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DRY WASHER.

No. 535,144. Patented Mar. 5, 1895.

Fig. 1

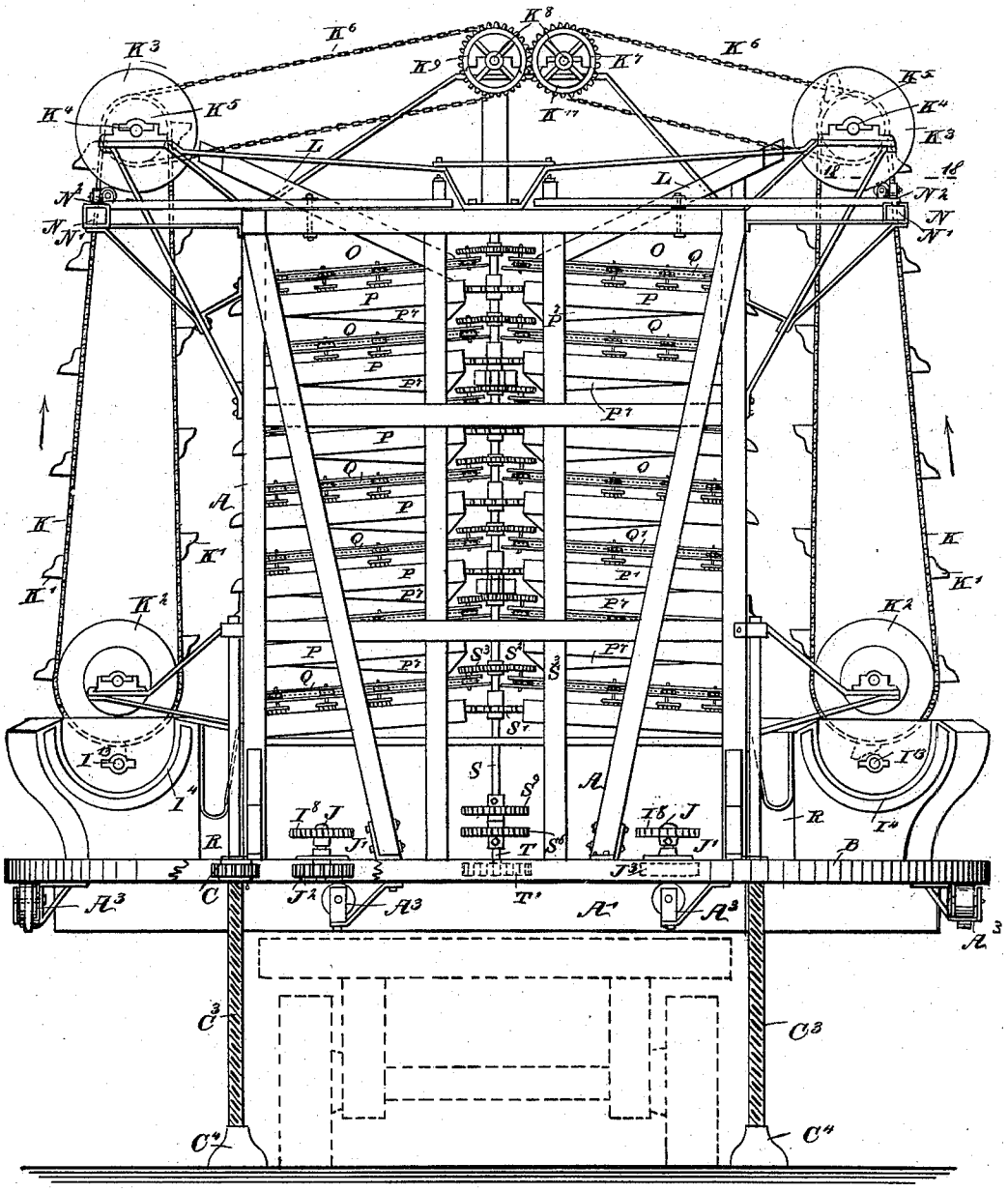

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Fig. 2.

