No. 701,851. Patented June 10, 1902.

C. CULVER.

ORE SEPARATOR AND CLASSIFIER.

(Application filed July 6, 1901.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

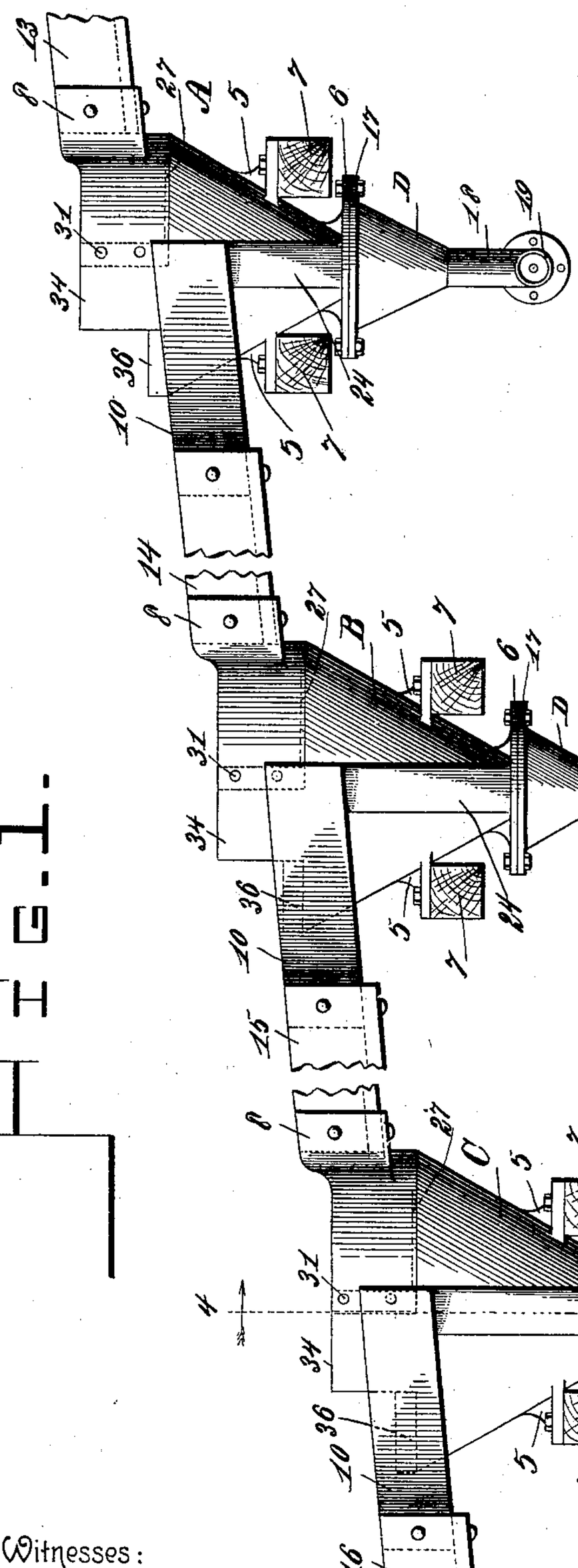


FIG. 5.

