

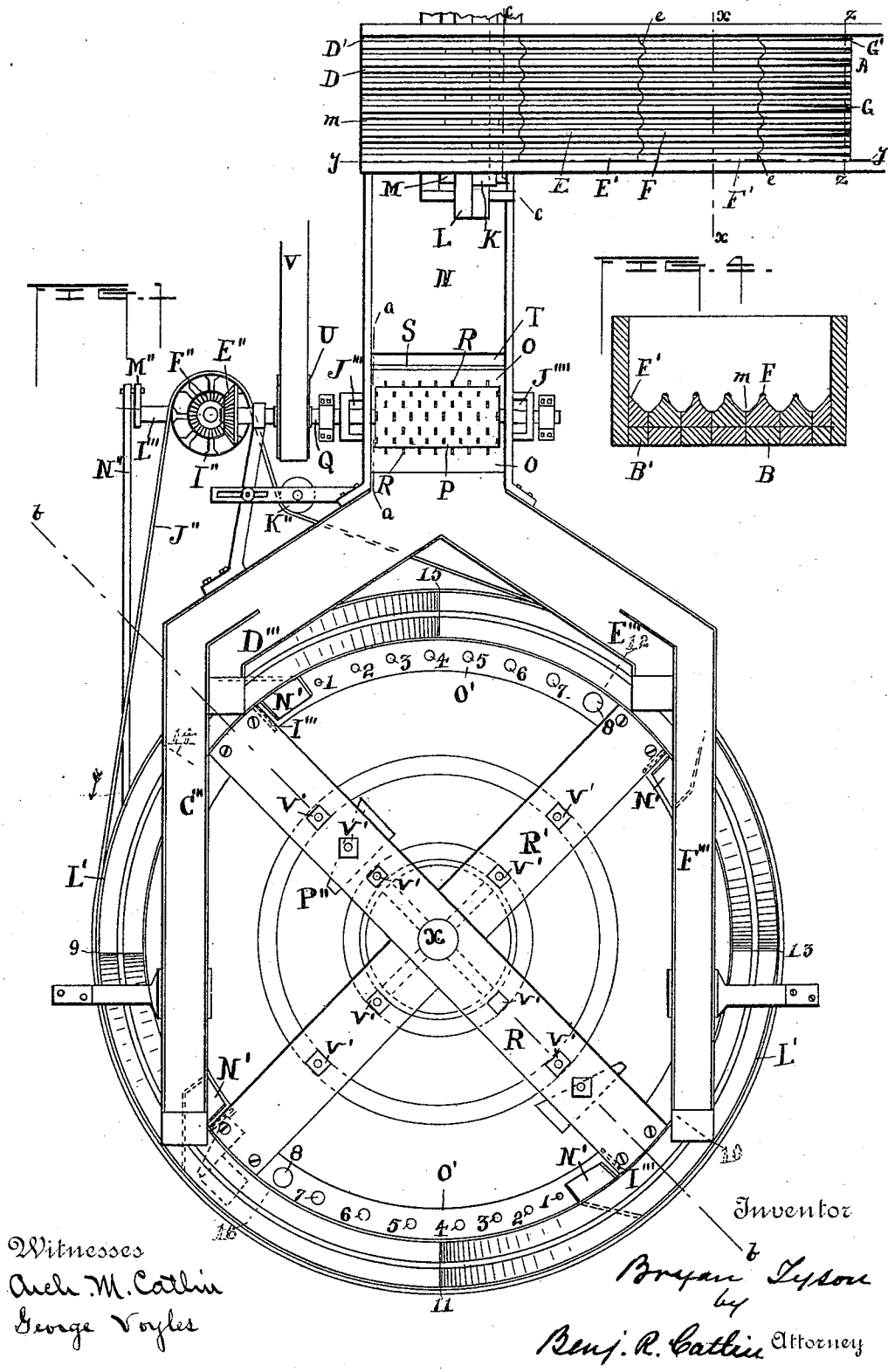
(No Model.)

