

Feb. 19, 1935.

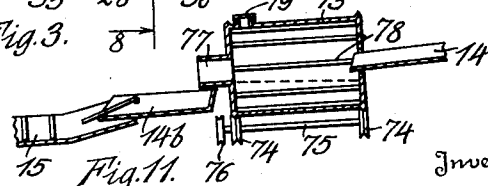
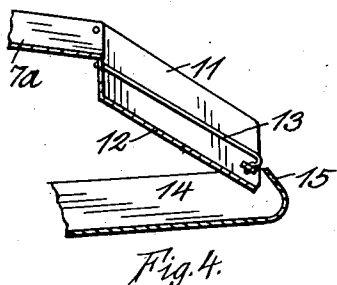
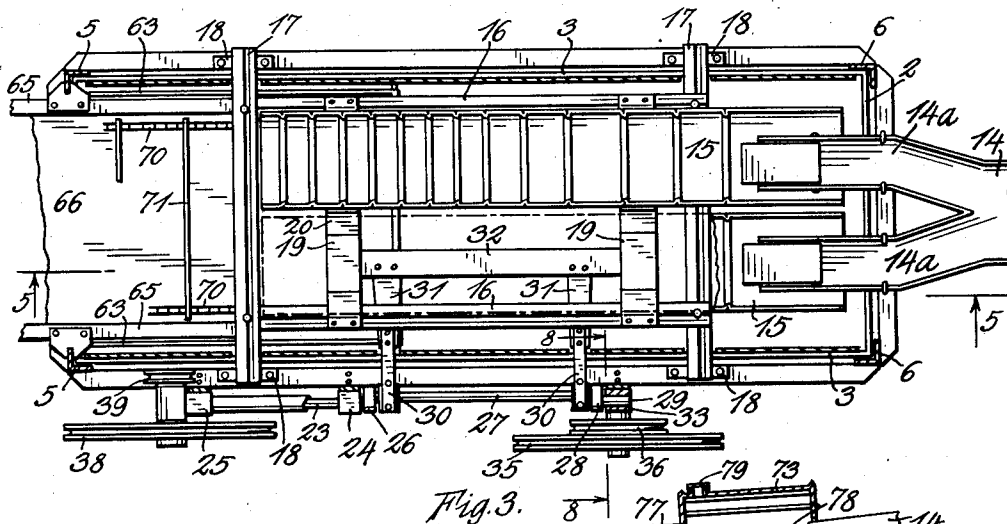
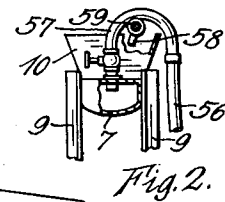
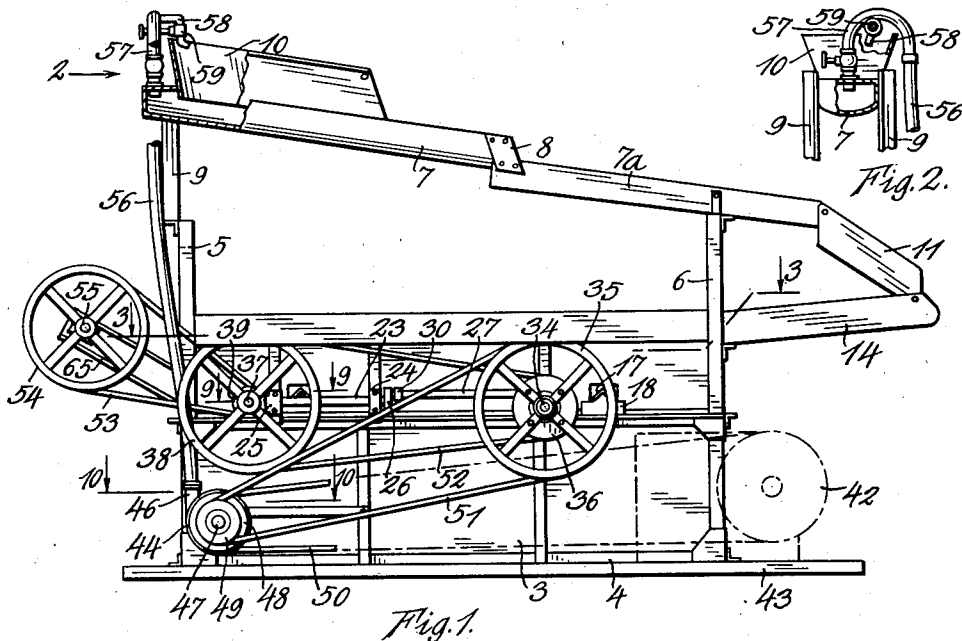
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ORE SEPARATOR

