May 5, 1936. M. C. BRIGHT 2,039,291

MINER'S SEPARATING APPARATUS

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Fig. 1.

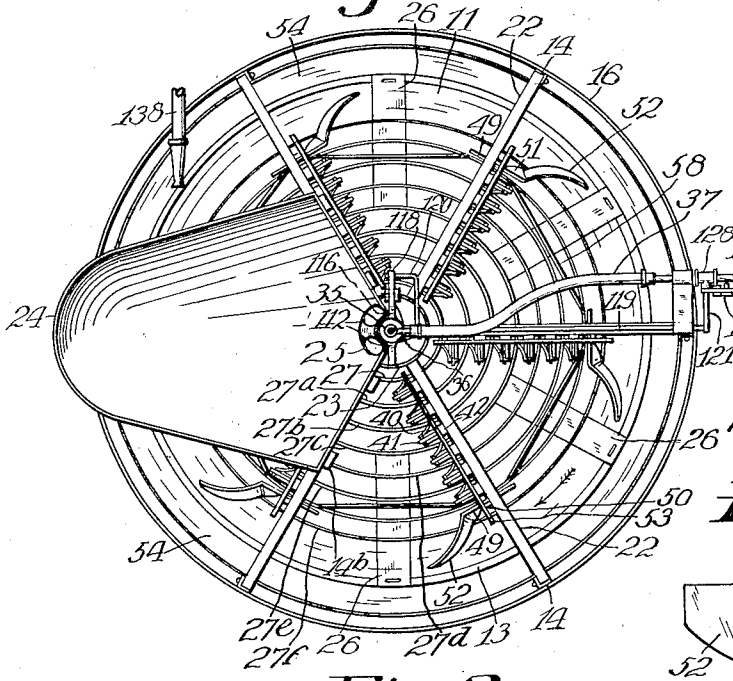


Fig. 3.

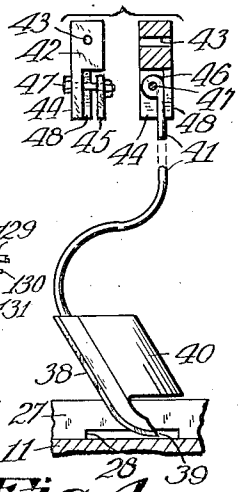


Fig. 4.

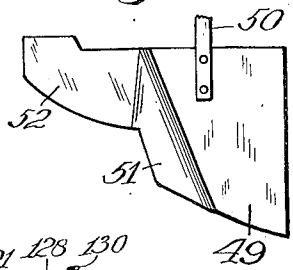


Fig. 2.

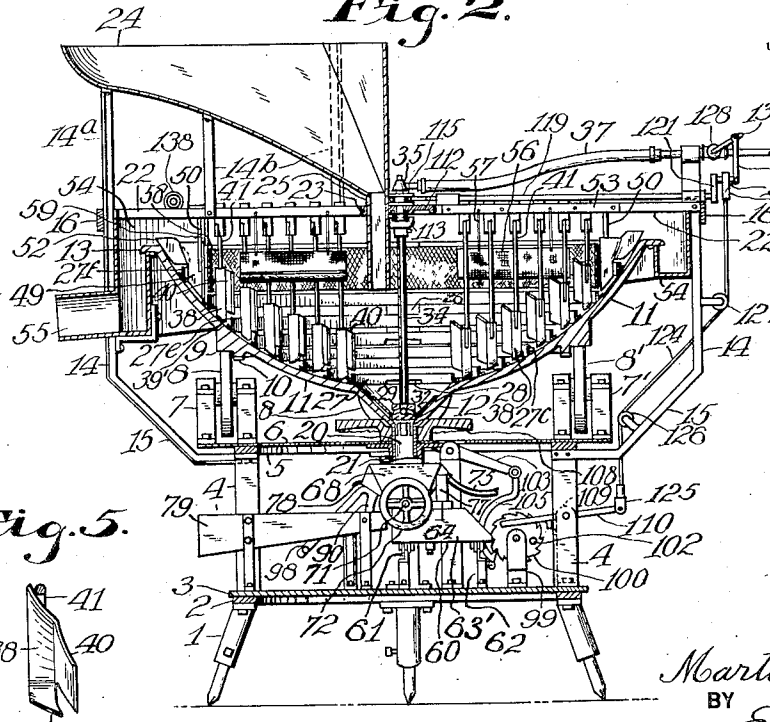


Fig. 6.

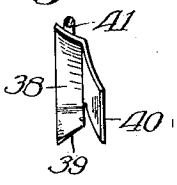


Fig. 5.

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MINER'S SEPARATING APPARATUS

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Fig. 7.

