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C. F. PIKE.

ORE WASHER OR CONCENTRATOR.

No. 529,307. Patented Nov. 13, 1894.

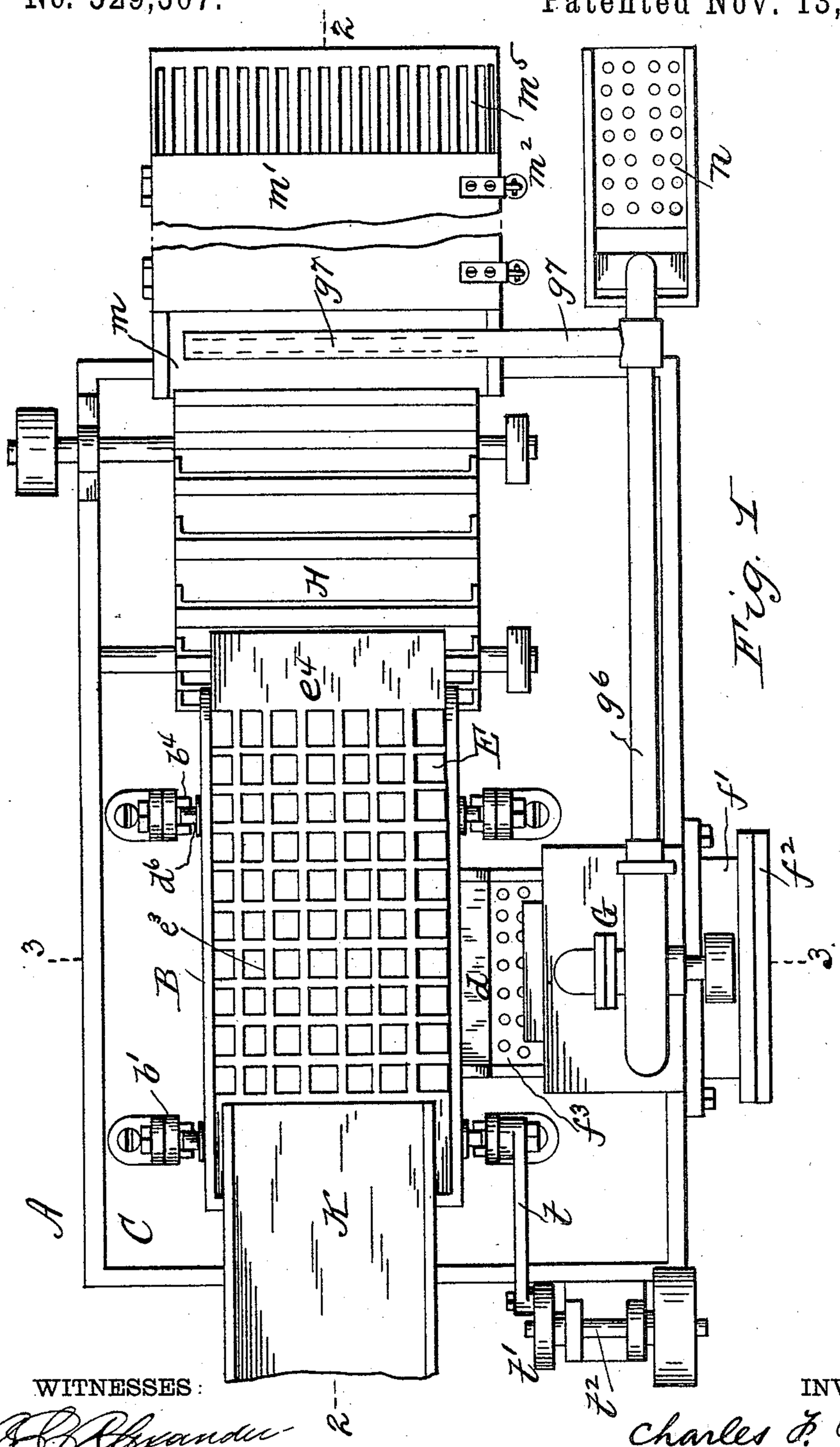

Fig. 1.