3 Sheets—Sheet 1.

B. TYSON.
CONCENTRATOR.

No. 461,693.

Patented Oct. 20, 1891.



Witnesses
Arch. M. Catlin
George Voyles

Inventor
Bryan Tyson
by
Benj. R. Catlin Attorney

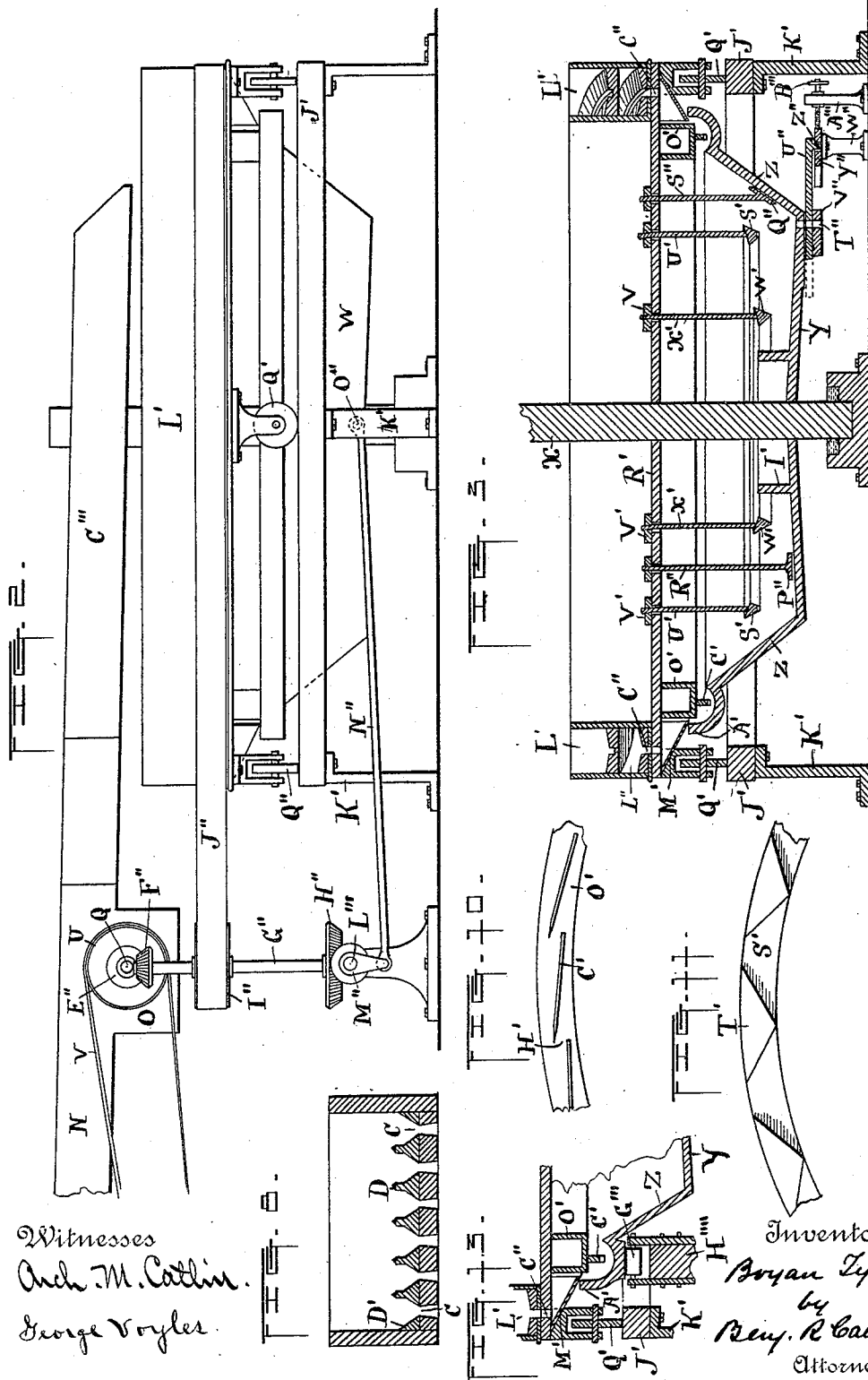
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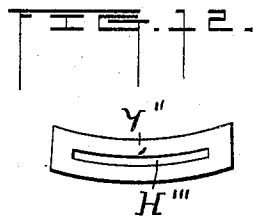
