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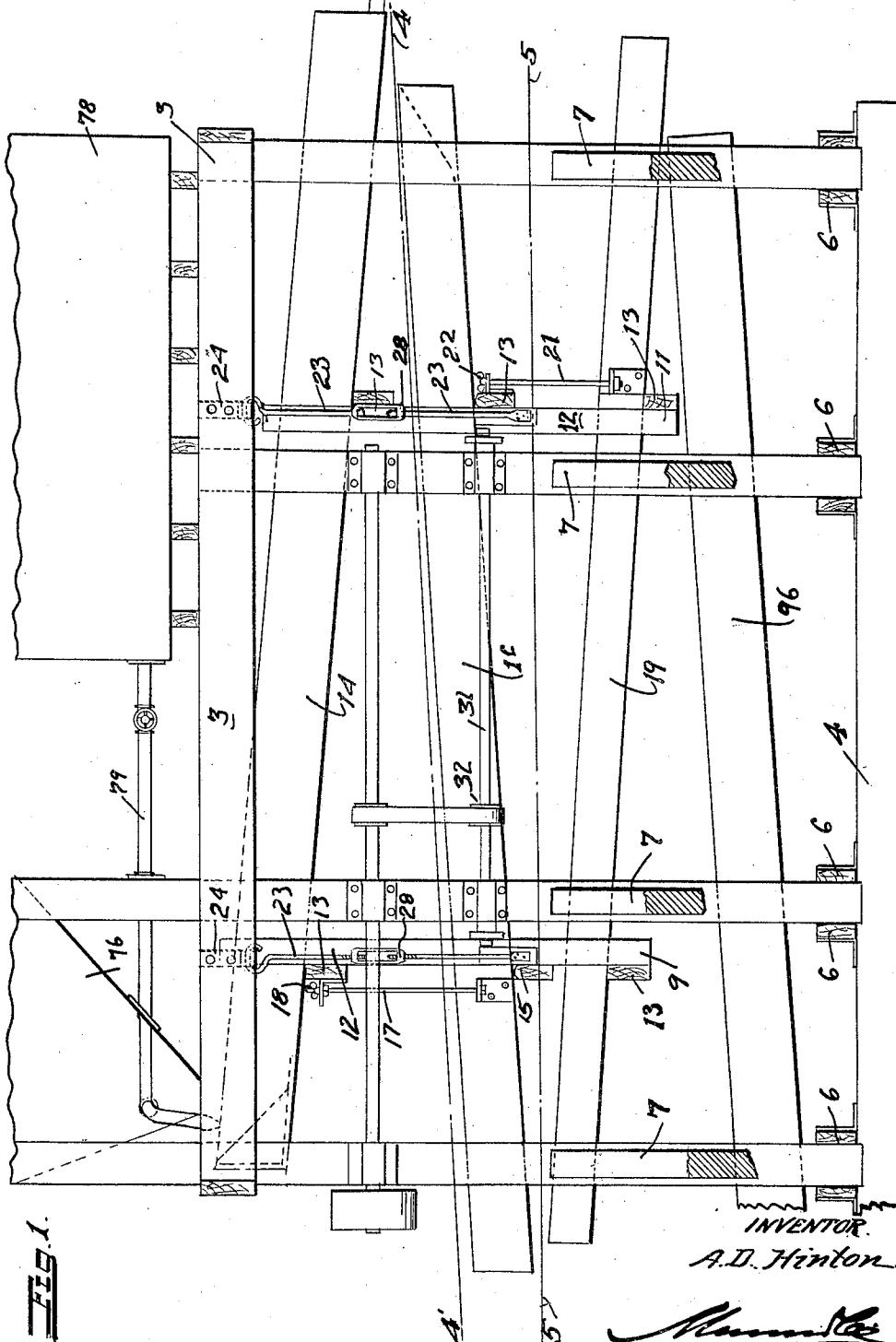
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A. D. HINTON