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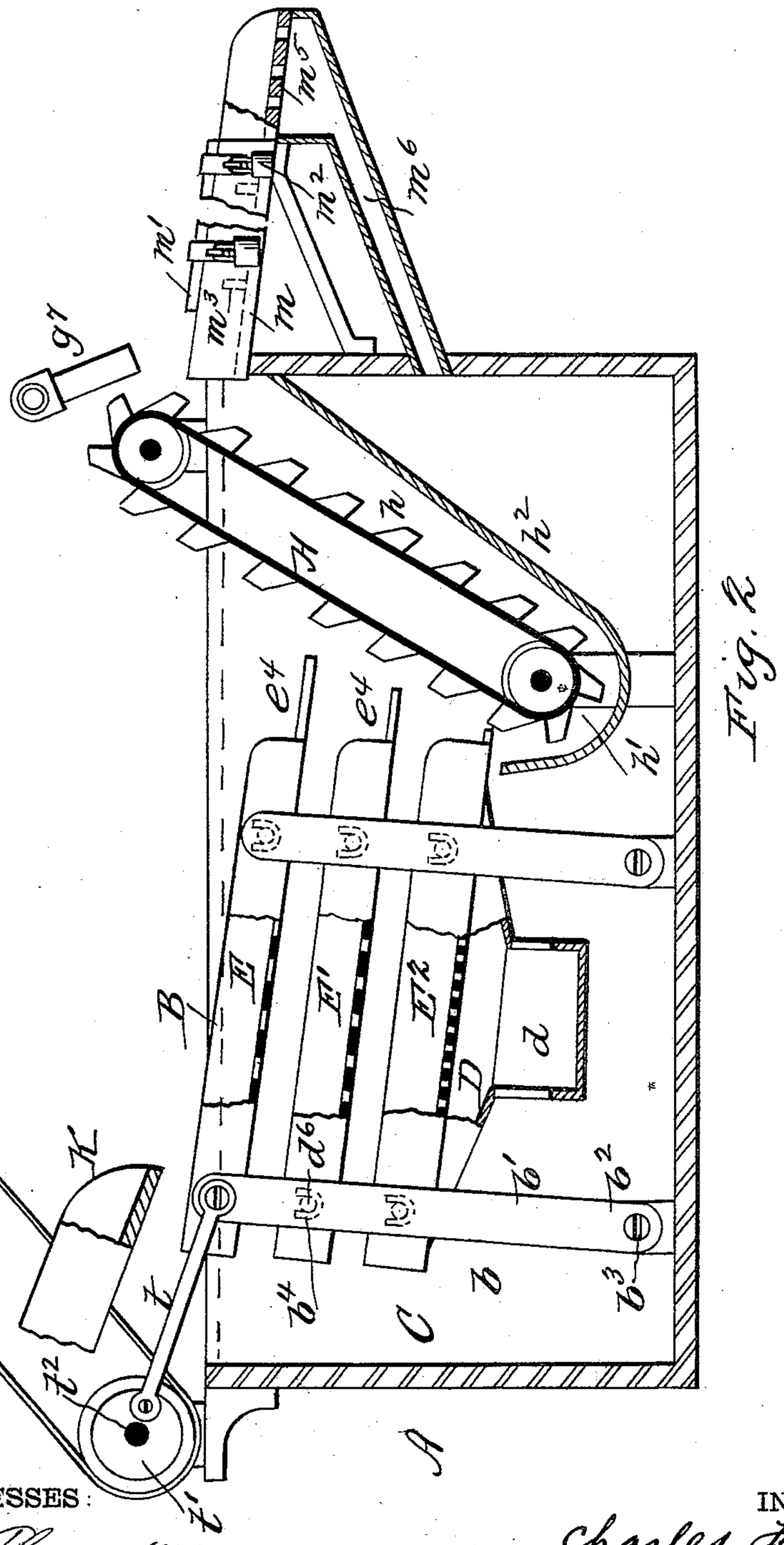

Fig. 2.