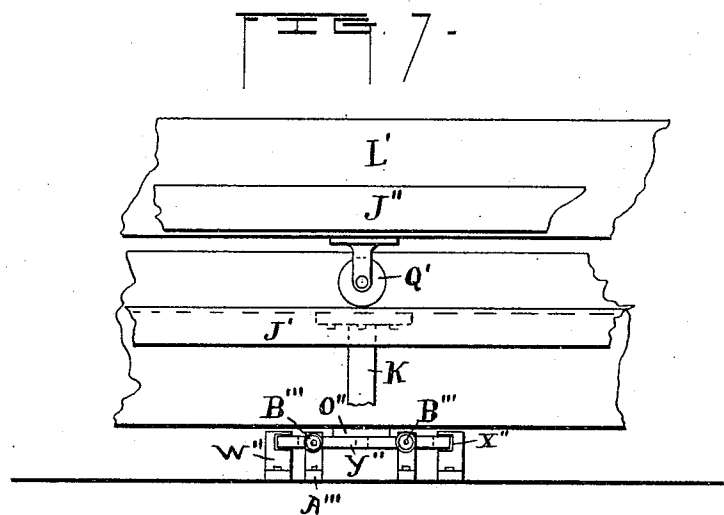
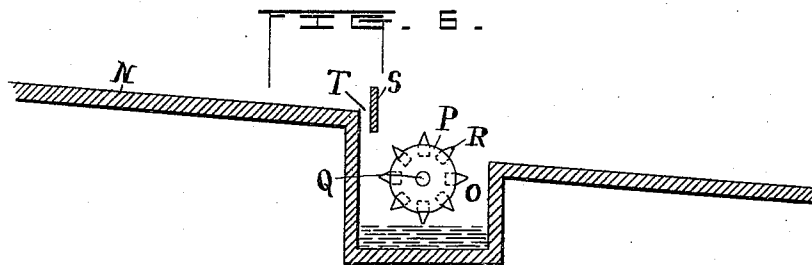
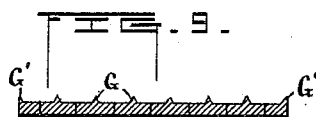
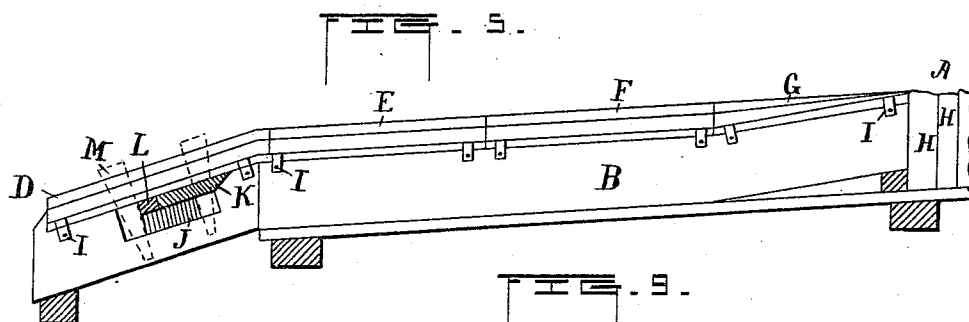
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3 Sheets—Sheet 3.