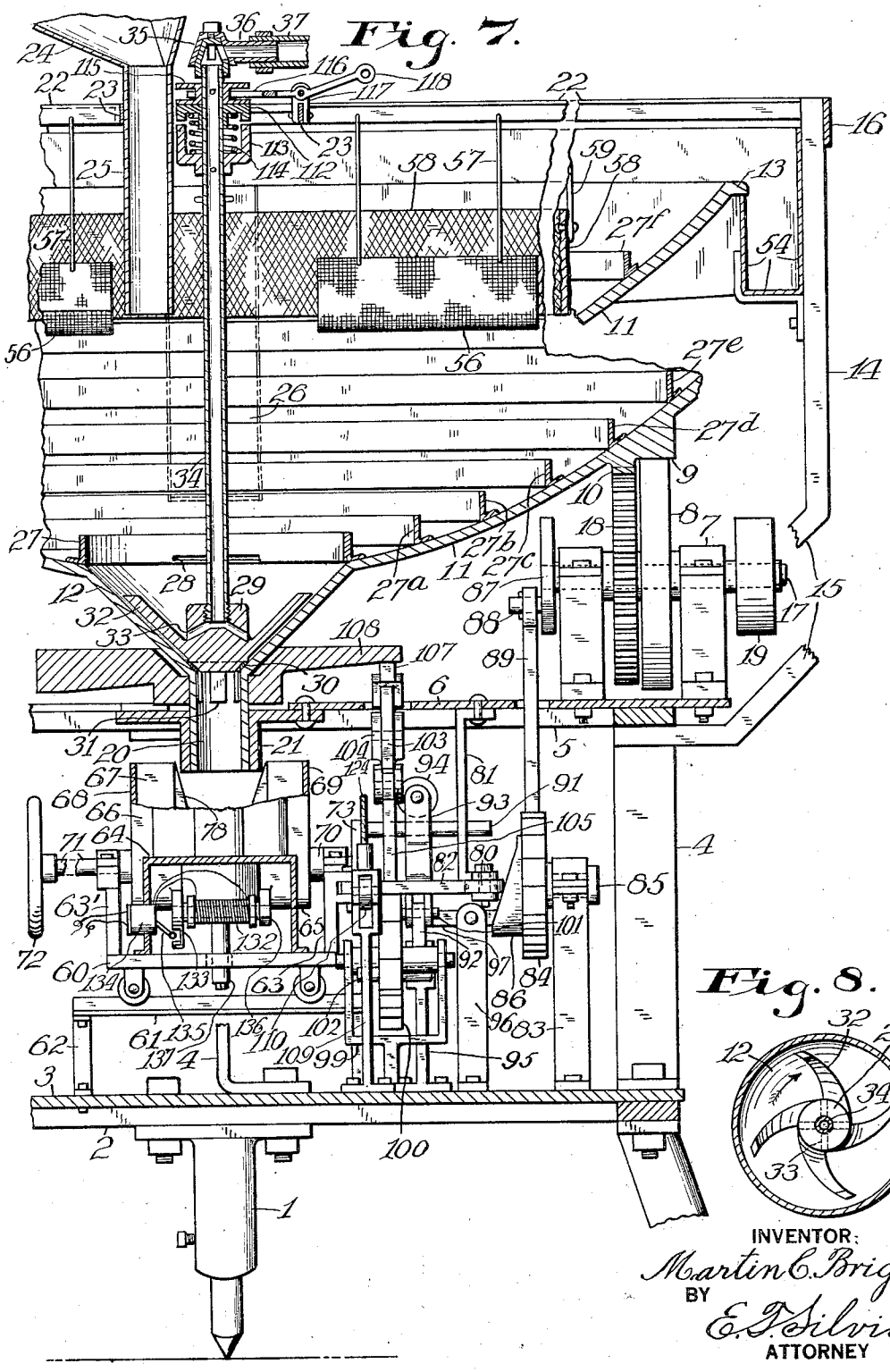


Fig. 8.

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MINER'S SEPARATING APPARATUS

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Fig. 9.

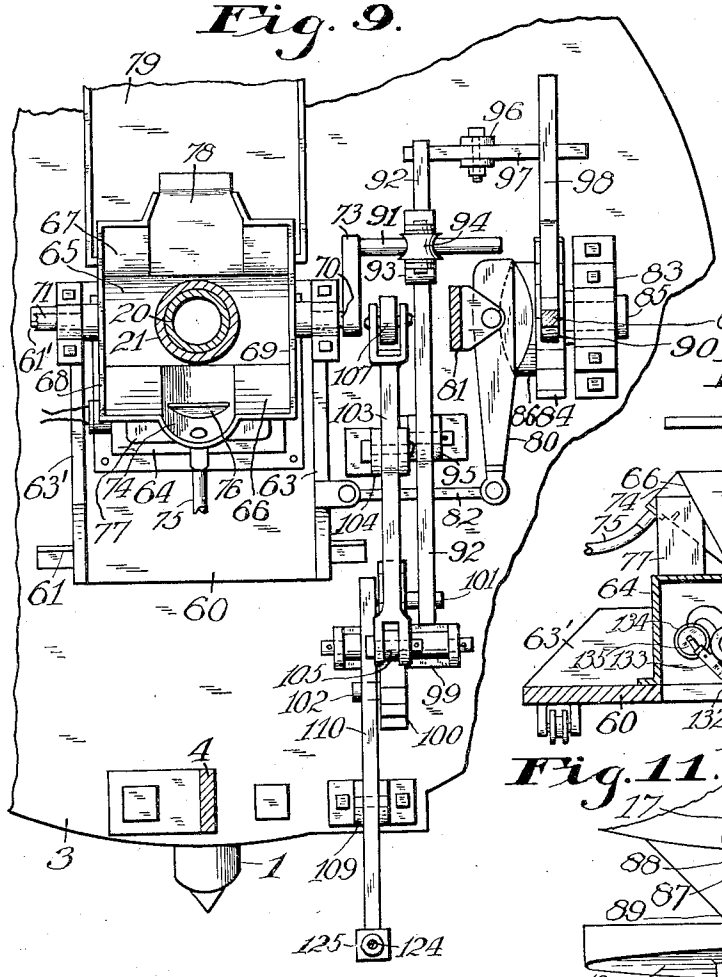


Fig. 10.