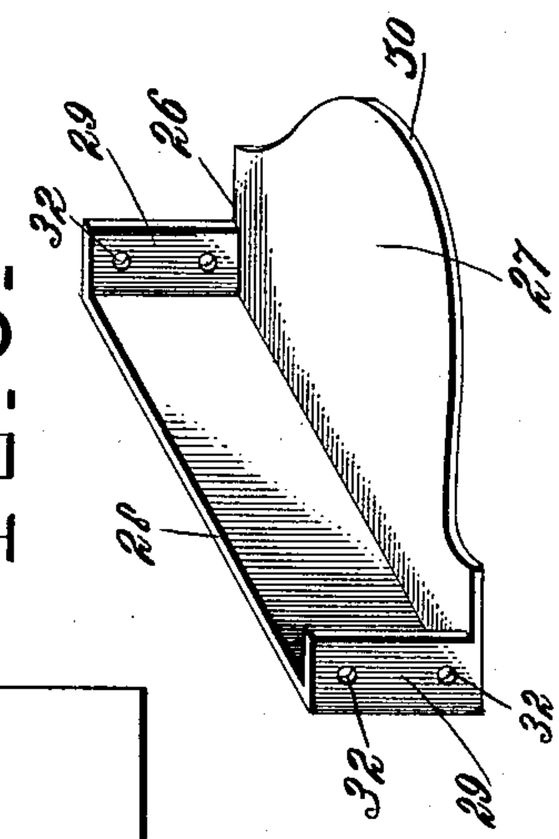
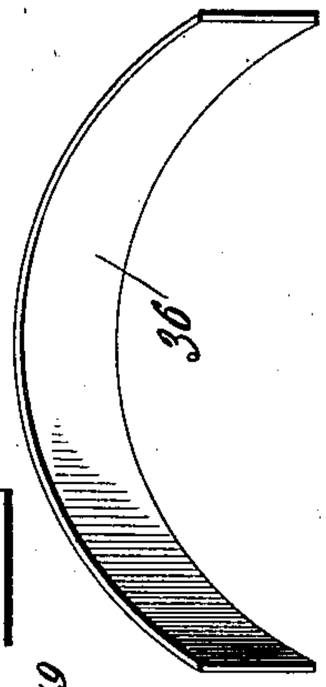


FIG. 6.



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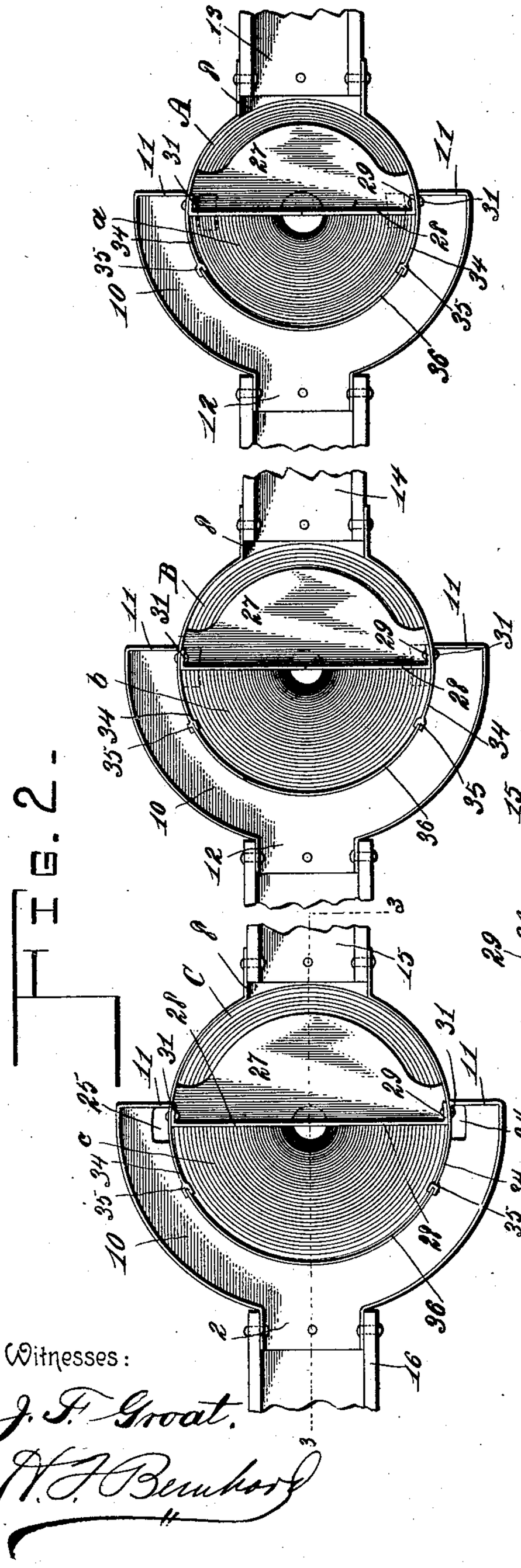

FIG. 2.