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Witnesses
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George Vayles

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UNITED STATES PATENT OFFICE.

BRYAN TYSON, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR OF
ONE-TENTH TO CHARLES A. METCALF, OF SAME PLACE.

CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 461,693, dated October 20, 1891.

Application filed February 6, 1891. Serial No. 380,451. (No model.)

To all whom it may concern:

Be it known that I, BRYAN TYSON, residing at Washington, in the District of Columbia, have invented certain new and useful
5 Improvements in Ore-Concentrators, of which the following is a specification, reference therein being had to the accompanying drawings.

My invention relates to ore-concentrators,
10 and has for its object to reduce the cost of concentration, principally by improvements which obviate the detrimental effects in such operations of the sulphurets, and which provide for working pulp in unusual quantities;
15 and the invention consists in the matter hereinafter described, and particularly pointed out in the claims.

Figure 1 is a plan of my concentrator. Fig. 2 is a partial elevation of the concentrator.
20 Fig. 3 is a section of the same on line *b b* of Fig. 1. Fig. 4 is a transverse section of a portion of the same on line *x x* of Fig. 1. Fig. 5 is an enlarged section on line *y y* of Fig. 1. Fig. 6 is a section on line *a a* of Fig. 1. Fig.
25 7 is a partial elevation showing devices for controlling discharge of concentrates. Fig. 8 is a transverse section on line *c c* of Fig. 1. Fig. 9 is a transverse section of the bottom of the sluice-box on line *z z* of Fig. 1. Fig. 10
30 is a bottom plan of a detail shown in transverse section in Figs. 3 and 13. Fig. 11 is a similar view of another detail shown in said figures. Fig. 12 is a plan of a detail of discharge-controlling devices. Fig. 13 is a partial
35 section of a modification.

For use in the primary operation I employ a sluice-box A of ordinary construction and of a width suitable for the quantity or pulp to be worked in it.

40 B B' are bars, preferably constructed of wood, placed longitudinally in the sluice-box, a sufficient number being employed to cover the entire bottom. Said bars are preferably constructed about two and a half inches
45 thick on the face, four inches deep, and six feet long. The two outside bars B' B' should be only half the thickness of bars B B; but any desired dimensions in place of the above may be employed. At the lower end of the
50 sluice-box said bars are inclined downward

at a proper angle, twenty-two and one-half degrees being recommended as suitable. Between said bars, at or near the commencement of the incline, are spaces C C, preferably from one-fourth to one-half inch wide 55 and four inches long.

The bars B B' are capped or surmounted by bars D D' E' F' F' G' G', preferably of cast metal. These have at their top sharp edges, and between them are channels *m m*.
60 These bars make a practically water-tight bottom for the sluice-box, except that discharge-openings C C are provided near the upper end of the inclined bars D D', as shown in Fig. 8. In order to prevent choking by
65 débris, said spaces are widest at the bottom. The portion of the sluice-box A situated above the bars G' G' is preferably paved with blocks H H, thus virtually raising the bottom of the sluice-box to a level with the surface
70 of said bars. The ridges on the bars G' G' are brought to mere points at their upper ends. (See Fig. 9.) They thence gradually increase in depth and widen at the bottom
75 until at their lower ends they attain the full depth of the bars F, which latter, together with the intervening spaces *m m*, are of uniform size. The tops of the bars of the several sections when in position are in the same vertical plane. The ends of the bar-sections
80 are so shaped as to interlock to prevent their lateral displacement, as indicated in Fig. 1 at *e*.

I I indicate wrought-iron lugs cast in the bars for securing the same to their respective
85 supporting-bars B B'.

J, Fig. 5, is a bar, constructed of wood, that extends entirely across the sluice-box A and projects a suitable distance beyond on either side. The bars B B' are cut away to form a
90 transverse passage for this bar in which it can be worked back and forth both laterally and longitudinally, and K is a blade constructed of any suitable hard metal, the upstream edge of which is made sharp, the
95 bevel preferably being on the bottom. The blade extends across the sluice-box and projects beyond either side and is supported by the bar J.

L is a bar or strip secured to the bar J to 100

prevent the blade K from slipping down stream.