CONCENTRATOR

Filed August 6, 1923

4 Sheets-Sheet 1



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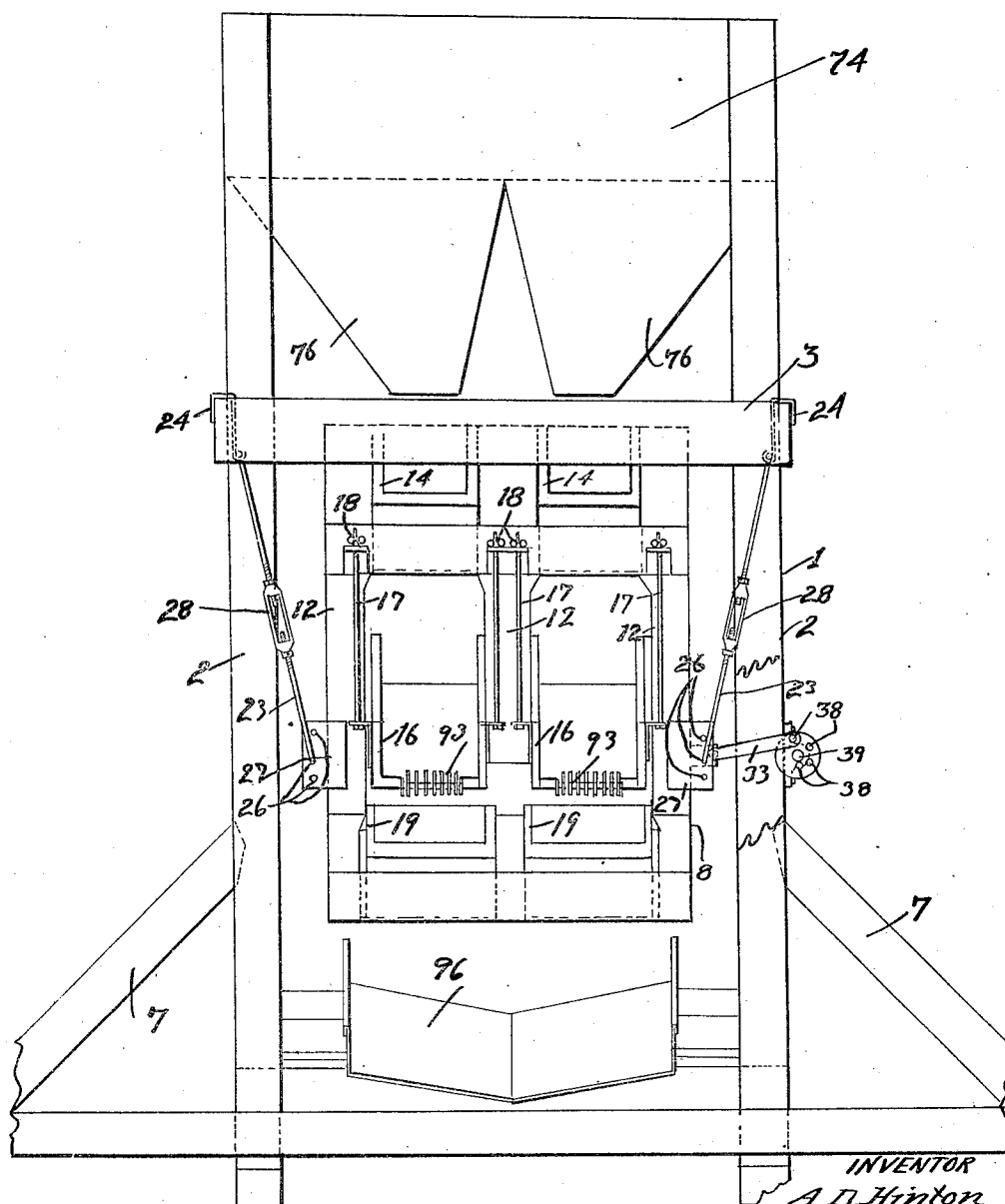
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Fig. 2.



