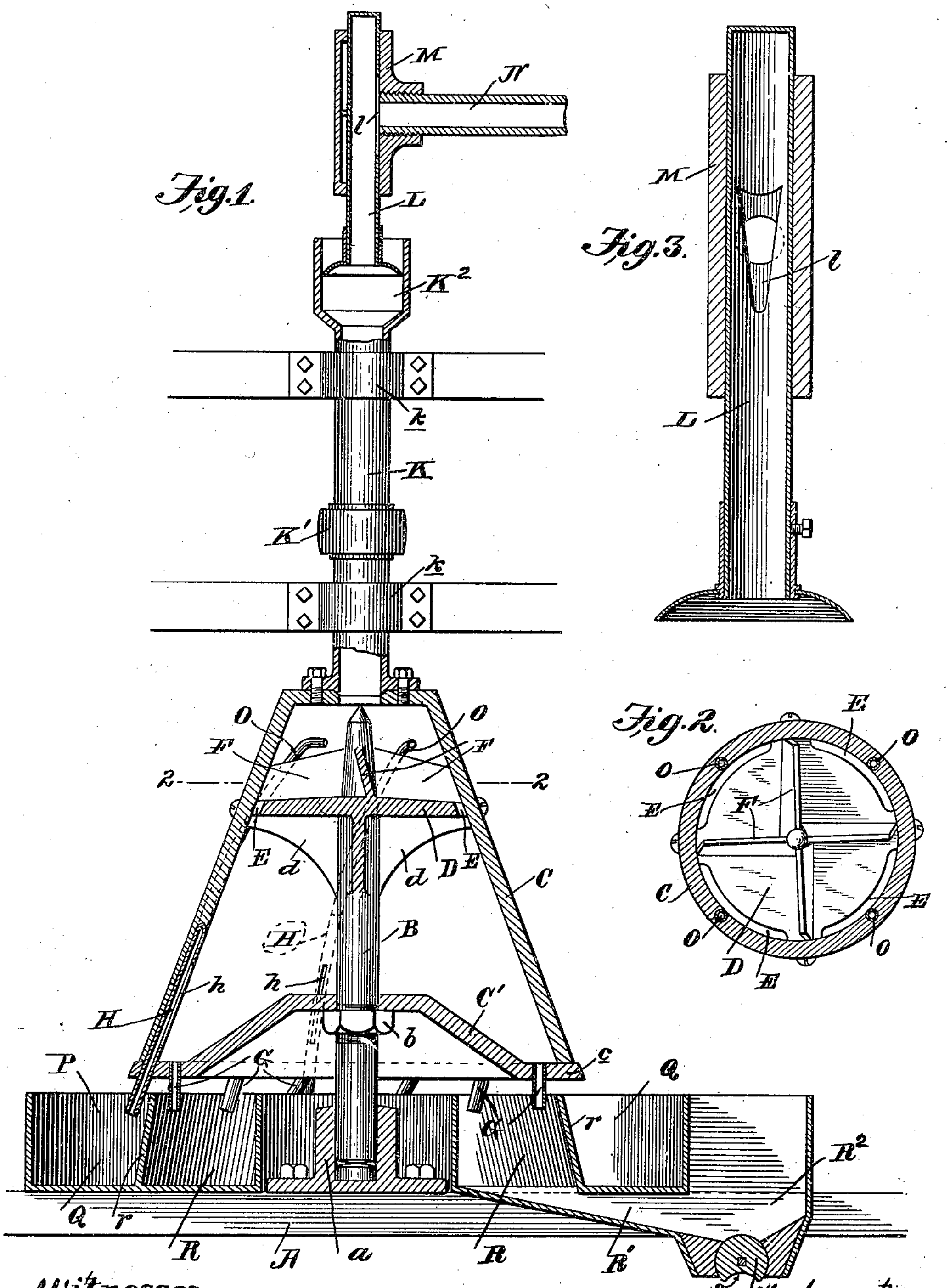
No. 648,088. Patented Apr. 24, 1900.

P. H. SHUE.

CENTRIFUGAL CONCENTRATOR.