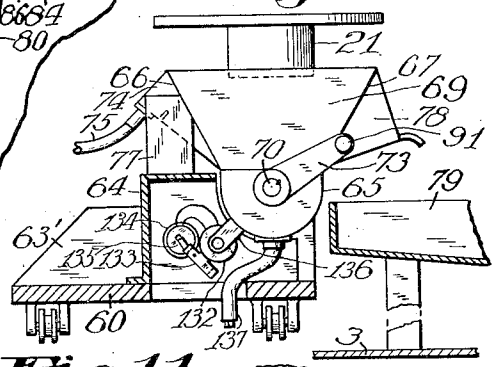
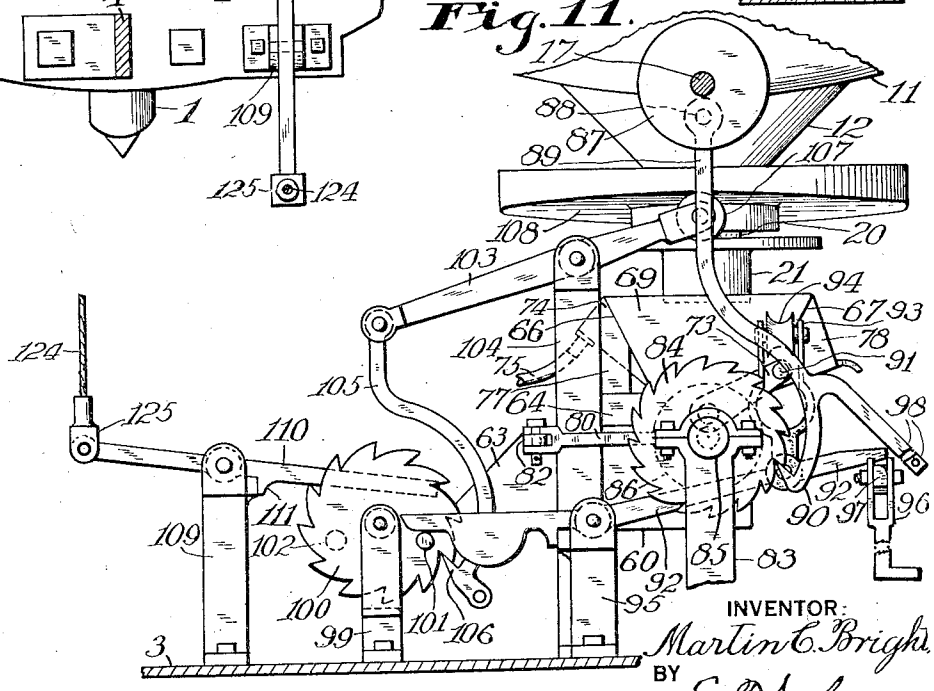


Fig. 11.



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MINER'S SEPARATING APPARATUS

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Fig. 12.

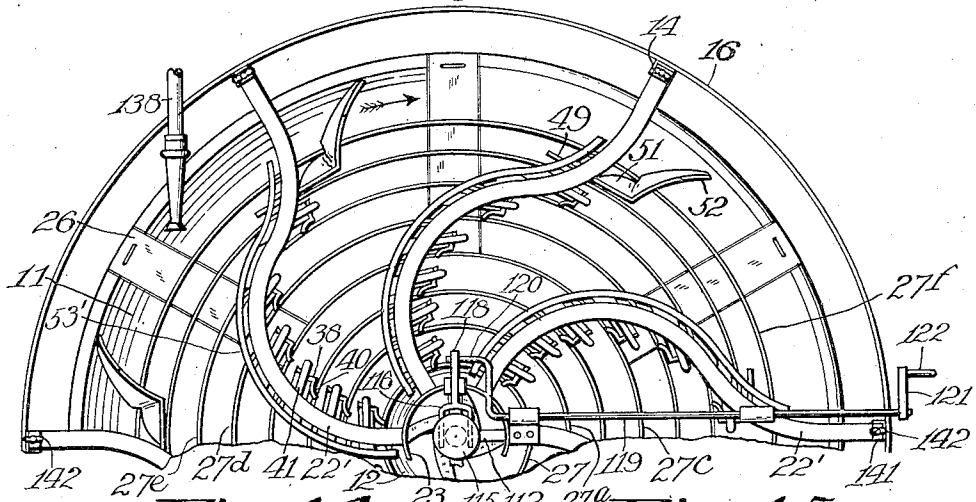


Fig. 14.

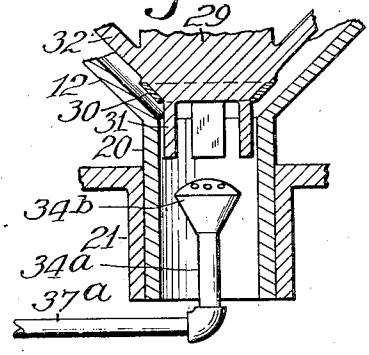


Fig. 15.