Filed Aug. 20, 1932

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

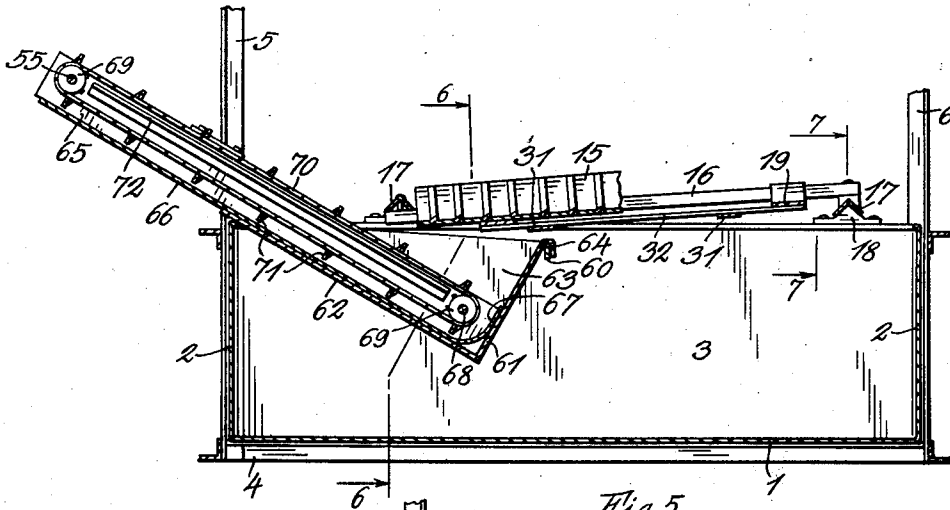


Fig. 5.

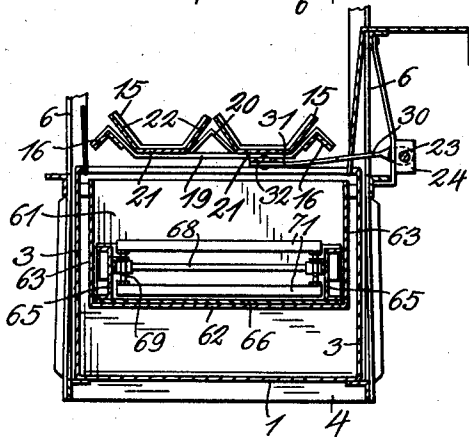


Fig. 6.

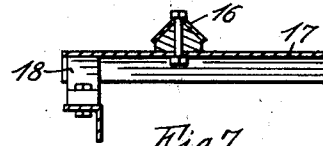


Fig. 7.

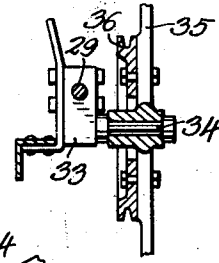


Fig. 8.

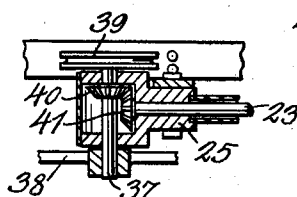


Fig. 9.

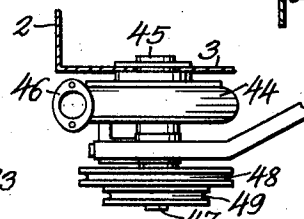


Fig. 10.

