(No Model.) 3 Sheets—Sheet 1.

# C. WALLACE.

## CONCENTRATOR.

No. 522,172. Patented June 26, 1894.

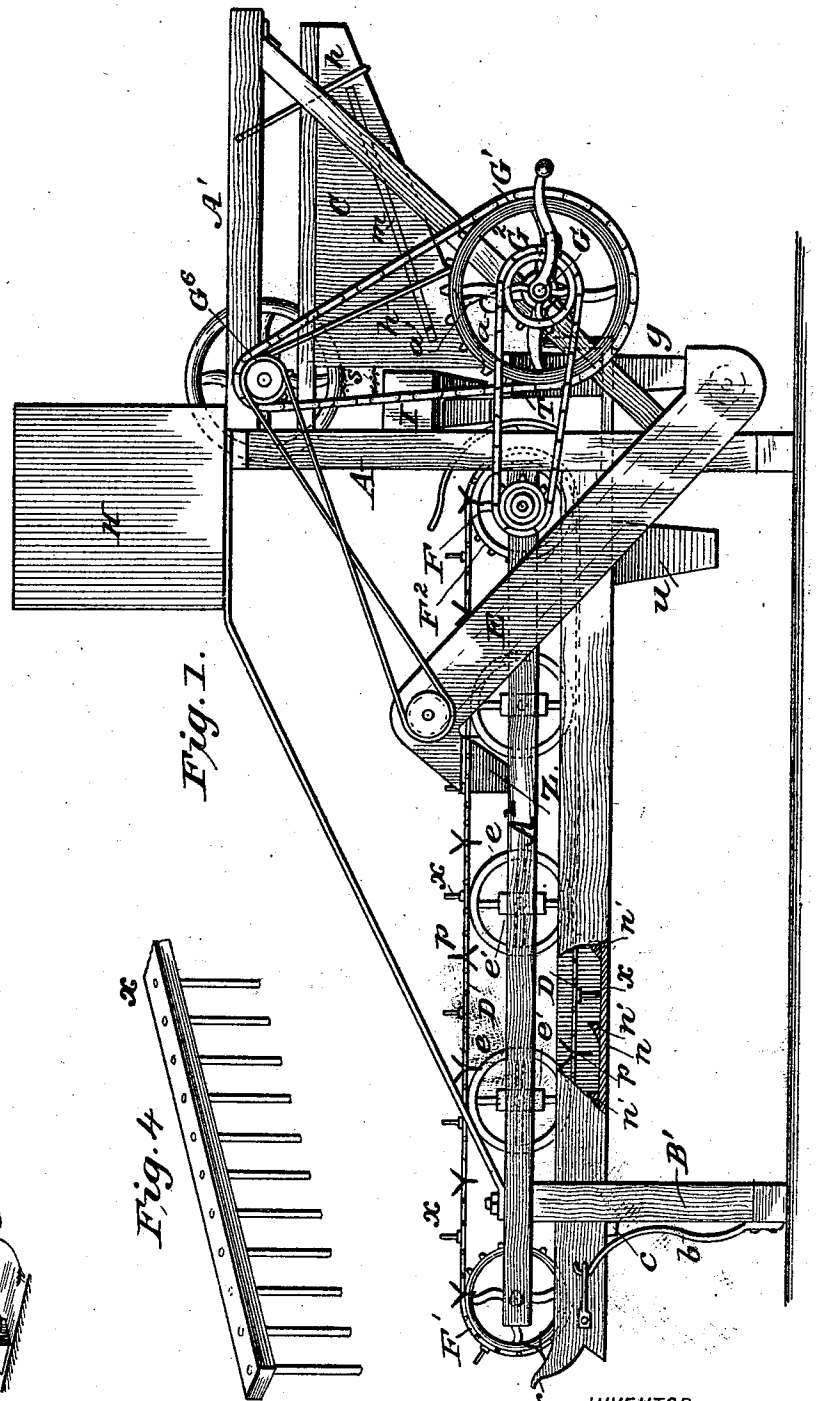

Fig. 1.

