will. Means are provided for opening the outlet tube O by the bottom H when the latter is closed. As shown, this includes an intermediate device in the form of a slide Q having arms Q′, bearing beneath a shoulder O′ on the inner side of the outlet tube O, such arms forming a spider frame from which a tripping pin Q^3 depends through an opening N^3 in the crown of the valve plate N and extends at its lower end Q^4 in position to be engaged by the bottom H when the latter is closed in such manner as to be forced upwardly by said bottom and so lift the outlet tube O to the position shown in Figs. 2 and 3.

When the bottom H is opened the spring P acting upon the upwardly facing shoulder O^2 of the outlet tube O will force such outlet tube down until the flared portion O^3 at the lower end of the bore of the tube will seat upon the valve plate N and shut off the passage of the material from the inlet tube to the concentrating chamber. This construction is simple and operates efficiently for the desired purpose, and by operating the feed controlling devices from the bottom H, I am always able to secure a feed when said bottom is closed and to shut off the feed when the bottom is open. In order to regulate the feed it may be preferred to connect the lower end portion Q^4 adjustably with the stem Q^3 by threading it thereto, as shown in Figs. 2 and 3, so the said end portion Q^4 may be adjusted to vary the extent to which the outlet tube will be opened when the bottom H is closed. This feed device it will be seen delivers the material to be treated at the center of the concentrating chamber and also to the lower portion of the placer material in the concentrating chamber thus requiring all of the tailings to pass upwardly from the mass of material or quartz in the concentrating chamber in order to secure a saving of practically all of the precious metals.

Manifestly, in practice, whenever desired, the feed valve and its spring, etc., may be omitted and the material to be treated be delivered through the inlet tube I to the central tube M and discharged to the center of the bottom of the concentrating chamber.

In practice the storage tank L^2 may be charged in any suitable manner with air under pressure, and the head may be operated through the rack C^3 which latter may be driven by any suitable means.

My invention involves a novel application of agitation with air under pressure and a means therefor to produce a more perfect and rapid concentration of gold or mineral bearing materials as heretofore described.

In operation the placer or quartz material is pulverized or crushed to its natural fineness or to any degree of fineness desired by any suitable mechanism, and it is graded to different sizes by any suitable device, usually by means of revolving or shaking screens, and the material so graded is treated in different concentrating chambers involving my invention as before described as may be desired; the agitating feeding feet and pins may be made in different sizes and lengths to adapt them to the sizes of the particles of the material being treated. It will be understood also that in order to treat simultaneously the pulverized material of different grades and to obtain any desired capacity I may employ my machines or concentrators in a battery or series in which event the rack bar C^3 or any other suitable device may extend throughout the series and operate the several heads.

Instead of feeding the material from above onto the bottom of the concentrating chamber, as shown in Figs. 2 and 3, and before described, it may be fed from below through the bottom by means such as shown for instance in Fig. 13 of the drawings.

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

1. An ore concentrator substantially as herein described, comprising the framing having a top plate provided with a central opening and with a concentrator suspended from said plate open at the top and having a movable bottom, means for closing said bottom, the operating head having a top portion resting on the top plate of the frame and provided with a pressure chamber, and with a central depending tubular portion having air passages and a lower section provided with feet made triangular in plan view and having air discharge openings in communication with the passages leading from the pressure chamber, and an outwardly projecting flange provided on its lower side with depending agitating feeding pins made triangular in plan view with the bases of the triangles toward the center of the head, the agitating air pipes communicating at their upper ends with the pressure chamber and depending thence in a series surrounding the lateral flange of the central tube and provided at their lower ends with discharge openings, the inlet tube, the frame supporting said tube from the main frame, the valve plate supported at the lower end of the inlet tube, the outlet tube movable relatively to said valve plate and seating when lowered against said valve plate, a spring for pressing the outlet tube to closed position against the valve plate, and a slide to engage with the outlet tube and having a portion projecting through the valve plate in position for operation by the movable bottom of the concentrating chamber, substantially as and for the purposes set forth.

2. A dry ore concentrator comprising a main frame having a concentrating chamber open at its upper end for the discharge of tailings and provided with a bottom arranged to open for the discharge of the concentrates, and a head oscillating within said concentrating chamber to produce a reciprocating agitation of the fed material within and upon the bottom of said chamber in a contracted area surrounding and beneath a central depending feeding portion with the settling periods coincident with the stationary points of the oscillations and carrying depending air pressure delivering and agitating devices

to produce said reciprocating agitation of the material and having means for feeding said material to the concentrating chamber.

