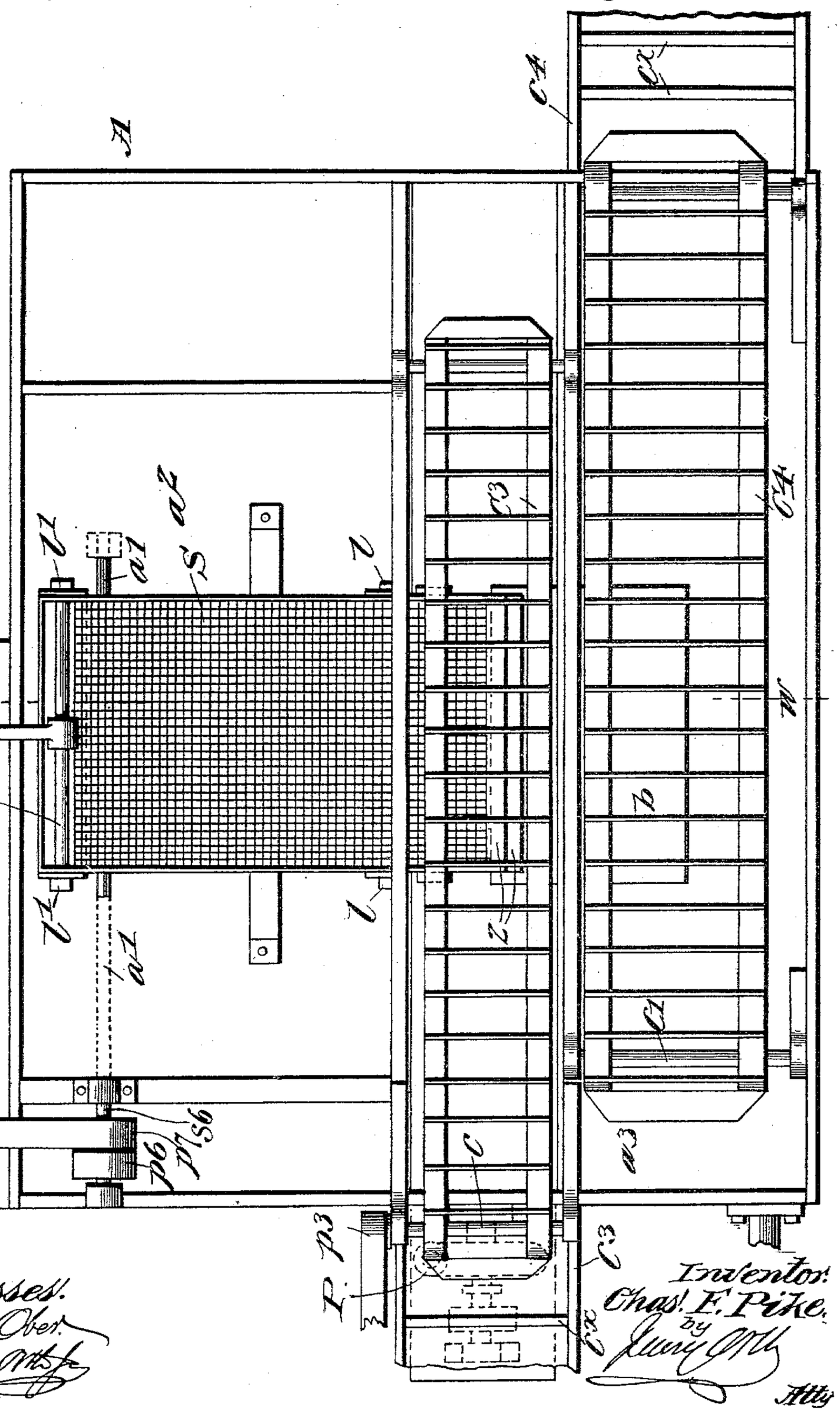
(No Model.) 6 Sheets—Sheet 1.

C. F. PIKE.

ORE WASHER AND SEPARATOR.

No. 566,533. Patented Aug. 25, 1896.

Fig. 1.



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(No Model.) 6 Sheets—Sheet 2.

