This invention relates to a machine of extremely simple construction which due to its unique construction and a unique motion thereof when in operation, is capable of handling raw materials such as ancient river gravel, clay, slate and other gold bearing formations and which may be fed directly into the machine without requiring preparation such as washing and sizing, which is necessary with most grade materials profitably and which could not be worked at a profit with machines now in use.

Still another object of the invention is to provide a machine which may be driven at any speed and whereby the efficiency of the machine can be increased by increasing the speed thereof so that gold recovery of as much as from 95 to 98 percent is obtainable.

Still another object of the invention is to provide a machine of extremely simple construction which due to its efficiency in operation may be employed to work vast amount of low grade materials profitably and which could not be worked at a profit with machines now in use.

Still another object of the invention is to provide a machine which may be used for washing gravel and sand for producing clay and slime free sand and gravel which may be employed to produce a concrete of much greater strength than ordinary concrete.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating a presently preferred embodiment thereof, and wherein:

Figure 1 is a side elevational view partly in vertical section and partly broken away and looking toward the front or discharge end of the washing and concentrating container;

Figure 2 is an enlarged sectional view taken substantially along a plane as indicated by the line 2—2 of Figure 1 and longitudinally through the container;

Figure 3 is a cross sectional view through the container, taken substantially along a plane as indicated by the line 3—3 of Figure 2;

Figure 4 is a horizontal sectional view through the bottom portion of the container, taken substantially along a plane as indicated by the line 4—4 of Figure 2;

Figure 5 is a fragmentary top plan view of the left-hand portion of the machine as seen in Figure 1, and

Figure 6 is an enlarged fragmentary horizontal sectional view, taken substantially along a plane as indicated by the line 6—6 of Figure 1.

Referring more specifically to the drawings, the washer and concentrator in its entirety and comprising the invention is designated generally 8 and includes an elongated frame designated generally 9, having corresponding elongated sides including a front side 10 and a rear side 11. The frame sides 10 and 11 include longitudinally extending bottom portions 12 to the undersides of which may be secured runners or skids 13 to facilitate movement of the machine 8. A supporting plate 14 extends between complementary end portions of the parts 10 and 11 and is disposed thereon and secured thereto to provide a support for a motor 15 of any conventional form having a driving shaft 16 disposed transversely of the frame 9.

The motor 15 is disposed adjacent the bottom of the frame 9 and near its left-hand end, as seen in Figures 1 and 5. The frame sides 10 and 11 have top rails 17 extending longitudinally of the frame from the left-hand end thereof to midway of the ends of the frame. A pair of bearings 18 are mounted on and secured to the top rails 17 and are disposed in alignment with one another. A shaft 19 is journaled in the bearings 18 and has a large belt pulley 20 fixed thereto and disposed in alignment with a small belt pulley 21 which is fixed to the motor shaft 16. An endless belt 22 is trained over the pulleys 20 and 21 whereby the shaft 19 is driven from the motor shaft 16 and at a substantially lesser speed than the speed of said motor shaft. A pair of discs 23 are eccentrically fixed to the shaft 19, between the bearings 18 and in alignment with one another.

The frame sides 10 and 11 have top rail members 24 at their opposite right-hand ends which are downwardly offset relatively to the top rail portions 17. The top rail portions 24 are each provided with a pair of bearings 25 and 26. The bearings 25 and the bearings 26 of said rail members 24 are disposed in alignment and provide journals for an inner roller 27 and an outer roller 28. The ends of the roller 27 are journaled in the bearings 25 and the ends of the roller 28 are journaled in the bearings 26. Accordingly, the rollers 27 and 28 are disposed transversely of the frame 9 and are longitudinally spaced from one another.