M M are keys that hold the bar J in position and afford means of adjusting the blade K with reference to the apertures C C. By loosening one key and driving down the other the bar K, that supports the blade, can be moved up or down stream, thus regulating its relation to the apertures C C, as desired. The top of the blade K should fit loosely against the bottom of the bars D D', thus permitting it to be readily moved for adjustment by means of its support J and keys M M. The object of the series of bars and intervening channels *m m*, acting in conjunction with the blade K and apertures C C, is first to precipitate to the bottoms of the channels the heavier and more valuable substances and then to cut them out and to pass them down through said apertures, the heavier particles falling below the edge thereof, effecting a partial concentration, and consequently enabling the rest of the apparatus to subsequently separate the sulphurets from the gangue and to work a much larger quantity of pulp than could otherwise be done. In working coarse material it is of special importance to incline downward by the downstream ends of the first series of bars D D'; otherwise the slots would soon become choked with débris. The substances of value, after passing through the slots C C fall into the sluice-box N. It will be necessary to here add a proper quantity of water as free from pulp or sediment as practicable, in order to cause the said heavy substance to flow down the sluice-box N to devices that will now be described.

It is a well-known fact that chlorination—the usual method for reducing sulphurets—will not readily dissolve particles of gold of any considerable size. In order to obviate said difficulty it is deemed best to first extract the coarser gold by the gravity process, and then to pass the residue to another device for a final separation of the sulphurets. For the purpose first named I employ a suitable trough or receptacle *o* for quicksilver, that extends at right angles across the sluice-box N. The length of said receptacle may vary, according to the quantity of pulp to be worked, from about two to about five feet. Said receptacle may be constructed six inches broad and four inches deep, the upstream wall being preferably about two inches deeper than the downstream wall, thus giving the pulp a fall of about two inches as it enters the receptacle O.

P is a roller, preferably constructed of metal, cast around a wrought-iron axle Q. Said roller is provided with teeth R R, that are preferably constructed of wrought-iron or steel, about one inch broad and from about one-sixteenth to about one-eighth of an inch thick and about one inch long. The following dimensions are recommended. The wrought-iron axle Q may be one and a half inches in diameter. The shell of cast metal

may be of one-half inch thick and the teeth may extend about one inch beyond the cast metal, thus making the roller four and a half inches in diameter. Suitable bearings are provided at or near each end of the receptacle O, in which the axle Q works. A sufficient number of teeth R R should be employed to agitate the pulp thoroughly. The roller P should be so placed as to give the water and pulp a proper fall as they pass over the same—say one-fourth to one-half inch.

J''' J''' are chambers constructed immediately adjacent to the end walls of the receptacle O. The inner and outer walls of said chambers are provided with apertures for the passage of the axle Q, that should fit sufficiently tight to prevent material leakage. The tops of said chambers should extend about a foot above the pulp in the receptacle O. A stream of water delivered of each of said receptacles will create a pressure inward, and thus prevent the pulp from flowing out to interfere with the working of the bearings. Said receptacle O is filled with quicksilver or other heavy liquid to a depth of about one inch. The quicksilver is employed specially for floating the pulp, thus rendering it possible to agitate the pulp overlying the same. This use of a heavy liquid is merely mechanical, and unless the pulp be floated it will soon pack to such an extent that it will be impossible to revolve the roller by ordinary means. Hence the necessity for employing quicksilver or equivalent to float the pulp.

U is a pulley secured to the axle Q, and V is a belt for revolving the same; but other convenient gearing may be employed. The roller P is preferably revolved downstream at about the rate of forty-eight revolutions per minute; but it can be run faster or slower as may be found necessary.

The sluice-box N, a short distance below the receptacle O, has preferably four parts or branches C''', D''', E''', and F''' to deliver the pulp to an annular revolving sluice-box L' at four equidistant points. The pan W is supported by the vertical axle X, which works in proper bearings, one situated above and the other below the pan. The bottom Y of the pan is preferably made convex and lowest at the periphery. The inner wall I', surrounding the axis X, is preferably vertical. The waste water and waste pulp flow over this wall. The outer wall Z inclines outwardly at an angle of about forty-five degrees. At the top of said inclined wall Z is an annular groove A', which terminates in a vertical wall on its outer side, sufficiently high to prevent an overflow of the water and pulp.

