Nov. 10, 1931. V. V. CLARK 1,831,524

AGITATING SLUICE CONCENTRATOR

Filed Aug. 30, 1928 3 Sheets-Sheet 1

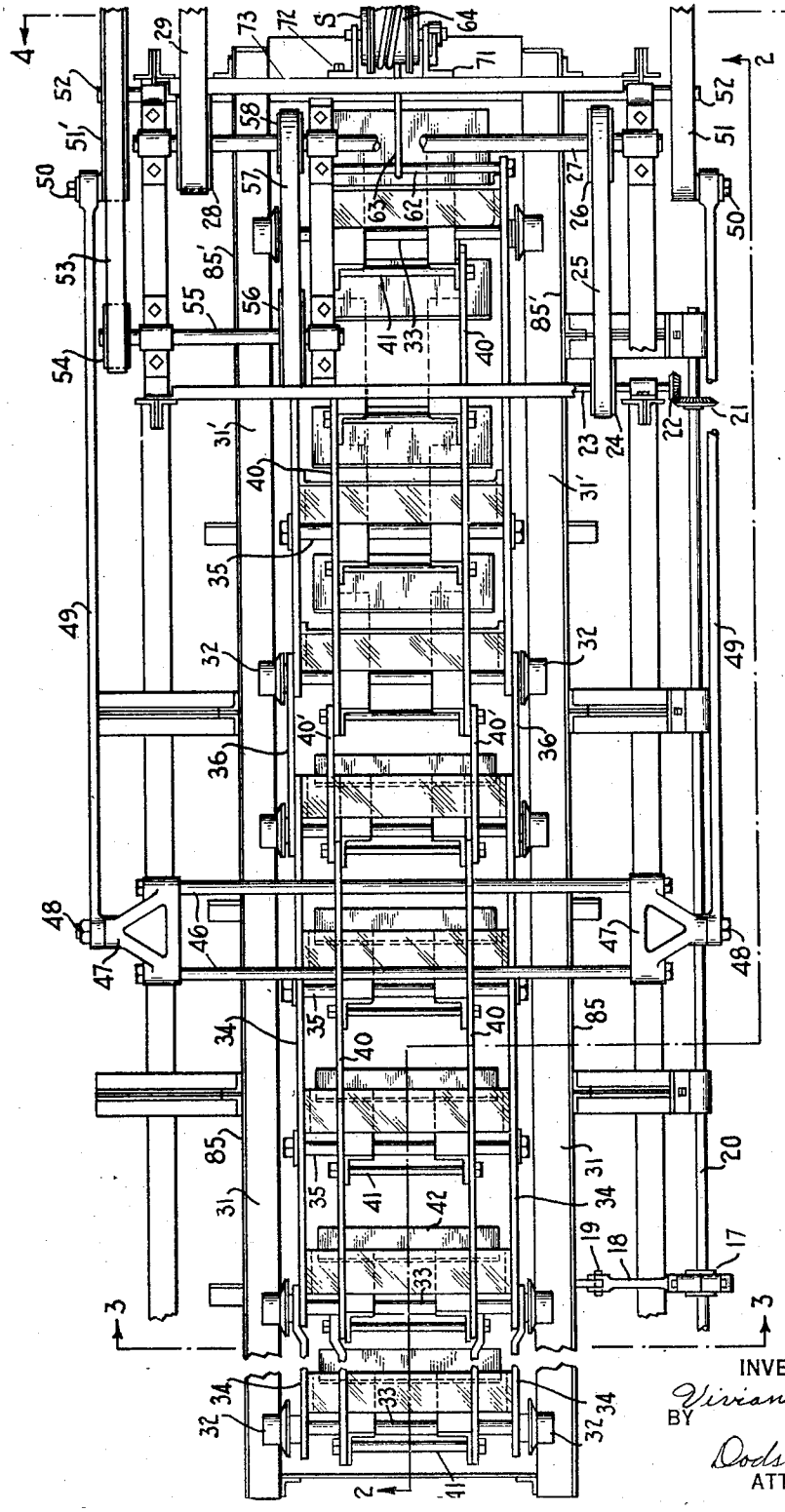


Fig. 1

INVENTOR
Vivian V. Clark
BY
Dodson and Roe
ATTORNEYS

Nov. 10, 1931. V. V. CLARK 1,831,524

AGITATING SLUICE CONCENTRATOR

Filed Aug. 30, 1928 3 Sheets-Sheet 2

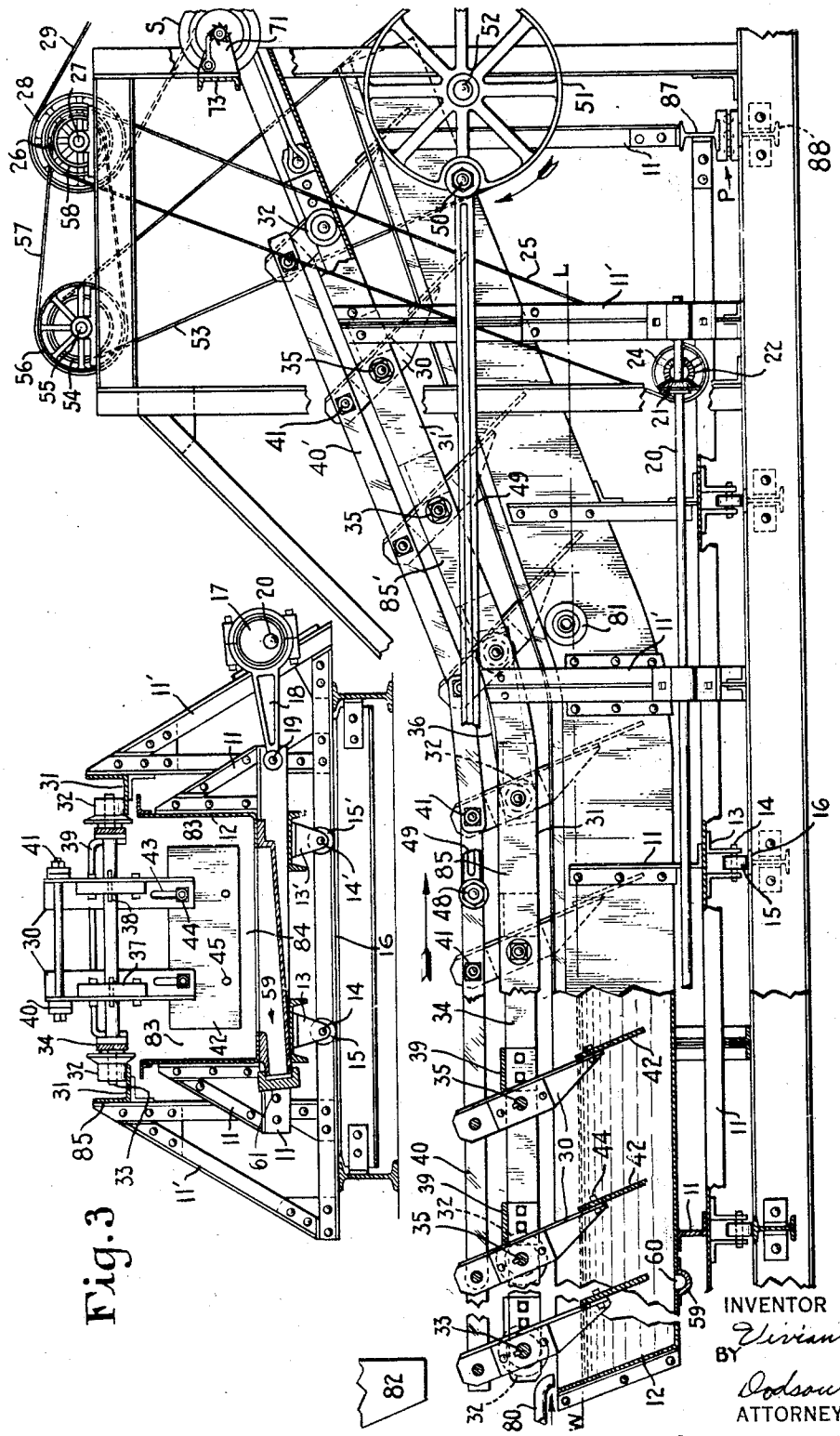


Fig. 2

Fig. 3

INVENTOR
Vivian V. Clark
BY
Dodson and Cox
ATTORNEYS

Nov. 10, 1931. V. V. CLARK 1,831,524

AGITATING SLUICE CONCENTRATOR

Filed Aug. 30, 1928 3 Sheets-Sheet 3

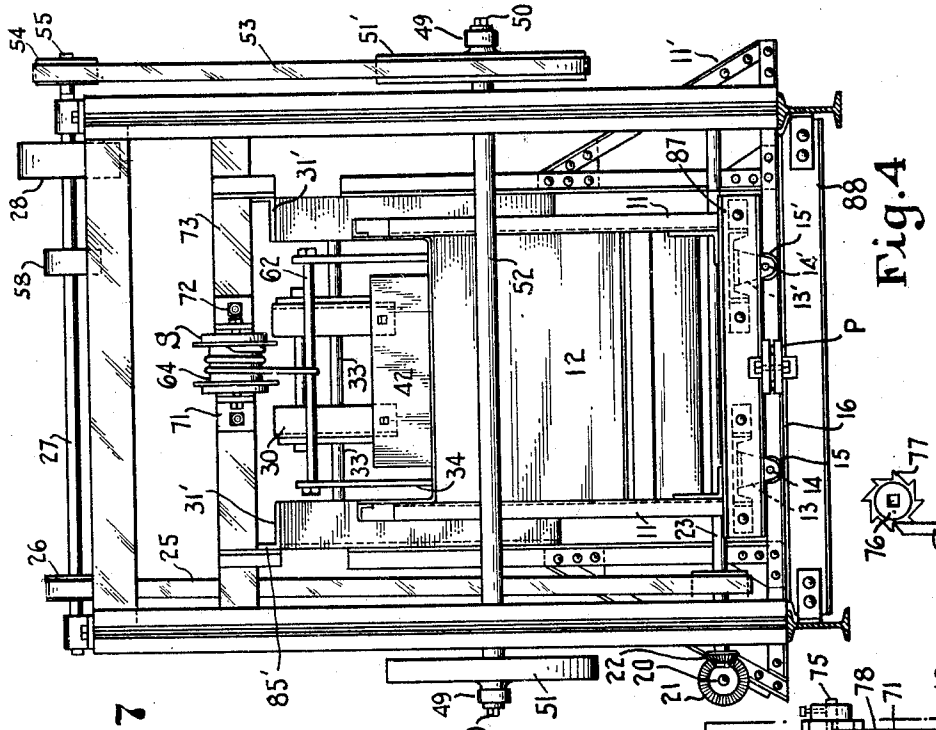


Fig. 4

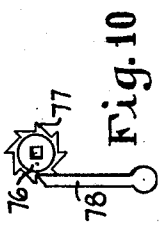


Fig. 10

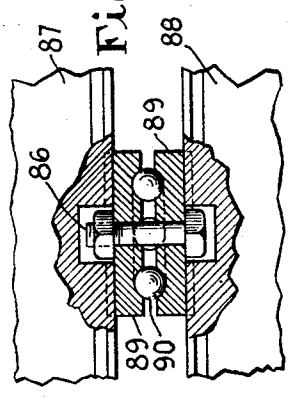


Fig. 7