An elongated container or box 29 is supported on the rollers 27 and 28 with its longitudinal axis disposed transversely of the frame 9. The container 29 includes a bottom 30, an inner side wall 31, an outer side wall 32, a rear end wall 33 and a front end wall 34. The bottom 30 at the ends thereof is provided with depending flanges 35 and the side walls 31 and 32 have outturned flanges 36 at the ends thereof. The end walls 33 and 34 have bottom portions disposed against the flanges 35 and side portions bearing against the flanges 36 and which portions are secured to the flanges 35 and 36 by suitable detachable fastenings 37, such as nut and bolt fastenings, to permit removal of said end walls 33 and
3. The side walls 31 and 32 may be suitably secured at their bottom edges to the bottom 30. The container 29 is disposed beneath the length of the rollers 27 and 28 and greater than the spacing between the bearings 25 and 26, so that the end flanges 35 are disposed beyond the bearings 25 and 26, as seen in Figure 2.

6. The rollers 27 and 28, intermediate of their ends, are provided with aligned restricted portions 38, as seen in Figures 2 and 3. A steel plate 39 is secured to the underside of the bottom 30 and has a direct contact with the rollers 27 and 28. A cleat 40 is secured to the underside of the plate 39 and transversely thereof and engages in the reduced roller portions 38 to prevent the container 29 from moving longitudinally of the rollers and to maintain the flanges 35 properly spaced outwardly from the bearings 25 and 26.

The side walls 31 and 32 have inwardly inclined upper portions 31a and 32a which combine with upper portions of the end walls 33 and 34 to define a restricted open area 41 of the container or box 29. The rear wall 33, between the side wall portions 31a and 32a has an upwardly and outwardly inclined lip portion 42 which is disposed beneath the lower discharge end 43 of an inclined chute, through which the material to be processed is supplied by gravity into the container 29 over the lip 42 and into the open top 41 thereof. The lip portion 42 is of a width substantially greater than the width of the chute 43. The rear wall 33 on the outer side thereof and immediately beneath the lip 42 is provided with a box-like portion 44 through a rear wall of which a hose 45 discharges into said box structure 44. A discharge end of a hose 46 is detachably connected to the coupler 45 and the other end of the hose 46 is adapted to be connected to any suitable source of water supply under pressure. The rear wall 33 is provided with apertures 47 opening into the box structure 44 and through which jets of water under pressure are discharged from said box structure into the upper part of the container 29 and longitudinally thereof toward its front wall 34.

The container 29 is provided with a perforated top plate 48, preferably comprising a steel plate, which is suitably fixed to the side walls 31 and 32 and which is disposed beneath and adjacent the apertures 47. A horizontal partition wall 49 is secured to the side walls 31 and 32 beneath and spaced from the plate 48 and, like said plate, extends between the end walls 33 and 34 and has an opening 50 adjacent said rear end wall 33. The partition wall 49 has a plurality of longitudinally extending rilles 51 which extend longitudinally of the container 29 from the front wall 34 to adjacent the opening 50. As seen in Figure 3, the rilles 51 are of substantially inverted V-shape cross section having upwardly converging side walls. The partition wall 49 also supports a pair of half rilles 52 each having a single upwardly inclined side which extends upwardly from the partition wall 49 to either the side wall 31 or the side wall 32. The rilles 51 and 52 are disposed in slightly spaced relation to one another as seen in Figure 3 and terminate substantially below the level of the perforated plate 48. A partial bottom 53 is supported by the side walls 31 and 32 beneath and relatively close to the plate 48 and above and spaced from the rilles 51 and 52, and extend from the end wall 33 a sufficient distance to overlie the passage 50 and the ends of the rilles 51 and 52 located adjacent thereto. The space above the partition wall 49 constitutes the upper chamber 54 of the box or container 29.

A mesh wire fabric screen 55 or its equivalent is supported horizontally in the box 29 by the walls 31 and 32 beneath and spaced from the partition wall 49. A lower horizontal partition wall 56 is supported by the walls 31 and 32, beneath and spaced from the screen 55, and likewise extend between the end walls 33 and 34. An inclined plate 57 has one end supported on the lower partition wall 56 against the front wall 34 and extends at an upward incline therefrom toward the rear wall 33 and has a downturned opposite end 57a, forming a supporting leg, which rests on the lower partition wall 56 and which is spaced from the rear wall 33. The inclined plate 57 extends between the side walls 31 and 32 and at its rear end is disposed beneath and spaced from the screen 55. The lower partition wall 56 is provided with an opening forming a passage 58, located between the part 57a and the rear wall 33. A deflecter 59 is secured to the side walls 31 and 32 between and spaced from the partition 49 and screen 55 and extends a short distance downwardly from the rear wall 33 and underlies the upper passage 56. The portion of the container disposed between the horizontal partition walls 49 and 56 constitutes the intermediate chamber 60 of the box 29.