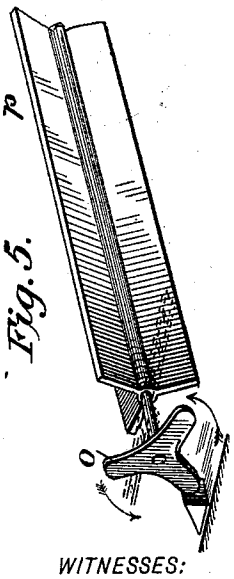

Fig. 5.



Fig. 4.

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(No Model.) 3 Sheets—Sheet 2.

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## CONCENTRATOR.

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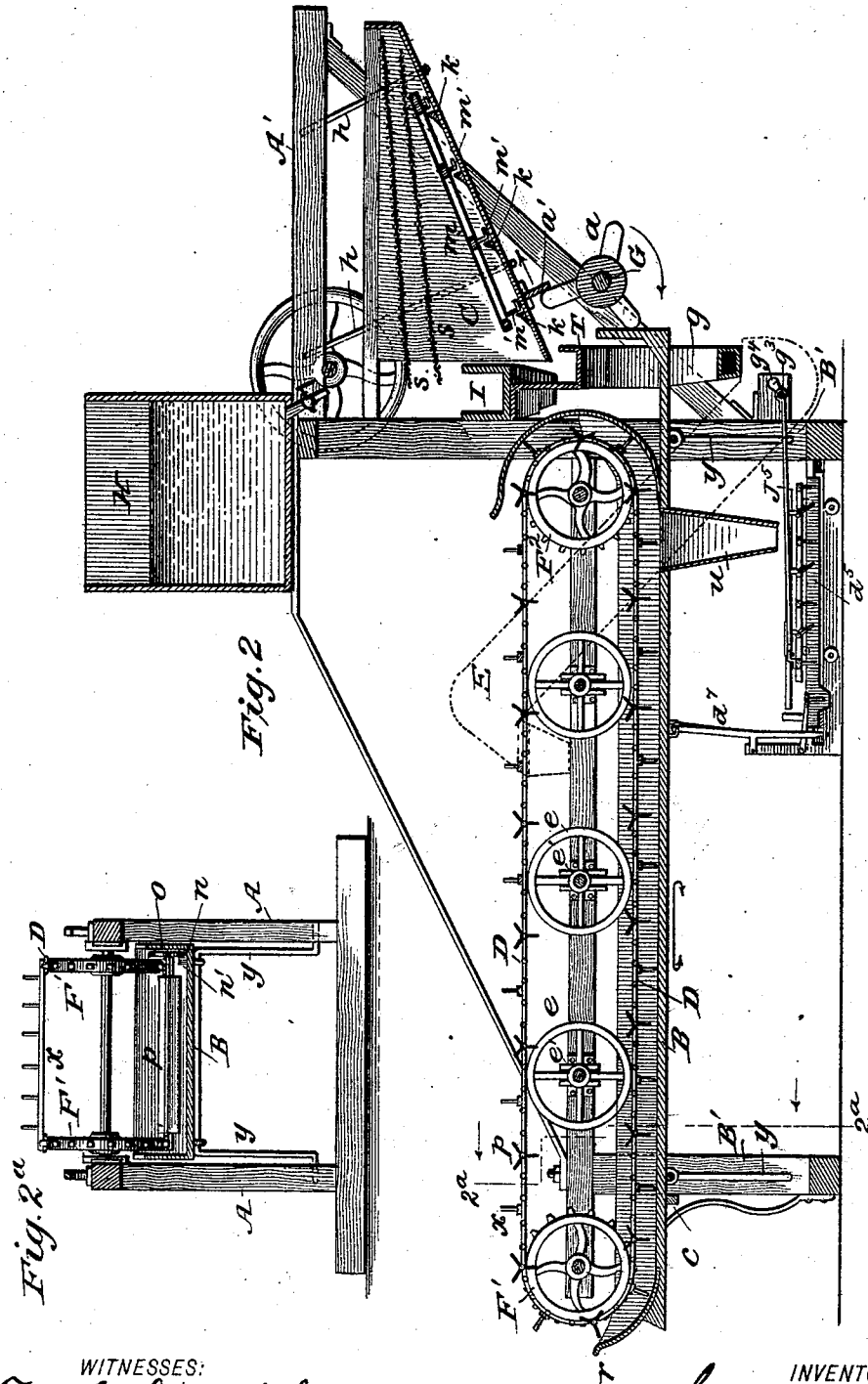

Fig. 2



Fig. 2a

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3 Sheets—Sheet 3.