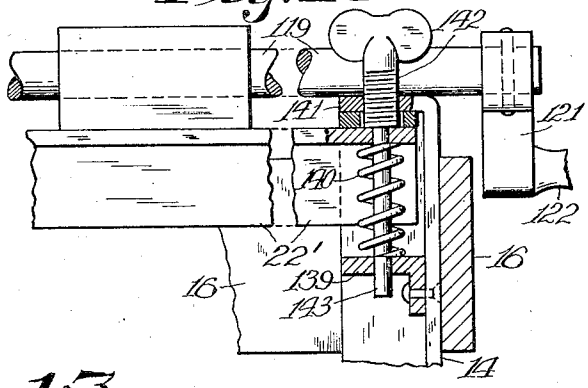
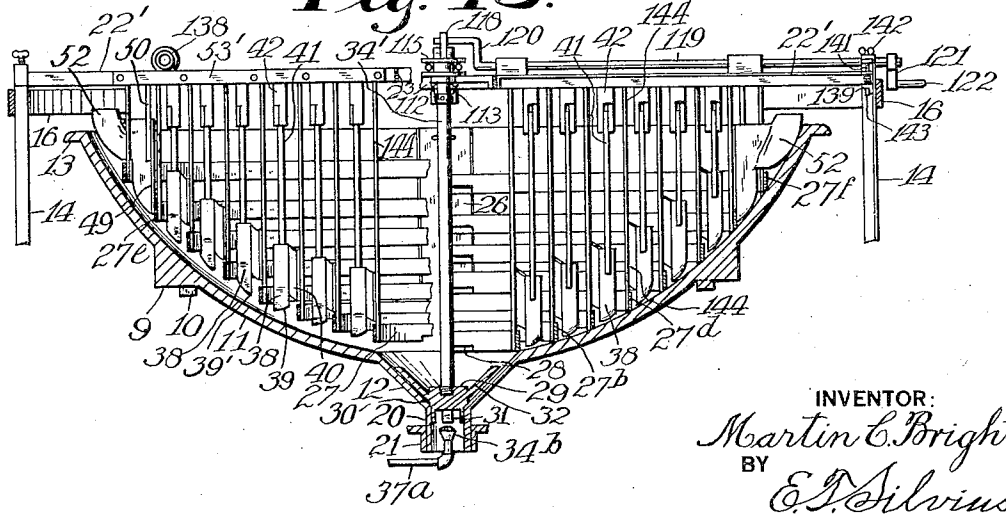


Fig. 13.



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Patented May 5, 1936 2,039,291

UNITED STATES PATENT OFFICE

2,039,291

MINER'S SEPARATING APPARATUS

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Application May 31, 1932, Serial No. 614,425

17 Claims. (Cl. 209—453)

This invention relates to apparatus designed to be used by persons, such as miners, in the separation of precious or highly valued metals from the substances bearing the metals, the invention having reference more particularly to means, principally mechanism, whereby the separation is effected.

An object of the invention is to provide separating apparatus whereby valuable metals may be efficiently and economically obtained from alluvium or gangue through operations of the force of gravity.

Another object is to provide separating apparatus for miners or others which shall be of such construction as to constitute a complete machine adapted to be readily set up for use in outlying districts or elsewhere in mining localities, and which may be inexpensively composed of simple parts and not requiring great accuracy in construction.

A further object is to provide an improved separating machine in which water may be economically used in the process of separation and recovery of gold and other precious or valuable metals from gangue which may contain quantities of the metals, which machine shall be adapted to be used in the separation of the more valuable metals in an economical manner from the product of stamping mills resulting from the treatment of gold bearing quartz.

A still further object is to provide a miner's separating machine which may readily be transported from place to place so as to be advantageous in association with placer mining and shall be qualified to be highly efficient in the separation, particularly where a relatively large percentage of dust or flour gold values is found in auriferous deposits, so as to contribute to the productivity of placer mining, which machine shall be adapted to have a wide separating range from dust to nugget gold, and be durable and economical in use.

With the above-mentioned and other objects in view, the invention consists in a machine having a rotary bowl and apparatus therein of novel structure for the treatment of gangue or similar substances in water and furthering the separation of metals of relatively higher specific gravity from that of the remaining substances such as different particles of alluvium; and further, the invention consists in the novel parts, and in the combinations and arrangements of parts, as hereinafter particularly described and further defined in the claims appended hereto.

Referring to the accompanying drawings,—Figure 1 is a top plan of one form of construction of a machine or apparatus embodying the invention; Fig. 2 is a transverse sectional elevation of the machine; Fig. 3 is an enlarged detail view of one of the principal elements of the machine, one portion showing a front view and another portion of the figure showing a central section of the base part thereof; Fig. 4 is an enlarged side view of another one of a group of attachments embodied in the machine; Fig. 5 is an enlarged top plan of an outer one of a series of plow devices comprised in the machine; Fig. 6 is an enlarged top plan of an inner one of the plow devices comprised in the machine; Fig. 7 is a fragmentary sectional elevation on an enlarged scale in which parts are omitted and other parts of the machine are shown that are obscured in other views; Fig. 8 is a horizontal section of features of the lower portion of the vessel in which substances are treated; Fig. 9 is an enlarged horizontal section disclosing parts that are obscured in other figures; Fig. 10 is an enlarged fragmentary sectional elevation showing details of the apparatus; Fig. 11 is a fragmentary elevation showing parts and controlling apparatus of the machine; Fig. 12 is a fragmentary top plan of a modified machine structure; Fig. 13 is a sectional elevation of the modified structure; Fig. 14 is an enlarged sectional view clearly showing the lower portion of Fig. 13; and Fig. 15 is an enlarged sectional elevation clearly showing details of structure of the modifications.

Similar reference characters in the various figures of the drawings indicate corresponding elements or features of construction herein referred to in detail.