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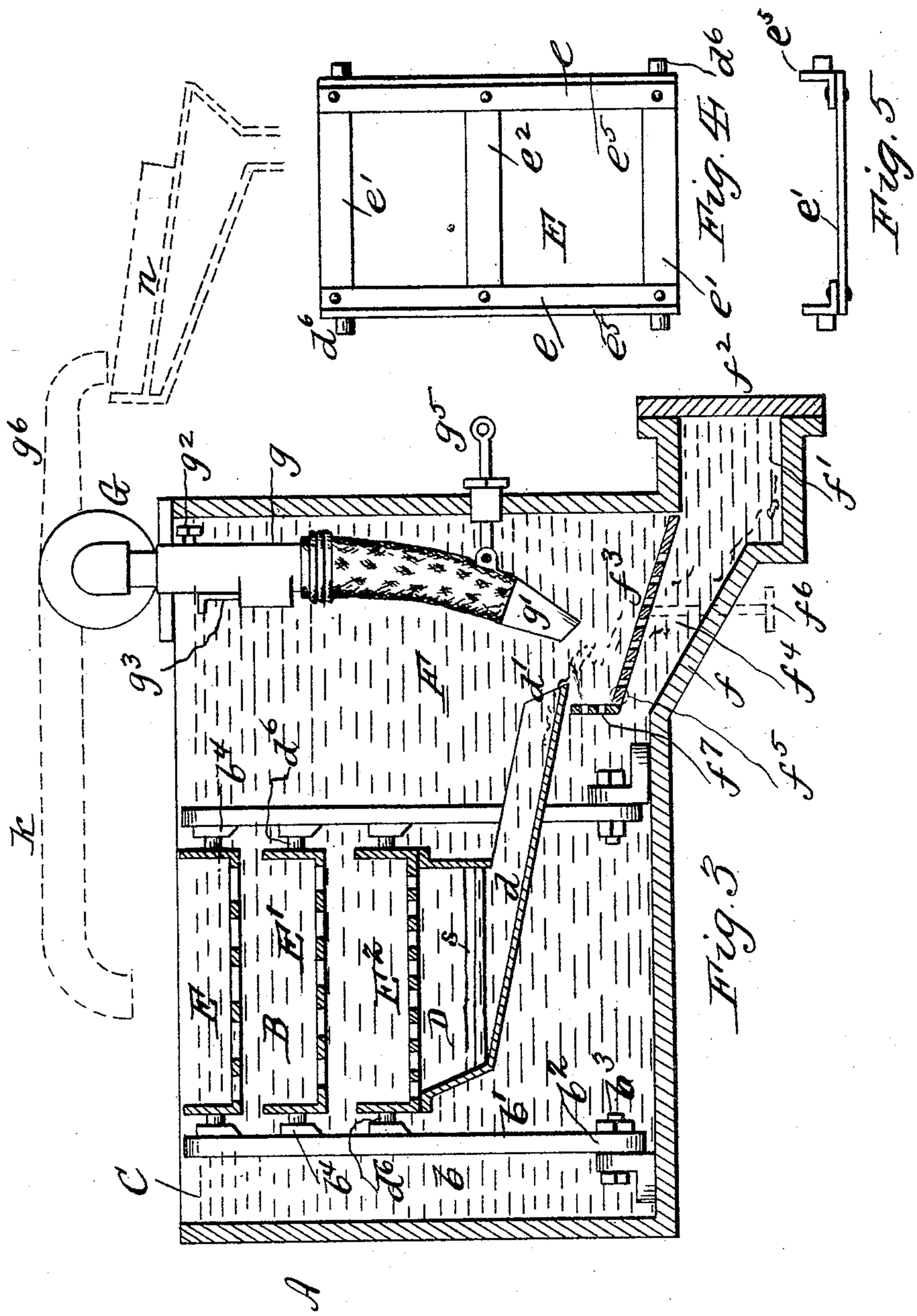

Fig. 3

Fig. 5

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(No Model.) 4 Sheets—Sheet 4.