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## CONCENTRATOR.

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Fig. 6.

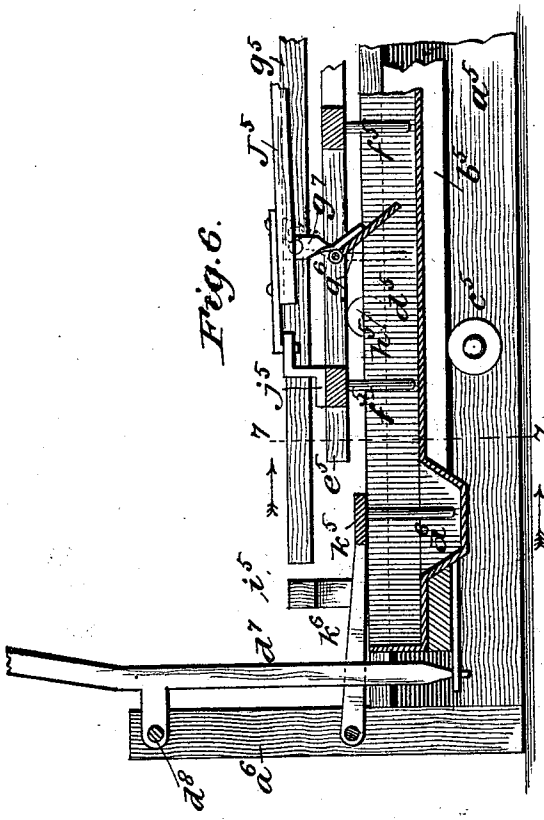


Fig. 7.

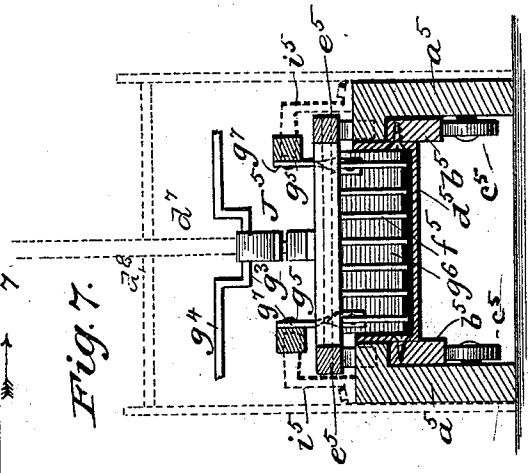
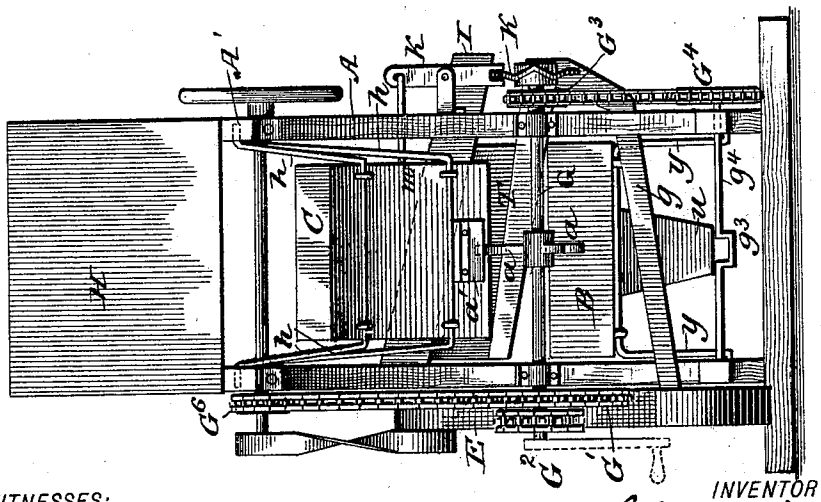


Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 522,172, dated June 26, 1894.

Application filed July 29, 1893. Serial No. 481,815. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES WALLACE, a citizen of Denver, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in 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.

My invention relates to certain improvements in concentrators and belongs to the class in which a percussion table or pan is employed for separating and discharging the coarser refuse material at one end and the ore or sulphuret at the other.

It consists in certain details of construction and arrangement of parts hereinafter more particularly described in the specification, illustrated in the drawings and pointed out in the claims.