C' C', Figs. 3 and 10, are pieces or blades preferably constructed of thin iron about two inches deep and eight inches long, the front ends having a sharp edge. Said pieces are secured to the under side of the annular sluice-box O' and lap a suitable distance, leaving openings H' H' for the flow of the water and pulp between them. Said blades

or pieces extend down into the pulp with which the annular groove A' is filled. They extend around said annular sluice-box. The revolving of the sluice-box O' causes the water and pulp to flow through the openings H' H' between blades or pieces C' C', from whence they will be distributed over the top of the inclined wall Z of the pan W. It will be readily seen that the foregoing arrangement virtually converts the annular groove A' and the inclined wall Z into a sluice-box, the width of which is equivalent to the circumference of the annular groove A', since the pulp flows from every part of said groove down over the whole of the inclined wall Z. The pulp will thus be very evenly and thinly distributed to the pan, and a much larger quantity can be worked than would otherwise be possible.

The following dimensions are recommended for the pan: from the center of the axle X to the wall I', thirty-six inches; depth of the wall I', five inches; distance between the wall I' and the wall Z, (at its foot,) twelve inches; vertical height of the wall Z, ten inches; width of the annular groove A', five inches; height of the wall B' above the annular groove A', two inches. The total distance across the pan between the annular wall B' will thus be ten feet and six inches. Other dimensions, however, may be used, if desired.

J' is an annular track constructed around the pan W, a proper space intervening between them. Said track is supported by standards K' K'.

L' is an annular sluice-box supported by a number of rollers Q' Q', which in turn are supported by the annular track J', upon which they revolve. The bottom of said sluice-box is preferably constructed in four sections that overlap each other slightly, a sufficient space being left between said sections where they lap, as at L'', (see Figs. 1 and 3) for the flow of the water and pulp.

Referring to Fig. 1 and beginning at 9, the transverse lines at 9, 11, 13, and 15 indicate the highest end of the respective sections, the lowest end thereof being, respectively, indicated by the dotted lines 10, 12, 14, and 16. Said sections are preferably constructed with a groove in the center into which the pulp will in the main settle. Each section is given the necessary grade or inclination to cause a proper flow of the water and pulp. A short distance beyond the point where the sections lap the bottom section is constructed with an aperture C'' (see Fig. 3) for the passage of the water and pulp onto a short sluice box or spout M', from whence it will be delivered to the annular groove A'. The quantity of pulp and water discharged through said four apertures C'' may be regulated by a blade in the same way that the discharge through the apertures C C (see Figs. 1 and 3) are regulated. It is desirable to discharge the main body or pulp through the apertures C'' C'' and the residue of the pulp and the water through the spouts N' N', with which

the annular sluice-box L' is provided, into the annular sluice-box O'. The apertures C'' C'' may be made sufficiently large to admit the entire quantity of water and pulp, if found best in practice so to do. The annular sluice-box O' is preferably subdivided in four sections by partitions I''' I''', a partition being placed a little in advance of the mouth of each spout N', as indicated in dotted lines in Fig. 1. Said sections may be constructed either level or inclined in a direction opposite to the inclination of the corresponding sections of the annular sluice-box L'. As shown in the drawings, they are level. The bottom of each section is preferably provided with a series of apertures 1 to 8, any desired number being employed. In order to make the flow of water through each aperture as nearly equal as possible, it is deemed best to gradually increase the size, commencing with the smaller apertures 1 in the immediate vicinity of the spouts N' N'. In operation both of said annular sluice-boxes L' and O' will have about eight revolutions a minute, while the pan W will have a reciprocating motion communicated by a crank M'' on shaft L''' and connecting-rod N'', having a stroke of about eighteen inches. Said shaft will preferably be revolved at the rate of about one hundred and twenty revolutions per minute.

R' R' are bars that cross each other above pan W and rest upon bracket-studs that furnish bearings for the rollers or wheels Q' Q'. They are each provided with a proper aperture where they cross, through which the axle X passes sufficiently loose to permit said bars to be revolved. The annular sluice-box O' is secured to said cross-bars, and consequently is supported by the rollers Q' Q'.