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Fig. 6

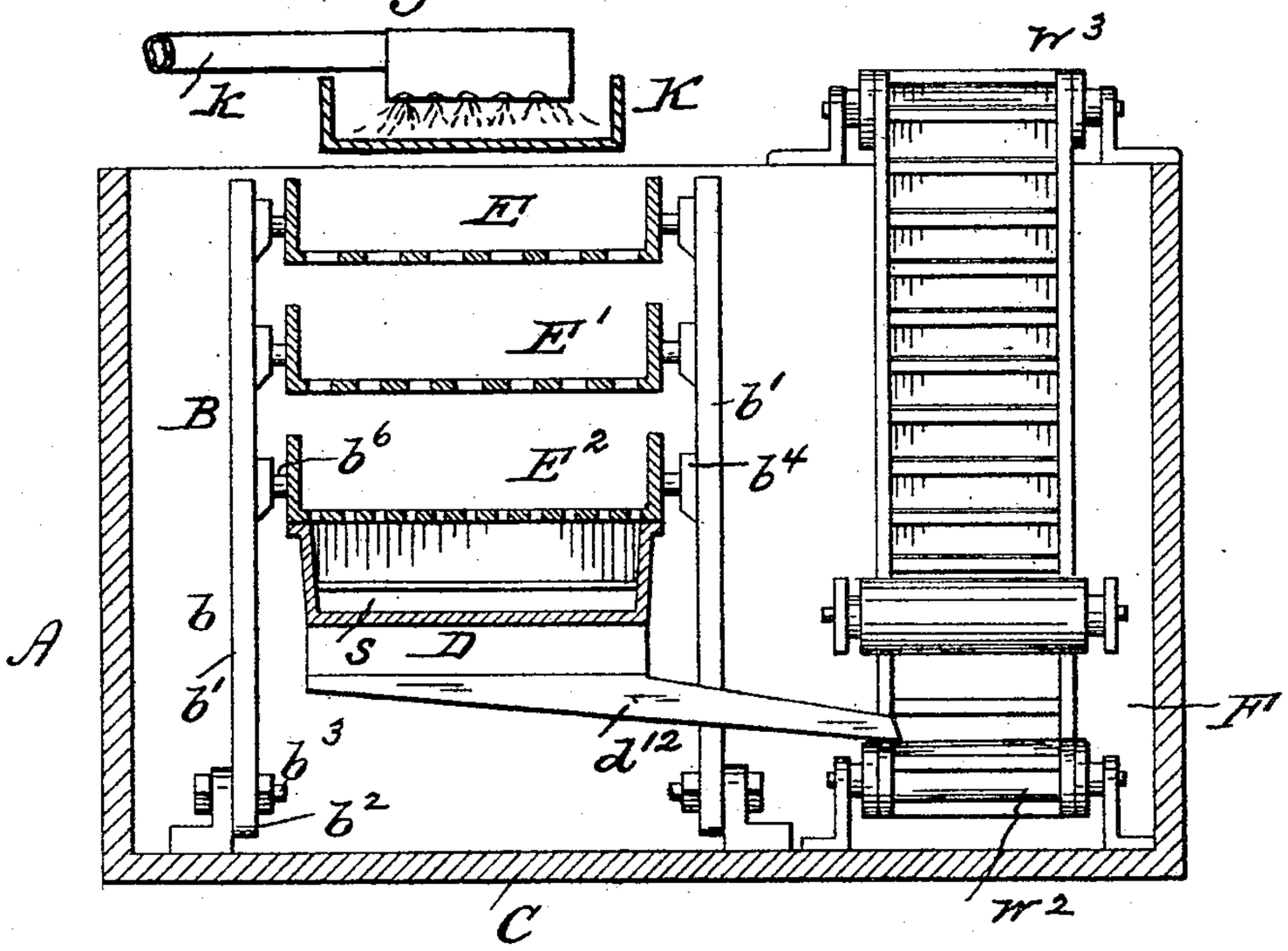
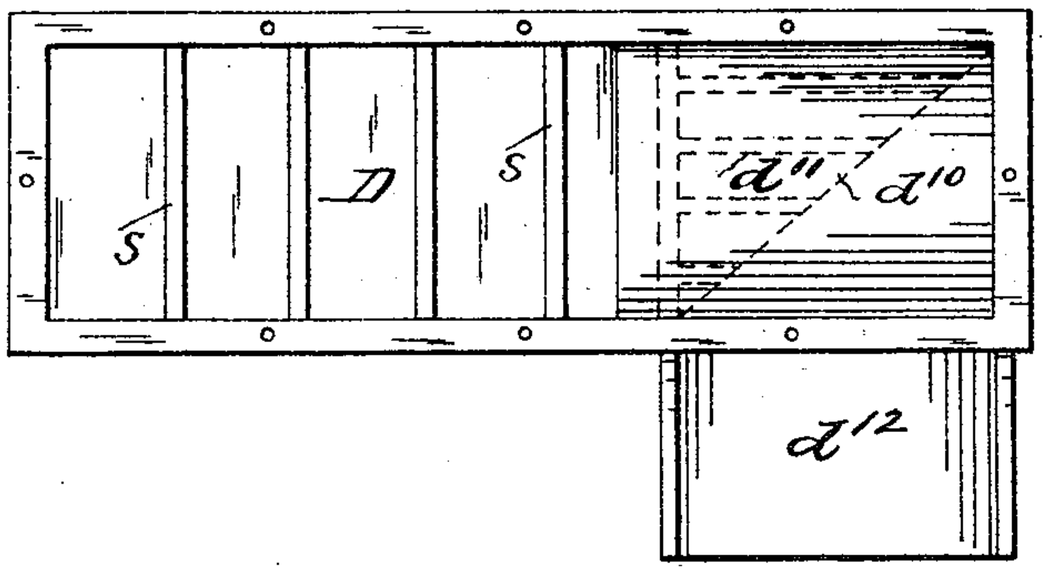