In the drawings: Figure 1, is a side elevation of my device. Fig. 2, is a vertical longitudinal section. Fig. $2^a$ is a transverse section through the line $2^a$, Fig. 2. Fig. 3, is a front end view. Fig. 4, is a detail of the rake. Fig. 5, is a detail of the rotary scraper. Fig. 6, is a partial side elevation of the auxiliary or final separator. Fig. 7, is a transverse section through the line 7—7, Fig. 6.

Referring more specifically to the drawings by letter: A represents the main frame which supports the operative parts.

B is the pan supported in the frame on U shaped bails *y*, having their ends pivoted near the bottom of the legs B′ of the frame, which allow it to oscillate.

C is an oscillating receptacle or hopper suspended in the front part of the frame by rods or loops *h* and containing the screens *s s*. This receptacle has a forwardly inclined bottom, and on the under side of same is secured a projection *a′* against which a cam *a* on the main shaft G, impinges and imparts a vibratory or oscillating motion to the receptacle. The main shaft G is provided at one end with sprocket wheels G′ $G^2$, the former of which is connected by a belt with a wheel $G^6$ and a pulley on a shaft journaled in the upper frame piece A′ and connected by belting with a pulley at the upper end of the elevator E. The sprocket wheel $G^2$ is in like manner connected by sprocket chain with sprocket pulley F on shaft carrying sprocket wheel $F^2$ journaled at the front end of the frame piece $A^2$, by means of which the sprocket chain D is actuated. At the opposite end of the frame piece, $A^2$, is journaled a like sprocket wheel F′ over which the sprocket chain is carried. At the opposite end of shaft G is a sprocket wheel $G^3$, shown in Fig. 3, the purpose of which will be presently explained.

Upon the sprocket chains carried over sprocket wheels $F^2$ F′, at suitable intervals are alternately secured rakes *x* and scrapers *p*, the latter being so attached or journaled in the chain as to permit of an intermittent rotary motion. These scrapers are provided at one end with a three armed spur cam *o* which runs on a track *n* at one side of the pan. This track is provided at regular intervals with stops or projections *n′* against which the spur cam abuts, as shown in Fig. 5, and causes it to tilt and lift making a one-third revolution of the scraper shaft.

Within the circuit described by the chain D and for the purpose of holding its sides apart between the sprocket wheels F′ $F^2$, I provide wheels *e* journaled in horizontally slotted boxes *e′* secured on the inner sides of the frame pieces $A^2$, (shown in Fig. 2.) The wheels *e* bear upon the sprocket chains and cause the spur cam *o* to slide along the track until the projections *n′* are reached, when the spur cam strikes the projection and raises and turns the shaft.

The object of the vertically slotted boxes *e′* in which are located the bearings of the wheels or rollers *e*, is to afford to the chains D a yielding upward movement as they are lifted or raised by the action of the spur cams *o*, sufficiently to enable the scraper shafts to perform the necessary one-third revolution.

The pan B, being loosely mounted on the supports *y*, immediately beneath the sprocket chain, is adapted to move longitudinally upon said supports and its forward movement is limited by a block or chuck *c* secured to the bottom of the pan, and which, when the pan occupies its normal position bears against the rear leg or upright B′ of the frame as shown in Figs. 1 and 2. For the purpose of holding

the pan in its normal position with the blocks *c* against the posts B′, springs *b* are secured to said posts, their opposite ends being attached or hooked to the pan. A reciprocating motion is imparted to the pan by means of the cam wheel *a*, as shown in Figs. 2 and 3, which impinges against its front end, and also serves to oscillate the hopper or receptacle C as already described.

H represents a water tank, mounted at the top of the frame from which a spray of water is discharged upon the material introduced into the hopper or receptacle C. The teeth of the rakes *x* extend to the bottom of the pan, but the scraper flanges are shorter, and extend to a point a short distance above the bottom, the object of which will be presently explained.

T is an inclined discharge spout at the rear of the hopper or receptacle C leading to one side of the machine and designed to receive and discharge the coarser material delivered from the end of the screens *s s*.