S' is a ring, preferably of an approximately triangular shape in cross-section and provided on the bottom with triangular lugs T' T'. (See Fig. 11.) Said ring is suspended from the cross-bars R' R' by rods U' U'. It can be readily raised or lowered by means of screws and nuts V' V'. The top of the ring is preferably constructed with a grade slightly greater than that which will be assumed by the flowing pulp. The object of the lugs T' T' is to draw the pulp, or a proper percentage thereof, beneath the ring and work it toward the center of the pan.

W' is another ring of similar construction, except that the bottom thereof is not provided with the triangular lugs. It is suspended by the rods X' X' and is adjustable by means of screws and nuts V' V'. Any desired grade or levels of the rings can thus be produced by raising or lowering them. In operation it is preferable to raise both of said rings sufficiently high to give the water and pulp a slight fall as they pass over the same. Either one or both of said rings may be dispensed with, as may be found to be best in practice, or a greater number than two may be employed.

E'' is a gear-wheel secured to the axle Q, which meshes with the gear-wheel F'', secured to a vertical axle G''.

H'' is another gear-wheel secured to the axle G'', and it meshes with a wheel secured to the shaft L'', to which is secured the crank M''. I'' is a belt-pulley, also secured to the axle G'', and J'' is a belt that connects said pulley and the annular sluice-box L'', the latter serving in the double capacity of sluice-box and belt-wheel. The crank M'' is secured to the axle L''.

N'' is a rod connecting said crank with the pin O'' secured to the pan.

In order to prevent the sulphurets from banking on the bottom of the pan, I employ scrapers P'' P'' to work over the bottom Y, and others Q'' Q'' to work over the inclined wall Z. The scrapers P'' P'' are suspended by rods R'' R'' from the cross-bars R' R', and are adjustable by screws and nuts. Said scrapers have preferably a sharp edge, said edge being made on an angle to work the sulphurets to the base of the inclined wall Z, where they will be discharged through an aperture T'' in the bottom Y of the pan.

Q'' Q'' are other scrapers, the front edge of which preferably are arranged on an angle the reverse of those of P'' P'', the object being to work the sulphurets down to the base of the incline Z. Said scrapers are suspended from the cross-bars R' R' by rods S'' S'', and are adjustable by means of screws and nuts. A sufficient number of said scrapers should be employed to prevent the pulp from banking. Said scrapers may be omitted, if found best in practice.

T'' is an aperture of proper size in the bottom of the pan W for the discharge of the concentrates.

U'' is a sliding bar provided with an aperture similar to T''. It is held in position against the bottom of the pan by guides V'' V'', that are properly secured to the pan. Said guides should fit sufficiently loose to admit of the sliding bar U'' readily being worked back and forth.

W'' W'' are stationary upright supports, each one provided near its upper end with a groove X'', in which a sliding board Y'', which contains a curved slot H''', works.

Z'' is a lug properly secured to the sliding bar U'', and extends thence therein into the slot H''' of the sliding board Y'', fitting therein sufficiently loose to be readily worked back and forth.

A''' A''', Fig. 7, are stationary posts in which set-screws B''' B''' are properly fitted. The ends of set-screws are secured to the sliding board Y''. It will be seen that by turning said set-screws (which can be done while the pan is either at rest or in motion) the sliding bar U'' can be moved, and thus the discharge-aperture T'' can be opened or closed, as desired. If the weight of the pan W and its contents be too great to be practically borne by the axle X, a proper number of rollers

G''', supported by an annular track H''', Fig. 13, may be employed to bear a portion or even all of the weight.