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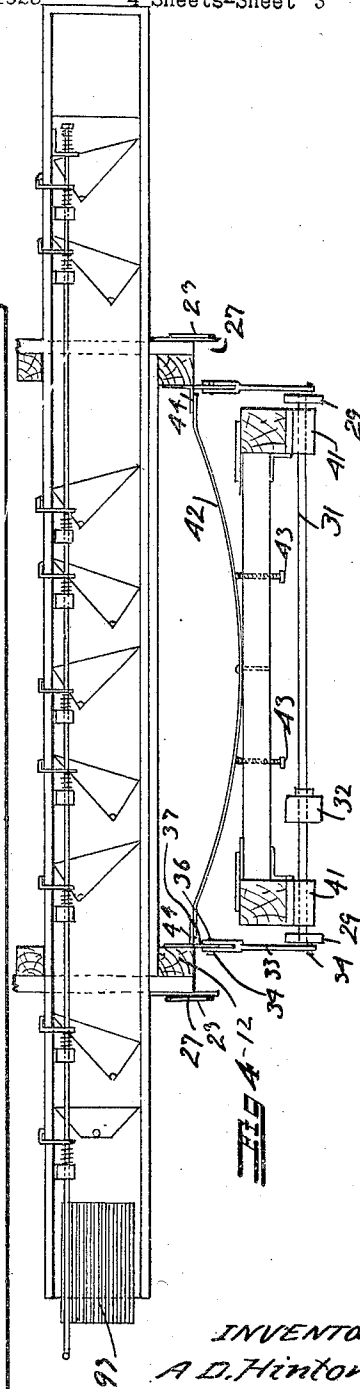
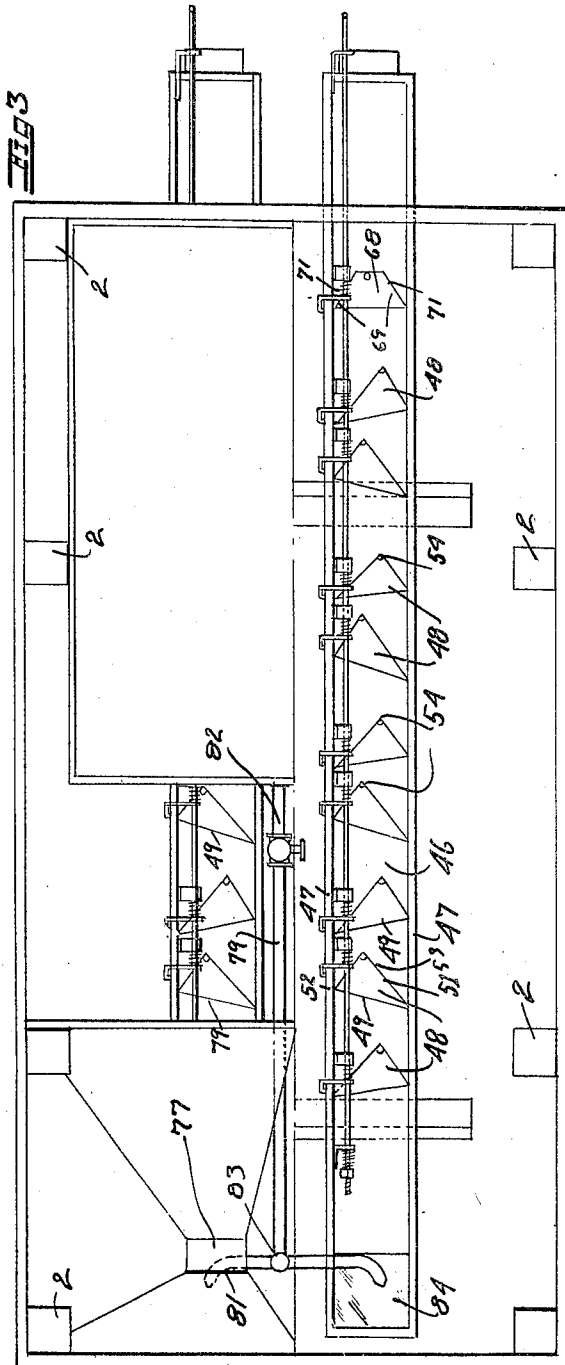
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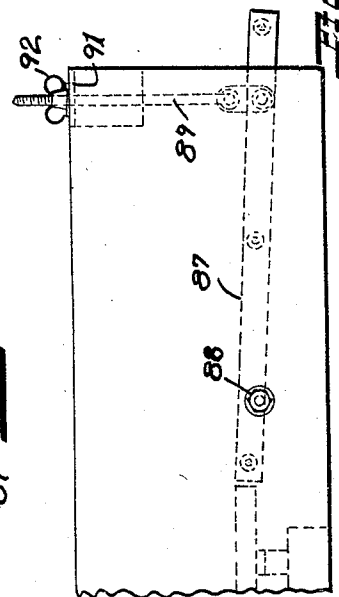