The bottom portion of the box, located between the lower partition wall 56 and the bottom 30, constitutes the bottom or lower chamber 61 of the box 29. The chamber 61 includes a short baffle 62 which is secured to the sides 31 and 32 and which extends a short distance from the rear wall 33 to underlie the passage 58. The baffle 62 is spaced from the bottom partition 56. The lower chamber 61 includes a plurality of rilles 63 which are disposed in end-to-end relationship longitudinally of the chamber 61 and each of which extends from side-to-side thereof. Each individual rille 63 has a rearwardly and inwardly inclined top surface 64 which is inclined downwardly and rearwardly from its forward end and downwardly and inwardly from the side edge portions and away from the side walls 31 and 32.

The front wall 34 is provided with a relatively wide upper outlet 65 constituting an opening in said front wall which extends from the level of the plate 48 to the top of said front wall and which constitutes the outlet of the upper chamber 54. The intermediate chamber 60 has an outlet opening 66 of substantially the same width as the opening 65 but of relatively restricted height, which extends upwardly from the level of the screen 55 and terminates below the level of the partition wall 49. The lower chamber 61 has an outlet opening 67 of substantially the same size as the opening 66, the bottom edge of which is disposed at approximately the level of the upper forward edges of the rilles 63. The front wall 34 on the outer side thereof is provided with vertically spaced spouts 65a, 66a and 67a for the discharge openings 65, 66 and 67, respectively. Each of said spouts includes a downwardly and outwardly inclined bottom and upstanding side walls and the bottoms of the spouts extend downwardly and outwardly from the bottom edges of the discharge openings, individual thereto. The side walls of the upper spout 65a are ribbed to provide vertical guideways 68 for receiving a gate valve 69 which is inserted downwardly through the upper ends of said guides 68 and which rests upon the spout bottom. Gate valves 69 of different heights may be selectively applied to the spout 65a for varying the level of the water and material in the upper chamber 54, as indicated by the liquid and material level 70 in Figure 2. An inclined chute 71 is supported outwardly with respect to the front frame side 10 by brackets 72 and longitudinally of said frame, and has its upper end disposed beneath the discharge ends of the spouts 65a, 66a and 67a for receiving the waste materials or tailings therefrom.

An elongated angle member 73 is secured to the outer side of the inner side wall 31 and extends longitudinally thereof and has a vertically disposed outer flange 74. The angle member 73 is preferably anchored adjacent its ends between pairs of vertical angle members 75, which are suitably secured to the outer side of said wall 31, as best seen in Figures 1, 2 and 3. A pair of connecting rods 76 are rigidly connected to the flange 74 in any suitable manner and are disposed at substantially a right angle to the wall 31. The opposite ends of the connecting
rods 76 are provided with circular straps or collars 77 which are rigidly fixed thereto and which turnably fit around the discs 23 and combine therewith to form eccentric 78.