(Application filed May 5, 1899.)

(No Model.) 3 Sheets—Sheet 1.



Witnesses:
G. A. Pennington
[illegible]

Inventor:
Philip H. Shue
by Milo B. Stevens & Co.
Att'ys.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

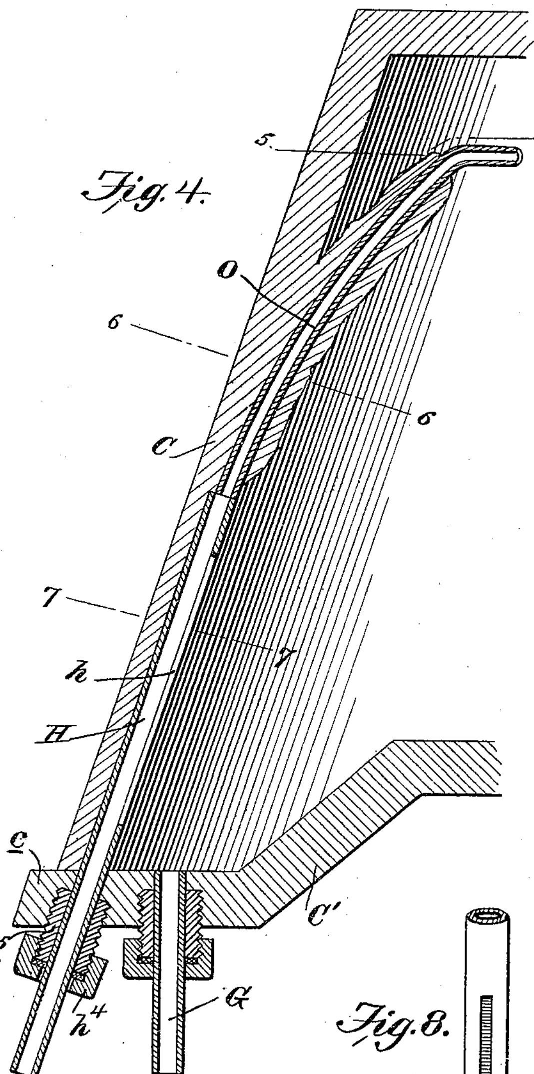


Fig. 5.

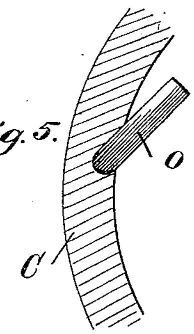


Fig. 6.

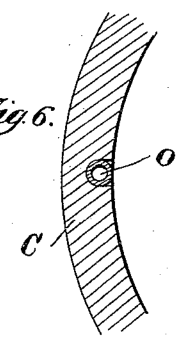


Fig. 7.

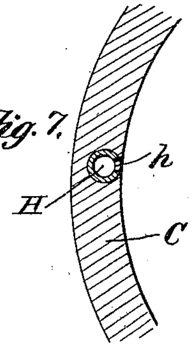
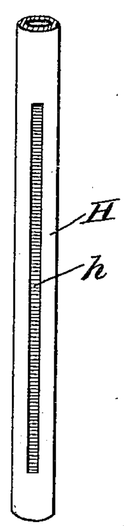


Fig. 8.



Witnesses:
G. A. Pennington
Jas. J. Mclaren

Inventor:
Philip H. Shue
by Milo B. Stevens & Co.
Att'y.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 648,088. Patented Apr. 24, 1900.

P. H. SHUE.

CENTRIFUGAL CONCENTRATOR.

(Application filed May 5, 1899.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 9.