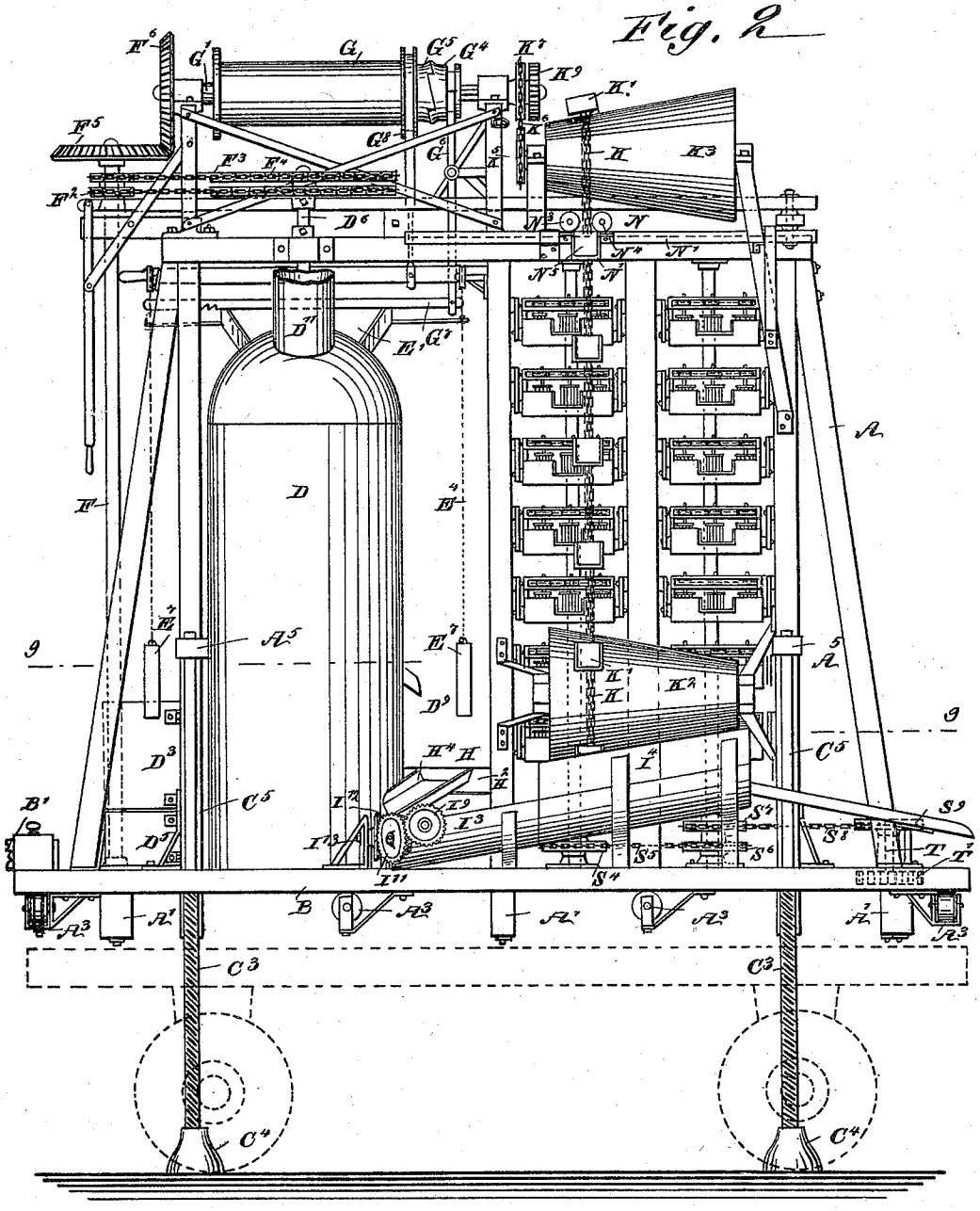

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Fig. 3

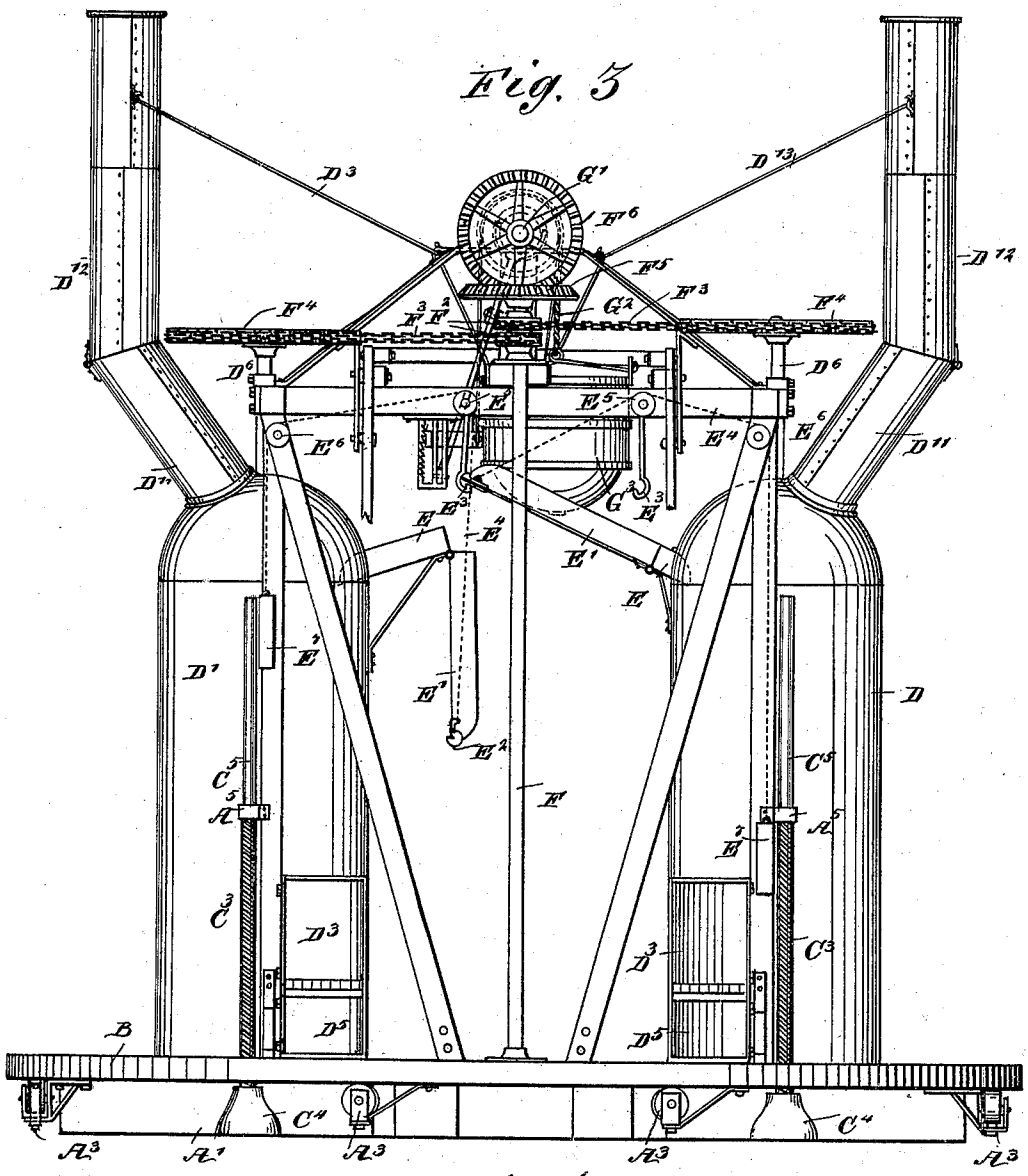

Fig. 4

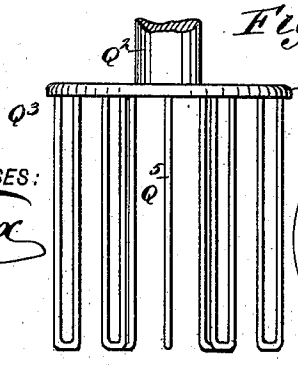

Fig. 5

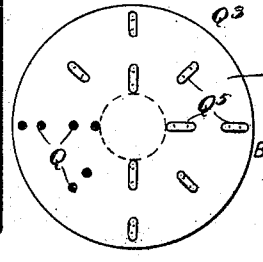

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Fig. 6

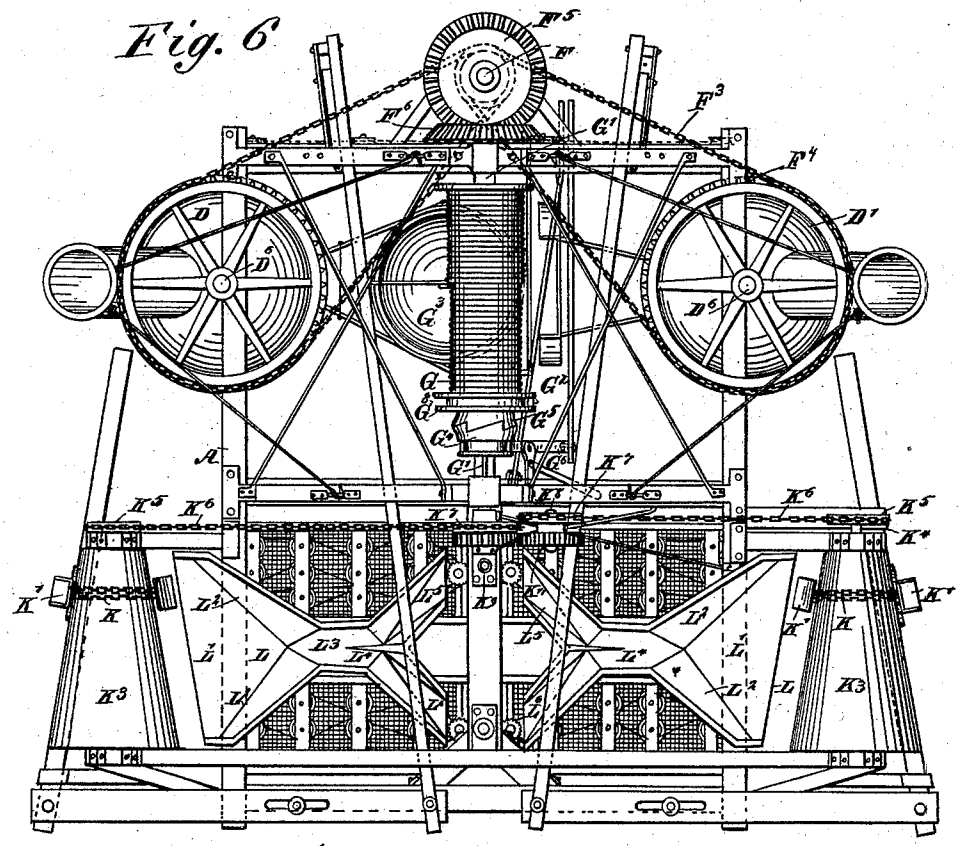

Fig. 7

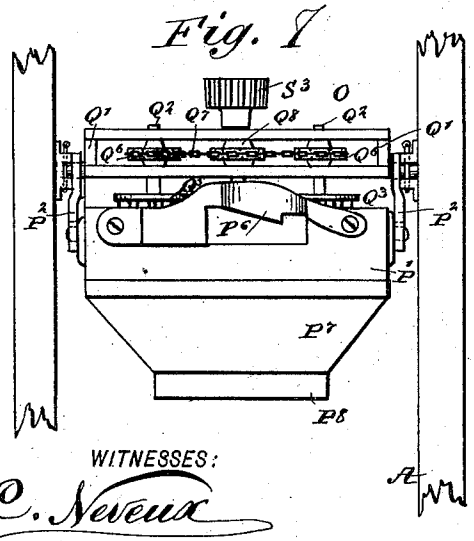