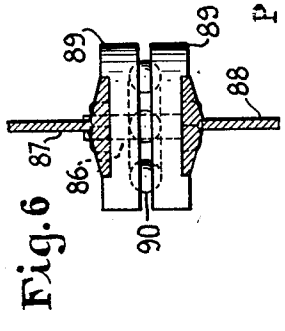


Fig. 6

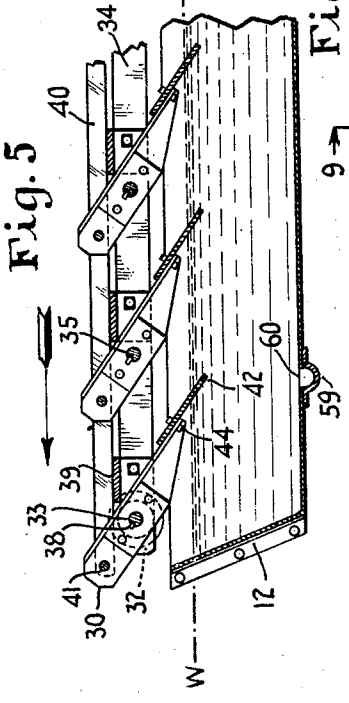


Fig. 5

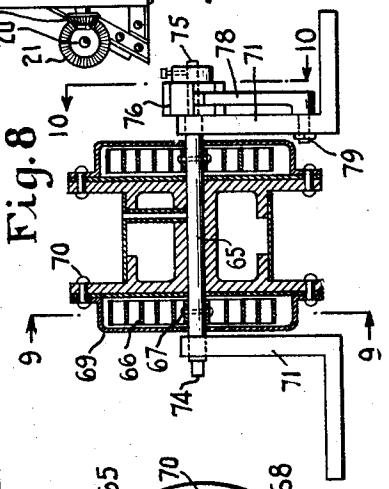


Fig. 8

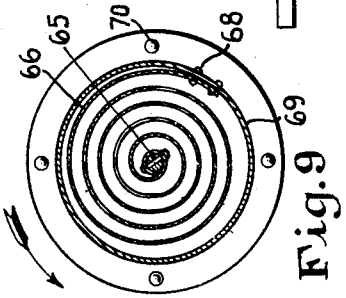


Fig. 9

INVENTOR
Vivian V. Clark
BY
Dodson and Roe
ATTORNEYS

Patented Nov. 10, 1931

1,831,524

UNITED STATES PATENT OFFICE

VIVIAN V. CLARK, OF NEW YORK, N. Y.

AGITATING SLUICE CONCENTRATOR

Application filed August 30, 1928. Serial No. 303,077.

My invention is suitable for either placer-mining gravels or lode-mining ores, whereby the precious metals and valuable minerals contained in said gravels and ores may be removed with the aid of a very small amount of water.

My invention has for its objects, to provide a machine which can be profitably operated on gravels and ores which heretofore have been unprofitable and has for its further object, to provide a machine which will successfully concentrate unclassified gravel or ore; and has another object, to provide a construction in which the water can be used over and over, thereby attaining a maximum efficiency of water in concentration operations; and also has an additional object, to construct a machine in which only a minimum of power will be required for operating the apparatus; and to accomplish the above objects in a simple machine that will be easy to adjust and operate, and yet will be capable of attaining a very high efficiency.