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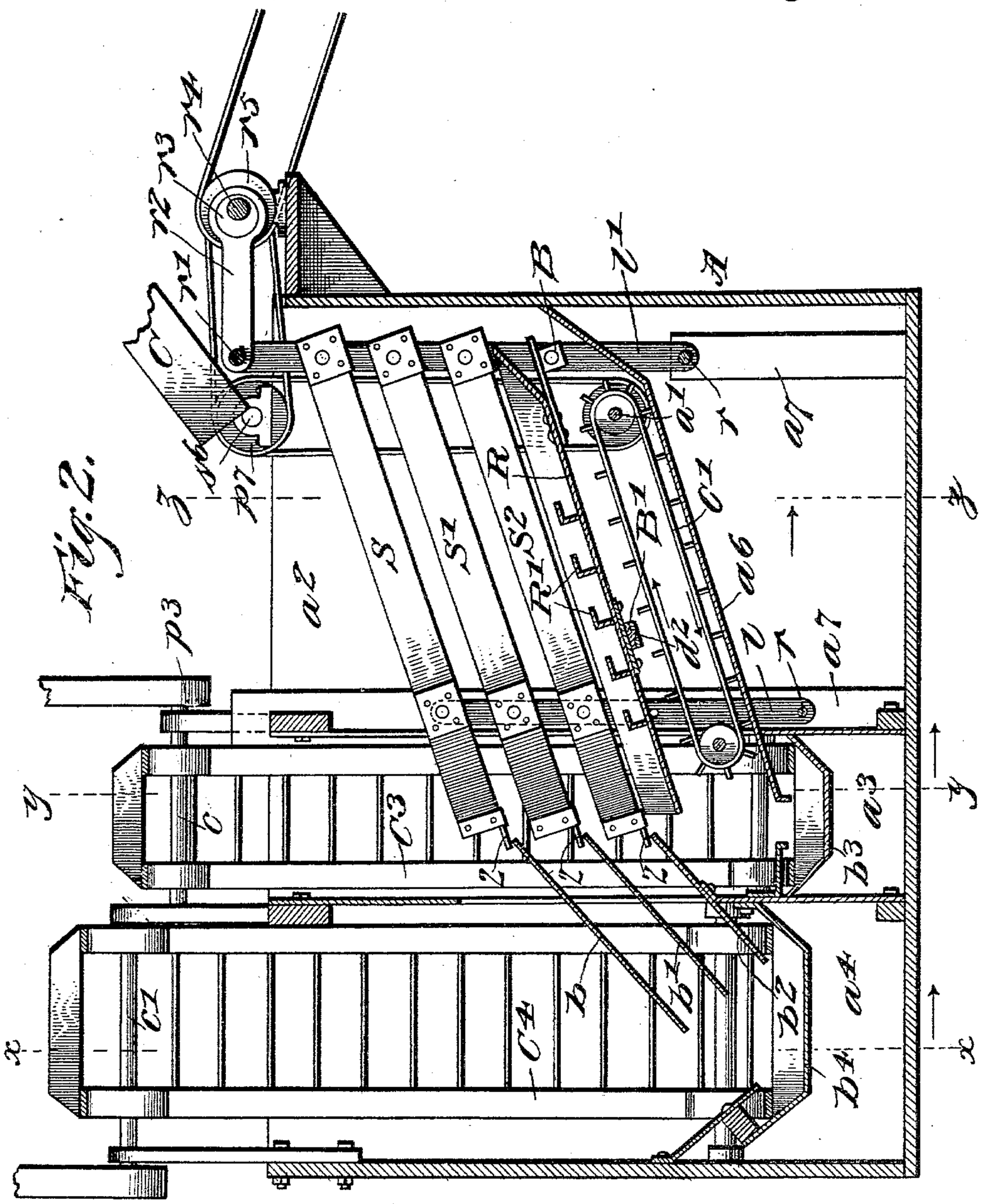
No. 566,533. Patented Aug. 25, 1896.

Fig. 2.