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3 Sheets-Sheet 3

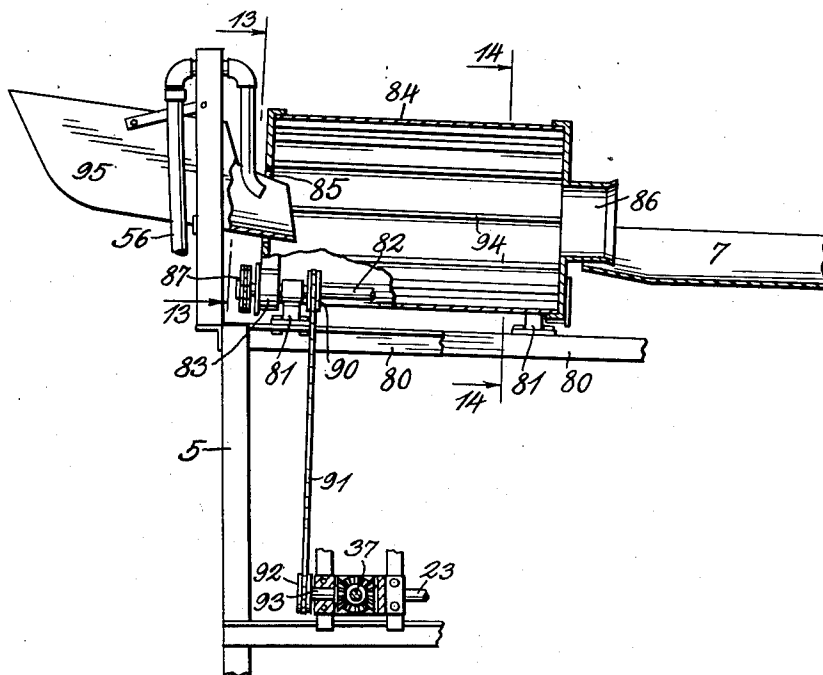


Fig. 12.

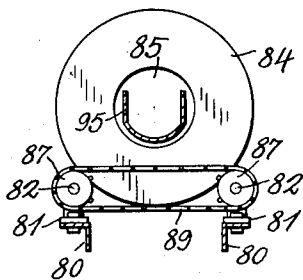


Fig. 13.

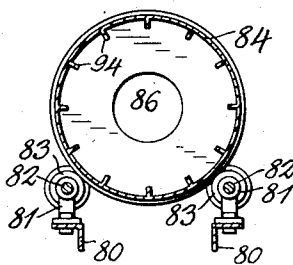


Fig. 14.

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UNITED STATES PATENT OFFICE

1,991,667

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Application August 20, 1932, Serial No. 629,648

1 Claim. (Cl. 210—52)

This invention relates to improvements in placer mining machines and has reference more particularly to a simplified construction of machine that is designed with special reference to water conservation and to transportability.

It has been recognized for a long period of time that the arid regions of this and other countries contain large amounts of gold in placer deposits, either mixed with gravel or with sand. Heretofore it has been difficult, if not impossible, to separate this gold successfully, due to the fact that water is scarce in such regions and no thoroughly successful dry separating method has so far been devised. Mining operations in these arid regions have been greatly limited.

It is the object of this invention to produce a complete placer mining machine of a size and construction that can be readily transported by truck to any desired part and which can be operated with a minimum amount of water, and therefore even where it is necessary to transport the water by truck, extensive mining operations can be carried on.

Another object of this invention is to produce a mining machine that shall be adapted to be operated by power derived from an internal combustion engine or any other prime mover and which will therefore have large capacity and can be operated with the minimum of labor.

This invention, briefly described, consists of a tank that is adapted to contain water and over the top of which are located two riffle boxes that are movable transversely of the tank. Means is provided for reciprocating the riffle boxes and for raising the water from the bottom of the tank to the elevated end of a chute through which the material is fed to the riffle box. The chute is supported above the tank and is provided with means for separating the large particles from the smaller ones. Means is also provided for removing the tailings from the machine and therefore the machine is capable of handling a large amount of material and only requires this material to be fed to the hopper while the machine is in operation.

Having thus briefly outlined the objects of the invention and the structure by means of which these objects are attained, the invention will now be illustrated in its preferred form and for this purpose reference will be had to the accompanying drawings in which the preferred embodiment has been illustrated, and in which:

Fig. 1 is a side elevation of the machine, portions being broken away to better disclose the construction;

Fig. 2 is an end view of the receiving hopper and chute, looking in the direction of arrow 2, Fig. 1;

Fig. 3 is a section taken on line 3—3, Fig. 1 with one of the riffle boxes removed;

Fig. 4 is a section through the grizzly that is employed for separating the larger particles from the finer ones;

Fig. 5 is a section taken on line 5—5, Fig. 3;

Fig. 6 is a section taken on line 6—6, Fig. 5;

Fig. 7 is a section taken on line 7—7, Fig. 5;

Fig. 8 is a section taken on line 8—8, Fig. 3;

Fig. 9 is a section taken on line 9—9, Fig. 1;

Fig. 10 is a section taken on line 10—10, Fig. 1;

Fig. 11 is a section through a portion of a modified machine showing a rotating agitator interposed in the chute between the grizzly and the riffle box;

Fig. 12 is a view partly in side elevation and partly in section and shows a combined rotary feed hopper and stirring-device;

Fig. 13 is a section taken on line 13—13, Fig. 12; and

Fig. 14 is a transverse section taken on line 14—14, Fig. 12.