In work of this character, it is recognized as good practice to keep the riffle layer of gravel, that is, the gravel which will collect under the lower edge of the shoe, in gentle suspension, so that the gold will work its way down to the bottom of the sluice. This is a close imitation of nature's method of concentration in the creeks and rivers.

In my machine, I provide a type of reciprocating conveyor, the sluice itself having a lateral vibratory movement which minimizes the possibility of escape of the riffle layer of gravel, regardless of its character. I accomplish this result by locating a pivot bearing near the discharge end of the sluice. This enables the gravel to more easily climb the sharply inclined portion of the sluice box, due to the reciprocating movement, and at the same time this construction provides for the greatest vibration of the sluice at the receiving end, where it is most needed.

In my construction, my concentrating machine will take unclassified gravel, and will have a larger capacity, obtain a higher recovery, use less water, and consume less power per ton of ore treated, than is at present obtainable in machines of this type.

My means for accomplishing the objects of my invention may be more readily comprehended by having reference to the accompanying drawings, which are hereunto annexed and made a part of this specification, in which—

Fig. 1 is a plan view of my improved machine;

Fig. 2 is a side elevation, part of the machine being broken away to show a portion of a vertical longitudinal sectional view, the view being taken on line 2—2 in Fig. 1;

Fig. 3 is a vertical cross-section, taken on line 3—3 in Fig. 1;

Fig. 4 is an end elevation, taken on line 4—4 in Fig. 1, in the direction indicated by the arrows;

Fig. 5 is a fragmentary view of Fig. 2, taken along the line 2—2 in Fig. 1;

Fig. 6 is an enlarged end view of the pivot bearing shown in Figs. 2 and 4;

Fig. 7 is an enlarged vertical section of the pivot bearing shown in Fig. 6;

Fig. 8 is an enlarged plan view of the spring counter-balance;

Fig. 9 is a section taken on line 9—9 in Fig. 8, in the direction indicated by the arrows; and

Fig. 10 is a side view, taken along line 10—10 in Fig. 8.

Similar reference numerals refer to similar parts throughout the entire description.

As shown in the drawings, 12 is a trough-like sluice box, closed at one end, and inclined upwardly, and open at the other end, said box comprising an end member, two side members, and a bottom member which is inclined to the trap 59 so that the heavy gravel and metals will travel down to the trap of the sluice box 12. Said box 12 may be braced and supported by members 11, as shown in Figs 2, 3 and 4. To the under side of supporting members 11 are attached bearings 13 and 13′, which bearings respectively mount rotatably axles 14 and 14′ of rollers 15 and 15′, which rollers travel to and fro on trackways 16, as shown in Figs. 2, 3 and 4. At the power end, the machine as shown in and near the base of Figs. 2 and 4, is located a pivot bearing P, the details of construction of which are here-

inafter described as shown in Figs. 6 and 7. Said pivot bearing P, bearings 13 and 13′, axles 14 and 14′, rollers 15 and 15′, and trackways 16, support and form a movable mounting for the box 12, of which mounting the pivot bearing P forms a hinge connection, so disposed that the receiving end of the box 12 and the intermediate sections thereof may travel in arcs of variable radii, which arcs and radii lessen as they approach the power end of the box 12 until they become nil at the pivot bearing P.

Lateral motion, to and fro, may be transmitted to the box 12 and its respective parts as herein above described, by means of the eccentric 17, which eccentric 17 is attached to the box 12 by means of connecting rod 18 and pivot 19, as shown in Figs. 1 and 3. Motion is transmitted to the eccentric 17 from a shaft 20, which shaft may be driven by any source of power, but in these drawings I have, for the sake of convenience, shown the power as transmitted to the shaft 20 through bevel gears 21 and 22, shaft 23, pulley 24, belt 25, pulley 26, shaft 27, pulley 28 and belt 29, which belt 29 is connected with a source of power (not shown), which power likewise drives other portions of my concentrator to be hereinafter described.

Suspended above the box 12 is a plurality of flights 30, adapted to be reciprocally operated over and within the box 12 by means of an independent supporting structure 11′, for the trackways 31 and 31′, on which trackways wheels 32 may travel back and forth.

To the axle 33 of each pair of wheels 32 is connected a frame-like structure of parallel members 34, which frame-like structure 34 reaches forwardly to another axle with its pair of wheels 32, forming thereby a truck-like arrangement of parts, on which the truck and frame said flights 30 are pivotally supported by means of axles 33 and rods 35, thereby permitting three or more flights 30 to be mounted on each truck-like frame, of which frame the members 34 are a part.

In the drawings I have shown two complete trucks with their respective frame-like structures 34, one on the horizontal track-way 31 and the other on the inclined trackway 31′, these trackways 31 and 31′ being mounted upon independent supports 11′ which are stationary and free from movement. These trackways 31 and 31′ are so disposed that the two separate frame-like structures 34 may be connected at the rise of the inclined trackway 31′ by means of pairs of link bars 36, thereby forming a flexible chain-like combination for supporting a plurality of flights 30 on said horizontal and inclined trackways 31 and 31′ respectively. Manifestly this system of trucks and frames with their respective flights may be extended to any length desired, as suggested by broken lines at the receiving end of the machine as shown in Figs. 1 and 2.