*k* are riffles arranged transversely across the inclined bottom of the hopper or receptacle C, and *m* is a frame placed above the bottom, provided with right angled teeth or scrapers *m′* resting upon the bottom above the riffles as shown in Fig. 2, and capable of a transverse oscillatory movement whereby the teeth *m′* will agitate the material lodged against the riffles *k* and clear them. The object of these transverse bars *k*, is to arrest or retard the finer material containing the valuable ores, which being heavier sink to the bottom of the incline, and being thus arrested by the bars or riffles *k*, and there agitated by the teeth *m′* of the oscillating frame *m* the lighter and less valuable material is brought to the surface and carried off first over the riffles. The frame *m* is oscillated by means of a centrally pivoted lever K, to one end of which the frame is attached, the opposite end of the lever being slotted to receive a cam wheel K′ on the end of shaft G, as shown in Fig. 3.

T is an inclined apron at the end of hopper C and *g* is a spout into which the fine material, which passes through the screens, is discharged from the bottom of the hopper, being directed to mouth of spout *g* by apron T. This spout *g* delivers the fine material into the boot of elevator E, whence it is carried up by the elevator and discharged into spout Z through which it flows to the bottom of the pan. The teeth of the rakes *x* secured to the sprocket chain, and which project to the bottom of the pan, pass through the material and serve to agitate and distribute it evenly over the bottom. The flange of the rotary scraper, one of which follows each rake but does not extend to the bottom of the pan, carries the coarser portion of the material on the surface along until one arm of the spur cam *o* strikes the projection *n′* on the track *n* when the scraper is tilted bringing the next flange in position, leaving the material thus carried forward to be again distributed by the succeeding rake-teeth, until again gathered by the next scraper. By this operation the entire material on the bottom of the pan is constantly distributed and agitated by the teeth of the successive rakes, while the coarser material constituting its surface is gathered up, carried along and dumped at regular intervals by the downward flange of the alternatly revolving scrapers. During this operation, the pan is oscillated by means of the cam *a* at its forward end and the spring *b* at its rear end; the flange of the former forcing the pan outward until released from contact, when the spring suddenly forces it back until the block or chuck *c* on its bottom strikes the leg B′ of the frame, which causes a sudden concussion or jar, driving the finer material on the bottom toward the forward end where it is discharged or delivered through a spout U into the auxiliary or final separator, shown in Figs. 2, 6 and 7. It will thus be seen that the first separation is effected by the screens *s s* placed within the oscillating hopper or receptacle C which discharges the material too coarse to pass through the meshes of the screens, into spout I through which it is carried out to the side. The remaining material after being further separated and concentrated by the riffles and teeth *m′* of the frame *m″* is delivered from the bottom of the hopper through spout *g* and elevator E into the pan and then distributed, agitated and the lighter and worthless portions separated from the ore or sulphurets and carried forward along the bottom of the pan by means of the alternately arranged rakes *x* and revolving scrapers *p* to its outer end, up the incline *r* where it is discharged, while the heavier and valuable material sinks to the bottom and is carried forward by the concussion created by the oscillatory motion of the pan and discharged near its front end, through the spout U.

The foregoing operation is generally found sufficient for the concentration of ordinary ores, but in placer mining and where finer particles are to be treated, the auxiliary separator and concentrator is usually employed to effect a still further concentration after the fine material has been delivered from the spout U of the main concentrator. This auxiliary concentrator differs from the main concentrator in its construction, and when employed is placed beneath the main concentrator and secured to the mud sills of the latter. It consists of the main frame pieces $a^5$, having journaled upon their inner sides friction rollers $c^5$ as shown in Figs. 6 and 7, which support the frame pieces $b^5$ to which the pan $d^5$ is screwed or bolted, thereby adapting the pan to move horizontally backward and forward within the main frame upon said rollers. This pan is actuated or caused to move backward and forward upon the friction rollers, by a vertical lever $d^7$ pivoted near its center by a short arm at the point $d^8$ to an up-

right post $a^6$ extending from the main frame piece $a^5$. The lower end of this lever is pivotally connected to the pan $d^5$, and its upper end, to the bottom of pan B of the main concentrator, as shown in Fig. 2, so that when the pan of the main machine is oscillated, a corresponding motion is imparted to the pan of the auxiliary concentrator by the lever $d^7$, except that they move in opposite directions. $e^5$ is the rake frame, mounted upon friction rollers $h^5$ journaled in the top or upper face of the main frame pieces $a^5$. This frame is provided with rakes $f^5$ and scrapers $g^6$ alternately arranged at suitable distances apart as shown in Fig. 6, and is adapted to move horizontally over the friction rollers upon which it is mounted. The rakes are fixed rigidly to the frame and the teeth of same extend to the bottom of the pan, but the scrapers $g^6$ are pivoted to it and adapted to swing. At the upper or pivoted edge of the scraper is bolted at each end a shank or arm $g^7$, shown in Figs. 6 and 7, extending upward.