A practical embodiment of the invention includes a metallic machine frame having a number of suitable legs 1 that are longitudinally adjustable whereby to readily level the frame on uneven ground, the legs being secured to and directly supporting a base ring 2 having a floor 3 on its top which supports a suitable number of posts 4 on the tops of which a frame ring 5 is supported and having a floor plate 6 secured to the top thereof. A suitable number of stands 7, 7' are secured upon the floor plate and rotatively support bearing rollers 8, 8' which support a rotary vessel having a circular track 9 on its under portion which travels on the rollers. One or more of the rollers may be driven to rotate the vessel, or the vessel may be rotated by means of a toothed rack bar 10. In approved construction the vessel is bowl-shaped or hemi-spherical, having a concavely dished bottom and side portions 11 on which the rack bar is fixed. The vessel has a central depressed bottom portion 12 which is approximately funnel-shaped

and constitutes a sub-receptacle to receive substances with water in the operations of separation. The upper portion of the bowl has an outward extending flange 13. The machine frame comprises also a suitable number of vertical post members 14 arranged outward beyond the vessel or bowl and having foot members 15 extending inward below the bowl and secured to the frame ring 5, a hoop 16 extending about the upper portions of the post members and rigidly secured thereto.

For the purpose of positively rotating the vessel and controlling rate of rotation or speed thereof, the main shaft 17 is rotatively supported by one stand 7 to constitute an axle for the roller 8 and has a gear wheel 18 secured thereto that meshes with the rack bar 10, the shaft being suitably driven, as by means of a pulley 19 secured thereto.

The sub-receptacle 12 has a hollow neck 20 constituting a journal which rotates in a journal bearing 21 fixed to the floor plate 6 to guide and steady the movement of the bowl and contribute to the smooth operation thereof while performing the functions of an outlet for contents of the sub-receptacle. The frame comprises also a suitable number of beams 22 which are radially secured to a center ring 23 and extend to and are secured to the post members 14 adjacent to the hoop 16 and thereby practically secured to the hoop. One of the post members has an upper extension 14*a* supporting a suitable hopper 24 which has also other supports 14*b* secured to beams 22, the hopper having a spout 25 extending downward through the ring 23 so as to discharge gangue into the upper portion of the bowl in proximity to the axis of rotation thereof.

A suitable number of face sections 26, 26' composed of strips of plated sheet copper or loosely inset in the upper portion of the wall 11 of the bowl so as to be radially arranged and longitudinally removed to facilitate washing and cleansing of the bowl, and copper strips being let into suitable grooves so as to afford an even top surface. The bowl has a suitable number of circular barriers 27, 27*a*, 27*b*, 27*c*, 27*d*, 27*e*, 27*f*, composed of metallic rings differing in diameter and concentrically arranged on and may be secured to the wall 11, each ring having a port hole 28 in its lower portion. The smaller or inner ring 27 is slightly less in diameter than the diameter of and overlaps the upper portion of the depression 12. Centrally in the depressed portion 12 a valve body 29 is arranged and it has a conical valve 30 which may be removably attached for renewals and can be seated to close the neck 20, being provided with wings 31 that are guided in the neck. The valve body has a number of curved fingers 32 fixed thereon and designed to loosen the substances that have a tendency to become packed in the sub-receptacle, the fingers being designed to centripetally draw the loosened substances as the bowl is rotated with the valve 30 unseated, the valve body having radial ports 33 therein for the passage of water to aid in the loosening process, a hollow valve stem 34 being vertically secured to the valve body to conduct water thereto, the stem extending upward approximately to the top of the machine frame and having a swivel head 35 thereon which has a side inlet 36 to which a flexible pipe 37 is connected which may suitably be supplied with water. In some cases the water supply may be augmented by arranging a pipe 34*a* vertically in the neck 20 and connecting a supply pipe 37*a* with the lower end thereof, the upper end of the pipe having a spray device 34*b* thereon to discharge water past the unseated valve 30 to aid in loosening the substance to permit the flow thereof downward through the neck 20.

Arranged in the space outside the inner barrier 27 is a series of plow devices 38 having each a forwardly curved edge 39 adapted to plow up and turn over a substance against a wing 40 fixed to the device and extending above the barrier. Outside of one or more adjacent barriers a series of similar plow devices is arranged so as to draw a substance containing the heavier metallic substance inward. A series of plow devices is arranged in the spaces between the larger barriers and each plow device has a reversely inclined cutting or scraping edge 39' designed to work the substance outward over the outer barriers as the bowl is rotated. Each plow device has a handle 41 that is carried by a head block 42 having a bolt hole 43 therein by which to secure the head to a beam 22, the head having a side plate 44 against which to clamp the handle by means of a washer 45, the handle having an eye 46 through which a clamp bolt 47 extends, the plate 44 having a rib 48 to guide the handle 41. The clamping connection permits the handle to swing backward from the rib in emergency of a stone being accidentally dropped into the bowl. Outside the outer barrier a series of scraping blades 49 is arranged and carried by means of anchor bars 50 that are secured to the beams 22 and having each a plow member 51 adapted to force the lighter weight substance up over the upper edge of the bowl, the plow portion 51 having a deflector blade 52 on its upper portion adapted to deflect the substances over the flange 13. The blocks 42 may be further secured by a reinforcing strap 53 extending across their backs and secured to the adjacent beam. The discarded matter is received into a trough 54 extending about upper portions of the bowl and suitably supported by the machine frame, the trough having an inclined bottom and a discharge spout 55 connected to the lower portion of the trough, the substance being in mixture with water.

A suitable number of skimmer devices 56 composed of fabricated material, such as wire screening and coarse cloth, are arranged in the upper portion of the bowl to catch floating flour gold and contribute to the operating efficiency of the apparatus, the devices being supported by hangers 57 secured thereto and to the beams 22 under which they are arranged. Another skimmer device 58 which may be composed of coarse cloth and provided with hangers 59 are supported also by the beams, the device extending about the other skimmer devices in the upper portion of the bowl to enhance the value of the apparatus by retaining some of the floating flour gold that may rise or be lifted by operation of the machine.