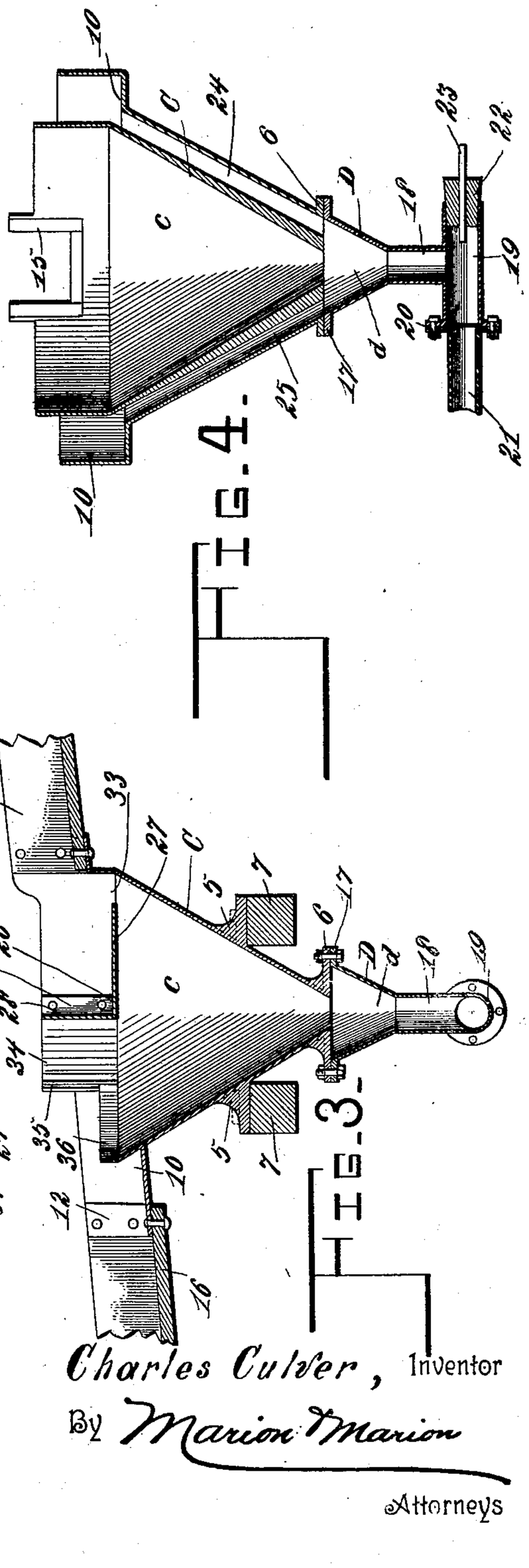

FIG. 4.

FIG. 3.

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UNITED STATES PATENT OFFICE.

CHARLES CULVER, OF SANDON, CANADA.

ORE SEPARATOR AND CLASSIFIER.

SPECIFICATION forming part of Letters Patent No. 701,851, dated June 10, 1902.

Application filed July 6, 1901. Serial No. 67,277. (No model.)

To all whom it may concern:

Be it known that I, CHARLES CULVER, a citizen of the United States of America, residing at Sandon, county of Kootenay, Province of British Columbia, Canada, have invented certain new and useful Improvements in Ore Separators and Classifiers; and I do hereby declare that the following is 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.

My invention relates to improvements in ore separators and classifiers of that class wherein a current of water is employed to carry off the light refuse from the heavier particles of ore which are free to drop through the water and accumulate at the bottom of the apparatus.

The object of this invention is to separate crushed ores according to their relative sizes and weights, the invention being susceptible of use advantageously in the treatment of various classes of ore or of ores of certain fineness.