It will be readily apparent that when the motor 15 is in operation for driving the shaft 19, that the container or box 29, through its connection to the shaft 19 by the connecting rods 76 and eccentrics 78 will have a back and forth movement longitudinally of the frame 9 over the rollers 27 and 28 on which the box 29 is supported. In addition to this back and forth reciprocating motion in a direction transversely of the longitudinal axis of the box 29, as the eccentrics 78 move upwardly from their positions of Figure 1 and Figure 5, to their dotted line positions of Figure 1, the box 29 in addition to moving transversely to the right will addititionally rock clockwise from its full line to its dotted line position of Figure 1 and in which position the plate 39 will be elevated out of engagement with the inner roller 27 and supported solely by the outer roller 28. As the eccentrics continue to move from their upper positions to their lower positions, through an arc of approximately 90°, the box 29 will continue to be displaced to the right as seen in Figure 1 and will be rocked in the opposite direction or counterclockwise to bring the plate 39 back into engagement with the outer roller 28. Thereafter, the eccentrics 78 return to their full line positions of Figure 1 the box 29 will complete its movement from right to left and will be rocked counterclockwise back to its horizontal full line position of Figure 1 to bring the plate 39 back into contact with the outer roller 28. It will be apparent that when the machine is operated at a high speed, as for example 130 R. P. M. or more, that the oscillating or rocking movement imparted thereto will produce a very pronounced bumping action as the plate 39 strikes the rollers 27 and 28, in addition to the transverse reciprocating action to effect a violent transverse and vertical agitation of the contents of the box. The cleat 40 by engagement with the roller grooves 38 will effectively prevent any longitudinal movement of the box in a direction transversely of the frame 9. The box 29 may be thus agitated at any speed and the greater the R. P. M. of the shaft 19, the more efficient will be the washing, scrubbing and concentrating action of the structure contained in the box 29.

Due to this agitation of the box 29 and the structure contained within the box, as previously described, no pre-preparation of the material which is fed to the box through the chute 43 is required and accordingly ancient river gravel from the beds of rivers and other low grade raw materials including packed clay and even cemented material may be fed directly into the top portion of the upper chamber 54 from the chute 43 to which said materials may be supplied in any suitable manner as by a conveyor belt. At the same time, water is supplied to the upper part of the container through the discharge apertures or jets 47 in sufficient quantity to maintain the level of the materials and the water in which said materials are submerged at the level of the upper edge of the gate valve 69, as indicated by the broken line 70. The water and material submerged therein will have a surging action transversely of the box 29 due to its transverse reciprocating, rocking and bumping motion which will cause the water and material to have a movement similar to a horizontally disposed figure eight, between the side walls 31 and 32. The gate valve 69 will prevent large gold nuggets from escaping through the upper outlet 65 and rocks and other large formations will likewise be retained on the top plate 48 and will produce a grinding action thereon tending to force the finer materials through the apertures of the plate 48 and to prevent clogging of said apertures.

The lighter waste materials and tailings will be washed toward the outlet 65 by the direction of flow of water from the jet openings 47 and will thus be washed over the gate valve 69 and be discharged from the spout 64 into the waste trough or chute 71. The finer materials and a part of the water which passes through the perforated plate 48 is thereby again subjected to the afore-described agitation motion in the bottom part of the upper chamber 54 so that the material is thoroughly washed and scrubbed in passing back and forth across the longitudinal riffles 51 so that all clay and slime are dissolved and separated from the fines and other gold bearing material, thus freeing such material and the fines, which material is lodged between the riffles 51 on the partition 49, while the separated slime and clay eventually washes toward the end wall 33 and is discharged therefrom downwardly through the passage 50 into the intermediate chamber 60. The water and materials passing through the perforated plate 48 are prevented from going directly to the passage 50 by the upper baffle 58 which deflects the materials away from the passage 50 during their initial descent. Similarly, the materials upon entering the intermediate chamber 60, which pass through the passage 50 are initially deflected away from the end wall 33 and the lower passage 58 disposed adjacent thereto, by the intermediate baffle or deflector 59. The water and materials are submerged therein after entering the upper part of the intermediate chamber 60, and subjected to agitation and the finer materials pass through the screen 55, the openings of which are smaller than the perforations of the plate 48. The remaining waste materials and a part of the water escape through the intermediate waste outlet 66 and are directed by the spout 66a into the waste trough 71. The direction of flow in the chamber 60 is likewise toward the front wall 34 so that the water and finer gold bearing materials which pass through the second separating action as provided by the screen 52 are directed toward the lower end of the inclined plate 57. Here in the bottom part of the intermediate chamber 60, the finer materials are again subjected to a violent washing and scrubbing action as said materials, carried by the water surge transversely back and forth over the plate 57. The heavier gold bearing materials, as indicated at 75 in Figure 2, tend to lodge and are trapped on the plate 57 adjacent its lower end. The lighter waste materials suspended in the water eventually flow over the upper end of the inclined plate 57 and escape through the passage 58 into the bottom chamber 61 and are initially deflected by the upper baffle or deflector 62 away from the portion of the bottom chamber located immediately adjacent the rear wall 33.