Fig. 8

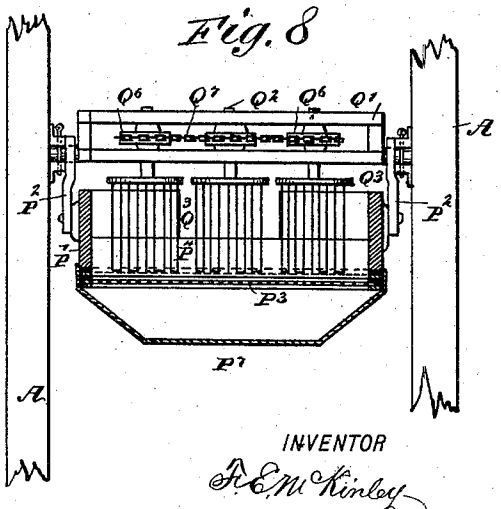

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Fig. 9

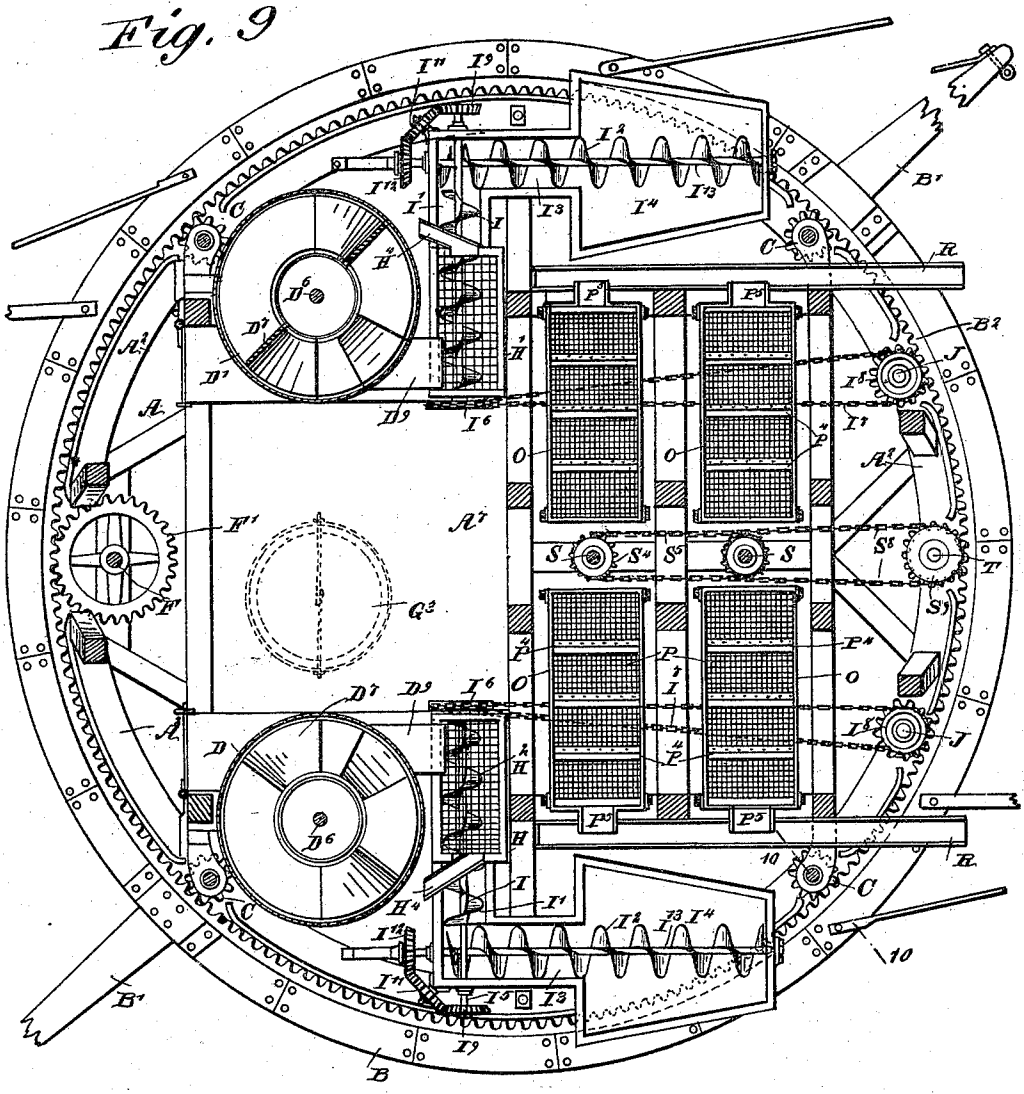

Fig. 10

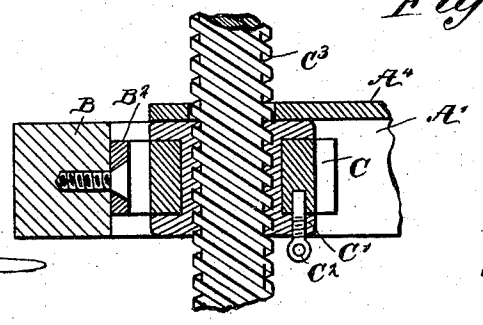

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Fig. 11

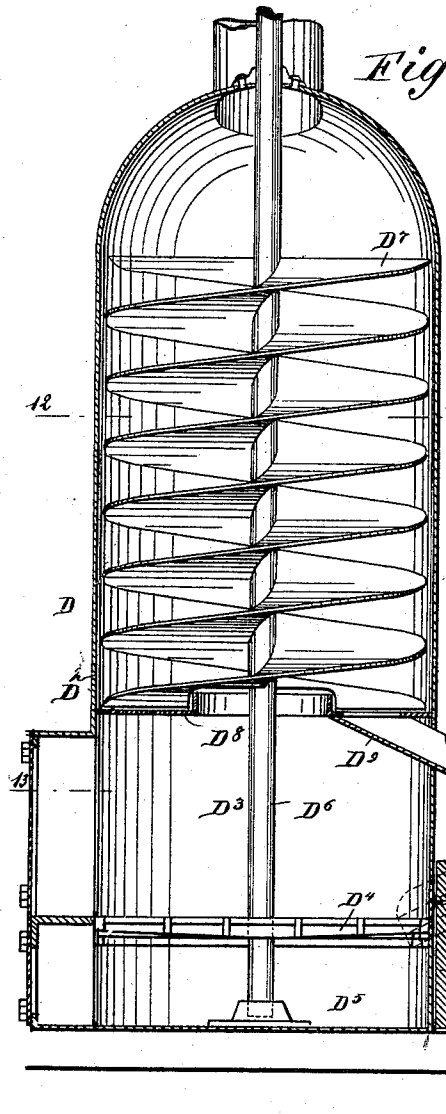

Fig. 12

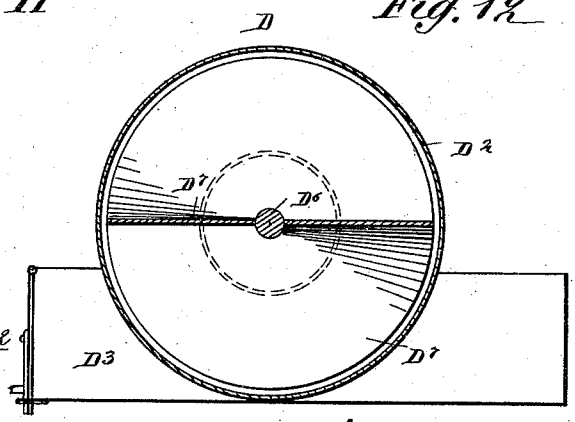

Fig. 14

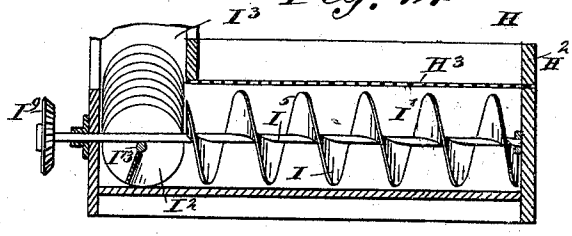