A carriage 60 is mounted upon a pair of track rails 61 and 61' supported upon posts 62 which are secured upon the floor plate 3, the carriage having end members 63 and 63' and carrying a casing 64 between the end members. A novel pan is provided which has a concavely curved bottom 65, oppositely sloping sides 66 and 67 connected with the bottom, and end members 68 and 69, the latter having trunnions 70 and 71 fixed thereto that are mounted on the carriage end members, supporting the pan under the neck 20, one of the trunnions having a hand wheel 72 fixed thereto whereby to manually tilt the pan

if desired, the opposite trunnion having a crank arm 73 fixed thereto whereby to automatically tilt the pan. The side 66 of the pan has a curved depressed portion 74 with which a flexible pipe 75 is connected for conducting water to the pan, the depressed portion having a transverse baffle plate 76 therein. The casing 64 supports a rubber cushion 77 which the side portion 66 is in contact with when the pan is in normal position. The opposite side 67 of the pan has a depressed portion 78 constituting a spout to discharge into a trough 79 supported in appropriate position by means of the floor 3 of the machine frame.

In order to automatically move the carriage to-and-fro to agitate the contents of the pan a lever 80 is horizontally arranged opposite to one end of the carriage and pivotally supported intermediately of its opposite ends by a bracket 81 which is secured to the floor plate 6 of the frame and extends downwardly a suitable distance, a connecting rod 82 being pivotally connected with one end portion of the lever and with the end member 63 of the carriage. A standard 83 is rigidly secured upon the floor 3 and rotatively supports a ratchet wheel 84 which has a suitable axle 85 journaled in the standard; and a cam 86 is fixed to the ratchet wheel and contacts with the lever 80 to alternately engage portions of the lever on opposite sides of its pivot, the cam being intermittently moved by means of a disk 87 secured to the shaft 17 and carrying a crank pin 88 to which a pull rod 89 is connected that extends downward towards the ratchet wheel and has a pawl member 90 engaging the teeth of the ratchet wheel when drawn upward. For automatically tilting the pan the crank arm 73 is provided with a long crank pin 91 and a long lever 92 is arranged lower than the crank pin and has a shackle 93 pivotally connected thereto that is carried by a grooved roller 94 arranged to bear upon the crank pin 91 and roll thereon as the carriage is moved on its tracks, the lever 92 being pivotally supported intermediately of its ends by a post 95 secured upon the floor 3. Another post 96 is secured also upon the floor 3 and pivotally supports a trip lever 97 intermediately of its ends so that it extends under the lever 92 adjacent to one of its ends, the opposite portion of the trip lever extending up and being adapted to move a finger 98 which is fixed to the pawl 90 whereby to appropriately hold the pawl away from contact with the ratchet wheel 84. A suitable post 99 is secured upon the floor 3 and rotatively supports a ratchet wheel 100 having a trip pin 101 fixed to one side and another trip pin 102 fixed to the opposite side thereof. One of the trip pins is arranged to engage and lift one end portion of the lever 92 to tilt the opposite end into contact with the lever 97, the pin being intermittently moved and carried from beneath the lever which then falls again into the path of the pin to be again tilted in accordance with the timing determined upon. For intermittently turning the ratchet wheel 100 a lever 103 is arranged with one of its ends above the wheel and is pivotally supported by a post 104 which is secured to the floor 3 and pivotally supports a pull rod 105 having a hook 106 for engagement with the teeth of the ratchet wheel. The opposite end of the lever 103 has a roller 107 which contacts with a cam 108 which is secured to the depressed portion 12 of the bowl or to its neck 20. A post 109 is suitably arranged and secured to the floor 3 and it pivotally supports a trip lever 110 having a stop shoulder 111 limiting its movement in one direction so as to be contacted with by the pin 102 whereby to periodically tilt the lever.

In order to control the valve 30 in the sub-receptacle the center ring 23 is provided with a central hub 112 in which the hollow stem 34 is movably guided and has a cup 113 secured thereto below the hub, a coil spring 114 being seated in the cup and bearing against the hub to yieldingly force the valve into place, permitting rotation of the stem with the bowl. A grooved collar 115 is secured to the stem above the hub and is engaged for lifting the stem by a fork 116 pivoted to a block 117 fixed on the ring 23, the lever having an operating lever 118. A shaft 119 is suitably mounted on a beam 22 and has a crank arm 120 on one end connected to the arm 118, the outer end of the shaft having an arm 121 fixed thereto which has a crank pin 122 thereon. A strap 123 is connected with the crank pin 122 and has a cable 124 attached thereto which is provided with a jaw 125 that is connected with the actuating end portion of the lever 110 whereby to lift the valve stem 34 against the tension of the spring 114 and cause clutching engagement of the cup 113 with the spider hub 112 so as to prevent rotation of the valve body 29. The cable 124 is guided on pulleys 126 and 127 mounted on the frame of the machine. For conducting water periodically to the sub-receptacle when the valve 30 is unseated a regulating valve 128 is mounted upon the machine frame and has a supply pipe 129 connected thereto and is connected with the conduit 37 and permissibly a conduit 37*a*. The regulating valve has a control lever 130 which is controlled by a connecting rod 131 that is connected with the crank pin 122.