In the drawings reference numeral 1 indicates the bottom of a tank which is provided with ends 2 and sides 3. This box is supported in and rests on a frame made from angle irons and which has been indicated in a general way by reference numeral 4. No attempt will be made to describe the construction of this frame with any greater particularity than absolutely necessary to explain the operation and construction of the machine. The frame is provided at each corner with a vertical corner post and those at the front end of the machine have been designated by reference numeral 5, while those at the rear end have been indicated by reference numeral 6. These posts extend over the top of the tank in the manner shown in Figs. 1 and 5 and are adapted to support a chute 7 that is employed for feeding the material to the riffle box. The chute consists of several sections, the two upper ones having been designated by reference numerals 7 and 7a. It will be seen from Fig. 1 that chute section 7a is slightly lower than the one indicated by reference numeral 7 and the two are connected by plates 8. The front end of chute section 7 is supported on a frame work having side members 9 and is provided with a hopper 10 into which the material to be separated is fed, either by means of a conveyor or by being shoveled into the same by hand. At the lower end of section 7a, there is a separator section 11 which has been shown

in longitudinal section in Fig. 4 and which consists of a sheet metal chute having a bottom 12. Intermediate the upper edge of the sides and the bottom 12 are located a number of parallel bars 13 that form a grizzly which serves to separate the larger materials from the smaller. At the lower end of section 11, a chute 14 is placed, and this has its rear end turned upwardly as indicated by reference numeral 15, so that the material that has passed through the grizzly between the bars 13 will be discharged into the chute 14 and transported by it to the upper end 15 of a riffle box. From Fig. 3, it will be seen that chute 14 is forked or divided so as to form two narrower chute sections 14a. Each of these narrow chute sections discharges into the upper end of a riffle box in the manner shown in this figure. The riffle boxes are supported by a frame work comprising two parallel angles 16 that are connected by transverse angles 17. The angles 17 are longer than the width of the tank and project beyond the sides of the same. The upper edges of the tank or the frame work surrounding the same are provided with bearing blocks 18 like those shown in Fig. 5 and on which the angles 17 are supported. The construction is such that the frame comprising members 16 and 17 can be reciprocated transversely of the tank. For the purpose of supporting the riffle boxes, two wide metal supporting members like those designated by reference numeral 19 are provided and these extend across the frame and have their ends secured to the side members 16 in the manner shown in Figs. 3 and 6. At the center members 19 are bent upwardly as indicated by numeral 20 in Fig. 6, or a separate angle member can be secured to their upper surfaces in such a way as to form saddles in which the riffle boxes 15 are supported. The riffle boxes are preferably formed from copper or some other suitable material and have flat bottoms 21 and inclined sides 22. The bottoms and the sides are provided with transverse riffles or ribs, whose upper walls are vertical and whose lower walls may be inclined. The function of the riffles or ribs is to retain the gold and other heavy material that is present in the material that is treated.

For the purpose of reciprocating the riffle boxes, a shaft 23 has been mounted for rotation in bearings 24 and 25, and one end of this shaft is provided with a crank disk 26 to which an elongated crank pin 27 is secured. The other end of the crank pin 27 is connected with a crank disk 28 and has a pivot pin 29, which is in axial alignment with shaft 23. Connecting rods 30 are rotatably connected with the crank pin 27 at their outer ends and have their inner ends 31 connected to a bar 32 that extends from one of the supporting members 19 to the other, as shown in Fig. 3. When shaft 23 is rotated, a frame comprising members 16 and 17 will be moved back and forth and this will impart a corresponding movement to the riffle boxes for the purpose of facilitating the separation of the gold from the nonmetallic particles. A bearing block 33 is attached to the upper frame member and has an opening that serves as a bearing for the pin 29 and is also provided with a stub shaft 34 on which is rotatably mounted a pulley 35. Pulley 35 has attached to its inner surface, a smaller grooved pulley 36. One end of shaft 23 is journaled in a bearing block 25 and this block is also provided with bearings for a shaft 37 like that shown in Fig. 9. Secured to the outer end of this shaft is a large grooved pulley 38 and secured to the inner end is a smaller grooved pulley which has