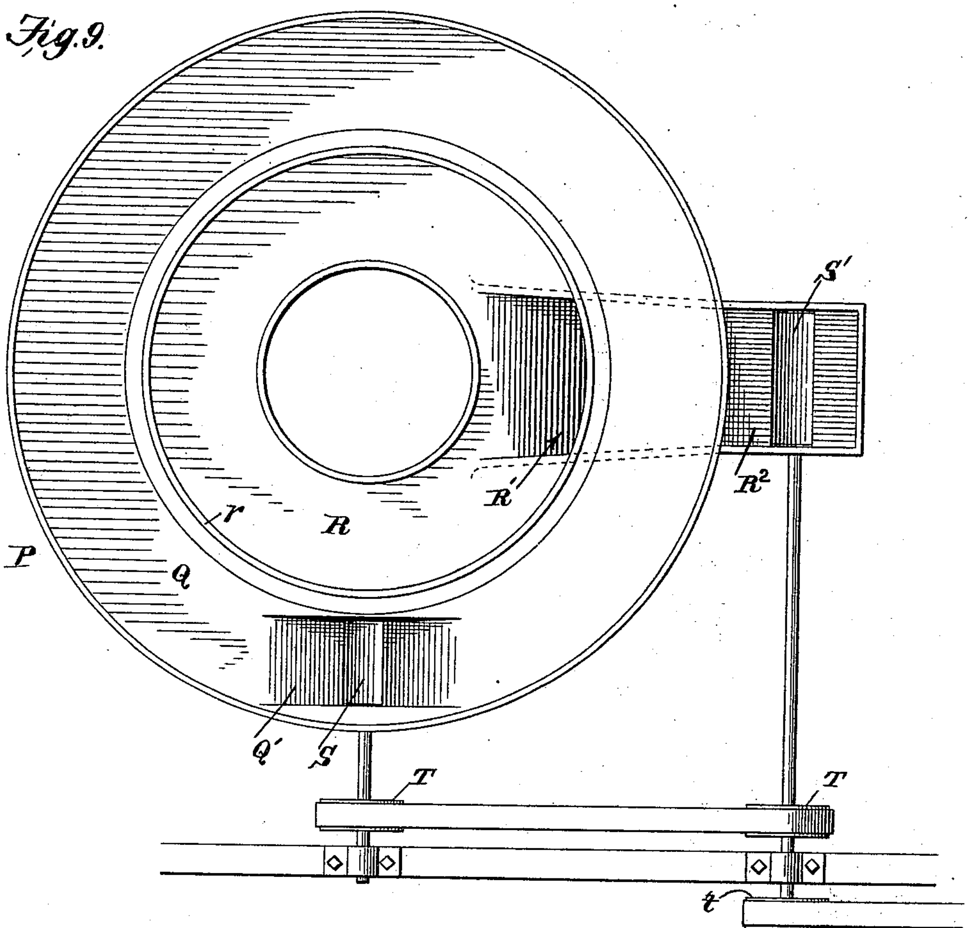
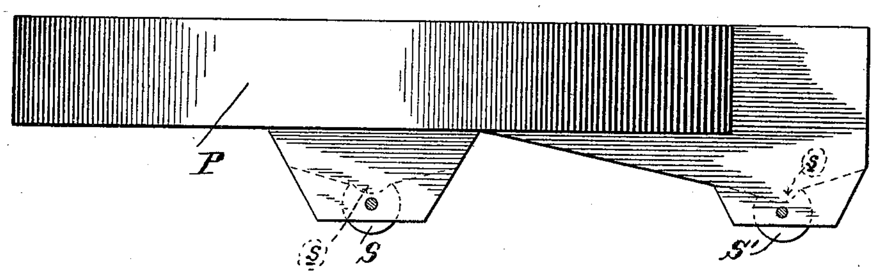


Fig. 10.



Witnesses:
G. A. Pennington
Jas. P. Mullan

Inventor:
Philip H. Shue
by Milo B. Stevens & Co.
Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

PHILIP H. SHUE, OF OURAY, COLORADO.

CENTRIFUGAL CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 648,088, dated April 24, 1900.

Application May 5, 1899. Serial No. 715,668. (No model.)

To all whom it may concern:

Be it known that I, PHILIP H. SHUE, a citizen of the United States of America, residing at Ouray, in the county of Ouray and State of Colorado, have invented certain new and useful Improvements in Centrifugal Concentrators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improvement in centrifugal concentrators; and it is embodied in the construction and arrangement of parts hereinfter described, and defined in the claims.

The aim and purpose of the invention is the production of a centrifugal separating-machine wherein the material being treated can be effectively and thoroughly separated and a machine wherein force of gravity is utilized in the separation of the material, as well as that of centrifugal force.