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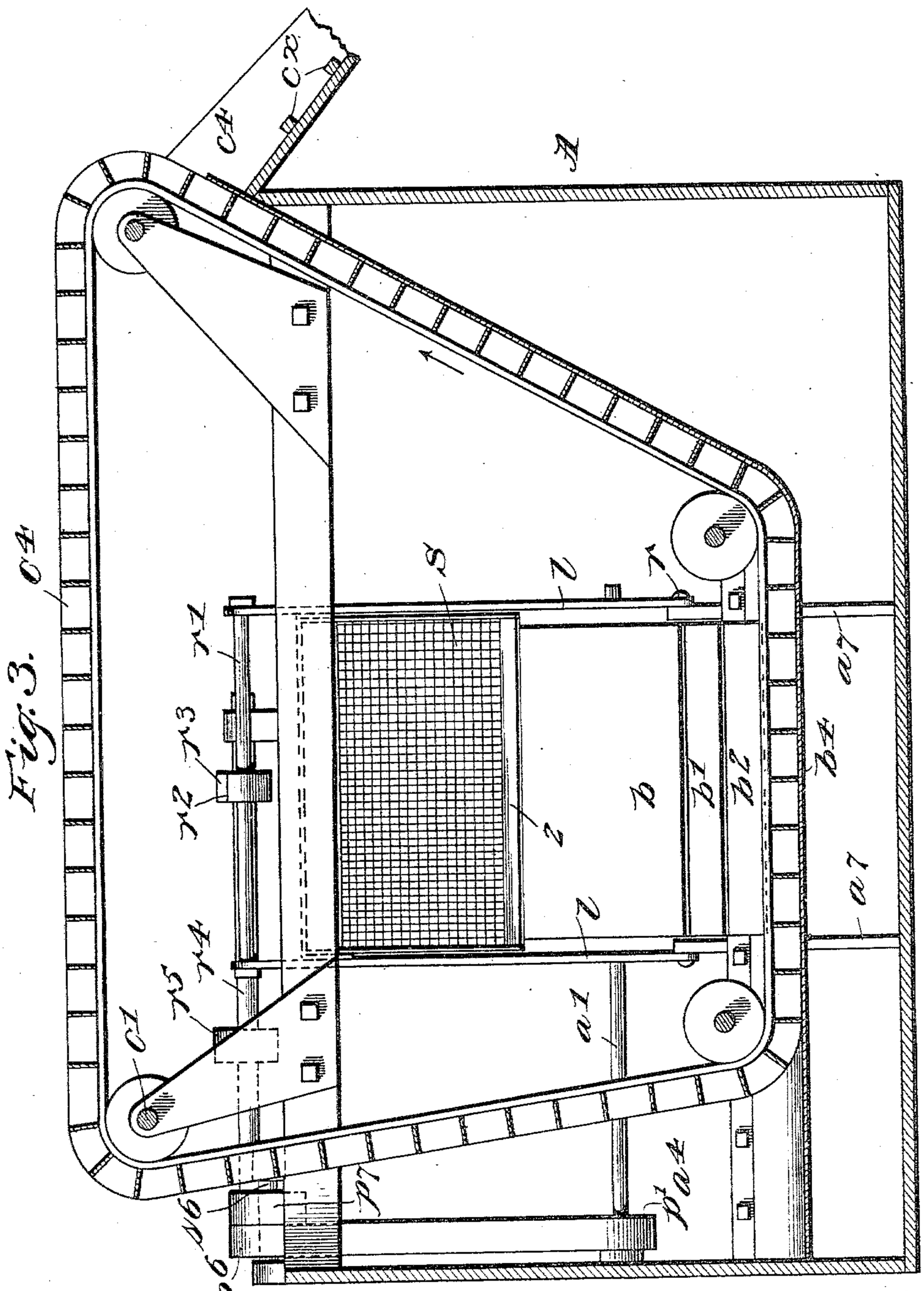

Fig. 3.