Flights 30 may be constructed of iron or steel members, of which 37 is a reinforcement for the key 38, thereby enabling each said flight 30 to be rigidly attached to the axles 33 and the rods 35, by which attachment, by reason of the axles 33 being pivotally mounted within the wheels 32, and the rods 35 being pivotally mounted within the frame-like structure 34, said flights 30 are, therefore, swingingly mounted on both the axles 33 and the rods 35. This enables said flights 30 to assume an approximately vertical position, as shown in Fig. 3, when the direction of travel is toward the power end, as indicated by the arrow in Fig. 5, and likewise the flights 30 may assume an inclined position, as shown in Fig. 2, when the direction of travel is toward the receiving end, as indicated by the arrow in Fig. 2.

Flights 30 are arrested in their downward movement when traveling toward the receiving end, by their engagement with stop plates 39, which stop plates 39 likewise arrest the upward movement of flights 30 by link bars 40 resting upon the stop plates 39. These stop plates 39 are rigidly connected to said frame-like structures 34, as shown in Figs. 2, 3 and 5. Link bars 40 and 40′ are pivotally connected with the flights 30 by means of bolts 41, thereby permitting ample freedom of movement as the flights 30 swing downward and upward.

To the lower portion of the flights 30 are attached shoes 42, which shoes 42 are slidably adjustable on the flights 30 by means of slots 43 in the flights 30, as shown in Fig. 3. Bolts 44 secure the shoes 42 to the flights 30, and it will be noted in said Fig. 3 that the shoes 42 are reversible by means of holes 45.

To impart backward and forward vibratory movement to the plurality of flights 30 and their respective frame-like structures 34, axles 33 and rollers 32, for the sake of convenience I have shown rods 46 passing through and connecting with the link bars 40, as shown in Fig. 1. To the ends of the rods 46 are attached yokes 47, which yokes 47 terminate in pivots 48 to which are attached connecting rods 49, which extend forwardly to crank pins 50 of wheels 51 and 51′, said wheels being mounted on and attached to the axle 52. Wheel 51′ carries a belt 53, which belt 53 passes to a pulley 54, attached to the shaft 55. To this shaft 55 is likewise attached a pulley 56, which pulley carries the belt 57, which belt 57 passes to the pulley 58, said pulley 58 being attached to the shaft 27 heretofore mentioned, and which shaft 27 receives power from the pulley 28 and the belt 29 from the source of power not shown in the drawings.

Near the receiving end of box 12, and to the bottom portion thereof, is attached a clean-up trap 59, as shown in Figs. 2, 3 and 5. The bottom of the trap 59 is inclined down-

ward, so that the direction of travel of material therein may be toward the outlet, as shown by the arrow in Fig. 3. A slotted entrance 60 to the trap 59 regulates the size of the material that may pass into and through said trap 59. A cap 61, provided with screw threads, may be screwed to the outlet end of the trap 59 so that the material therein may be retained or discharged at will. This restricted neck for the trap 59 is designed to prevent the splashing of the mercury in the trap 59.

Rod 62 passes through the extreme forward ends of the frame-like structure 34, which rod 62 serves as an attachment for cord 63, which cord 63 passes over and is attached to the drum 64 of the spring counterbalance S, as shown in Figs. 1, 4 and 8. This drum is rotatably mounted on the shaft 65, to which is attached a plurality of spiral springs 66 by means of pins 67. The other ends of said spiral springs 66 are attached to casings 69, by means of rivets 68, and the casings 69 are in turn attached to the drum 64 by means of rivets 70, all of which parts, 64 to 70 inclusive, are clearly shown in Figs. 8 and 9. Shaft 65 is rotatably mounted on bearings 71, which may be attached to the member 73 by means of bolts 72, as shown in Figs. 1 and 4. Shaft 65 terminates in squared ends, 74 at the one end for engagement with a crank or a wrench, and 75 at the other end to which is attached ratchet head 76, containing teeth 77 which engage a pawl 78, which pawl 78 is pivotally mounted within the bearing 71 by means of a pin 79. By reason of the engagement of the pawl 78 with the ratchet teeth 77, the shaft 65 may be rigidly held in one position while the spiral springs 66 are operating or have tension thereon. Manifestly greater tension may be transmitted to the drum 64 by turning the shaft 65 at its end 74 in the direction of the arrow shown in Fig. 9.

At the receiving end of the machine as shown in Fig. 2, is a water conduit 80, through which water may flow into the box 12, and fill the said box 12 to approximately the level indicated by line W—L of Figs. 2 and 5. At the forward point along said water line W—L an overflow orifice 81 is provided in the box 12, for withdrawing the excess of water in said box 12 coming from either conduit 80 or from any other source of supply.