3. An ore concentrator comprising a concentrating chamber open at its upper end for the discharge of the tailings and having a conical bottom arranged to open bodily for the discharge of the concentrates, a central tube arranged to discharge the material to be treated to the center of and upon and closely adjacent to said bottom, and an operating head surrounding said central tube and having agitating devices operating around the feed devices.

4. In an ore concentrator the concentrating chamber, the central supply tube and an operating head having a central depending tubular portion and triangular feeding feet depending therefrom, each of said triangular feet having a base facing toward the center of said operating head and having an opening in each of its faces for the discharge of air under pressure into and upon the material being treated, whereby to cause said material to move outwardly by the wedging motion of said feet when said head is operated and by the application of air under pressure, substantially as set forth.

5. An ore concentrator comprising a concentrating chamber, an operating head depending within the concentrating chamber and provided with a lower portion projecting outwardly from a central feeding tube whereby to confine the material adjacent to the bottom of the chamber, means for delivering the material to be treated to the space between said portion and the bottom of the concentrating chamber, and means for delivering air under pressure to the material adjacent to the outer edge of said portion and to the space between said portion and the bottom of the concentrating chamber adjacent the inner edge of said portion, and to the material within the central feeding tube adjacent to the inner edge of said portion.

6. An ore concentrator comprising a concentrating chamber having a movable bottom arranged to be opened for the discharge of the concentrates, and a feed for delivering the material to be treated to said bottom and having a valve plate, an outlet tube and means whereby the outlet tube may be moved to open position by the movable bottom when the latter is closed.

7. An ore concentrator comprising the concentrating chamber having a movable bottom, the inlet tube, the valve plate supported from the lower end of said tube, the outlet tube encircling the lower end of the inlet tube and arranged to seat at its lower end on the valve plate, a spring for seating the outlet tube, and a slide engaged with the outlet tube and having a portion projecting through the valve plate in position to be engaged and operated by the movable bottom of the concentrating chamber.

8. An ore concentrator comprising the main frame having a central opening and surrounding the same bearings for the operating head, the operating head having a pressure chamber and depending portions provided with outlet openings for the delivery of pressure from said chamber, the concentrating chamber supported from the main frame and having a movable bottom, the inlet tube, the top frame mounted on the main frame and carrying the inlet tube, and the feed controlling devices at the lower end of the inlet tube and comprising a valve plate, an outlet tube seating against said valve plate and movable to and from open position, and means whereby the outlet tube may be opened by the closing of the movable bottom of the concentrating chamber.

9. In an ore concentrator the combination with the concentrating chamber of an operating head operating within the concentrating chamber and having a pressure chamber and a central feeding portion depending from such pressure chamber within the concentrating chamber, and pipes depending from the pressure chamber and arranged in a circular series surrounding said depending feeding portion and within the concentrating chamber and arranged at their lower ends to deliver air under pressure from the pressure chamber to the material within the concentrating chamber for agitating and lightening such material.

10. An ore concentrator comprising a concentrating chamber open at the top for the discharge of tailings, a conical bottom arranged to open bodily for the discharge of the concentrates, a central feed tube discharging the material to be treated at the base of the chamber and to the apex of the conical bottom, and means for introducing fluid under pressure to the material surrounding the central tube.

11. The combination of the concentrating chamber and the operating head having agitating feeding devices operating within the concentrating chamber and agitating fluid discharge devices operating in the concentrating chamber and arranged in a circular series surrounding the agitating feeding devices.

12. An ore concentrator comprising the concentrating chamber, the operating head having a depending central portion provided at its lower end with the outwardly and downwardly projecting flange, and with the agitating feeding pins projecting from the under side of said flange and operating adjacent to the bottom of the concentrating chamber.

13. An ore concentrator comprising the concentrating chamber and the head operating in the concentrating chamber and hav-

ing agitating and feeding devices at its lower end and operating adjacent to the bottom of the concentrating chamber and made triangular in plan view with the base of the triangles facing toward the center of the head.

14. An ore concentrator having a concentrating chamber and an operating head having a central depending portion operating in the concentrating chamber and provided at its lower end with the triangular feet operating adjacent to the bottom of the concentrating chamber and with the outwardly projecting flange having the depending triangular pins operating adjacent to the bottom of the concentrating chamber.

15. An ore concentrator comprising the concentrating chamber and the operating head having a central depending portion provided with fluid passages and at the lower end thereof with the feet operating adjacent to the bottom of the concentrating chamber and having outlet openings communicating with the fluid passages and means whereby fluid may be supplied to the said passages.