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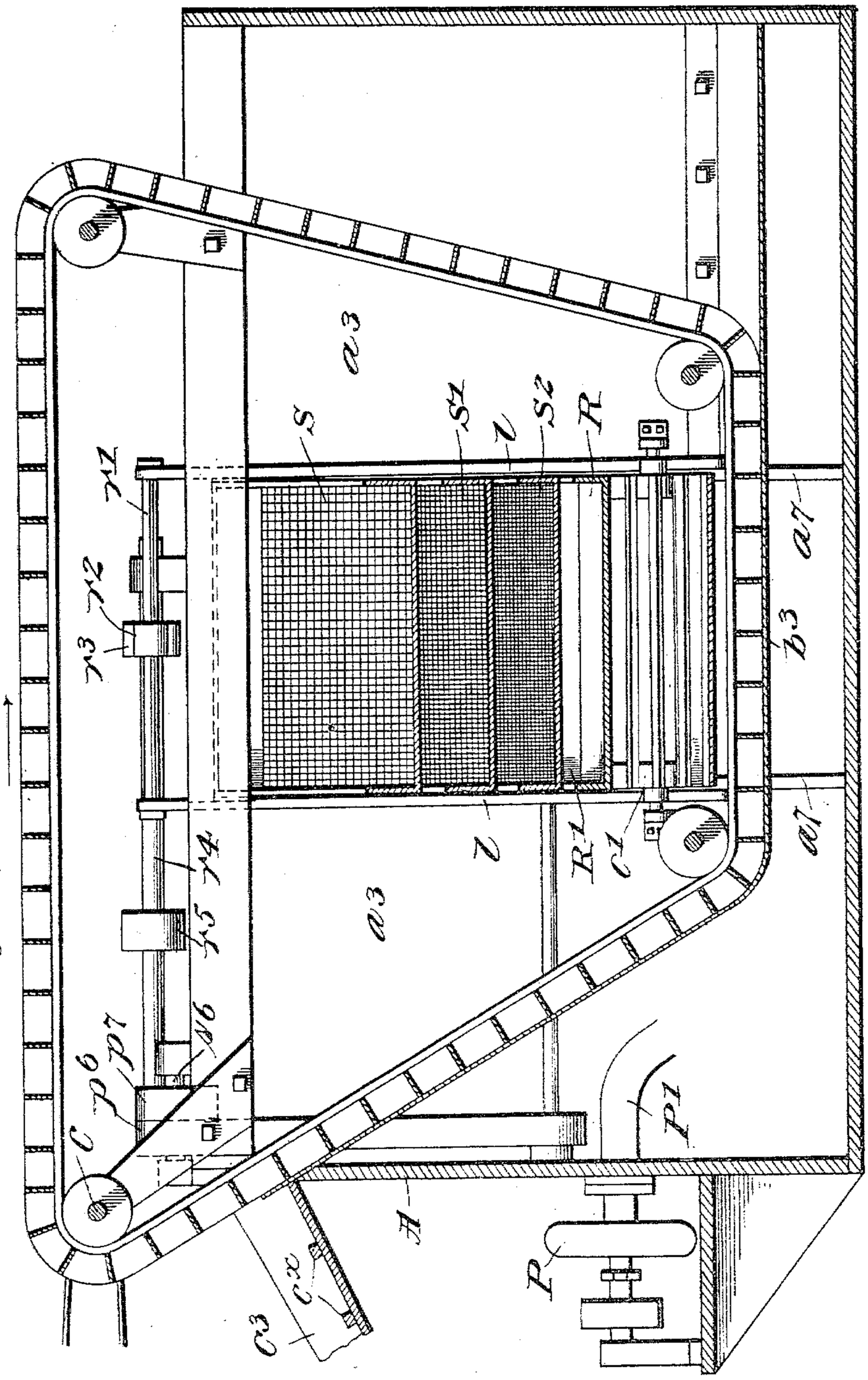
Fig. 4.