The novelty in the present invention consists in balancing the hydrostatic head of water in an ore-settling chamber by the velocity of an ascending hydraulic supply, thus maintaining the liquid in the settling-chamber in a comparative state of rest, whereby complete subsidence of all but the finest slimes is permitted into an assorting-chamber, while the sorting hydraulic supply is passed off through upper discharge-passages, thus exposing every particle of the pulp to the selective action of the sorting-current, with the result that the heavier particles sink in direct opposition to it, while the lighter particles are swept off by it.

The invention further consists in the novel construction, arrangement, and combination of parts forming an improved ore-classifying apparatus, as will be hereinafter fully described and claimed.

In the drawings hereto annexed, forming a part of this specification, I have illustrated a preferred embodiment of the apparatus by which my invention may be carried into effect, and in which—

Figure 1 is a side elevation. Fig. 2 is a plan view. Fig. 3 is a sectional elevation taken in the direction of the line of flow of the current from one hopper to the other, the plane of the section being indicated by the dotted line 3 3 on Fig. 2. Fig. 4 is a vertical transverse section in a plane at right angles to Fig. 3 and indicated by the dotted line 4 4 on Fig. 1 looking in the direction of the arrow. Fig. 5 is a detail perspective view of the baffle removed from the hopper with which it is associated; and Fig. 6 is a detail perspective view of one barrier or gate, which is adapted to be employed interchangeably in connection with similar barriers of different widths in order to regulate the hydrostatic head in the settling-chamber formed by the hopper.

The same numerals and letters of reference denote like parts in all the figures of the drawings.

In carrying my invention into practice according to the apparatus shown by the accompanying drawings I employ a series of hoppers, which are represented as three in number and are indicated by the reference characters A B C; but it is to be understood that the number of hoppers employed is not material. Hence the number may be increased, or, if desired, they may be decreased. Each hopper may be cast in a single piece of metal or made in any other desired way or of any appropriate material. The hopper is essentially of inverted conical form, and it is provided on its outside with the lugs or flanges 5 and at its bottom with an annular face-plate 6, said lugs or flanges being arranged to rest upon the beams 7 of a suitable framework, whereby the lugs may be attached to the beams in order to support the hopper firmly in a vertical position. Each hopper is furthermore provided on the side into which the current flows with an offstanding mouth 8, and on the opposite or delivery side of the hopper the latter is formed with an overflow-tray 10. This tray is curved in an arc concentric with the vertical axis of the hopper, so that the tray has an approximately semicircular form in plan view, (see Fig. 2,) and the ends of this tray are closed by the radial walls 11, while the delivery side of the tray terminates in a spout 12. The hopper A is arranged and supported at a suitable elevation above the hopper B, and this last-named hopper B is arranged and supported to occupy a like relation to the final hopper C of the series when only three hoppers are employed, thus making provision for the flow of the cur-

rent by gravity from one hopper to the other throughout the series. Furthermore, I prefer to make the hoppers of increasing diameter and of size from the uppermost to the lowermost hoppers of the series—that is to say, the upper hopper A is smaller in diameter than the second hopper B of the series, while the hopper C is considerably larger in diameter than the hopper B. Each hopper is provided with a hydraulic supply, which is admitted to the lower portion thereof in the manner which will hereinafter appear, and the hoppers are connected for communication one with the other in series by suitable intermediate devices, as will now appear.

The ore to be treated is fed to the hopper A through the inclined flume 13, which is fastened to the mouth 8 and arranged to discharge its contents directly into the settling-chamber *a*, which is provided by the conical hopper A. The overflow from the settling-chamber of the first hopper is carried to the settling-chamber *b* of the second chamber through an intermediate inclined trough 14, the same having one end united to the spout on the tray 10 of the hopper A, while its other end is coupled to the mouth 8 on the second hopper B. In like manner the overflow from the second hopper B is fed to the settling-chamber *c* of the third hopper C through an intermediate trough 15, the same having one end united to the spout 12 of the tray 10 at the upper part of the hopper B, while the other end of said trough is connected to the mouth 8 on the hopper C, all as clearly indicated by Figs. 1 and 2. From the spout 12 of the tray 10, near the upper end of the hopper C, leads a delivery-trough 16.