Above the receiving end of the machine as shown in the Fig. 2 is a hopper-like arrangement 82, through which gravel or ore may be fed into the receiving end of said box 12, only a fragmentary portion of said hopper 82 being shown, as obviously it forms no part of my invention.

Between the side members of the box 12 and the shoes 42, spaces 83 are provided to avoid interference by the edges of the shoes 42 with the to and fro movements of the box 12 when operated upon by means of the eccentric 17. As the spaces 83 also allow unclassified gravel or ore to pass between the walls of the box 12 and the edges of the shoes 42, it may be necessary to screen out the fragments of gravel or ore which are larger than the space intermediate the side wall of the box and the edges of the shoes 83, which larger fragments of gravel or ore, if allowed to enter the box 12 would have a tendency to wedge between the side walls of the box and the shoes 42. To minimize the possibility of fragments of gravel or ore wedging between the side walls of box 12 and the edge of the shoes 42, said spaces 83 may be made of a width to accommodate the passage of any size fragment of gravel or ore that a given deposit may contain, thereby avoiding any screening or classification whatsoever.

Space 84, between the bottom member of the box 12 and the under edges of the shoes 42, permits the accumulation of concentrate therein, which space 84 can be varied in thickness by adjusting the shoes 42 upwardly or downwardly on the flights 30 in the manner hereinbefore described.

Guide plates 85 and 85′ serve to limit the lateral movement of the frame-like structure 34 in the event the flights 30 thereon encounter an obstruction and raise upwardly from the trackways 31 and 31′, which upward movement would cause said trucks and rollers to jump off said trackways 31 and 31′ were it not for said guide plates 85 and 85′.

Pivot bearing P is shown in the enlarged drawings Figs. 6 and 7, in which 86 is a bolt or pivot, securing 87 (a supporting member of box 12) to 88, which is a supporting member for trackways 16. Between the members 87 and 88 are bearing plates 89, which plates 89 contain circular grooves, in which grooves rotate a plurality of steel balls 90, which balls 90 reduce friction and permit sufficient freedom of movement in the vibratory movement of the box 12 when acted upon by the eccentric 17.

In the operation of my invention, a site is selected, preferably adjacent to the deposit of gravel or ore, and the sluice concentrator is set on a firm foundation. Power is applied to the belt 29 which rotates the pulley 28, and in turn transmits motion to the frame-like structure 34 that supports the flights 30 on the axles 33 and the rollers 32, which travel reciprocally on the trackways 31 and 31′. Likewise, the lateral vibratory movement of the box 12 is set in operation from the same source of power, as hereinbefore described, through the shaft 20 to the eccentric 17, so that both flights 30 and the box 12 move in their respective directions at the same time.

Water is introduced into the box 12 through the conduit 80, or through any other suitable or convenient means of conveying water, until the water level is approximately at the line

W—L, as shown in Fig. 2, whereupon the excess water overflows through the orifice 81, which excess may be carried therefrom by means of a pipe or trough, to a convenient distance away from the concentrator, where said water may be impounded and pumped back for re-using.

After water is introduced into the box 12 with the plurality of the flights 30 reciprocally operating within said box, said flights 30 will move forwardly in their upward position as shown in Figs. 2 and 3, by reason of the shoes 42 resisting the medium of water through which they are traveling, and the flights 30 likewise encounter stop plates 39 on the other side of the fulcrum or axle 33.

When the flights 30 are traveling in the rearward direction, as shown in Fig. 5, the resistance of the water in box 12 against the shoes 42 of said flights 30 causes said flights 30 to assume their inclined position, as shown in Fig. 5, by reason of the axle 33 serving as a fulcrum for the flights 30. It will be observed that the flights 30 traveling on the inclined trackway 31′ operate above the water line W—L in the box, and would not, therefore, rise and fall by the resistance of water against the shoes 42. To cause the flights 30 that operate within the sharply inclined portion of the box 12 to rise and fall in unison with the flights 30 that operate below the water line W—L within the box 12, I have employed connecting link bars 40 and 40′, whereby the force that is accumulated through the plurality of flights 30 operating within the medium of water in the box 12 in their forward and rearward movements is, transmitted to the link bars 40 and 40′ and from thence to the flights 30 in the sharply inclined portion of the box 12, which flights 30, therefore, rise and fall in unison with the flights 30 operating within the medium of water within the box 12.

The rising and falling action of the flights 30 within the box 12 is assisted in their forward and rearward movements by means of the thrusting and pulling action of the connecting rods 49 against the rods 46, which rods 46 pass through the link bars 40, as shown in Fig. 1. That is to say, when connecting rods 49 are pulling forward, as shown in Fig. 2, the strain of the movement is transmitted from said link bars 40 through the rods 41 to the upward ends of flights 30, as shown in Figs. 1, 2 and 3.

With axles 33 and rods 35 acting as fulcrum points, said flights 30 are, when connecting rods 49 pull forward, set against stop plates 39 and remain thereupon until connecting rods 49 thrust rearward, whereupon flights 30 fall downward on fulcrums 33 and 35 and assume a downward position, with link bars resting upon stop plates 39, as shown in Fig. 5.