In furtherance of the separating operations an electromagnet 132 is arranged under the curved bottom 65 of the pan and supported by means of a plate 133 fixed to the pan and appropriately equipped with electrical circuit wiring, a suitable switch box 134 being secured to the casing 64 and provided with a switch lever 135 arranged to be operated in connection with the plate 133, the electromagnet being further supported by an ear 136 carried by the bottom of the pan, said bottom having also a clean-out pipe 137 connected therewith. The arrangement is such that when the pan is being tilted to discharge matter from the spout 78 the plate 133 operates the switch arm 135 to close the electrical circuit so as to energize the electromagnet which causes the bottom of the pan by induction to be magnetized for drawing magnetic metal thereto, the switch lever being oppositely actuated to open the circuit so as to demagnetize the electromagnet on return of the pan to upright position, various details of the electromagnet control being permitted to be modified in accordance with the knowledge of the electrican to obtain the required result. The terminal of a supply pipe 138 may be anchored on the top of the frame to discharge water into the bowl, particularly for washing out purposes.

In order to facilitate washing out of the bowl following completion of separating operations the circular barriers are suitably supported by the machine frame independently of the bowl and may be slightly lifted therefrom, as seen in a portion of Fig. 13; and to attain other advantages in the performances of the plow devices various modifications are devised, as more particularly illustrated in Figs. 12, 13 and 15, the beams 22′ being reversely curved approximately

as shown in Fig. 12, and strap plates 53' are correspondingly curved, so that the plow devices are in staggered arrangement in radial direction aiding in circulation of the matter approaching the outer edge of the bowl above the barriers. In the modification a bracket 139 is secured to a frame post 14 below the beam and supports a coil spring 140 which yieldingly supports the outer end portion of a beam, the frame member having an integral head member 141 extending above the beam and supporting an adjusting screw 142 which has a stem 143 extending through the adjacent beam and the spring and also through the bracket 139 whereby the outer end of each beam is vertically adjusted, and the head blocks 42 are mounted on the beams, and also hangers 144 are connected to the beams and also to the circular barriers.

In practical use the bowl which is a water holding vessel is rotated at moderate speed and gangue or conglomeration of various metallic substances and associated substances, previously screened, is placed in wet condition in the hopper 24 and passes through the discharge pipe 25 and into the central zone adjacent to the axis of rotation of the bowl, the latter being nearly full of water in which the substances circulate, the heavier metallic substances gravitating into the sub-receptacle or depressed portion of the vessel bottom while buoyant substances or precious metals having relatively less specific gravity may float into contact with the fabricated skimmer devices and are caught thereby as the water is appropriately replenished and passes over the top edge of the bowl and into the trough 54. As the bowl rotates the plow devices cause the mass which may have descended upon the bottom of the bowl between the barriers to be lifted and spilt over the barriers, those plow devices adjacent to the inner ones of the barriers causing the matter to be turned over mainly centripetally with a substantially churning action of the substance to effect separation and flow of the heavier precious metal downward along the inclined bowl bottom and through the port holes in the barriers and into the sub-receptacle, the conglomerate that sinks in the mass in the spaces outside the remaining or outer ones of the barriers being plowed up and agitated by the outer plow devices and turned over mainly in an outward or radial direction over the adjacent barriers with churning effect, so that the matter of relatively low specific gravity rises and flows out into the trough 54 while separation of the heavier precious metals occurs so that the heavier metallic values pass down along the inclined bottom portions and upper side portions of the bowl and pass through the port holes and downward into the sub-receptacle, with concentration in the sub-receptacle, the substances in the sub-receptacle being largely metallic and becoming undesirably packed in the sub-receptacle until loosened by the fingers 32 upon stationarily holding the valve stem 34 by securely clutching it to the frame, the loosening of matter being facilitated by the admission of water under the mass of substances in the sub-receptacle, enabling the matter to flow past the valve 30 and out the neck 20 and into the hopper-like upper portion of the pan. During the rotation of the bowl the pan is given intermittent reciprocatory motion by the cam 85 actuated intermittently by the ratchet wheel 84 and the pawl 90. On operation of the ratchet wheel 100 the lever 92 is periodically tripped to impart movement to the pin or rod 91 and the arm 73 which causes tilting of the pan and discharge of refuse matter therefrom while the bottom of the pan becomes magnetized and holds magnetic substances to the bottom together with gold or precious metals therewith. Following discharge of the refuse by the pan it is automatically returned to normal position and its bottom demagnetized. The contents of the pan may be permitted to flow out through the pipe 137 and the precious metals saved and dried for further treatment if desired. Washing out of the pan is facilitated by supplying water thereto through the conduit 75. The skimmer devices 56 and 58 are to be removed from place and separately treated to cause separation of metallic values therefrom which may have become enmeshed therein in the operation of the machine, and the values thus recovered may be appropriately treated as may be desired. Following operation of the machine during a period of time various parts thereof are suitably washed and prepared for a repetition of the operations.

What is claimed is:

1. Separating apparatus having a rotary water-holding vessel provided with a central sub-receptacle depressed in its bottom, the sub-receptacle having a discharge-valve seat at its bottom, a valve co-operating with the seat and curved loosening fingers on the body of the valve, and means to lift the valve body and hold it against rotation.

2. Separating apparatus having a rotary hemispherical bowl having concentrically arranged circular barriers therein and a funnel-like sub-receptacle at the lowermost central portion of the bowl, the inner one of the barriers being diametrically smaller and overlapping the upper portion of the sub-receptacle, a frame, and loosening means in the sub-receptacle and having means to stationarily secure the same to the frame.

3. Separating apparatus including a rotary water-holding vessel having a funnel-shaped sub-receptacle provided with a hollow discharge neck, a stationary frame, a regulating valve mounted on the frame, timing means operating and controlled by rotary movement of the vessel to control the regulating valve, and means to conduct water from the regulating valve to the sub-receptacle.