With each hopper A, B, and C is associated a smaller subhopper D, the same having a conical body arranged to form a conical assorting-chamber *d*. The upper part of this subhopper D is provided with a flange or face-plate 17, that is disposed in registering relation with the face 6 of the hopper with which it is associated, whereby the subhopper may be firmly secured by bolts to the lower smaller extremity of the primary hopper. This subhopper is furthermore provided with a tubular foot 18, which terminates in a horizontal length of pipe 19, and to one end of this length of pipe is coupled, as at 20, the water-feed pipe 21, while the other end of the horizontal length of pipe 19 is closed by a plug 22, in which is formed an ore-discharge passage 23. This ore-discharge passage is shown by Fig. 4 in the form of a pipe, the cross-sectional area of which is quite small as compared with the diameter of the hydraulic supply, which is formed in this instance by the water-feed pipe 21, whereby the outlet afforded by the ore-discharge passage does not appreciably lower the velocity of the hydraulic supply, which is free to pass from said pipe 21 and the length of pipe 19 into the foot and the assorting-chamber of the subhopper. The assorting-chamber *d*, formed by the subhopper which is attached to each of the primary hoppers, communicates directly with the contracted lower end of the settling-chamber, which is formed by the vertically-tapered primary hopper, and thus the widest end of the sorting-chamber has communication with the contracted end of the settling-chamber. The primary hopper is furthermore provided with two discharge-flues 24 25, the same being formed on the external surface of each primary hopper and on opposite sides thereof. These discharge-flues partake of the inclination of the inverted conical hopper, so that they will diverge upwardly in the manner shown by Fig. 4, and said flues have communication at their lower ends with the wide part of the sorting-chamber *d*, while the upper ends of the flues communicate directly with the chamber of the overflow-tray 10.

Within each primary hopper is arranged a baffle 26. (Shown by Figs. 2 and 3 in position within the hopper and in detail by Fig. 5.) Each baffle consists of a horizontal plate 27 and a vertical web 28, the same being cast in a single piece of metal, as shown by Fig. 5. The web is formed at its ends with the flanges 29, while the plate 27 has a curved edge 30, the radius of which is less than that of the hopper. The baffle is arranged in the upper part of the hopper, so that the web will extend diametrically across the settling-chamber therein, thus bringing the flanges 29 of said baffle in positions to bear against the wall of the hopper, whereby the baffle may be secured to the hopper by means of the rivets or screws 31, which are adapted to pass through the perforations 32, that are formed in said flanges 29, as shown by Fig. 5. The curved edge 30 of the plate forming a part of the baffle is parallel to the wall of the hopper, on the receiving side thereof, thereby forming a long curved space or opening 33, which permits the material to pass from the flume or a trough into the settling-chamber, but the plate 27 of the baffle is arranged in a horizontal plane below the discharge from the flume or the trough, so that the current from the latter will flow upon the plate and thence pass into the settling-chamber, thus preventing the incoming current from disturbing the hydrostatic head within the settling-chamber and insuring tranquilization. The vertical web 28 of the baffle extends upwardly for a suitable distance beyond the plate of said baffle, and this web dams the flow of the incoming current, so that the latter will pass into the settling-chamber over the curved edge 30 of the plate 27, and thereby prevent said inflowing current from passing directly over the discharge side of the hopper and into the tray 10. I have also provided each hopper with means for regulating the hydrostatic head within the settling-chamber, and to this end the wall of the hopper, at the upper portion thereof and on the delivery side, is cut away, as shown by Fig. 3, thus making the terminals 34 of the divided hopper-wall extend in rear of the union of the baffle-flanges