After power is applied to my concentrator and its various parts are functioning properly, with water in box 12 to the level W—L as described, gravel or ore may be introduced into the machine through hopper 82, or by shoveling into box 12, or by any other suitable means, into the receiving end portion of box 12, whereupon the flight 30 nearest to said gravel or ore conveys it in a drag-like manner along the bottom of box 12 to the next succeeding flight 30 when the flight movement is forward, as shown in Fig. 2. Upon their rearward movement, said flights 30 automatically assume the position shown in Fig. 5, thereby passing over the gravel or ore so conveyed until the complete rearward movement is reached; thereupon the flights 30 assume the position shown in Fig. 2, and convey other portions of gravel or ore to the respective succeeding flights 30 along the bottom of the box 12, until the waste portions of said gravel or ore are discharged at the open end of the box 12, which waste material may be received by a continuous belt conveyor, a bucket conveyor, or by any other method of handling gravel or ore waste as used in well known metallurgical operations.

The lateral vibratory movement transmitted to the box 12 cooperates with the reciprocal movements of the flights 30 in the concentration action upon said gravel or ore as it passes through the box 12, the water therein serving to settle out all the precious metals and heavy minerals that such gravel or ore may contain, which metals and minerals fall to the bottom of the box 12, there to remain until drawn out of the box through the clean-up trap 59, which clean-up operation will be hereinafter described.

In the passage of the gravel or ore through the box 12 by means of the reciprocal movement described for flights 30, the lateral vibratory movement of box 12 lessens in arcs of variable radii as pivot bearing P is approached, thereby permitting the waste from said gravel or ore to more readily climb the more sharply inclined plane at the discharge end of the box 12, under the reciprocation-conveying movement of the flights 30 along said box 12. Moreover, as the greatest intensity of vibration of the box 12 is at the point of attachment with the eccentric 17, it is manifest that the greatest settling or concentrating action must occur within the zone of greatest vibration, while other metals and minerals would settle out in zones of lesser vibration, all of which concentration is accomplished under and within a variable medium of water. In other words, my concentrator has a universal lateral vibratory movement along a transverse plane, the maximum vibration of which may be made as much as conditions of gravel or ore may require to obtain complete settling of metals and minerals under water, but in any case the minimum vibration ceases at pivot point P. This

pivot P may be located at any desired point, but it is preferably located, as shown in the drawings, near the discharge end of the box 12, so as to permit the gravel to be shaken back and thus in a degree prevent its discharge without the assistance of the flights 30.

As the waste or tailings from the gravel or ore ascends the sharply inclined portion of the box 12 by means of the reciprocating movement of the flights 30, as described, said waste is carried above the water line W—L, and as said waste material continues to ascend, the water that may be contained in the interstices of said waste or tailings drains out and flows back into the box 12. It is apparent, therefore, that the only water lost in the waste material at its point of discharge from the box is that which is absorbed in said waste and not amenable to further drainage through gravity action.

Unclassified gravel or ore may be passed through my concentrator by means of the conveying action of the shoes 42 attached to the flights 30, and the spaces 83 between said shoes 42 and the walls of the box 12 may be proportioned to allow passage within said spaces 83 for the largest piece or fragment of ore or gravel that a given deposit may contain. Or, it may be advisable to screen out, or to throw out by hand, or otherwise, such pieces of fragments of gravel or ore that are too large to pass within spaces 83, and would have a tendency to wedge therein and thereby stop the operation of the machinery.

Space 84, between the bottom of the box 12 and the under edge of the shoes 42, is variable, which variation is accomplished by means of bolts 44, securing the shoes 42 to the flights 30, sliding up or down in slots 43, thereby allowing a thick or a thin bed of concentrate to accumulate on the bottom of the box 12, which said concentrate may be drawn off through the clean-up trap 59.

The water in the box 12 may be used to aid drawing off said concentrate through the cleanup trap 59, by reason of the carrying action such water would have in its passage through the slotted entrance 60 to the trap 59, whereby the concentrate would follow the flow of water, both concentrate and water being received in a suitable receptacle under the discharge spout of said trap 59. Or, the water in the box 12 may be drained or drawn off by other means, leaving the concentrates exposed on the bottom of the box 12, whereupon the trap 59 may be opened by removing the cap 61, and with the aid of scrapers and a hose with water, said concentrate may be discharged through said trap 59 into a suitable receptacle placed under the discharge spout of the trap 59.

In the upward and downward movements of the flights 30 on the inclined trackways 31′, there is an obvious tendency to consume unnecessary power in the upward movement and to rush down the inclined trackways 31′ in the downward movement, causing thereby a violent recoil at the end of the downward movement. To avoid this recoil action, and the attendant loss of power in the subsequent upward movement, I have employed a spring counter-balance S, to which is attached one end of a cord 63, the other end of said cord 63 being attached to the rod 62, this rod 62 being attached to the upward end portion of the frame-like structure 34, as hereinbefore described. It is manifest, therefore, that the spring counter-balance S serves to maintain the equilibrium of the flight action in its upward and downward movements, by storing power within spiral springs 66 in the downward movement, and applying said stored power to the cord 63 in the upward movement, thereby avoiding any recoil whatsoever when said flights 30 reach the limit of their downward travel on said inclined trackways 31′.