16. An ore concentrator comprising a concentrating chamber, a head operating therein and having a depending lower portion extending adjacent to but spaced apart from the bottom of the concentrating chamber whereby to provide a contracted feeding space below the said lower portion in which to confine the material to be treated, and means whereby to mechanically and pneumatically agitate the material in said space, the said lower portion being of substantially smaller diameter than the concentrating chamber whereby there is provided a contracted open space or area within the chamber and surrounding the lower portion of the operating head, and agitating and air pressure delivering devices operating in said contracted space or area.

17. An ore concentrator comprising the framing having a top plate provided with a central opening and surrounding said opening with bearings for the operating head, the concentrating chamber supported below the top plate and in line with the opening in the latter, and the operating head having a top portion bearing upon the top plate of the main frame surrounding the central opening and provided with depending devices operating in the concentrating chamber, a central inlet tube for the material to be treated, and a top frame supporting said inlet tube from the main frame.

18. An ore concentrator comprising a main frame, a concentrating chamber open at its upper end for the discharge of the tailings and having a movable bottom arranged to be opened to discharge the concentrates, an operating head having a top portion bearing upon the main frame and depending devices operating in the concentrating chamber, a central inlet tube, means supporting the inlet tube from the main frame and feed controlling devices including a valve plate supported from the inlet tube, a sliding outlet tube and means whereby the sliding outlet tube may be operated from the movable bottom of the concentrating chamber.

19. In an ore concentrator, the combination of a concentrating chamber a central feed tube and an operating head in said chamber and having at its base triangular feeding feet provided with air discharge openings in their several faces and arranged around the central feeding tube and with the base of each triangle toward the center of the head.

20. An ore concentrator comprising a concentrating chamber, an operating head depending within the concentrating chamber and provided with a lower portion to confine the material adjacent to the bottom of the chamber means for delivering the material to be treated to the space between said lower portion and the bottom of the concentrating chamber and triangular feeding and agitating feet depending from said lower portion.

21. An ore concentrator comprising a concentrating chamber, an operating head depending within the concentrating chamber and provided with the outwardly projecting flange to confine the material upon and adjacent to the bottom of the chamber, means for delivering the material to be treated to the space between said flange and the bottom of the concentrating chamber, and means for supplying fluid under pressure to the material in said concentrating chamber adjacent to the outer edge of said outwardly projecting flange.

22. An ore concentrator comprising a concentrating chamber, an operating head depending within the concentrating chamber and provided with the outwardly projecting flange to confine the material adjacent to the bottom of the chamber, means for delivering the material to be treated to the space between said flange and the bottom of the concentrating chamber, and means for introducing fluid under pressure to the space between said flange and bottom of the concentrating chamber at the inner edge of said flange.

23. An ore concentrator comprising a concentrating chamber, an operating head depending within the concentrating chamber and provided with the outwardly projecting flange to confine the material adjacent to the bottom of the chamber, means for delivering the material to be treated to the space between said flange and the bottom of the concentrating chamber, and means for introduc-

ing fluid under pressure adjacent to the inner and outer edges of said flange.

24. In an ore concentrator the combination of the concentrating chamber, means for feeding material to said chamber, an operating head surrounding said feeding means and having a pressure chamber and pipes depending therefrom and extending down nearly to the bottom of the concentrating chamber and adapted to mechanically agitate the material in said chamber and to discharge air under pressure thereto substantially as set forth.

25. An ore concentrator comprising the main frame, the concentrating chamber and the operating head supported on the main frame and provided with a pressure chamber and with a central tubular portion having fluid passages and outlets at its lower end, and a laterally projecting flange at its lower end and provided with depending agitating pins, and the circular series of pipes surrounding the central portion of the operating head and communicating at their upper ends with the pressure chamber of said head, and having discharge outlets at their lower ends.

26. An ore concentrator comprising the concentrating chamber, the inlet tube, a valve plate at the lower end of the inlet tube, the outlet tube controlling the discharge of the inlet tube, and movable relatively thereto, and the bottom plate of the concentrator chamber opening bodily and arranged when closed to open the outlet tube.

27. The combination of the concentrating chamber, the central feeding devices, means for mechanically agitating the fed material in close proximity to the feeding devices and the circular series of depending pipes open at their lower ends and arranged at such ends to deliver fluid pressure to the material being treated, the pipes being arranged in a circle surrounding the feeding devices.