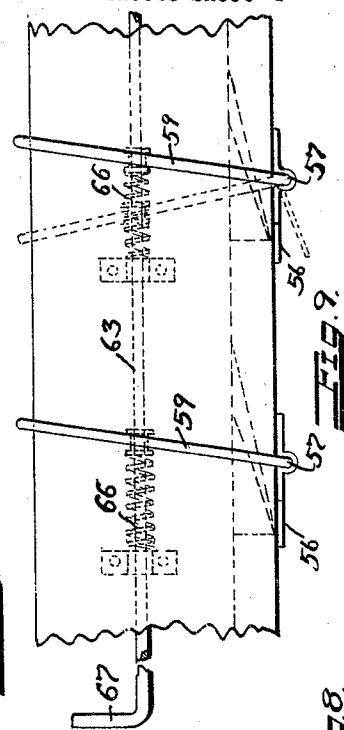
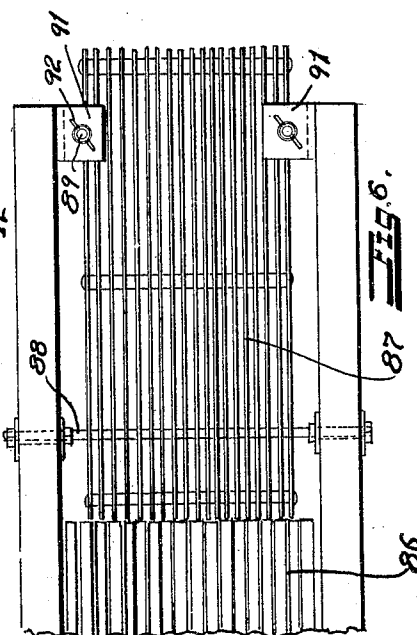
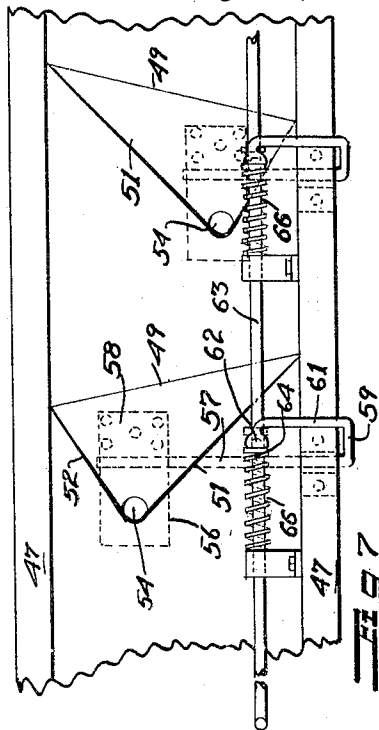
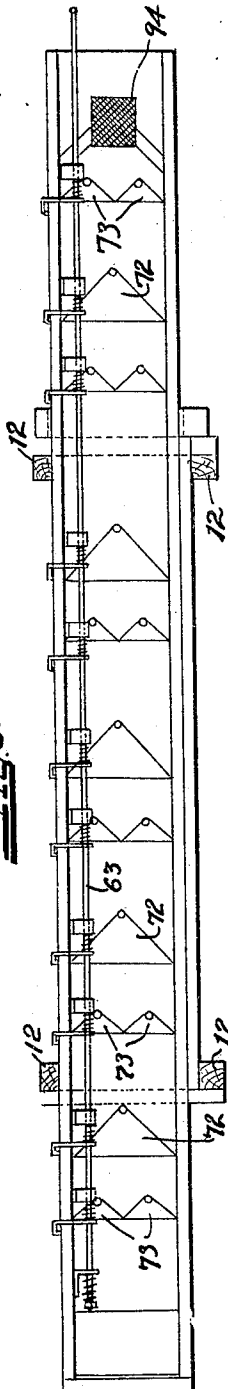
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FIG. 5.