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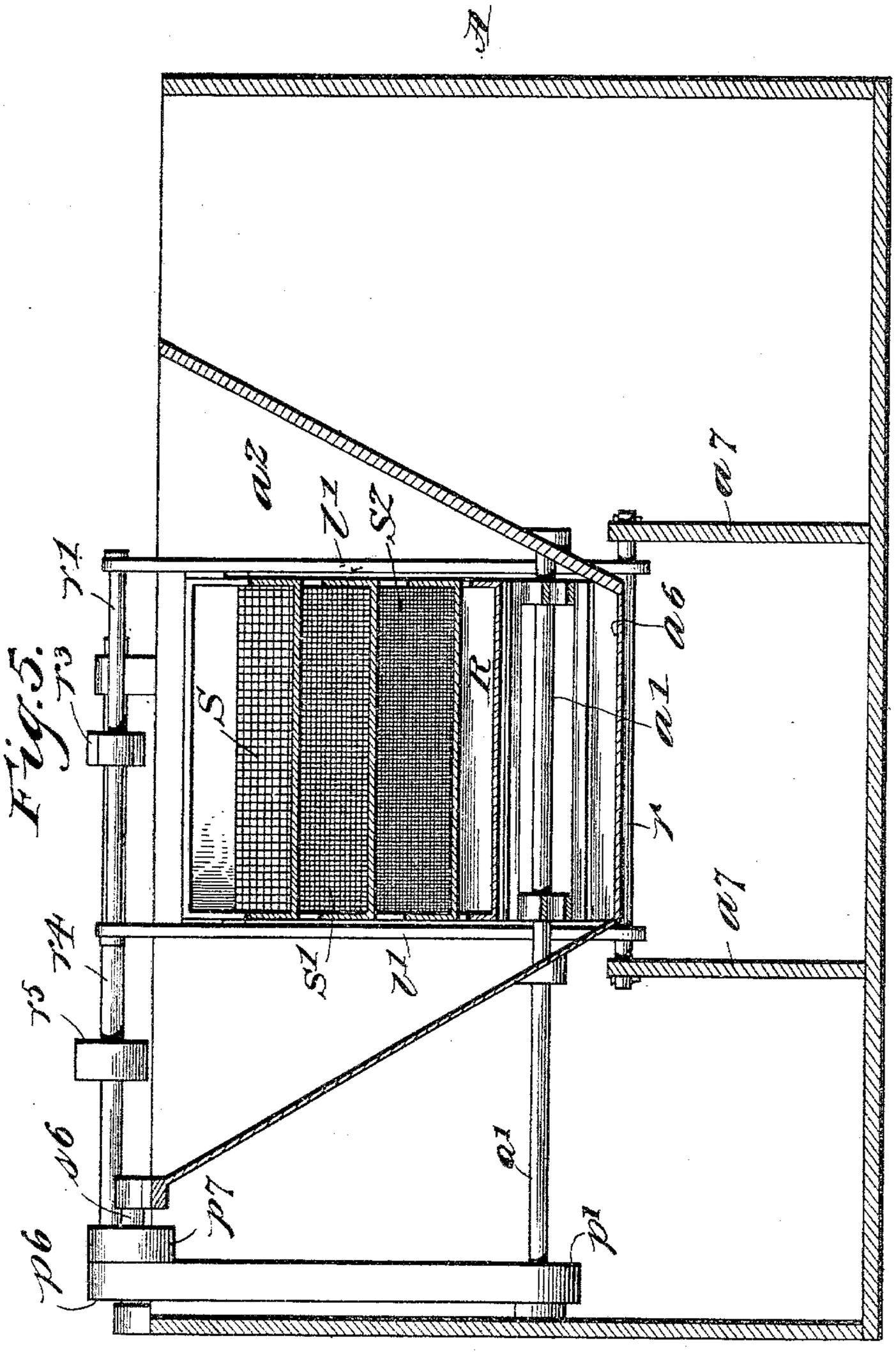
No. 566,533. Patented Aug. 25, 1896.