Fig. 13

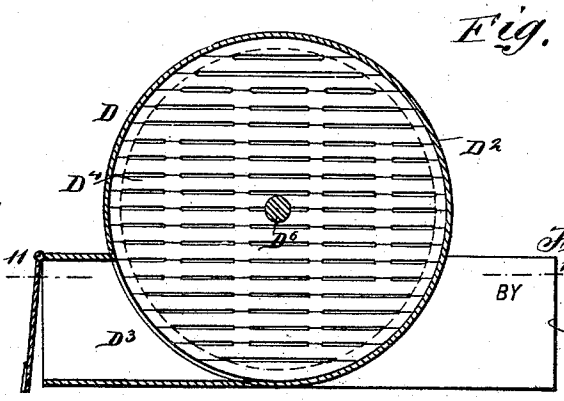

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Fig. 15

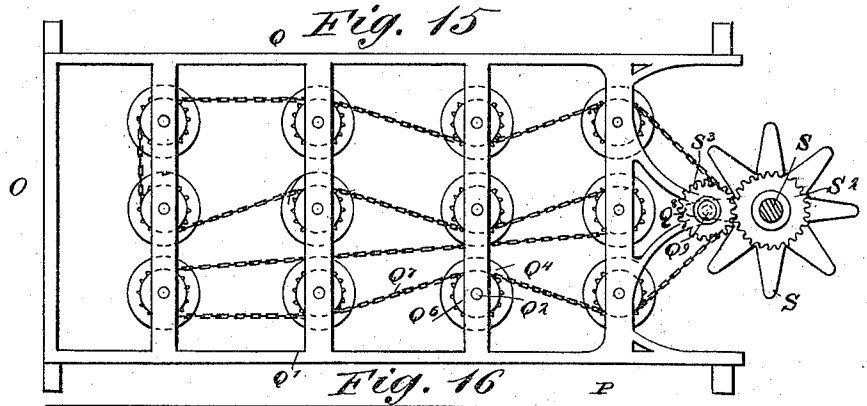


Fig. 16

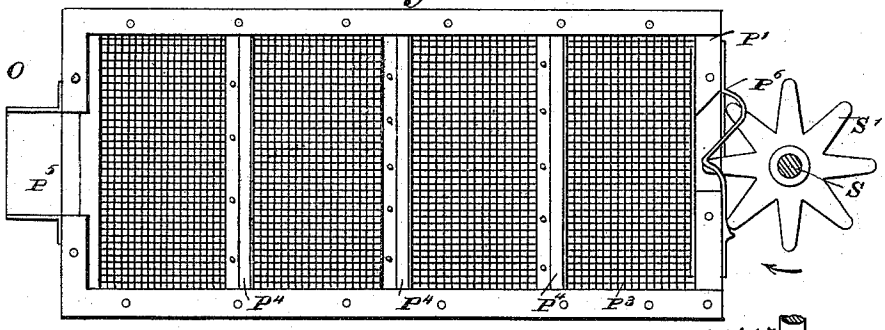


Fig. 17

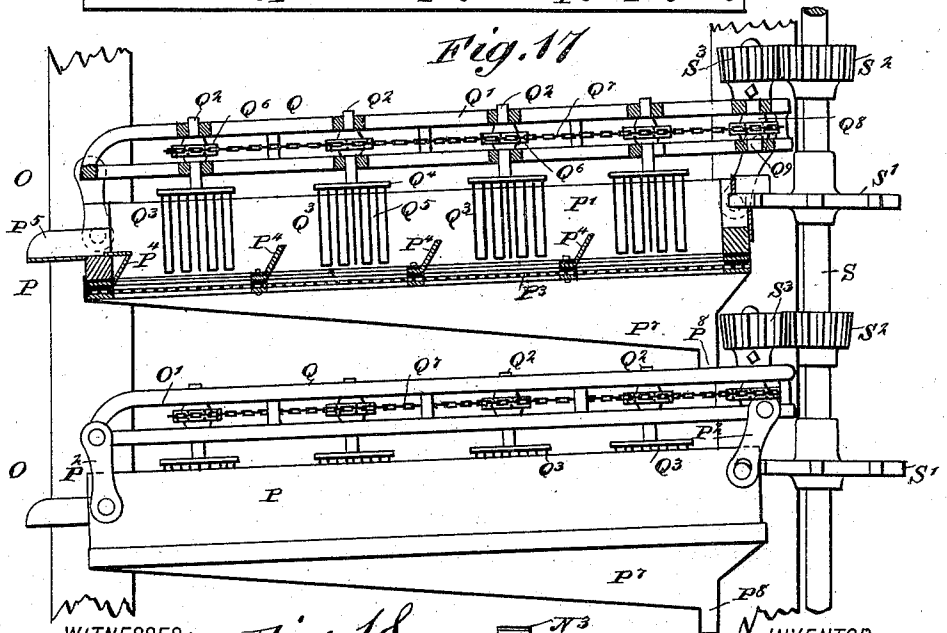
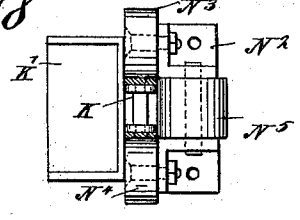


Fig. 18



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UNITED STATES PATENT OFFICE.