Fig. 7



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UNITED STATES PATENT OFFICE.

CHARLES F. PIKE, OF PHILADELPHIA, PENNSYLVANIA.

ORE WASHER OR CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 529,207, dated November 13, 1894.

Application filed April 6, 1894. Serial No. 506,647. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. PIKE, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Ore Washers or Concentrators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has relation to that type of machines or apparatus for working placer gravel, wherein the gravel is washed by screening it and the screened product is caused to travel over riffle plates for separating the gold from the black-sand.

In profitably working placer gravel, it is necessary to pass large quantities of the dirt or gravel through the machine rapidly, and it is essential that all of the gravel or dirt should be thoroughly washed. As such large quantities of the gravel are passed through the machine, the black-sand contained therein accumulates very rapidly and fills and packs in the riffles which then become inoperative, and then in the further treated or succeeding accumulations the metal passes off with the black-sand and is lost. This occurs in all placer working machines or apparatus wherein riffles are employed, whether such machines be sluice boxes or specially designed machines. The loss of metal due to the packing of the black sand in the riffle diminishes the out-put of the metal or the efficiency of the machine as the recovery of metal is not as large as would be the case if such packing did not take place.

My invention has for its object to avoid such disadvantages, and to this end I keep the black sand alive or in a state of suspension during its passage over the riffles. This is accomplished by giving to the riffles a reciprocating movement below the surface of the water. The screens are also reciprocated to obtain more thorough washing and separation. Said screens and riffle plates are so constructed that their forward movement positively advances the material through the water, and that as they make their return movement, said material is left in a state of temporary suspension above such screens or plates. This successive suspension in water of the material more readily admits of the metal particles falling through the gravel. To effectually accomplish these results, I employ a series of screens which are preferably inclined downward from their feed to their discharge end and are reciprocated through a body of quiescent water, and with these screens I combine a riffle plate, that is to say, an imperforate or non-foraminous plate having riffles at short intervals arranged at right angles to the direction of reciprocation, said plate adapted to receive the fine material (black sand and metal particles) passing through that screen having the finest mesh, the riffles obstructing the step by step forward movement of the material imparted to it by the movement of the plate, which plate acts not only as a catch plate to catch the particles of metal, but also to throw up the material at each movement of the plate in the direction of its discharge, thereby scattering or keeping such material alive in the body of water. By this forward movement and suspension of the gravel, the latter is not only more thoroughly washed, but the metal separates therefrom more rapidly and effectually. Hence large quantities of gravel can be more thoroughly and rapidly washed economically.

To prevent the black-sand filling and packing in the riffles, the riffle plate is inclined correspondingly, and reciprocated in water to repeatedly advance and place in semi-suspension above the riffle plate the black-sand as it is moved along over said plate, allowing the particles of gold to fall freely through the sand back of the riffles, where it remains while the sand is advanced over the riffles. The sand, therefore, does not have any opportunity to pack in the riffles, and they never become inoperative, and such being the case, metal particles do not pass off with the black sand. Hence a larger recovery of metal is obtained.