The following is the operation of my device: Water containing the pulp is turned into the sluice-box A and power is applied to the belt-wheel U, which communicates a rotary motion to the roller P, and to the annular sluice-boxes L' O', and to the rings S' and W', and a reciprocating motion to the pan W. A partial concentration of the pulp is effected by means of the apertures C C and the blade K. The more valuable substances will fall into the sluice-box N, and will thence be washed to the receptacle O, where by means of the roller P the coarser particles of gold and other substances of value will be precipitated. The pulp thence flows through the four branches C''' D''' E''' F''' and is properly distributed to the annular sluice-box L', and thence passes through apertures C'' C'', in connection with which latter blades K, such as shown in Fig. 5, may be used, if desired. From apertures C'' the pulp flows down the inclined chutes M' M' to the annular groove A'. The surplus water flows through spouts N' to the annular sluice-box O', and will flow thence through the apertures 1 to 8 into the annular groove A' between the outer wall B' and the pieces or blades C' C'. As both of said annular sluice-boxes have a rotary motion the sharp edges of said pieces will draw the pulp from the outer to the inner side of the annular groove A', from whence it will be evenly distributed to the inclined wall Z. By means of the reciprocating motion communicated to the pan by the crank-arm M'' on shaft L''' and the connecting-rod N'' the heavier substances of value will be precipitated to the bottom of the pan, while the valueless portion of the pulp will flow over the tops of the rings S' W', and thence over the wall I' into the waste. The lugs T' T', constructed on the bottom of the ring S', will as said ring rotates draw a portion of the pulp beneath the same, and thus facilitate the setting of the heavier substances of value. The scrapers P'' and Q'', having a rotary motion, will prevent the pulp from banking on the bottom Y or on the inclined wall Z of the pan and will at the same time work the concentrates toward the base of the inclined wall, to be discharged at the aperture T''. The concentrates can be discharged as desired by turning set-screws B''' B'', which will slide the bar U'' and open the aperture T''. The aperture can be again closed by turning the set-screws in an opposite direction, all of which can be done while the pan is in operation.

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

1. The sluice-box A, having a bottom composed of inclined bars with intermediate grooves or channels, the lower section of said bars having a greater inclination than the upper and provided with discharge-apertures

C C in the channels, in combination with a blade having an edge located near the plane of the bottom of the channels, substantially as set forth.

5 2. The sluice-box A, having a bottom composed of inclined bars with intermediate grooves or channels, the lower section of said bars having a greater inclination than the upper and provided with discharge-apertures
10 C C in the channels, in combination with a blade having an edge located in the plane of the bottom of the channels and devices for adjusting said blade in said plane, substantially as set forth.

15 3. The combination of the pan W, the sluice-box N, having several branches, the annular sluice-box L', and mechanism for moving said annular sluice-box, substantially as set forth.

4. The pan W, provided with an annular
20 groove A', in combination with the sluice-box N, having four branches, and the annular revolving sluice-box L', provided with apertures C'' C'', and inclined chutes M' M', substantially as and for the purposes described.

25 5. The pan W, provided with an annular groove A', in combination with the sluice-box N', having four branches, and the annular sluice-box L', provided with apertures C'' C'', inclined chutes M' M'; and spouts N' N', and
30 the annular sluice-box O', provided with apertures, substantially as and for the purposes set forth.

6. In combination with the pan W and means for delivering pulp, a ring located in said pan below the pulp-inlet and having 35 an inwardly-inclined upper surface, substantially as set forth.

7. In combination with the pan W and means for delivering pulp, the ring located in said pan below the pulp-inlet and having an inwardly-inclined upper surface, and lugs T' on 40 its bottom surface, substantially as set forth.

8. The annular movable sluice-box L', in combination with the pan and with scrapers secured to said box, the pan W, having the 45 annular channel or groove at its rim, an annular wall I' on its bottom, a discharge-outlet, and devices for regulating the size of said outlet, all in combination substantially as set forth.

9. The annular sluice-box L', having spouts 50 N' and discharge-apertures in its bottom, in combination with the annular sluice-box O', provided with holes in its bottom, and the annular channel or receptacle A', whereby the 55 pulp is parted and then reunited, substantially as set forth.

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

BRYAN TYSON.

Witnesses:

BENJ. R. CATLIN,
EMMA M. GILLET.