FREDERICK EVERHART McKINLEY, OF ALBUQUERQUE, TERRITORY OF NEW MEXICO.

DRY WASHER.

SPECIFICATION forming part of Letters Patent No. 535,144, dated March 5, 1895.

Application filed May 5, 1893. Renewed June 15, 1894. Serial No. 514,703. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK EVERHART McKINLEY, of Albuquerque, in the county of Bernalillo and Territory of New Mexico, have invented a new and Improved Dry Washer, of which the following is a full, clear, and exact description.

The invention relates to machinery for placer mining and its object is to provide a new and improved dry washer which is very effective in operation and arranged to successfully save all the gold, both flour and nuggets contained in the placer sand and without the use of water and quicksilver.

The invention consists principally of a sand roaster discharging into a nugget separating machine leading to conveyers connected by elevators with the uppermost of a series of screens located one above the other, and each provided with riffles to retain the gold and also each provided with an outlet for the tailings.

The invention further consists of a series of graduated screens arranged one above the other and each provided with a hopper discharging into the next lower screen.

The invention also consists of certain parts and details, and combinations of the same, as will be hereinafter described and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a front elevation of the improvement in a raised position to take the machine off the car or other vehicle. Fig. 2 is a side elevation of the same. Fig. 3 is a rear elevation of the same in a lowered or working position. Fig. 4 is an enlarged side elevation of one of the agitators for the screens. Fig. 5 is an inverted plan view of the same. Fig. 6 is a plan view of the top portion of the improvement. Fig. 7 is an enlarged end elevation of one of the screens and agitators therefor. Fig. 8 is a cross section of the same. Fig. 9 is a sectional plan view of the improvement on the line 9—9 of Fig. 2. Fig. 10 is an enlarged sectional side elevation of one of the raising jack screws and adjacent parts on the line 10—10 of Fig. 9. Fig. 11 is an enlarged sectional side elevation of one of the sand roasters on the line 11—11 of Fig. 13. Fig 12 is a sectional plan view of the same on the line 12—12 of Fig. 11. Fig. 13 is a like view of the same on the line 13—13 of Fig. 11. Fig. 14 is a transverse section of the nugget separating device, the section being taken on the line 14—14 of Fig. 11. Fig. 15 is an enlarged plan view of the driving gear for the agitators of a single screen. Fig. 16 is a like view of one of the screens. Fig. 17 is a side elevation with parts in section of a pair of screens and their agitators and mechanism for actuating the same; and Fig. 18 is an enlarged plan view of part of the shifting mechanism for the elevator chains and buckets.

The improved dry washer is mounted on a suitably-constructed frame A provided with bottom cross beams A′ adapted to rest on the ground when the machine is in use as illustrated in Fig. 3. The cross beams A′ support a series of segments A^2 having the center of the frame on their center and supporting on their under sides a number of friction rollers A^3 on which travels a ring B, concentric with the segments A^2 and provided at its inner edge with an internal gear wheel B^2 adapted to impart motion to the several devices of the dry washer, as hereinafter more fully described, the said ring B being preferably set in motion by teams of horses attached to sweeps B′ projecting from the ring at opposite sides as plainly illustrated in Fig. 9.

When the machine is to be moved about from one mining shaft to another, then it is rested on a platform car or similar vehicle indicated in dotted lines in Figs. 1 and 2, and in order to raise the machine off the ground to move the car under the beams A′ and to lower the machine back to the ground when over a shaft I provide the following device: The internal gear wheel B^2 meshes into pinions C (see Figs. 9 and 10) preferably placed equi-distant apart and adapted to be fastened to nuts C′ by means of keys or pins C^2, as plainly shown in Fig. 10. Each of the nuts C′ screws on a jack screw C^3 provided at its lower end with a suitable base or foot C^4 adapted to rest on the ground the upper end of each jack screw being reduced, as at C^5, and the jack screw is mounted in bearings A^4 and A^5 formed or secured on the frame A.

Now, when it is desired to raise the machine from the ground a rotary motion is given to the ring B by the animals pulling on the sweeps B′, so that the internal gear wheel B^2 rotates the several pinions C and likewise the nuts C′, whereby the latter screw upward on the jack screws C^3, thus carrying the frame A and the devices supported thereon in the same direction. When the machine has been raised the desired distance with the feet C^4 resting on the ground, to permit of pushing a car under the beams A′, then the machine is somewhat lowered by turning the ring B in an opposite direction until the said beams A′ rest on top of the car. The machine can now be transported over a mining shaft and when in position, the car is run from under the beams A′ and then the machine is lowered by either turning the ring B in the opposite direction or by withdrawing the pin C^2 to disconnect the pinions C from the nuts C′ to allow the latter to freely rotate on the jack screws C^3 to lower the machine until the beams A′ rest on the ground.

The machine is so located over the mining shaft that an aperture A^7 in the framework, see Fig. 9, is directly over the mining shaft, to admit the bucket for carrying the sand from the mining shaft to the machine, as hereinafter more fully described.

On the beams A′ of the frame A are arranged two sand roasters D and D′, alike in construction, so that it suffices to describe but one in detail. Each sand roaster is provided with a shell D^2 in which is arranged a fire-box D^3 (see Fig. 11), containing in its bottom a grate D^4 leading to an ash pit D^5, the latter as well as the fire-box D^3 being provided with suitable doors for the introducing of fuel or removing of ashes in the usual manner. In each shell D^2 is mounted to rotate the vertically-disposed shaft D^6 carrying above the fire-box D^3 a double spiral D^7 extending with its periphery to the inner surface of the shell D^2, the said spiral terminating at its lower end on a fixed bottom D^8 arranged within the shell D^2 and provided with a downwardly and outwardly extending chute D^9 passing through the side of the shell to the outside thereof, to lead the roasted sand to the nugget separating device, as hereinafter more fully described.

The sand to be treated in the respective sand roasters D and D′ is introduced at the upper end of the shell D^2 through a chute E having a hinged extension E′ adapted to be swung into an uppermost position or permitted to hang down as will be readily understood by reference to Fig. 3. The upper end of each shell D^2 is provided with a smoke stack D^{11} for the discharge of the smoke and gases arising from the burning fuel in the fire-box D^3 and the moisture arising from the sand passing down the spiral D^7 in the shell D^2. As illustrated in Fig. 3, each smoke stack D^{11} is provided with a hinged extension D^{12} which is let down while transporting the machine from place to place, but is held in an uppermost position while the machine is at work by means of rods D^{13} connecting the upper part of the main frame A with the said extension D^{12}. In order to agitate and circulate the sand discharged into the upper end of each shell D^2, I rotate the sand by revolving the shaft D^6 and the spiral D^7 secured thereon and for this purpose I drive the said shaft D^6 from the ring B set in motion by the team of horses, as previously described.