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UNITED STATES PATENT OFFICE.

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CONCENTRATOR.

Application filed August 6, 1923. Serial No. 655,966.

The present invention relates to improvements in concentrators, and has particular reference to a multistage concentrator for placer gravel or the like which is very effective in raising the percentage of concentrates gained from a certain quantity of placer gravel. A further object of the invention is to provide a multi-stage concentrator of the character described with particularly effective means for agitating the placer gravel or other material passing over the sluice boxes of the concentrator. A further object of the invention is to provide sluice boxes with depressions or riffles particularly adapted to allow the heavier portions of the placer gravel to be trapped in pockets, while the waste material is allowed to pass these pockets. A further object of the invention is to provide a concentrator that will handle a great amount of placer gravel with the minimum amount of water, said water being recovered and used over again if found necessary. Other objects and advantages of my device will appear as a specification proceeds.

The preferred form of my invention is illustrated in the accompanying drawings in which Figure 1 shows a side view of my device; Figure 2 an end view of the same; Figure 3 a plan view with certain portions removed; Figure 4 a horizontal section taken substantially along line 4-4 of Figure 1; Figure 5 a partial horizontal section taken substantially along line 5-5 of Figure 1; Figure 6 an enlarged detail view in plan of the end of one of the sluice boxes; Figure 7 an enlarged detail in plan of another part of the sluice box; and Figures 8 and 9 side views of the parts shown in Figures 6 and 7 respectively. While I have shown only the preferred form of the invention it should be understood that various changes or modifications may be made within the scope of the claims hereto attached without departing from the spirit of the invention.

The frame (1) comprises a plurality of upright members (2) arranged in two or more parallel rows so as to form a rectangle and joined by means of a girder (3) engaging the upper parts of the uprights, while the lower parts are held in their relative positions by their engagement with the base (4), and by means of horizontal mem-

bers (6). The frame may be strengthened by means of proper braces (7).

In the frame is supported a cage (8) which holds a plurality of sluice boxes of which six are shown in the drawings. The cage comprises two frames (9) and (11) disposed in spaced relation to one another. Each frame consists of three uprights (12) and a plurality of transverse members (13) secured to the vertical members. On the two uppermost transverse members (13) rests the sluice box (14) slanting downwardly in a forward direction. The second sluice box (16) slants downwardly in the opposite direction, and its upper end rests on the second transverse member (13) of one of the two frames, while its front end is adjustably supported by means of rods (17) from the uppermost transverse member (13) at the other end, so that the rear end may be lifted or lowered by turning the two nuts (18) at the top end of the rods (17). In a similar manner is the upper end of the sluice box (19) supported on the lowermost transverse member (13) at the rear end of the cage, while the front end of this third sluice box is supported from the second transverse member (13) by means of rods (21) and two nuts (22). It will thus be seen that the lower end of the two lower sluice boxes can be adjusted to any angle or grade that may be considered desirable for the proper concentration of values as material becomes finer and water-supply remains practically the same as in sluice (14). It should be understood that I preferably provide the sluice boxes in pairs as is shown in Figure 2 so that each machine would have two sets of sluice boxes or more which may work simultaneously or separately.

The two frames (9) and (11) forming the cage are supported from the girder (3) by means of rods (23) secured to the girder by hooks (24) and engaging perforations (26) in plates (27) secured to the upright members (12) of the cage. The rods have turn buckles (28) embodied therein which allow them to be adjusted as to length whereby the cage may be brought to a proper level, (which is absolutely necessary for the concentration of submerged placer gravel), even if the ground on which the main frame stands should be slightly uneven.

One of the principal advantages of my

concentrator is the means for rocking the cage which contains the sluice boxes. Rocking motion is imparted by means of rotary wheels (29) mounted on the shaft (31) adapted to be actuated from any suitable means by means of a pulley or sprocket (32). These wheels are operatively connected to the uprights (12) of the cage by means of connecting rods (33) pivotally engaging pins (34) projecting from the faces of the wheels, and also engaging by means of bolts (36) plates (37) projecting from the said upright members. To enable the operator to control the intensity of the rocking or swinging motion, I provide a plurality of holes (38) at unequal distances from the center (39) of the wheel (29) allowing the length of the stroke to be increased or decreased by changing the pin (34) from one hole to another.

Particular attention is called to the following facts: It will be noted that if a cage suspended in the manner described hereinabove and shown in the drawings, particularly in Figure 2, is swung laterally, the swinging motion will be accompanied by a tilting motion. Viewing for instance the machine as shown in Figure 2, when the cage is thrown to the left, the left hand side of the same will also move downwardly due to the fact that the rods (23) are thrown into a position approaching a vertical line, while the right hand side of the cage will be raised due to the fact that the angle of the rod (23) to a horizontal line is decreased. And vice versa, when the cage is swung to the right, its right hand side will drop while its left hand side will be raised. This tilting motion is particularly adapted to work in conjunction with the special kind of riffle board provided in my device and described hereinafter. It will be noted that the plates (27) receiving the lower ends of the rods (23) are provided with several perforations (26) allowing the point of engagement to be changed. This offers the following advantage: Where a series of sluice boxes is disposed one above the other are used, it is very desirable at times that the uppermost sluice box handling the rougher and heavier material be rocked back and forth more violently than the lower sluice boxes. It will be seen that my plates (27) allow the relative rocking motion of the upper sluice and the lower sluice to be regulated. If the holes (26) were provided in the exact center of the cage, the uppermost and lowermost sluices would rock with the same intensity. But it will be seen at a glance that as the points of engagement are lowered, the rocking motion of the top member will be increased and of the bottom member decreased. Since a plurality of holes (26) are provided for each engagement, the relative intensity of rocking motion of the top and bottom