Heretofore in the art of centrifugal separation of ores various devices have been suggested; but it has been found that satisfactory and rapid separation could not be well secured by such machines, owing to the fact that their constructions prohibited or prevented the proper movement, collection, and discharge of the various grades of material being treated. My invention, while being of the class commonly known as "centrifugal separators," differs materially from those heretofore made, inasmuch as I employ practical arrangements and constructions whereby the separation is effected, and so in a complete and rapid manner, and in this connection the machine is so arranged and constructed that the force of gravity is an element of considerable importance in the act of separating.

The objects I attain by the mechanism illustrated in the accompanying drawings; but I desire it understood that the construction therein exhibited is shown for the purpose of this specification and not for the purpose of limitation, it being understood that many changes, variations, and arrangements of parts can be made without departing from the nature and principle of my invention.

In the drawings, Figure 1 is a vertical central section through the machine embodying the invention, showing parts in elevation. Fig. 2 is a cross-section through the line 2 2 of Fig. 1, showing the parts in plan. Fig. 3 is an enlarged detail view of the feed-governor. Fig. 4 is an enlarged detail section through one side of the machine. Figs. 5, 6, and 7 are detail sections taken through lines 5 5, 6 6, and 7 7 of Fig. 4. Fig. 8 is a perspective view of one of the collecting and discharge pipes. Fig. 9 is a plan view of the collecting-pan, showing the pan disassociated from the machine. Fig. 10 is a side elevation of the pan.

In the drawings, A designates a support having a suitable step-box *a* thereon, in which is supported a vertically-disposed spindle B. The spindle B is a carrying-spindle for the machine and supports the separating-casing C. The casing C is of substantially frusto-conical formation, having its inclined side walls supported on the base-plate C', which has an upwardly-extending central portion with sloping sides and a horizontal peripheral portion *c*, on which the casing C rests. The casing C may be composed of any suitable material, preferably metal, and is held in position by being secured firmly to the bottom C', which latter is supported on the spindle B and held in position by a suitable nut *b* or any other desirable instrumentalities. The upper part of the spindle B has formed conveniently integral therewith a flange D, being connected firmly with the spindle and braced by suitable webs or brackets *d*. The upper face of this flange is slightly inclined, and its outer edge extends to and is bolted or otherwise secured to the walls of the casing C in any convenient manner. This flange is located adjacent the upper part of the casing, as shown in Fig. 1. The periphery of the flange is cut away at diametrically-opposite points, forming escape-openings E.

Above the flange are a series of vanes or wings F, radiating from the upper end of the spindle B and slightly tipped or inclined from the vertical, as shown in Figs. 1 and 2. These wings extend to the inner face of the casing and terminate slightly below the upper end of the spindle, which upper end is conveniently pointed.

In the bottom C' of the casing are formed a series of openings which have passed therethrough and secured therein discharge-nip-

ples G, leading downward and preferably at a slight incline for some distance, the inclination being in the direction of the rotation of the casing, so that a rapid discharge is secured. In the side walls of the casing are secured conveniently four collecting and conducting tubes H, the same being spaced an equal distance apart. These tubes are fitted into the casing and have their innermost faces flush with the inner face of the casing and are formed with elongated slots *h* along their exposed sides. The ends of the tubes project slightly below the base or bottom C′ and through the same at points outwardly beyond the discharge-tubes G. The openings *h* of the collecting and conducting tubes are extended upwardly a considerable distance above the bottom, and these openings serve as discharge-openings and a collecting means for the heavier materials driven outward in a manner presently to be stated.

Securely bolted to the upper end of the casing C is a hollow stem K, journaled in suitable boxings *k*, fixedly supported in any convenient manner. On this stem is placed the driving-pulley K′, to which a suitable belt is applied and through which power is transmitted to the machine. The upper end of the stem is flared out into somewhat funnel-shaped form, as at K^2, the same having a hopper-shaped base and vertical side walls with an open upper end. In this casing is fitted the feed-governor L, the same consisting of a tube having a cup-shaped disk on its lower end closely fitting within the vertical portion of the funnel K^2 and having a central opening registering with the central opening of the tube L. The tube L has a closed upper end and a V-shaped opening *l* in its side. The tube is supported in a bearing M, supported in any convenient manner, but preferably by the supply-pipe N, leading transversely thereinto through a suitable nipple. The end of the supply-pipe M registers with the V-shaped supply-opening in the tube L.