Fig. 5.



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(No Model.) 6 Sheets—Sheet 6.

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ORE WASHER AND SEPARATOR.

No. 566,533. Patented Aug. 25, 1896.

Fig. 6.

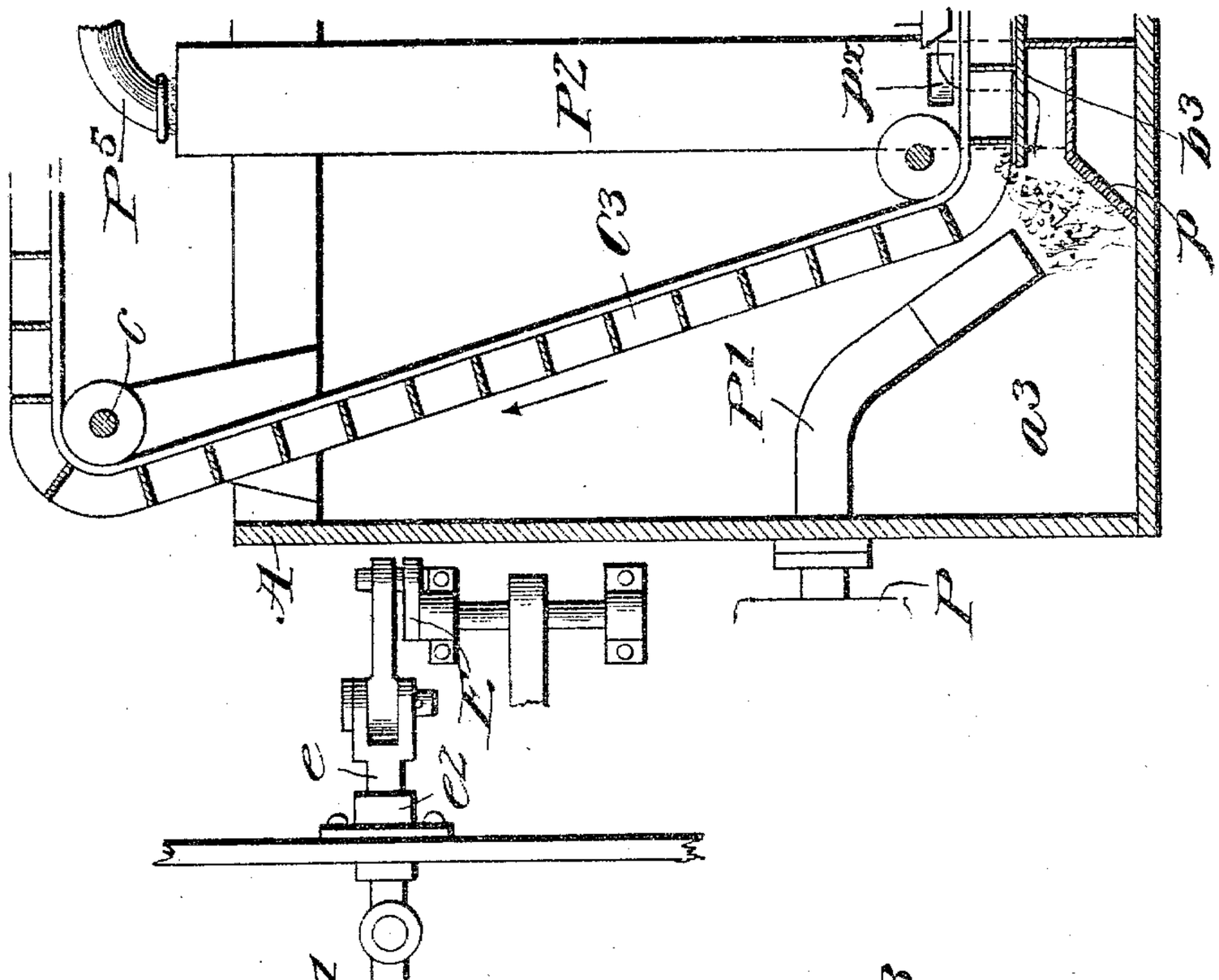

Fig. 9.

Fig. 8.

Fig. 7.

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UNITED STATES PATENT OFFICE.

CHARLES F. PIKE, OF PHILADELPHIA, PENNSYLVANIA.

ORE WASHER AND SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 566,533, dated August 25, 1896.

Application filed January 25, 1895. Serial No. 536,244. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. PIKE, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in Ore Washers and Separators, of which the following is a specification.

This invention relates to ore washers or concentrators, and more particularly to the type or class of machines or apparatus for working placer-gravel, wherein the latter is washed, graded, and the metal separated. It is well known that placer gravel or dirt cannot be profitably worked unless the apparatus is of such a construction that large quantities of the material can be rapidly operated upon, the thorough washing of the material being an essential requirement. When, however, large quantities of placer-gravel are rapidly passed through the machine, the heavy black sand contained in the gravel accumulates very rapidly, and as the separation of the particles of metal from the sand is effected by means of riffled plates the sand is liable to pack behind the riffles, which then become inoperative, both metal and black sand passing over the riffles and out of the machine with the tailings. This occurs in all placer-working apparatus wherein riffled plates are employed, whether such apparatus be sluice-boxes or specially-designed apparatus. The disadvantage referred to has been overcome by me to a great extent by imparting to the riffled plate a jigging or longitudinal reciprocating motion and effecting the washing and separation or concentration in a body of substantially quiescent water, as fully set forth in Letters Patent granted to me under date of November 13, 1894, No. 529,307. I have found, however, that the separation or concentration can be very materially improved; and my present invention has for its object certain improvements on the machine or apparatus and on the process or method shown and described in the aforementioned patent, as will now be fully described, reference being had to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a top plan view; Fig. 2, a transverse sectional view on or about on line $w\ w$ of Fig. 1. Figs. 3, 4, and 5 are longitudinal sections taken, respectively, on or about on lines $x\ x$, $y\ y$, and $z\ z$ of Fig. 2. Fig. 6 is a fragmentary sectional view about on line $y\ y$ of Fig. 2, illustrating a suction device for the removal of the black sand. Fig. 7 is an edge or side view, and Figs. 8 and 9 plan views, of the riffled plate.

Similar symbols indicate like parts wherever such may occur in the figures of drawings just described.

A indicates a vessel or tank of suitable construction adapted to contain water and divided into three chambers $a^2\ a^3\ a^4$. The chamber a^2 is arranged at a suitable distance above the bottom of the vessel, and, as shown in Fig. 5, has its side walls arranged to converge in a downward direction to the bottom a^6 of said chamber for the purpose of collecting such material as may be spilled over the sides of the screens and riffled plate, such material being conveyed by a scraper-conveyer C′ into chamber a^3 of the machine, Fig. 2. Motion is imparted to said conveyer through its rear shaft a', a pulley p' thereon belted to a pulley p^6 on a counter-shaft s^6, which carries another pulley p^7, belted to a pulley p^8 on a shaft r^4. (See Figs. 2 and 5.)