members can, therefore, be adjusted to suit conditions.

It will be noticed particularly from Figure 4 that on the side of the main frame are supported bearings (41) in which the shaft (31) previously mentioned is journaled, and which also serves as a support for a spring (42), the tension of which may be adjusted by means of set screws (43) and the extreme ends of which are adapted to engage projections (44) extending from the plates (37) on the cage. The function of this spring is to offer yielding resistance to the swinging cage at the end of each stroke, and to impart motion to the cage at the beginning of the next stroke by means of its tension. This spring serves to relieve the wheel (29) from the strain of changing the direction of the cage at the end of each stroke, and at the same time delivers the energy received at the end of one stroke to the cage at the beginning of the next stroke with very little loss of power. It also serves to tap the cage whereby the settling of the values in the sluice boxes is facilitated. This spring is not in contact with the cage while the machine is at rest.

Referring to the sluice boxes, it may be first stated that in their general features they decrease in depth and increase in width from top to bottom so that the top sluice (14) is comparatively deep and narrow causing the water to rush through the same, while the bottom sluice (19) is comparatively shallow and wide allowing the water to move more calmly. The construction of the top sluice box appears from Figure 3 from which it will be seen that the sluice box comprises a bottom member (46) surrounded by walls (47) and provided with depressions (48) adapted to serve as traps for the heavier particles of precious metal contained in the placer gravel these depressions are made triangular with the longest sides (49) disposed transversely to the direction of the flow of water but forming a slight angle with a line drawn at right angles to the sluice box, with the angles alternating in direction. The apex of each triangle points in the direction of the flow and the depression gains in depth toward the apex. The apices of the various triangles are not disposed on the central line but alternate, one being slightly to the left and the other slightly to the right. Each triangle, therefore, has a long side, (51) and a short side (52), and the long side is preferably reinforced by a strip (53) preventing the water and the placer gravel from passing over the same and forcing it to pass the short side of each triangle so that it assumes a zig-zag motion with the dimensions preferably selected in such a manner that the zig-zag motion of the gravel and water caused by the arrangement of the depressions or riffles coincides

with the natural zig-zag motion imparted to the material by the rocking motion of the cage. At the apex of each triangle is provided a hole (54) allowing the precious metal deposited to drop through the bottom of the sluice box onto the next sluice box. These holes are normally closed by means of hinged gates (56) illustrated in Figures 7 and 9. The gates are provided at the bottom of the sluice and are secured to transverse pins (57) pivotally supported in the hinged member (58) and adapted to be actuated by means of an arm (59) extending upwardly from the pin (57) and terminating in a transverse member (61) extending over the top of the sluice box. A fork (62) at the end of the transverse member (61) is adapted to engage the longitudinal rod (63) between two collars (64), which construction allows the gate to be opened and closed by a forward or rearward motion of the rod (63). Normally the latter rod is forced into a gate closing position by means of springs (66). At its end the rod (63) is provided with a handle (67). The last depression (68) on the uppermost sluice box is formed slightly different from the other depressions in so far as it presents two slanting walls (69) arranged symmetrically to the flow of water and material with slats (71) provided behind each wall so that the material and the water are forced through a comparatively narrow passage whereby the speed is increased in order to assist screening at end of sluice.

The second sluice box is made substantially the same as the top box, while the third box shown in detail in Figure 5 is preferably constructed slightly different. In this box depressions (72) controlling the whole width of the sluice box alternate with depressions (73) of much smaller dimensions, of which latter two are necessary to cover the width of the box. This construction, while still forcing the water and the material into a zig-zag line, allows this line to be less pronounced than the line of travel in the upper boxes.