Spring counter-balance S may be adjusted to any required tension, by turning the shaft 65 by the squared end 74, thereby adjusting it to any load that said flights 30 may be carrying up the sharply inclined portion of the box 12.

For the purposes of full disclosure of my invention I have described in some detail a specific embodiment thereof; but it will be apparent that numerous changes might be made in the physical embodiment of my invention within the scope of the claims, without departing from the spirit of my invention or sacrificing any of its advantages, and I do not desire, therefore, to be understood as limiting myself, in the broader aspect of my invention, to the specific construction shown and described.

Having described my invention, what I regard as new and desire to secure by Letters Patent of the United States is:

1. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box and provided with an open end, means to reciprocate the closed end of the box in a substantially horizontal plane on said pivot, a plurality of flights mounted within said box, and means to reciprocate said flights longitudinally in said box, simultaneously with the transverse movement of the box.

2. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box and provided with an open end, of pivotal mounting for the box adjacent its open end, means to reciprocate the closed end of the box in a sub-

stantially horizontal plane on said pivot, a plurality of flights mounted within said box, means to reciprocate said flights longitudinally in said box, simultaneously with the transverse movement of the box, and a transversely inclined trap at the bottom of said box adjacent its closed end, said trap being provided with a slotted entrance.

3. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box and provided with an open end, of a pivotal mounting for the box adjacent its open end, means to reciprocate the closed end of the box in a substantially horizontal plane on said pivot, a frame having longitudinal and transverse members, said transverse members forming tracks, rollers positioned to ride said tracks and means to connect said rollers to the horizontal portion of said box, a plurality of flights mounted within said box, and means to reciprocate said flights longitudinally in said box, simultaneously with the transverse movement of the box.

4. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box and provided with an open end, of a pivotal mounting for the box adjacent its open end, means to reciprocate the closed end of the box in a substantially horizontal plane on said pivot, a plurality of flights mounted within said box, driving means to reciprocate said flights longitudinally in said box, simultaneously with the transverse movement of the box, a frame which forms a common support for said flights, said flights being mounted pivotally thereon and having projecting portions, members connecting said portions, said driving means operatively connected to said members, whereby said flights are individually movable of their mounting means as they are longitudinally reciprocated.

5. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box and provided with an open end, of a pivotal mounting for the box adjacent its open end, means to reciprocate the closed end of the box in a substantially horizontal plane on said pivot, a plurality of flights mounted within said box, means to reciprocate said flights longitudinally in said box, simultaneously with the transverse movement of the box, a frame which forms a common support for said flights, said flights being mounted pivotally thereon and having projecting portions, said driving means operatively connected to said members, whereby said flights are individually movable of their mounting means as they are longitudinally reciprocated, a transversely inclined trap in the bottom of said box adjacent its closed end, said trap being provided with a slotted entrance.

6. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box and provided with an open end, of a pivotal mounting for the box adjacent its open end, means to reciprocate the closed end of the box in a substantially horizontal plane on said pivot, a plurality of flights pivotally mounted within said box, means to reciprocate said flights bodily and longitudinally in said box, simultaneously with the transverse movement of the box, a frame which forms a common support for said flights, said flights being mounted pivotally thereon and having projecting portions, members connecting said portions, said driving means operatively connected to said members whereby said flights are individually movable of their mounting means as they are longitudinally reciprocated, coil springs mounted on the frame adjacent the pivoted end of the box and substantially in line with and operatively connected to the longitudinally reciprocating frame.

7. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box, and provided with an open end, of a pivotal mounting for the box adjacent its open end, means to reciprocate the closed end of the box in a substantially horizontal plane on said pivot, a plurality of flights pivotally mounted within said box, means to reciprocate said flights bodily and longitudinally in said box, simultaneously with the transverse movement of the box, and means operatively connected to said flights to swing same on their pivots and means to limit said swinging movement.

8. In a device of the character described, the combination with a substantially rectangular box, the bottom of said box having a horizontal portion, one end of which is closed, and an inclined portion rising above the top of the horizontal portion of the box and provided with an open end, of a pivotal mounting for the box adjacent its open end, means to reciprocate the closed end of the box in a substantially horizontal plane on said pivot, a plurality of flights pivotally mounted within said box, means to reciprocate said flights bodily and longitudinally in said box, simultaneously with the transverse movement of

the box, and means operatively connected to said flights to swing said flights on their pivots, means to limit said swinging movement, axles on said reciprocating means, flanged rollers on said axles, track members comprising a horizontal portion and vertical portions which form guide plates spaced outwardly from said rollers to permit relative transverse movement of the longitudinally reciprocating frame.

VIVIAN V. CLARK.