My invention, accordingly, consists of the combinations, constructions and arrangements of parts as hereinafter more fully described in the specification and pointed out in the claims.

Reference is had to the accompanying drawings, wherein—

Figure 1 is a plan of a washer or concentrator embodying my improvements. Figs. 2 and 3 are sections, partly in elevation, on lines 2—2 and 3—3, Fig. 1. Fig. 4 is a plan, partly broken away, showing preferable construction of a rocking or reciprocating screen for use in the washer and detached therefrom. Fig. 5 is an end view of the same. Fig. 6 is a sectional view, partly in elevation, similar to Fig. 3, showing modified form of one of the concentrating chambers for the washer; and Fig. 7 is a detail plan of part of the same.

A, represents the washer or concentrator, of any suitable form of construction, as shown. It relates to that type of washers wherein the ore is screened in or below a body of water contained in the washer and the black-sand is passed over a riffle plate below the screens, and to this end I locate the screening appliances B within the apartment C, of the washer A.

Any form of screening devices B may be used. In the drawings I have indicated a preferable form of reciprocating or shaking screen device, which consists of any suitably constructed frame *b* having legs or uprights *b'* at its four corners, the lower ends b^2 of which are suitably pivoted at b^3 to the bottom of the vessel C, or to fixtures thereon, so that the upper part of said frame is free to reciprocate.

At suitable intervals on the inner adjacent sides of the posts *b'* are located open top or other suitable sockets or bearings b^4, in which loosely rest pins or studs d^6 attached or projecting from the sides of the screens E, E', E^2, at each end, to loosely support the latter upon the frame *b* so that they will accommodate themselves to the rocking motion of the frame *b*.

In the drawings, three screens E, E' and E^2 are shown, but a more or less number may be used, as desired. The screens E, E', E^2 may be made as desired. A cheap and durable form of the same, and one the parts of which may be cheaply renewed when worn out, may be constructed of angle iron sides *e*, with end and middle cross-pieces *e'* and e^2, respectively, upon which the screen bottom e^3 may be fastened as desired. (See more plainly Figs. 4 and 5.) This construction of screen provides for its being open at both ends, if desired, or only one end may be open and also for having upwardly projecting side edges e^5 to prevent escape of any material off of the screens, except at their discharging ends e^4.

The lowest screen E^2 has beneath its screen bottom a riffle plate D, as shown in Fig. 2, provided with an outlet chute *d* at right angles to the screen, or it may be constructed as shown in Figs. 6 and 7. This chute *d* leads to the receiving chamber F for the materials from riffle plate D, in which is located a discharge device G.

The screens E, E', E^2 and riffle plate D, it will be noted, are inclined downwardly from their receiving to their discharging ends e^4 and *d* respectively. This angle of inclination is preferably such that when the screens are at rest, the ore thereon will not have a descending motion on the screens, due to gravity.

The ore is advanced by the screens and riffle plate in their forward movement. The screens and riffle plate in retreating or in making their return movement withdraw from the ore, leaving it suspended to admit of the metal particles falling freely. The suspended ore in descending is again met, shaken, and advanced by the next advanced movement of the screens and riffle plate, and so on, until the waste-matter or remainder of such ore on the screens is discharged over the screen and riffle plate ends e^4 and *d* respectively. The suspended ore or waste-matter on the screens is subjected, therefore, to successive violent bumpings or shakings.

Owing to the suspension of the gravel and black sand in the water and the rapidity of the rocking or reciprocation of the screens, which may be of a high speed, or as the requirement of service demands, and furthermore, the violent agitation to which the ore is subjected by the screens and riffle plate as well as that due to the friction of the water in which said screens and ore are immersed, effects a thorough washing of the ore for securing a maximum separation of the metal from the ore in a minimum period of time.