Below the bottom a^6 is arranged a suitable framing or standards a^7 for two fulcrum-rods r, one near the open front end and the other near the rear end of the chamber a^2, and on each of said rods r is pivoted the lower end of two levers l and l', respectively. At their upper ends the levers l' near the rear end of chamber a^2 are connected by a rod r', the latter being connected by rod r^2 with an eccentric r^3 on shaft r^4, above referred to, said shaft carrying a suitable driving-pulley r^5, adapted to be belted to any desired prime motor. To the levers l and l' are journaled three screens S S′ S² and a riffled plate R in the order named, one below the other, Fig. 2, the upper screen S having the coarsest mesh and the lower screen S² the finest mesh, said screens and riffled plate receiving a longitudinal to-and-fro or jigger motion through the medium of the eccentric r^3 and the described connections with the rear levers l', the placer-gravel being fed to the upper screen from a suitable chute C, Fig. 2. The screens and riffled plate

are suitably inclined from the head or feed end to the tail or discharge end, at which point the said screens are provided with a tail-board 2, projecting over inclined guide-boards or chutes b b' b^2, Fig. 2. As shown in said Fig. 2, the tail ends of the screens project into chamber a^3, while the guide-boards or chutes extend from said chamber a^3 into chamber a^4, so that the coarse material is discharged into said chamber a^4, while the finer material, principally black sand, is discharged from riffled plate R into chamber a^3, said materials being removed from their respective chambers by separate devices, as, for instance, by endless scraper-conveyers C^3 C^4, respectively, the bottom or trough b^3 b^4 of chambers a^3 a^4 being carried upwardly to suitable discharge-chutes c^3 c^4, respectively, as shown in Figs. 3 and 4, the said conveyers running over suitable guide-pulleys.

The conveyer C^3, Figs. 1 and 4, receives motion through the shaft c and a suitable belt-pulley p^3 thereon, while the conveyer C^4 receives motion through its shaft c' and a suitable belt-pulley thereon, Figs. 1 and 2.

In practice I preferably construct the discharge-chutes c^3 c^4 with riffles $c^\times$ for the purpose of catching such particles of metal as might be carried thereto with the tailings or black sand. The conveyers C^3 and C^4 operate to rapidly and positively remove the black sand and tailings from their respective chambers a^3 a^4 or troughs at bottom of such chambers without unduly agitating the body of water in the vessel A, the movement imparted to the water by the conveyers being slight and uniformly in the direction of motion of said conveyers, which is of importance, since any undue agitation of the said body of water would not only retard the subsidence of the heavier particles of metal, but would tend to prevent the subsidence of the lighter particles and carry the same over the tail end of the riffled plate, and it is obvious that by dividing the vessel A, as described, and arranging the conveyers to move in a direction at right angles to the direction of reciprocation of the screens and riffled plate the liability of undue agitation of the body of water in vessel A is greatly reduced.

Instead of arranging the trough or floor b^3 of chamber a^3 to connect with a discharge-chute c^3 at or near the upper edge of vessel A, the black sand may be discharged by suction, as shown in Figs. 1 and 6, in which case the trough or floor b^3 does not extend from front to rear wall of the vessel A, the black sand being discharged into chamber a^3 at its rear end and is removed by suction.

The suction-pipe P′ of pump P projects into chamber a^3 near to the discharge end of trough or floor b^3, and in order to prevent the subsidence of the heavy black sand, which would render its removal by suction very difficult, I arrange a perforated inclined partition p below the discharge and provide a vertical pipe P^2, to which water is continuously supplied from a pipe P^5, said perforated pipe p covering the outlet of pipe P^2, as shown in Fig. 6. The pipe P^2 is furthermore provided with a port $p^\times$ in a plane slightly above the conveyer C^3 to admit water into the body of vessel A, sufficient head or pressure being thus produced to scatter or keep the black sand alive in the water, and thus facilitate its removal by suction without undue agitation of the body of water in aforesaid vessel A.

The effect of the jigging motion of the riffled plate upon the heavy black sand is to impart to the latter successive short forward movements, the riffled plate in its backward movement withdrawing from the sand and leaving it temporarily scattered and suspended in the body of substantially quiescent water, thereby facilitating the separation of the particles of metal from the black sand and allowing them to subside and collect behind the riffles, as has been fully set forth in the Letters Patent hereinbefore referred to.