To prevent clogging of the material in the collecting and conducting tubes H, I place a series of pipes O in the sides of the casing, the same being of a diameter somewhat smaller than the diameter of the tubes H and extending from a point above the open upper ends of the tubes above the plane of the flange and the wings on the spindle. At this point the pipes are carried inward from the casing to a point substantially below the feed-opening thereinto.

Below the casing and surrounding the lower end of the spindle is a collecting-pan P. This pan is conveniently divided into two chambers Q and R, the chamber Q being the outermost, and it is divided from the chamber R by a vertical partition *r*, extending upward and located between the discharge-tubes G and H, so that the discharge from the inner tubes will be in the chamber R and of the outer tube will be into the chamber Q. The chamber Q has an inclined depression Q′ at one side, while the chamber R has a conducting spout or trough R′ leading downward below the chamber Q and terminating in the hopper R^2. In the base of the depression Q′ and the hopper R^2 are formed discharge-valves S and S′, which have segmental depressions *s* therein on one side only, the remaining portion of the valve closely fitting the valve-seats provided therefor. To actuate these valves, suitable pulleys T are mounted on their stems, which carry the driving-belt, and one of the stems is provided with an additional pulley *t*, over which a suitable belt is passed, the same extending from any suitable source of power. By this means the valves can be conveniently turned or can be turned at specified intervals, and as the pockets or depressions therein are inverted the material contained therein is discharged and can be collected in any suitable receptacle. The collecting-pans can be made of copper and the same can be used as amalgamating-pans, if desired.

In operation the material is fed into the separating-chamber within the casing. As the material passes through the feed-tube the feed-governor, being at its lowest point, permits the material, which is in a semiliquid condition, to freely enter the separating-casing. The size of the feed-opening is conveniently greater than the combined discharge-openings, so that the casing will soon become filled with the material. During this operation the casing is rapidly rotating through the instrumentalities of the driving-belt, and as the material strikes the flange at the top of the chamber and is brought into contact with the wings it is forced to rotate with the casing. This gyratory motion is continued, the material passing down through the openings at the sides of the flange. The speed of the casing is such that by centrifugal force the heavy particles will be directed to the wall of the casing in a well-known manner. By forming the casing conical or inclined it will be noted that the diameter increases from top to bottom, so that the gyratory field is consequently increased. This results in permitting the heavier particles to hug the casing-walls, while permitting also the lighter particles to descend by gravity and eventually pass through the tubes G in the bottom. The heavier particles hugging the inclined wall will continue in their circular movement, and owing to the inclination of the side walls this movement will be in the nature of a compound movement—namely, downward as well as circular—and as they pass the discharge-slots in the tubes H they pass thereinto and are conducted to the collecting-chamber Q. After the separating-chamber has been filled there is a sufficient back pressure to force the governing-pipe upward, reducing the size of the feed-opening, so that the feed is partially cut off. By this means a uniform amount of material is maintained in the casing, the inflow equaling the

outflow. Owing to the rapid circulation of the material in the separating-casing it will be manifest that the water, which is the vehicle carrying the ores, will be practically clear at the center. This I take advantage of for the purpose of supplying water to the discharge-tubes H through the pipes leading from the point above the flange. These pipes take the water in at their upper ends at or near the center, and there being a free outlet at that point the water is conducted directly down into the ends of the discharge-tubes.

By forming the bottom of the casing slightly inclined at the center a natural tendency of the material is to seek a horizontal portion, at which point the discharge-tubes G are placed. The inclination of the wings or vanes is important, although not necessarily material, inasmuch as they act more positively against the material discharged into the casing. In the adjustment of the separating-tubes H, I preferably form the same sufficiently long so that their ends will receive a locking-nut h^4, which engages with a suitable threaded stem h^5, a packing being interposed. This construction is shown in Fig. 4, and the same applies to the arrangement of the discharge-nipples G. By this means the tubes and nipples can be withdrawn and replaced if the same should be worn out.