It is obvious that the described method of separating metal particles from placer gravel can be effected by means of the described reciprocating riffle plate alone, but in order to expedite the operation and to more effectually and thoroughly separate the metal particles from the gravel and black sand, I combine screens with the riffle plate, as described. This mode of separation is clearly distinguished from the ordinary mode of screening by means of jigger screens which latter mode precludes the effectual working of placer gravel for the reason that the greater portion of the black sand and gold pass through the screen however fine its mesh. I am aware that so-called riffles have been applied to screens, but not for the purpose either of scattering the material and holding it in suspension in the water at each forward movement, to facilitate the separation of the heavier metal particles, or for the purpose of catching such particles, but solely for the purpose of arresting the progress of the material over the screen from time to time so as to prevent such material from passing over the screen too rapidly. The imperforate, or non-foraminous jigger riffle plate not only serves to prevent the material from passing over the screen too rapidly, but also to prevent the black sand from packing behind the riffles by scattering the same at each short forward movement, whereby such sand is held temporarily in suspension in the water to admit of the ready separation of the metal particles therefrom, while the riffles also serve to catch the separated metal particles.

The chamber F may be constructed as desired. In Figs. 1 and 3, it is indicated consisting of a chamber having an inclined bottom f leading into a metal particle accumulating chamber f', having a removable cap or cover f^2. Above bottom f in chamber F is a perforated plate or screen f^3, with a channel or passage-way f^4 between bottom f and screen f^3, for the passage of the concentrations from screen f^3 to chamber f'.

The discharge device G in Fig. 3 is represented as a suction pump. The depending end g of the suction discharge G may be constructed and arranged as desired, or as the requirements of service demand, and its inlet end is vertically adjustable to and from screen f^3, which adjustment may be made in any suitable manner. To provide for an easy and economical construction of tube g to admit of such adjustment, I have represented it as being a rubber hose or tube with a metal or other rigid inlet end g' of oblong shape, corresponding to the width of the screen f^3, from which the waste-matters are discharged, while the metal particles drop through screen f^3 to chamber f'. The tube g is made in sections, so as to slip over one another and are rigidly secured together by set screws g^2 so as to be adjustable. If desired, one of said sections, especially the metal or upper section, may be provided with an opening, covered by adjustable slide g^3 for varying the extent or degree of the suction discharge.

Any suitable adjusting rod or device g^5 may be provided for laterally adjusting the flexible or lower part of the suction pipe g, to alter the position of its inlet end g' to and from the screen f^3.

Adjacent to the outlet ends e^4 of screens E, E′ and E², is an elevator H, the lower part of which, on its side h and bottom h', may be inclosed by a bent plate h^2.

All of the screens E, E′, E² discharge their waste matter into the elevator H, which carries such matter to the chute m, having a hinged lid or removable cover m', with suitable lock m^2, to prevent access thereto by unauthorized persons. This chute m is of an extended length, having cross-riffles m^3 therein to catch any pieces of metal too large to pass through the mesh of screens E, E′, E². The chute m terminates in a perforated or slotted plate or screen m^5, from which the waste-matter escapes while the water falling through the screen m^5 is conveyed by a conductor m^6 back to washer A.

The discharge from pump G leads to a screen n from which escapes any waste-matter not fine enough to pass through the mesh of screen n, while the water and material falling through said screen may be conducted to a separate amalgamator or other concentrator, which, however, is not shown in the drawings, as it forms no part of this invention.

If desired a branch pipe g^7 from the outlet pipe g^6 of pump G may be conducted to the discharge end of elevator H to thoroughly wash the bulky waste of any metal particles adhering to or segregated with such waste-matter.

A separate water supply pipe k may be used for the flume K, feeding the ore to the screens E, E′, E², (see more plainly, Fig. 2,) or said pipe k may be a branch from pump pipe g^6, as indicated by dotted lines Fig. 3.

The discharge end d' of chute d is located a distance above the screen f^3, so that the matter discharged therefrom will have a drop or fall to the screen f^3 for dispersing or spreading the particles of the same to permit the metal particles to easily separate from the waste matter and fall to the screen f^3 before such waste is subjected to the action of the suction discharge. Furthermore, such drop is provided to admit of the introduction of a vertical, perforated plate f^7 between screen f^3 and chute d, for water to circulate through to aid such dispersion or spreading, and if desired, the screen f^3 may be pivoted at its end f^5 and be provided with a supporting and adjusting screw f^6 at its other end for altering its inclination.

The mesh of the screens E, E′, E² may be provided for to suit the requirements of service. In the drawings the screen E² has the finest mesh, that of the screen E′ and E increasing progressively, so that the upper screen has the coarsest or most open mesh.