Although results have been obtained by this method of separation which would not be attained by any of the older methods or means, in that I have been enabled to separate from placer-gravel the finer lighter particles of metal which are lost in the tailings in the said older methods of operation, I have since found that the separation can be made still more complete by imparting to the riffled plate a compound motion, namely, a reciprocating motion in the direction of its length and an oscillating motion across the plane of such reciprocating motion, whereby the material on the riffled plate is caused to move alternately from one side to the other of said plate. That is to say, the material will receive a forward and upward movement and simultaneously therewith a lateral movement in one direction during the forward reciprocations of the riffled plate, while a lateral movement in an opposite direction is imparted to said material by the backward movement of the plate, thus causing the material to travel from the feed to the tail end of the riffled plate in a zigzag course, whereby such material is more effectually and thoroughly scattered or kept alive in the body of water. To this end, the riffled plate R is not journaled directly to its supports l l', but adapted to oscillate about a vertical journal. Referring to Figs. 2, 7, and 8, it will be seen that the riffled plate R is provided at its head or feed end with a journal-bearing d' equidistant from either side of the plate and adapted to receive a journal or pin d, projecting from a bar B, that is pivotally mounted in the supporting-bars l'. To the under side of said riffled plate R near its tail end in the plane of the journal d is secured a pin d^2, that projects into a diagonal slot d^3 in a cross-bar B′. It is obvious that when the riffled plate R is reciprocated an oscillatory movement will be imparted thereto by the pin d^2 working in the slot d^3. It is further obvious that the bar B may be provided with the journal-bearing d'

and the riffled plate R with the journal *d*, and that the riffled plate may be positively oscillated, for instance, by connecting the pin or journal d^2 with a suitable crank or eccentric E, Fig. 9, and connecting-rods *e* and *e'*, said connecting-rod *e* passing through a suitable stuffing-box e^2 in the wall of vessel A.

In order that the lateral movements of the material on the riffled plate may be made uniform, or substantially so, I preferably arrange said riffles R' on radii having for center the center of oscillation of the plate, *i. e.*, the center of journal *d*, as shown in said Figs. 8 and 9. There is, however, another advantage derived from the described mode of operating the riffled plate, in that the rapidity of the jigging movement, within a specified time, can be materially reduced without affecting the action upon the ore or black sand, thereby reducing the work and consequently the strain and wear upon the operating devices and also lessening the agitation of the body of water within the vessel A.

Where the riffled plate is oscillated through the medium of a pin thereon working in a diagonal slot in a fixed bar, Figs. 7 and 8, the oscillations of said plate are synchronous with its reciprocations. When, on the contrary, the riffled plate is positively oscillated, as described in reference to Fig. 9, the oscillatory movement may or may not be synchronous with the reciprocations of the riffled plate, and the number of oscillations may therefore be varied relatively to a given number of reciprocations to more effectually keep the material in motion upon the riffled plate.

I have illustrated in the drawings and described a separate chamber for the reception of the screen and riffled-plate tailings, respectively, and separate discharge devices for such tailings; but this is not absolutely necessary, as these tailings may be discharged into the vessel A and removed therefrom in any suitable manner. I, however, prefer the construction shown and described, because the removal of the heavy black sand is more difficult when mixed with the coarser gravel and because said sand may be utilized and would for this purpose entail the additional labor of separation from the gravel or coarser material if both were discharged into or onto the same receiver.

In view of what has been said it is evident that the construction of the apparatus may be variously modified without departing from the nature of my invention, and I do not therefore desire to limit myself to the exact construction shown and described.

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

1. In a machine for working placer-gravel, the combination with a vessel containing a body of water, a hopper-shaped chamber open at one end and provided with an inclined bottom arranged in said vessel, superposed movable screens and a movable riffled plate below the said screens within the chamber and immersed in the aforesaid body of water, the tail end of said screens and riffled plate projecting from the open end of their chamber, of the conveyer C', substantially as and for the purpose set forth.

2. In a machine for working placer-gravel, the combination with a vessel adapted to contain a body of water, a hopper-shaped chamber open at one end and provided with an inclined bottom arranged in said vessel, superposed movable screens, and a movable riffled plate below said screens within the chamber and arranged for immersion in such body of water, the tail end of said screens and riffled plate projecting from the open end of their chamber; of the chutes *b b' b²* for the tailings from the screens, the trough b^4 into which said chutes discharge the conveyer C' working in said trough, the trough b^3 for the tailings from the riffled plate and material discharged from the aforesaid chamber, and the conveyer C working in said trough b^3 substantially as and for the purpose set forth.

3. In a machine for working placer-gravel comprising a vessel containing a body of water, a riffled plate or board immersed therein and a receiver for the tailings from said plate, the combination of the stand-pipe P^2, an outlet for said pipe below the discharge end of the receiver, said outlet closed by a perforated plate, a suction-pipe having its inlet proximate to said perforated plate, and a second outlet-port in the aforesaid pipe P^2 above the aforesaid receiver, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 27th day of December, 1894.

CHARLES F. PIKE.

Witnesses:
LOUIS E. PIKE,
THOS. S. RODGERS.