The intermediate mechanism for connecting the ring B with each shaft D^6 is as follows: A shaft F is vertically-disposed and journaled in suitable bearings on the main frame A and carries at its lower end a gear wheel F′ in mesh with the internal wheel B^2 of the ring B. See Fig. 9. On the upper end of the said shaft F are secured two sprocket wheels F^2, each connected by a sprocket chain F^3 with a sprocket wheel F^4 attached to the upper end of the shafts D^6 of the two sand roasters D and D′. Thus, when the ring B is turned a rotary motion is given to the gear wheel F′ whereby the shaft F is rotated, and its motion is transmitted by the sprocket wheels F^2 and F^4, and the sprocket chains F^3 to the two shafts D^6 of the sand roasters D and D′, whereby the spirals D^7 are set in motion, to agitate the sand in the shells, whereby the latter is freed of its moisture by coming in contact with the heat arising from the burning fuel in the fire-box D^3. The sand in a comparatively dried state is finally discharged at the lower end of the spiral D^7 into the chute D^9 to pass onto the nugget separating device.

On the upper end of the shaft F is secured a bevel gear wheel F^5 in mesh with a bevel gear wheel F^6 secured on the drum shaft G′, journaled in suitable bearings on the top of the frame A, and carrying a hoisting drum G on which winds a hoisting rope G^2 carrying a mine bucket G^3 adapted to carry the sand containing the gold, from the bottom of the mining shaft up the latter through the opening A^7 to the upper end of the extension E′ of the chute E, to finally discharge the sand into the said chute to permit the sand to pass into the sand roaster D or D′, for further treatment, as above described.

It is understood that the bucket G^3 may be of any approved construction, preferably, however, of the ordinary construction with drop bottom.

Both extensions E′ of the chutes E for the sand roasters D and D′, are in a lowermost or vertical position during the time the bucket G^3 rises to an uppermost position as illustrated in Fig. 3, and as soon as the bucket has reached this position, the desired extension E′ is swung upward to engage with its catch E^2, a supporting hook E^3 depending from the top of the main frame A, so as to hold the extension in an inclined position, to permit the sand to run from the bucket into the desired sand roaster D or D′. In order to conveniently swing the extension E′ into

the desired position I counterbalance the same, and for this purpose connect the free end of each extension E′ with a rope E^4, passing over pulleys E^5 and E^6 held on the main frame A, the downwardly-extending part of the rope, after leaving the pulley E^6 supporting a weight E^7 to counterbalance the chute.

The drum G is loosely mounted on the shaft G′ but is adapted to rotate with the latter by means of a clutch G^4 mounted to slide on and to turn with the shaft G′ and adapted to engage a like clutch G^5 on the inner end of the said drum G. Connected shifting levers G^6 and G^7 engage the said clutch G^4 to move the latter in or out of contact with the clutch G^5 on the drum G to rotate the latter with the shaft G′ for winding up the rope G^2 and raising the bucket G^3 to lift the sand out of the mining shaft to the extensions E′, as above described. When the clutch G^4 is disconnected from the clutch G^5 then the bucket G^3 is returned empty to the bottom of the mining shaft and in order to guide the movement of this loose revolving drum G I provide the latter with a suitable brake mechanism G^8 under the control of the operator. As this mechanism is of the usual construction no further description is necessary.

The chutes D^9 of the sand roasters D and D′ discharge onto the nugget separating devices H and H′ respectively, alike in construction, and each provided with a box H^2 formed in its bottom with a screen H^3 of a mesh to retain the nuggets, rock, or other large sized material, the latter being finally discharged at one end of the box H^2 through a chute H^4 to one side of the mining shaft on the top of the ground. The fine sand passing through the screen H^3 passes onto a conveyer screw I arranged in a conveyer box I′ held on the main frame A and supporting on its top the nugget screen box H^2. Each conveyer I, see details Figs. 9, 11 and 14, discharges at its forward end onto a second conveyer screw I^2 arranged in an inclined position and passing through a box I^3 at right angles to the box I′ and in communication with the same. The box I^3 connects with a receptacle I^4 in which the sand is taken up by buckets of an elevator as hereinafter more fully described.

The shaft I^5 of each conveyer screw I is provided on its inner end with a sprocket wheel I^6 over which passes a sprocket chain I^7 also passing over a sprocket wheel I^8 secured on the upper end of a short shaft J mounted to turn in suitable bearings J′ attached to the main frame A, the lower end of the said shaft J′ carrying a gear wheel J^2, see Fig. 1, in mesh with the internal gear wheel B^2 of the ring B. Thus, when the latter is rotated a rotary motion is given by the internal gear wheel B^2 to the gear wheels J^2 and consequently to the shafts J′ so that both sprocket wheels I^8 are rotated and this rotary motion is transmitted by the sprocket chains I^7 to the two sprocket wheels I^6 on the two conveyer screws I. The shaft I^5 of each conveyer screw I is provided on its outer end, see Fig. 9, with a bevel gear wheel I^9 in mesh with an idler I^{11} in mesh with a bevel gear wheel I^{12} secured on the shaft I^{13} of the second conveyer screw I^2, so that both conveyer screws I^2 and I, for each nugget separating device H and H′ are rotated simultaneously from the ring B. The sand thus passing through the screen H^3 is moved outward by the conveyer screw I and then transversely forward by the second conveyer screw I^2 into the receptacle I^4.

Into each receptacle I^4 passes the buckets K′ attached to an elevator chain K, so that the sand is taken up by the buckets and elevated to the top of the machine to be finally discharged into a spout L leading the sand to sets of screening devices O hereinafter more fully described.

Each elevator chain K passes with its lower end over a cone pulley K^2 journaled in suitable bearings on the frame A and located directly over the corresponding receptacle I^4. The said chain K also passes over a top cone pulley K^3 secured on a shaft K^4 journaled in suitable bearings on the top of the frame A as plainly illustrated in Figs. 1, 2 and 6. On each shaft K^4 is secured a sprocket wheel K^5 over which passes a sprocket chain K^6 also passing over a sprocket wheel K^7, the two sprocket wheels K^7 being located close to each other and one is secured on the drum shaft G′, while the other is secured on an independent short shaft K^8 extending transversely and journaled in suitable bearings on the frame A.

On the face of the sprocket wheel K^7 on the shaft G′ is secured a gear wheel K^9 in mesh with a gear wheel K^{11} secured on the face of the other sprocket wheel K^7 secured on the shaft K^8. Thus, when the drum shaft G′ is rotated a simultaneous rotary motion is given to the two sprocket wheels K^7, which, by their chains K^6, and the sprocket wheels K^5, rotate the two top cone pulleys K^3, so that the two elevators on the sides of the machine are actuated simultaneously to raise the sand from the receptacles I^4 to the top of the machine and to finally discharge the sand into the inwardly and downwardly inclined chutes L.