The final washing and separating action is accomplished in the bottom chamber 61 by the transversely disposed riffles 63. Here again the material is subjected to a washing and scrubbing action for separating the lighter sand and slime from the fine gold. The inclined top surfaces 64 of the riffles 63 effectively separate the fine gold from the remaining sand and slime and the said gold, as indicated at 80 in Figure 2, is trapped and lodged at the lower ends of the inclined top riffle surfaces 64, while the fine sand and slime washes over the riffle surfaces 64 and is discharged through the bottom outlet 67 and through the spout 67a into the tailing trough 71. Thus, recovery of gold is made possible by the machine 8 up to 95 to 98 percent and much of the gold entrapped in the riffles 63 is so fine that it cannot be seen under a magnifying glass.

The machine 8 may be made in various sizes including sizes capable of handling as much as 60 yards of raw materials per hour and two such machines may be operated by a single operator, so that the entire business is very inexpensive enabling profitable operation of the machine with raw materials which could not be profitably processed for gold recovery by other equipment.

Additionally, the machine 8 may be used for wash-
ing gravel and sand to obtain a clay and slime free material which can be used to produce a superior concrete of maximum strength.

It will be obvious that the gold remaining in the machine may be readily recovered by removal of either of the end walls of the box.

Various modifications and changes are contemplated and may obviously be resorted to, without departing from the spirit or scope of the invention as hereinafter defined by the appended claims.

I claim as my invention:

1. In a machine of the character described, an elon-
gated washing and concentrating box, means for supply-
ning raw materials to be processed to the upper portion
of said box adjacent one end thereof, means for sup-
plying jets of water under pressure to the box through
sided and adjacent the top thereof and in a direction
forwardly to the opposite, discharge end of the box, means con-
tained in said box for washing and scrubbing the raw
material while submerged in water and for separating
therefrom and entrapping the heavier valuable parts sepa-
rated from the raw materials, said outlet end of the box
having at least one discharge port through which the
waste material is carried off, supporting means on which
said box is supported for reciprocating movement trans-
versely of the longitudinal axis of the box, and driven agi-
tating means connected to said box for imparting a violent
rocking and oscillating motion to the box in a direction transversely thereof.

2. A machine as in claim 1, said box including a horizontal partition disposed substantially beneath the
top of the box and below the water supply means and
raw material supply means, a perforated plate secured
in said box and extending from side-to-side and end-
to-end thereof and disposed above and spaced from said
partition and beneath said water supply means, said dis-
charge port being disposed above the level of said per-
forked plate, said scrubbing and entrapping means in-
cluding a plurality of longitudinally extending transverse-
ly spaced riffles mounted on said partition and extend-
 ing from the discharge end of the box to adjacent the
opposite rear end thereof, said riffles defining substan-
tially V-shaped spaces therewithin constituting entrap-
ment areas and defining upwardly inclined walls afford-
ing washing and scrubbing surfaces over which the mate-
rials submerged in the water are caused to surge trans-
versely by the agitating motion of the box.

3. A machine as in claim 2, said partition and a second lower parti-
tion disposed substantially beneath the first men-
tioned partition wall and extending from side-to-side
and end-to-end of said box, said first mentioned parti-
tion wall having an opening adjacent the rear wall of
the box for the passage of the material and water from above
and beneath said first mentioned partition, a foraminous
separating element disposed between and spaced from the
partitions for separating the finer particles from the waste
material by the passage of said particles through said
foraminous member, said discharge end of the box hav-
ing a second smaller discharge opening located above said
foraminous member, an inclined plate supported on said
lower partition and beneath and spaced from the for-
aminous member and inclined upwardly and away from said
discharge end of the box and terminating at a point
spaced from the rear box end, on which the heavier
particles passing through said foraminous member are
collected and entrapped adjacent said discharge end of
the box.