4. Separating apparatus including a rotary bowl having a depressed central bottom portion constituting a sub-receptacle open at its bottom, a valve body in the sub-receptacle to close the opening in its bottom and having loosener fingers thereon curved to draw substances inward towards the axis of rotation of the bowl, the body having controlling means therefor, and means to conduct water to the sub-receptacle.

5. Separating apparatus including a stationary frame, a bowl having a discharge neck and rotatively supported by the frame, a carriage supported by the frame and horizontally movable thereon beneath said neck, a cam rotatably mounted on the frame to impart oscillatory movement to the carriage, means mounted on the frame and operable jointly with the bowl intermittently rotating the cam, and a pan tiltably supported below said neck by the carriage, and means responsive to bowl rotation for periodically interrupting said oscillatory movement and tilting said pan.

6. Separating apparatus having a rotary bowl

provided with a concentrating sub-receptacle in the lower portion thereof, a stationary frame, a valve body adjustably arranged in the sub-receptacle and having loosener fingers fixed thereon, the valve body having a controlling stem extending vertically thereon, means for clutching the controlling stem securely to the frame, and means to conduct water to the sub-receptacle.

7. Separating apparatus including a frame, a bowl rotatably supported by the frame and having a funnel-shaped sub-receptacle centrally in its bottom, a valve body in the sub-receptacle having a stem extending vertically in the bowl and provided with crank-operated clutch means supported by the frame for controlling the stem, the valve body having loosener fingers thereon curved to draw matter centripetally in the sub-receptacle.

8. Separating apparatus including a stationary frame, a separating rotary bowl adapted to collect the heavier particles of material placed therein and having a bottom discharge pipe, a carriage supported by the frame, an electric switch supported by the carriage and having a projecting switch lever, a pan tiltably mounted on the carriage below said discharge pipe and having a concave magnetizable bottom, an electromagnet carried by said concave bottom and having circuit connection with the electric switch, the pan having a controller to operate the switch lever to close the circuit upon tilting movement of the pan, and means responsive to bowl rotation for periodically tilting said pan.

9. Separating apparatus including a rotary bowl and separating devices therein including circular diametrically different barriers and plow devices between the barriers arranged in lower portions of the bowl, the lower central bottom of the bowl having a concentrating receptacle with an outlet valve at its bottom, a tiltable pan arranged below the receptacle, means automatically controlled by the bowl periodically to tilt the pan, and a device having connection with the pan for manually tilting the pan.

10. Separating apparatus including a stationary frame having top beams, a bowl rotatably supported by the frame below said beams and having a plurality of circular barriers differing in diameter and in relatively stepped arrangement therein, plow devices arranged between the barriers and having hangers supported by said top beams, a plurality of skimmer devices supported by said beams and having coarse fabric webs therein, and a hopper supported by said beams and having a discharge pipe leading to the area about the axis of rotation of the bowl above the space circumscribed by the inner one of the barriers.

11. Separating apparatus including a frame, rollers supported by the frame, a bowl supported rotatably on the rollers and having a depressed central bottom portion provided with a hollow neck, a journal bearing secured to the frame and guiding said neck, a conduit supported upon the frame and provided with a regulating valve, a conduit connected with said valve to conduct water therefrom to said depressed bottom portion, agitator devices arranged in the bowl, and intermittently operating means supported by the frame under control of the bowl and having control of the regulating valve.

12. In separating apparatus, the combination of a frame, a hemi-spherical bowl having a depressed central bottom portion provided with a hollow discharge neck, rollers supported by the frame and rotatably supporting the bowl, agitator devices arranged in the bowl, a guiding device supported by the frame and guiding said neck in co-operation with said rollers, and loosener devices operatively arranged in said central bottom portion.

13. In a separating apparatus, the combination of a rotary hemi-spherical bowl and separating devices therein including circular diametrically different barriers and plow devices projecting below the upper edges of and between the barriers and adapted to lift material caught by said barriers, the lower central bottom of the bowl having a concentrating receptacle with an outlet neck at its bottom, said barriers having ports in the lower portions thereof and adjacent to the bottom of the bowl to direct flow to said receptacle.

14. In separating apparatus, the combination of a stationary frame having top beams, a bowl rotatably supported by the frame below the beams, means supported by the frame adjustably supporting the beams respectively, agitator devices arranged in the bowl and controlled by said beams, a conduit supported by the frame and provided with a regulating valve, a conduit connected with said valve to conduct water therefrom and into the bowl, and operating means supported by the frame under control of the bowl and having control of the regulating valve.

15. In separating apparatus, a hemi-spherical rotary bowl having a central depressed portion provided with a discharge opening, a series of radially spaced annular barriers on the surface of said bowl, the barriers nearest said depressed portion being provided with openings at their bases to permit flow to said central portion, and a plurality of circumferentially spaced face plate sections removably inset in the face of said bowl beneath the others of said barriers to provide flow openings toward said central discharge upon removal of such face plate sections.

16. In separating apparatus, a bowl rotatable about a vertical axis, a plurality of circular barriers differing in diameter and in relatively stepped arrangement therein, stationary plow devices arranged between the barriers, a plurality of radially disposed skimmer devices depending into said bowl, and means for supplying material to be separated to the area about the axis of said bowl and above the space circumscribed by the inner one of said barriers.

17. In separating apparatus, a bowl rotatable about a vertical axis, a stationary porous annular member of smaller diameter than said bowl, said member being disposed generally coaxial with said vertical axis and projecting below the normal level of material in said bowl, and a plurality of radially disposed fibrous skimmer devices depending into said bowl within said annular member.

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