In order to shift each elevator chain K on the two cone pulleys K^2 and K^3 arranged with their bases in opposite directions, as will be readily understood by reference to Fig. 2, I provide a shifting device N, see Figs. 1, 2 and 18, having a transversely-extending shifting bar N′ mounted to slide in suitable bearings on the main frame A and carrying a bracket N^2 on which are journaled the two end rollers N^3 and N^4 adapted to engage the side edges of the chain K, and on which bracket is also journaled another roller N^5 adapted to engage the inner face of the said chain, as plainly illustrated in Fig. 18. Now, when the shifting bar N′ is moved transversely inwardly, then the chain K is shifted on the

top cone pulley K^3 from the base toward the apex while the said chain moves toward the base of the lower cone pulley K^2, so that the speed of the traveling chain K is increased. Now, when it is desired to decrease the speed of the traveling elevator chain K, then the shifting bar N′ is moved forwardly to move the chain K toward the base of the top cone pulley K^3 and toward the apex of the lower cone pulley K^2. Thus, the speed of the traveling elevator chain and its buckets can be increased or diminished without increasing or diminishing the speed of the drum shaft G′. It is understood that each receptacle I^4 with its conveyer screw I^2 therein is inclined to correspond with the periphery of the lower cone pulley K^2.

Each of the chutes L (see Figs. 1 and 6) is formed with an inlet L′, having its outer edge parallel to the side of the upper cone pulley K^3, so that the buckets discharge into the said chute L, no matter in what position they are on the top cone pulley K^3. The sides L^2 of the chute are slightly inclined and lead to a central part L^3 into which extends about midway a tongue L^4 dividing the downwardly moving sand into two parts of which one passes to a branch chute L^5 and the other to a branch chute L^6, each discharging at their lower ends into the top of a screening device O of which there are four in number, as will be readily understood by reference to the drawings, and all are alike in construction, so that it suffices to describe but one.

Each of the screening devices O consists principally of a series of graduating screens P located one above the other, and each provided with a hopper discharging into the next lower screen with the exception of the bottom screen of each series, which bottom screen is without a hopper. Each of the screens P is arranged in an inclined position and is provided with an agitating device Q to agitate the material so as to separate the sand from the gold. The screens have different sized meshes, the largest mesh being in the uppermost screen and then the following screens are graduated so that the last or bottom screen is of a, comparatively, very fine mesh.

The screens and agitators are shown in detail in Figs. 7, 8, 15, 16 and 17, and are constructed as follows: Each screen P is provided with a screen frame P′ connected at its sides by links P^2 with the frame Q′ of the corresponding agitating device Q, the said frame Q′ being rigidly attached to posts of the main frame A. Each screen frame P′ is covered on the bottom by a screen proper P^3 on the top of which are secured transversely-extending and slightly inclined riffles P^4, so as to retain the gold in the acute angle of the riffle with the screen. In the lower end of the screen frame P′ is arranged an outlet P^5 on a level with the lowermost riffle P^4 and discharging into a transversely-extending trough R supported on the main frame A, it being understood that all the outlets P^5 on the sides of the machine discharge into the corresponding side trough. See Fig. 1.

In order to impart a swinging motion to each screen P, I attach to the upper end of the frame P′ a cam plate P^6, see Fig. 7, on which operates a star wheel S′ secured on a vertically disposed shaft S, journaled in suitable bearings in the main frame A and containing all the star wheels for the corresponding series of graduated screens located one above the other. When the shaft S is rotated, the star wheel S′ by acting on the cam plate P^6 imparts a swinging motion to the screen frame P^5 as the latter is hung on the links P^2 at the same time the upper end of the frame is slightly raised and dropped by the action of the star wheel on the cam plate, to assist in agitating the material discharged on the screen P^3.

In order to permit the slight raising and dropping of the upper end of the screen frame P′, I form the uppermost links P^2 with elongated slots as indicated in Fig. 17. On the under side of each screen frame P′, except the bottom screen, is arranged a hopper P^7, preferably made of sheet metal and having an inclined bottom leading from the lowermost end of the screen frame inwardly and downwardly, as will be readily understood by reference to Fig. 17, the lowermost end of this hopper being provided with a spout P^8 discharging into the next lowermost screen frame P′, at the upper end thereof.

In order to agitate the material in each screen frame between the riffles P^4 and the ends of the screen frame I provide the agitator Q formed with a series of vertically-disposed shafts Q^2 journaled in the frame Q′ and each carrying at its lower end an agitator Q^3 proper, formed of a disk Q^4 secured on the shaft Q^2 and wire rods Q^5 projecting downwardly from the disk into the screen frame P′ next below, the lower ends of the said agitating rods or arms Q^5 projecting within a short distance from the top of the screen P^3 proper. See Fig. 17. The rods Q^5 are preferably made U-shaped with the ends secured in the disk Q^4, as plainly illustrated in Figs. 4 and 5. On each of the shafts Q^2 is secured a sprocket wheel Q^6 over which passes a sprocket chain Q^7. See detail Figs. 15 and 17. The said sprocket chain, after passing over all the sprocket wheels Q^6 in the frame Q′, finally passes over a driving sprocket wheel Q^8 secured on a shaft Q^9 journaled in the frame Q′ at the inner end thereof. This shaft Q^9 is driven from the vertical shaft S previously mentioned and for this purpose, the shaft S carries a bevel gear wheel S^2 in mesh with a bevel gear wheel S^3 secured on the upper end of the shaft Q^9, so that when the shaft S is rotated, the gear wheels S^2 and S^3 impart a rotary motion to the shaft Q^9, so that the latter, by its sprocket wheel Q^8, imparts a traveling motion to the sprocket chain Q^7, whereby all the sprocket wheels Q^6 in the frame Q′, are revolved simultaneously, thus revolving the agitators Q^3.

Now, it will be seen that on revolving the shaft S a swinging and dropping motion is given to the screen, and at the same time, a revolving motion is given to the agitators, so that the arms or rods Q^5 thereof disturb the material in the screen frame P′, whereby the finer material passes through the meshes in the screen P^3 to the hopper P^7 and from the spout P^8 thereof to the next lowermost screen to be again treated as above described. The heavy metal lodges under the riffle P^4 and is removed therefrom from time to time, whenever the machine is on "cleaned up." The tailings work gradually down in the screen frame P′ to be finally discharged over the outlet P^5 into the corresponding side trough R leading the tailings to the front of the machine. See Fig. 9. In order to prevent any escape of the precious metal in the screens P^3 and riffles P^4, I mount the latter on rubber gaskets on the screen, and also interpose rubber gaskets between the screen and the under side of the screen frame P′. See Figs. 8 and 17.

It will be seen by reference to Fig. 9, that two shafts S are employed for the four sets of screens O, the lower end of the rearmost shaft S being provided with a sprocket wheel S^4 connected by a sprocket chain S^5 with a sprocket wheel S^6 on the front shaft S, the latter carrying in addition, near the lower end, a second sprocket wheel S^7, connected by a sprocket chain S^8 with a sprocket wheel S^9, fastened to the upper end of a short shaft T journaled in the main frame A near the front end thereof and carrying at its lower end, a gear wheel T′ in mesh with the internal gear wheel B^2 of the ring B, so that when the latter is rotated, a rotary motion is transmitted to the gear wheel T′, the shaft T and sprocket wheel S^9, which, by the sprocket chain S^8, and sprocket wheel S^7, rotates the front shaft S. The rotary motion of the latter is transmitted by the sprocket wheels S^6 and S^4 and the chain S^5 to the rear shaft S, so that both said shafts are rotated simultaneously to actuate all the screening devices O simultaneously in the manner above described.