29 with the hopper. (See Figs. 2 and 3.) These terminals of the hopper-walls are enlarged somewhat and formed with grooves to produce the seats 35, and these seats are adapted to receive the end portions of a segmental barrier or gate 36. Each barrier or gate is confined securely in place by the seats and by fitting upon the hopper, on the rear side thereof, and the barrier thus lies in the path of the outflowing current from the settling-chamber and the slimes therein, but this barrier or gate is removable at will from the seats 35, thus making provision for the employment of other barriers or gates, the same being of different widths. It will therefore be understood that barriers or gates of different widths may be used interchangeably on the discharge side from the settling-chamber of each hopper, and I am thus able to regulate the height or level of the hydrostatic head in the settling-chamber.

From the foregoing description, taken in connection with the drawings, it will be seen that the current is led into the settling-chamber of large area within each hopper and that it lodges upon a baffle, which breaks the force of the inflow. A large overflow is provided on the opposite side of the hopper, so that the water in the settling-chamber will be maintained in a condition as still as possible, thus facilitating the complete settling of all but the finest slimes. The particles sinking through the hydraulic head into the settling-chamber drop into the sorting-chamber *d*, where they are met by an assorting-current supplied through the water-feed pipe 21 to the sub-hopper D. The velocity of this hydraulic current is regulated or adjusted by any suitable means in order to allow all particles over a certain size and weight to sink down through the tubular foot 18 and to be sluiced off through the ore-discharge passage 23. The remainder of the pulp being too light to sink in direct opposition to this assorting-current is caught up by it and carried off from the assorting-chamber *d* through the upwardly-inclined flues 24 25, the latter being of equal area throughout, or otherwise there would be a diminution of velocity as the area increases, and consequently a deposition of some of the suspended particles.

The important feature of my invention is a machine or apparatus by which the liquid in the settling-chamber is kept comparatively at rest, all the sorting hydraulic supply being passed off through the inclined discharge-flues. The hydrostatic head of water in the settling-chamber is balanced by the velocity of the ascending hydraulic supply, whereby the liquid in the lower portion of the settling-chamber is kept comparatively at rest, allowing the complete subsidence into the settling-chamber of all but the finest slimes, thus exposing the other particles to the selective action of the sorting-current. It is therefore to be understood that the vital feature is the maintenance of equilibrium between the head of the water in the settling-chamber and the ascending hydraulic current through the assorting-chamber, there being neither an upward current nor a downward current in the settling-chamber. This increases the adaptability of the classifier to various classes of ore, thus requiring different velocities of the sorting-current, and consequently different heads of water in the settling-chamber.

Changes within the scope of the appended claims may be made in the form and proportion of some of the parts, while their essential features are retained and the spirit of the invention is embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

Having thus described my invention, what I claim as new is—

1. An ore-classifier comprising a cone-shaped hopper forming a settling-chamber, an inflow-conduit leading into the top thereof, a secondary cone-shaped hopper forming an assorting-chamber and having its wide mouth attached to the reduced lower end of the main hopper, a pipe having a branch adapted to form a means for an upward current of water through said hoppers, one or more flues leading from the upper end of said second hopper upwardly, and a trough surrounding the upper end of the main hopper into which said flues debouch.

2. An ore-classifier comprising a cone-shaped hopper forming a settling-chamber, an inflow-conduit leading into the top thereof, a secondary cone-shaped hopper forming an assorting-chamber and having its wide mouth attached to the reduced lower end of the main hopper, a pipe having a branch adapted to form a means for an upward current of water through said hoppers, one or more flues leading from the upper end of said second hopper upwardly, a trough surrounding the upper end of the main hopper into which said flues debouch, and a baffle-plate comprising a vertical dam portion extending from side to side of the main hopper, across the open top thereof and a horizontal portion extending toward said inflow-conduit, whereby to check the disturbance caused by the inflow of water.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

CHARLES CULVER.

Witnesses:
A. W. GRIERSON,
O. V. WHITE.