28. The improvement in ore concentrators herein described, comprising the concentrating chamber open at the top and having a movable bottom, means for closing said bottom, an operating head provided with a pressure chamber and with a central tubular portion having passages for fluid under pressure and a lower section provided with feet made triangular in plan view and having fluid discharge openings in communication with the passages leading from the pressure chamber and also provided with an outwardly projecting flange provided on its lower side with depending agitating pins made triangular in plan view with the bases of the triangles toward the center of the head, the fluid tubes communicating at their upper ends with the pressure chamber and depending thence in a series surrounding the lateral flange of the central tube, and provided at their lower ends with discharge openings, the inlet tube, supports for said tube, the valve plate at the lower end of the inlet tube, the outlet tube movable relatively to said valve plate and seating when closed against said plate, and means connected with the outlet tube and arranged for engagement by the movable bottom of the concentrating chamber, whereby the bottom when closed may open the outlet tube, substantially as set forth.

29. In an ore concentrator, a central feeding tube and an operating head having depending triangular feeding feet provided with air discharge openings in their several faces and arranged around a central feeding tube with the base of each of the triangles facing toward the said central feeding tube.

30. In an ore concentrator the combination of concentrating chamber, an operating head therein and having a pressure chamber and discharge devices depending therefrom, means for oscillating said operating head, a feed for the ore extending centrally through said head, and flexible supply pipes connected with the pressure chamber substantially as set forth.

31. In an ore concentrator, the combination of a concentrating chamber, an operating head oscillating therein, a conical bottom, a central feeding tube for delivering the material to be treated centrally upon the conical bottom, means for feeding the material outwardly along the bottom to the open space in the concentrating chamber surrounding the feeding means, said space being open at the top, means for holding the material upon and close to the bottom during its passage outwardly from the central feeding tube, and for causing said material to pass to and under the waste or tailings in said open space, the operating head being provided with depending agitating devices for agitating the material within the open space and with means for the delivery of air under pressure closely adjacent to the bottom of the concentrating chamber and within the open area during the mechanical agitation whereby to cause the particles of greater specific gravity to remain at or near the bottom of the concentrating chamber and those of less gravity to rise and discharge outwardly from the open area as new material is fed into the concentrator in the operation of the machine, substantially as set forth.

32. An ore concentrator comprising a concentrating chamber having a conical bottom inclining downwardly towards its outer edge, an operating head having a central portion provided at its lower end with an outwardly projecting flange overlying the bottom of the concentrating chamber and inclining downwardly toward its outer edge and pins projecting downwardly from the said flange and operating adjacent to the bottom of the concentrating chamber.

33. An ore concentrator comprising a concentrating chamber, a central feed tube, and an operating head encircling the feed tube within the concentrating chamber and having adjacent to said feed tube a series of triangular feet provided with openings for discharging air, and also provided, surrounding said series of triangular feet with a depending series of agitating and air feeding tubes substantially as set forth.

34. The combination in a dry ore concentrator of the concentrating chamber having a bottom, a head operating therein and having means for holding the material to the bottom and also provided with a central longitudinal opening through which the material to be treated may be delivered to the center of the bottom of the chamber, the said operating head being also provided with means for distributing the material evenly and outwardly along the bottom of the concentrating chamber and with means for mechanically agitating the material upon the bottom of the chamber, and means for delivering air under pressure to the bottom of the concentrating chamber, substantially as set forth.

35. The combination in an ore concentrator of the concentrating chamber having a bottom and open at the top, an operating head oscillating within said chamber and having a central opening from top to bottom and provided at its bottom with an outwardly and downwardly projecting flange and with depending agitating feeding feet and agitating feeding pins thereon and projecting adjacent to the bottom of the concentrating chamber, said agitating feeding feet having openings for the discharge of air under pressure and the operating head being further provided with depending agitating air discharge pipes extending close to the bottom of the concentrating chamber, all substantially as described whereby the material fed to the center of the bottom may be caused to move outwardly between the same and the flange of the operating head by means of the feeding feet and pins and by the application of air under pressure and will thereby be caused to pass to and under the material just previously treated and will thereby be mechanically stirred and agitated by air under pressure by the depending devices, substantially as and for the purposes set forth.

36. An ore concentrator comprising a concentrating chamber, a head operating therein and having its lower end extending adjacent to but spaced apart from the bottom of the concentrating chamber whereby to provide a contracted feeding space below the said head in which to confine the material to be treated, and means whereby to mechanically and pneumatically agitate the material in said space, the head being of substantially smaller diameter than the concentrating chamber whereby there is provided an open space or area within the chamber and surrounding the operating head, substantially as set forth.

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