It will be seen that the material in each screening device works gradually downward through the graduating screens P^3, it being understood that the precious metal is retained in each of the screens under the riffles P^4, as above described, the tailings being discharged through the outlets P^5 into the troughs R, as above mentioned. When the machine has run for a certain length of time and it is desired to "clean up," then the machine is stopped and the individual screens P are cleaned to remove the precious metal which has accumulated under the riffles, as before mentioned.

The operation is as follows: When the machine is in place over the mining shaft and the ring B is rotated by the team attached to the sweeps B′, then the motion is given to the several devices by the internal gear wheel B^2 in mesh with the gear wheels, as before described. It is understood that the pinions C rotate loosely as the nuts C′ of the pins C^2 are withdrawn, while the machine is working. The hoisting drum G, by its rope G^2, and bucket G^3, elevates the material from the mining shaft and discharges it into the roasters D and D′, as previously explained, so that the material is finally discharged from the roasters in a comparatively dry state. The nugget separating devices separate the nuggets, rocks and coarser material from the sand, which latter is transported by the conveyer screws I or I^2 to the receptacle I^4 to be then elevated by the buckets K′ to the chutes L which discharge into the uppermost screens of the sets of screening devices O which completely separate the sand and precious metal as above described. Thus, it will be seen that the precious metal is separated from the sand without the use of water or quicksilver and no precious metal whatever is lost in the operation.

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

1. A machine of the class described, comprising a frame provided with friction rollers, a ring mounted to travel on said rollers and provided with an internal gear wheel, a sand roaster provided with means for agitating and moving the sand, and discharging into a nugget separating device, conveyers connected with the said device, elevators connected with the discharge receptacle of the said conveyer, a screening device provided with a series of screens located one above the other, and mounted to swing, and an agitating device arranged within each of the screens, the several parts being operated from the internal gear wheel, substantially as shown and described.

2. In a machine of the class described, the combination with a series of fixed frames, of a series of graduated screens suspended from said frames and arranged the one above the other, each screen being provided with a hopper discharging into the next lower screen, the said screens and hoppers having a longitudinally reciprocating movement and an independent vertical movement, and a series of rotary agitators carried by each fixed frame and arranged in rows within the corresponding screen, substantially as shown and described.

3. A machine of the class described provided with a screening device comprising a series of fixed frames, a series of graduated inclined screens having a swinging motion and arranged one above the other, the upper ends of said screens being suspended from the frames by means of slotted hangers permitting an independent vertical movement, means

for lifting and releasing the upper end of each screen, the said screens being further provided with an inclined hopper secured to and moving with said screen and a spout leading from said hopper and transversely extending inclined riffles arranged in each of the screens, substantially as shown and described.

4. In a machine of the class described, th combination with a fixed frame, a screen frame suspended therefrom, a cam plate secured on the end of the screen frame, and a rotating device acting on said cam plate, of a series of shafts journaled in the fixed frame, a disk secured on the lower end of each shaft, agitating rods or arms projecting downwardly from the said disk into the screen frame, and means for imparting rotary motion to the said shafts, substantially as described.

5. In a machine of the class described, the combination with a fixed frame, of a screen frame containing a screen proper and provided with slotted hangers by which it is suspended from said fixed frame, a hopper secured to the said screen frame and moving therewith, transversely extending riffles secured to the screen proper and inclining forwardly and upwardly, a series of rotary agitators carried by said fixed frame and suspended within the screen the said agitators being arranged to rotate in front of the riffles and means for imparting a longitudinal and a vertical movement to said screen frame, substantially as shown and described.

6. In a machine of the class described, the combination with a series of graduated inclined screens suspended one above the other and each provided with a hopper discharging into the next lower screen and slotted hangers supporting one end of each of said screens, of a cam plate secured on the end of the screen frame and a rotating device acting on said cam plate and imparting a longitudinally reciprocating movement to said screens and hoppers and an independent vertical movement to one end thereof, substantially as shown and described.

7. A machine of the class described, provided with a screening device comprising a screen frame mounted to swing and having a screen proper secured thereto, one end of said screen frame being provided with slotted hangers permitting of a vertical movement, a cam plate held on the end of the screen frame, a star wheel secured on a vertically disposed shaft and adapted to engage with the said cam plate and move said screen frame rearwardly and lift it vertically, and means for rotating said shaft, substantially as described.

8. A machine of the class described provided with an agitating device, comprising a fixed frame, a series of shafts journaled therein, a disk secured on each of the shafts and provided with downwardly projecting arms, a sprocket wheel secured on each of the said shafts, a sprocket chain passing over the several sprocket wheels, a driving sprocket wheel over which said chain passes, a gear wheel secured on the shaft of the driving sprocket wheel, a vertically disposed shaft carrying a gear wheel in mesh with the gear wheel on the shaft of the driving sprocket wheel, and means for rotating said vertical shaft, substantially as described.

9. In a machine of the class described, the combination with a frame provided with friction rollers, of a ring mounted to travel on the said friction rollers and provided at its inner edge with an internal gear wheel, and a sand roaster located on the said frame and provided with a revoluble spiral driven from the said internal gear wheel, substantially as shown and described.

10. In a machine of the class described, the combination with a frame provided with friction rollers, of a ring mounted to travel on the said friction rollers and provided at its inner edge with an internal gear wheel, a hoisting drum journaled in the said frame, and intermediate mechanism, substantially as described, for connecting the said drum shaft with the said internal gear wheel on the ring, substantially as shown and described.

11. In a machine of the class described, the combination with a frame provided with friction rollers, of a ring mounted to travel on the said friction rollers and provided at its inner edge with an internal gear wheel, and a nugget separating device comprising a screen box, and a conveyer screw driven from the said internal gear wheel, substantially as shown and described.

12. In a machine of the class described, the combination with a frame provided with friction rollers, of a ring mounted to travel on the said friction rollers and provided at its inner edge with an internal gear wheel, and an elevator comprising two cone pulleys, an elevator chain passing over the said pulleys, buckets held on the said chain, and intermediate mechanism for connecting one of the said pulleys with the said internal gear wheel, substantially as shown and described.

13. In a machine of the class described, the combination with a frame provided with friction rollers, of a ring mounted to travel on the said friction rollers and provided at its inner edge with an internal gear wheel, and a screening device comprising a screen frame mounted to swing and containing a screen proper, a cam plate held on the end of the said screen frame, a star wheel in engagement with the said cam plate, and means, substantially as described, for rotating the said star wheel from the said internal gear wheel, substantially as shown and described.

14. In a machine of the class described, the combination with a frame provided with friction rollers, of a ring mounted to travel on the said friction rollers and provided at its inner edge with an internal gear wheel, an agitat-

ing device comprising a fixed frame, a series of shafts journaled therein, a disk secured on each of the shafts, and provided with agitating arms, a sprocket wheel secured on each of the said shafts, a sprocket chain passing over the several sprocket wheels, and intermediate mechanism for driving the said sprocket chain from the said internal gear wheel, substantially as shown and described.

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