The frame b is rocked or shaken in any suitable manner. In the drawings such result is obtained by means of a link connection t between frame b and an eccentric t' on a driven shaft t^2.

As all the screens E, E′, E² are located upon the frame b, one above the other, they all shake or rock simultaneously, but as they are located in different planes, the extent of their rocking or shaking varies, the coarsest screen having the greatest extent of motion to have a maximum shaking and the finest screen the least motion to have a minimum shaking.

In Figs. 6 and 7, the riffle-plate D is illustrated as extending to near the discharge end of the screen E, and is provided with transverse riffles s for catching the particles of metal as they travel along its surface. Its outer end d^{10} is cut away at an angle and is provided with small strips d^{11} for distributing or spreading its discharge upon the chute d^{12}, which is fastened to the riffle plate D and rocks therewith.

The operation is as follows: The ore is fed on to the top screen E. All materials too large to pass through its mesh are discharged from its end e^4 on to the elevator H. The material from E falling upon screen E′ is likewise treated and it discharges any waste too large to pass through its mesh on to the elevator H. A corresponding action occurs for the screen E², so that all the waste matters from sub-screens are discharged on to a common elevator H and conveyed by it to the flume or chute m, where it is washed by the water from pipe g^7 before passing through chute m,

so that any metal escaping with such waste is recovered in the riffles m^3 in said chute, while the water from screen m^5 passes back into the washer A. The concentrates from screen E^2 fall upon the riffle plate D, which is subjected to the same shaking movements as the screens. Hence, the concentrates on said riffle plate are subject to the same character of agitations except that they are of a less violent nature; that is, said concentrates are advanced by the forward movement of the riffle plate D, and as the latter retreats from the concentrates when making its return movement, this, together with the resistance offered to such movement of the concentrates by the body of water in which they are treated, keeps them alive or in a state of suspension during their passage down said riffle plate. This active condition of the concentrates prevents the black sand from packing in the riffles *s* and also admits of the metal sinking or falling behind the riffles, accumulating therein, while the lighter particles or waste matter continue their passage along the riffle plate D, due to its shaking movements, until they are discharged on to chute *d*, from which they pass to the concentrating chamber F, or on to belt w^2, which carries such waste-matter to the discharge end w^3 of said belt for further treatment, or otherwise, as desired. The riffles are cleaned up from time to time, as is usual.

I do not confine myself to the construction and arrangements of parts as shown and described, as it is obvious that the same may be variously changed without departing from the spirit of the invention.

What I claim is—

1. The method of separating metal particles from placer gravel, which consists in imparting to the material repeated short advancing movements over a non-foraminous surface immersed in a body of substantially quiescent water, throwing up and scattering or keeping said material alive in the water at the termination of each such movement by interposing obstructions in and at different points of the path of the material, and catching or collecting the heavier metal particles by means of such obstructions, substantially as set forth.

2. In a machine for separating metal particles from black sand in working placer gravel, the combination of a stationary vessel containing a body of water, a riffle plate immersed in said body of water having its riffles at right angles to the plane of motion of such plate, mechanism for reciprocating the plate, and feed and discharge devices, substantially as set forth.

3. In a machine for working placer gravel, the combination of a stationary vessel containing a body of water, a series of screens, one above the other, inclining downwardly from their feed to their discharge ends and having different mesh, mechanism for reciprocating said screens bodily in the direction of their length, a correspondingly inclined riffle plate below the lowest screen and moving with the latter, a discharge device in said vessel for the waste matters from the screens, and a separate discharge device in said vessel for removing the black sand escaping from the said riffle, substantially as set forth.

4. In a machine for working placer gravel, the combination of a vessel containing a body of water, a series of screens one above the other inclining downwardly from their feed to their discharge ends and having different mesh, mechanism for reciprocating said screens, a discharge device common to all of said screens, an inclined receiving trough outside of said vessel for said discharge device, riffles at the upper end of said trough, a screen at its lower end and a reverse inclined trough below said screen leading back to the receiving vessel, substantially as set forth.

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

CHARLES F. PIKE.

Witnesses:

JOHN RODGERS,

S. J. VAN STAVOREN.