$g^5$ represents an automatic adjusting bar, suspended above the frame $e^5$ by the series of scraper arms $g^7$ to which it is pivotally secured, two of these adjusting bars being provided, one on each side.

$J^5$ is a pitman connecting the crank $g^3$ of the crank shaft $g^4$ on main concentrator with the rake frame $e^5$ by its connection $j^5$ and by means of which it is given an oscillating or vibratory motion backward and forward over the pan $d^5$.

$i^5$ represents stops projecting upward from the main frame at each end, against which the ends of the automatic adjusting bars abut when carried forward by the movement of the rake frame.

$d^6$ is a depression or transverse gutter in the pan-bottom having inclined sides, and $k^5$ is an automatically operating rake, the teeth of which are intended to travel through this depression as the pan is oscillated. $k^6$ is the handle of said rake, having its outer end pivoted to the upright $a^6$ of the main frame, whereby the rake is enabled to rise as its teeth climb the sides of the depression, and to fall by its own gravity when the teeth pass into the depression.

The operation of this auxiliary concentrator is as follows: Its pan is connected to the pan of the main concentrator by the vertical pivoted lever $d^7$ as already described, and its rake frame $e^5$ by the pitman $J^5$. When the main concentrator is set in motion, the pan of the auxiliary machine is caused to oscillate by the pivoted lever $d^7$, and its rake frame, by the pitman $J^5$. The material to be separated is received from the spout U of the main concentrator and is agitated and distributed over the bottom of the pan by the teeth of the rakes $f^5$, the finer portion seeking the bottom and the coarser refuse remaining on top. The scrapers being down, the forward motion of the rake frame causes them to gather up and carry forward this surface refuse, until the forward end of the adjusting bars $g^5$ strike the stops $i^5$ at that end, and being pivoted to the scraper shanks cause the scrapers to rise as the rake frame continues to move forward, as far as permitted by the pitman crank. As the frame is carried back by the revolution of pitman crank, the opposite end of the shifting bar strikes the stop at that end, and throws the scraper down in position for the next forward movement caused by the revolution of the pitman crank, so that it is only in contact with the surface during the forward movement of the rake frame, but is carried over it during the backward movement; meantime the oscillating movement of the pan causes the fine and valuable material to move along its bottom in the opposite direction, and the gutter or depression in the bottom of the pan will accumulate the gold, while the black sand, agitated by the automatic rake $k^5$ will be carried over it and discharged.

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

1. In a device for amalgamating and concentrating minerals, the combination, with a main frame having an oscillating percussion table or pan mounted therein, and a hopper or feeding device, of a series of rakes and a series of scrapers secured alternately upon an endless apron or sprocket chains mounted immediately above the pan or table, whereby they will traverse its bottom, the rakes being fixed to the belt or chains and the scraper shafts so journaled in bearings therein as to permit them to revolve, and provided at one end with a gig or star, having arms, corresponding with the scraper flanges, and a track at one side of the pan with projections or stops at intervals, on which track the gig of the scraper shaft travels, and is intermittently revolved by contact with the projections, substantially as and for the purpose described.

2. The combination in an amalgamating and concentrating device for minerals, of the main frame, the pan mounted therein on pivotal supports and adapted to oscillate, the spring attached to the pan and to the main frame, the stop or bumper secured to the pan, the hopper or ore receptacle mounted in hangers pivotally attached to the main frame, the projection on the under side of the hopper and the cam wheel mounted at one end of the pan in the main frame and having arms which, in its revolutions impinge against the end of the pan and against the projection on the hopper and cause both to oscillate, all arranged substantially as and for the purpose described.

3. The oscillating percussion pan mounted as described and provided at one side with the track having stops or projections at intervals, in combination with the flanged scraper shafts having gig projections at one end to travel on said track, secured in bear-

ings and carried along over the pan by an endless belt or sprocket chain, substantially as and for the purpose described.