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

1. In a centrifugal ore-separator, the combination with a vertical casing having inclined walls, of a spindle supporting the casing, means within the casing for causing the liquid to gyrate upon the rotation of the casing, means for rotating the casing, a feed into the casing, discharge-tubes extending through the bottom of the casing and having relatively-narrow elongated openings in their sides, the said tubes being arranged at the sides of the casing and extending upward, substantially as described.

2. In a centrifugal separator, the combination with a substantially frusto-conical vertically-arranged casing, having fixed vanes or wings therein, of means for rotating the casing, a supply entering the top of the casing and a series of collecting and discharge tubes arranged at the sides of the casing near and discharging at the lower end thereof, having elongated openings in the sides through which the material passes and liquid-supplies entering the top of the collecting and discharge tubes, substantially as described.

3. In a centrifugal separator, the combination with a substantially conical-shaped casing, having a feed-opening in its top, of means for supplying the material to be treated to the opening and a plurality of substantially-vertical discharge-tubes arranged in series at different distances from the center and adjacent to and discharging at the lower end of the casing, and water-supplies leading into the concentrates-discharge pipes near their upper ends, substantially as described.

4. In a centrifugal separator, the combination with a substantially conical-shaped casing having a series of discharge-openings in the bottom and a series of upwardly-extending elongated collecting and discharge openings in its side leading through the side wall of the casing, of means for creating a gyratory motion of the material in the casing, water-supplies entering the collecting and discharge openings in line with the elongated discharges, and a feed entering the top of the casing, substantially as described.

5. In a centrifugal separator, the combination with a casing and means for creating a gyratory motion of the material fed thereinto, of a series of discharge-tubes arranged along the sides of the casing, a series of discharges in the bottom of the casing, a feed-pipe entering the top of the casing, a feed- and a governor for the feed comprising a vertical reciprocating pipe having a variable inlet-opening, a disk and an enlargement in which the disk operates, substantially as described.

6. In a centrifugal separator, the combination with a casing, and means for rotating the same, of a feed-pipe entering the casing, a hopper at the end of the pipe, a feed-pipe having a disk at its base working in the hopper and formed with a substantially V-shaped opening in its side, and a pipe registering with said opening, substantially as described.

7. In a centrifugal separator, the combination with a substantially conical-shaped casing, of a series of collecting and discharge tubes arranged in the sides thereof having vertically-elongated openings on their inner sides, a series of discharge-nipples in the bottom of the casing, means within the casing for causing a rotary motion to the material fed thereinto, and a series of pipes leading from the upper central part of the casing into the collecting and discharge tubes, substantially as described.

8. In a centrifugal separator, the combination with a substantially conical-shaped casing, of a series of collecting and discharge tubes arranged in the sides thereof, having elongated openings on their inner sides, a series of discharge-nipples in the bottom of the casing, means within the casing for creating a rotary motion to the material fed thereinto, and a series of pipes leading from the upper central part of the casing into the collecting and discharge tubes, a feed and means for automatically actuating the feed, substantially as described.

9. In a centrifugal separator, the combination with a spindle having a flange at its upper end, of a substantially conical-shaped casing supported on the spindle, a series of vanes or wings arranged above the flange, a series of upwardly-extending collecting and discharge tubes arranged in the sides of the casing and having elongated collecting-open-

ings leading through the casing, a series of discharge-nipples arranged in the bottom of the casing, a feed entering the top of the casing, means for driving the casing and collecting-pans below the casing, substantially as described.

10. In a centrifugal ore-separator, the combination with a rotary casing, having an inner and outer series of discharge nipples or tubes leading below the casing, a circular inner collecting-pan, a pan surrounding the same, a channel leading from the inner pan, and valves having pockets for removing the material from the pans, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

PHILIP H. SHUE.

Witnesses:
G. A. SCOTT,
C. W. HASKINS.