4. In a machine as in claim 3, a portion of the box
disposed above said first mentioned upper partition con-
stituting an upper processing chamber of the box and
the area of the box located between said partitions con-
istituting an intermediate processing chamber thereof,
said box including a bottom discharge chamber disposed
between the bottom of the box and said lower partition,
said lower partition having an opening adjacent said rear
wall for the passage to the bottom chamber of materials
and water not entrapped by said inclined plate, said
bottom chamber having a plurality of transversely ex-
tending riffles disposed in end-to-end relationship longi-
itudinally of the box constituting additional entrapping
areas for more finely divided particles of the material to
be recovered, said outlet end of the box having a third
restricted outlet opening communicating with said bot-
tom chamber above the level of said transverse riffles.

5. In a machine as in claim 4, each of said transverse
riffles including a downwardly and rearwardly inclined
top surface extending from side-to-side of the box and
having end portions inclined downwardly and inwardly
away from the side walls of said box.

6. In a machine as in claim 5, and baffle members
mounted in said box above and beneath the openings
of said partition walls and disposed relatively close to
the undersides of the partition walls and more remote
from the upper sides thereof for deflecting the materials
and water passing downwardly through said chambers
away from the rear wall of the box.

7. In a machine of the character described, an elon-
gated washing, scrubbing and concentrating box having
vertically spaced chambers containing washing, scrub-
binding and concentrating means and including passages
located adjacent one end of the box through which the
material and water passes downwardly from the cham-
ber to the chamber therebeneath, means for supplying
raw materials to be processed to the upper portion of
said box adjacent said aforementioned end, means for
supplying water under pressure to said box through said
aforementioned end and in a direction toward the other
discharge end of the box, baffle means contained in each
of the chambers of the box for deflecting the material
and water longitudinally of the box whereby the mate-
rial and water is caused to reverse its direction of move-
ment longitudinally of the box a plurality of times during
its travel downwardly through the box chambers, said
outlet end of the box having a discharge opening for
waste materials individual to each of the box chambers
for carrying off waste and tailings with a portion of
the water from each of said chambers; supporting means
for supporting said box and on which the bottom of the
box rests including transversely spaced supporting mem-
bers extending longitudinally of the box, and driven agi-
tating means connected to a side of the box for recip-
rocating the box transversely of its longitudinal axis
on said supports in a means and in a direction toward the other
discharge port through which the waste material is
carried off, supporting means for supporting said box and
on which the bottom of the box rests including spaced
supporting members extending longitudinally of the box,
and driven agitating means connected to a side of the
box for reciprocating said box transversely of its longi-
dudinal axis on said supporting means and for causing
the box to impart a rocking motion thereto in a direction transversely of the box for rocking the box into
and out of engagement with said supporting members
in a direction transversely of the box.
alternately whereby a simultaneous transverse and vertical agitation of the box is accomplished.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor(s)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>391,257</td>
<td>Masters</td>
<td>Oct. 16, 1888</td>
</tr>
<tr>
<td>402,698</td>
<td>Talley</td>
<td>May 7, 1889</td>
</tr>
<tr>
<td>554,912</td>
<td>Derenberger</td>
<td>Feb. 18, 1896</td>
</tr>
<tr>
<td>832,091</td>
<td>Smith</td>
<td>Oct. 2, 1906</td>
</tr>
<tr>
<td>1,184,240</td>
<td>Hubbell</td>
<td>May 23, 1916</td>
</tr>
<tr>
<td>1,201,151</td>
<td>Cooley</td>
<td>Oct. 10, 1916</td>
</tr>
<tr>
<td>1,792,179</td>
<td>McLean</td>
<td>Feb. 10, 1931</td>
</tr>
<tr>
<td>2,216,962</td>
<td>Davis</td>
<td>Aug. 1, 1930</td>
</tr>
</tbody>
</table>