4. In combination with the endless chains or belt, carrying the rakes and scrapers, and the pan provided with the track at one side having the stops or projections, of the carrying rollers mounted in automatically adjustable vertical bearings on the main frame, substantially as and for the purpose set forth.

5. In a concentrating device for minerals, the swinging hopper secured to the main frame by pivoted hangers, and provided with interior screens and having riffles on its bottom, the waste spout I located beneath the end of the screens to receive and discharge the coarser refuse, the collecting spout beneath the hopper and the elevator extending from the bottom of said spout to the pan, and the pan, all combined and arranged substantially as and for the purpose described.

6. In an ore concentrating device, the swinging hopper secured to the main frame by pivoted hangers and provided with interior screens and transverse riffles on its base in combination with a scraper frame provided with teeth resting on the bottom above the riffles, said frame being connected at one end with a centrally pivoted lever slotted at its opposite end to receive a cam wheel whereby said frame is oscillated transversely within the hopper, all combined and arranged substantially as and for the purpose described.

7. In an ore concentrating device, the combination with the pivotally mounted pan having the spring bearing against its outer end and holding it normally forward, and the swinging hopper located in front of the pan, of the cam *a* located upon the main driving shaft between the front end of the pan and rear end of the hopper adapted to alternately engage with each and force them backward, substantially as and for the purposes described.

8. In an ore concentrating device having an oscillating percussion pan pivotally mounted in a main frame, as described, and driven by a cam on the main shaft, the combination with the main driving shaft having the cam *a*, the sprocket wheel $G^2$ of the pan, the swinging hopper provided with a projection on its under side, against which cam *a* abuts, the sprocket wheels $F^2$ $F'$ carrying the sprocket chains D, to which are attached the series of rakes and scrapers, the sprocket pulley F and the sprocket chain connecting sprocket pulley F and wheel $G^2$, substantially as and for the purpose described.

9. In an ore concentrating device, as described, an oscillating pan pivotally mounted in the main frame, driven by a cam on the main shaft, in combination with the said main or driving shaft, the sprocket wheels $G'$ and $G^2$; the swinging hopper provided with a projection against which cam *a*, abuts; the sprocket wheels $F'$, $F^2$ carrying a sprocket chain D, the pulley F and the sprocket chain connecting pulley F with wheel $G^2$, the pulley $G^6$, and its connection with the pulley $G'$, the elevator with its band connecting with pulley $G^6$, substantially as and for the purpose described.

10. In an ore concentrating device, the combination of main shaft G; an oscillating pan pivotally mounted in the main frame and actuated by the cam *a*, sprocket wheels $G'$, $G^2$; a swinging hopper, also operated by said cam *a*, sprocket wheels $F'$, $F^2$, carrying sprocket chains D, a sprocket chain connecting pulley F with wheel $G^2$, pulley $G^6$, having band connection with pulley $G'$ on the main shaft, the spout *g* and the elevator E with its connections substantially as and for the purpose described.

11. In combination with the main concentrator as hereinbefore described, the auxiliary pan $d^5$, provided with a transverse trough or depression $d^6$, and mounted on friction rollers, whereby it is adapted to oscillate, the centrally pivoted lever connecting at one end with the pan of main concentrator and at its opposite end with the auxiliary pan, and the rake frame $e^5$ provided with a series of fixed rakes and pivoted scrapers mounted over the pan, and adapted to oscillate, substantially as and for the purposes described.

12. In combination with the pan $d^5$ mounted on friction rollers, and adapted to oscillate, the pivoted lever $d^7$, the rake frame $e^5$ provided with a series of fixed rakes and pivotally attached scrapers, operated by the pitman $J^5$ adapted to be connected with the crank shaft $g^4$ of the main concentrator, the adjusting bar $g^5$ pivotally suspended to the shanks of the pivoted scrapers, and the stops $i^5$ located at the ends of the main frame substantially as and for the purpose described.

13. In an ore concentrator, as described, the combination with the pan $d^5$, having the transverse trough or depression in its bottom and adapted to oscillate; of the pivoted rake $k^5$ designed to automatically travel through the trough or depression in the bottom of the pan, substantially as and for the purpose described.

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

CHARLES WALLACE.

Witnesses:
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