Above the upper end of the top sluice box is provided a hopper (74) terminating in two feeding channels (76), one for each set of sluice boxes. The openings of the two channels (76) are controlled by means of sliding gates (77). Above the frame is also mounted a large water tank (78) provided with an outlet pipe (79) extending into close proximity of the hopper and dividing into two arms (81), so as to deliver the water at the upper ends of both top sluice boxes in operative proximity to the discharge openings of the hopper. The flow of water may be controlled by means of suitable valves (82) in the main pipe (79) and (83) in the side arms of the same. The water is preferably forced against a slanting wall (84)

of sheet metal, which allows the water to run off to follow the general direction of the sluice box immediately and preventing the accumulation or slacking up of gravel at this point.

Between the upper sluice box and the hopper I preferably provide slats (86) which carry off large rocks without allowing the same to touch the riffles of the sluice box whereby the life of the latter is prolonged considerably. The upper sluice box discharges on a metal grizzly (87) pivotally supported near its rear end on the transverse shaft (88), with its front end held by rods (89) suspended in angle irons (91) secured to the side walls of the box. The operative length of the rods (89) can be adjusted by means of the two nuts (92) so that the grizzly (87) may be given any fall desired. The larger particles of placer gravel which are without value are discharged over this grizzly onto the waste pile in the rear of the concentrator, while the smaller and heavier particles drop through the grizzly on the next sluice box. The latter is constructed in substantially the same manner as the upper box and terminates in a grizzly (93) which again partly discharges on the waste pile, and partly on the lowermost sluice box. At the end of this sluice box is provided a screen (94) which allows any valuable material still present to drop therethrough, while the other material is passed over the extreme edge of the lower sluice box on the waste pile. A chute (96) is provided under the lowest sluice box so that any values separated from the placer gravel during the process are finally collected on the chute and may be removed therefrom by any suitable means not shown in the drawing.

The operation of the concentrator is as follows: The placer gravel is unloaded into the hopper in any suitable manner and drops through the gate on the upper sluice box which at the same time receives water from the tank (78). The shaft (31) being rotated by any suitable power, rocking motion is imparted to the whole cage as explained in the description. The big rocks are prevented from coming in contact with the upper sluice box by the slats (86) and are delivered directly to the grizzly (87) together with such finer material as is not caught in the pockets of the depressions (48). The finer material which is allowed to pass through the spaces between the slats (86) is washed over the bottom of the upper sluice box in a zig-zag line, leaving the particles containing precious metal in the pockets (48) from which it may be occasionally removed by opening the gates (56). Material not entrapped in these depressions and not thrown on the waste pile, passes through the grizzly (87) on the sec-

ond box and is subjected there to a similar treatment travelling in the opposite direction until such portions as have not been trapped by the depressions of the second box reach the end and fall through the grizzly (93) on the third box, which again subjects the material to the same process retaining in its pockets anything that represents any value whatever.

10 I claim:

1. In a concentrator, an oblong upright frame, a cage having a plurality of inclined sluice boxes disposed longitudinally of the frame and mounted therein one above the other, hangers pivotally connected to the frame and pivotally connected to the cage on opposite sides at points intermediate the middle and lower end of the cage for suspending the same to rock with the transverse movement progressively decreasing in amplitude from the top to the bottom of the cage, and means connected to the cage for imparting transverse rocking motion thereto.
2. In a concentrator, a cage having a plurality of sluice boxes mounted therein one above the other and slanting alternately in opposite directions to provide a continuous path for a material, with the boxes successively decreasing in depth and likewise increasing in width from the top to the bot-

tom of the cage, and means for adjusting the angle at which the sluice boxes slant.

3. A sluice box having depressions of triangular form increasing in depth toward the apex of the triangle arranged therein, with the depressions disposed so as to cause material passing over the same to move in zig-zag form.

4. A sluice box having depressions of triangular form increasing in depth toward the apex of the triangle arranged therein, with the depressions disposed so as to cause material passing over the same to move in zig-zag form, and gates associated with the depressions allowing material gathered in the same to be dropped through the sluice box.

5. A sluice box having depressions therein for gathering material, hinged gates associated with the depressions allowing the material to be dropped through the sluice box and a common control for the gates comprising a rod mounted longitudinally with freedom of sliding motion and an operative connection between the rod and each gate allowing the gate to be opened and closed by moving the rod, having spring means associated therewith tending to maintain the gates in a closed condition.

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