been designated by reference numeral 39. Box 25 has a recess or opening in which are located two bevel gears. The bevel gear marked 40 is secured to shaft 37 while the one marked 41 is secured to shaft 23. Whenever shaft 37 is turned, it will produce rotation of shaft 23 and as a result of this the riffle boxes will be reciprocated transversely of the tank in a manner quite clear from the drawings.

For the purpose of operating the machine a motor which may be either a gasoline engine, or an electric motor, and whose belt wheel has been designated by reference numeral 42, is connected to the base 43 on which the machine is mounted. A pump 44 of the impeller or centrifugal type is secured to the outside of the tank and has a tubular portion 45 extending into the tank near the bottom. Member 45 serves as the intake port of the pump and the part designated by reference numeral 46 is the outlet port. The pump shaft 47 has secured to it two grooved pulleys 48 and 49. A belt 50 connects the belt pulley 42 of the engine with the larger pulley 48 on shaft 47 and another belt 51 connects the pulley 49 with pulley 35. A belt 52 connects the pulley 36 with pulley 38, while a belt 53 connects the pulley 39 with a pulley 43 and is secured to the outer end of shaft 55 for the purpose of operating the cleaning conveyor. Extending upwardly from the outlet opening 46 of the pump is a hose or pipe 56, whose upper end terminates in a gooseneck-like pipe section 57. One end of this pipe section extends through the covering of the sluice section 7 and terminates on the inside thereof, and when the pump is operating, water is delivered to the upper end of the sluice box from the tank or reservoir. A branch pipe 58 extends into the feed hopper and is provided with a valve 59 by means of which the quantity of the water that passes through this branch section can be controlled.

Extending transversely of the tank is a bar 60 like that shown in Fig. 5 and supported from this bar is a triangular tank having an end member 61 and a bottom 62 and sides 63. The upper end of member 61 is provided with a hook portion 64 to engage the transverse rod 60 while the upper end of bottom 62 rests on the end of the tank as shown in Fig. 5. Located within the tank that has just been described is a conveyor. This conveyor consists of two parallel channel irons 65, whose lower flanges are connected by a metal sheet 66 that forms the bottom of the conveyor. The lower end of bottom member 66 is bent upwardly as indicated by reference numeral 67. A shaft 68 extends through the two side channels at the bottom and this is parallel with shaft 55 which is similarly located at the top. Shafts 55 and 68 are each provided with two sprocket wheels 69 that cooperate with sprocket chains 70. The chains are provided at spaced intervals with transverse bars 71 that serve to carry material upwardly along the upper surface of the bottom member 66. Angles 72 secured to the inner surfaces of the channels serve to support the conveyor in the manner shown in Fig. 5. When the machine is operating, the conveyor is moved in such a way that the bars that are directly above the bottom 66 move upwardly and therefore any gangue that is deposited in this box will be carried out and deposited on the tailings pile.

Attention is called to the fact that the upper end of inclined sides 63 is somewhat below the top of the tank and therefore the water within the box formed in part by sides 63 can overflow

from this box into the tank without spilling over the sides of the latter.

From the above description it will be seen that when the machine is constructed as above described and the parts are operated by means of a motor, the pump will function to raise water from the tank to the upper end of the chute section 7 and also into the hopper 10. This water will carry with it the gravel or sand that is to be treated and when this reaches section 11, the larger particles will be separated by the grizzly comprising the bars 13. The smaller particles of the mixture will enter the chute 14 and after being divided will pass through the branches 14a onto the upper ends of the riffle boxes. When the other parts are operating, the riffle boxes will be moved back and forth by the action of the crank pin 27 and this will agitate the material and cause the heavier particles to settle to the bottom. The heavy particles, such as gold, will be detained by the transverse riffles, while the gangue will pass over and be deposited in the box containing the conveyor. The solid material that is rejected by the riffle boxes will finally be carried out by the action of the conveyor.

When the machine above described is operated by an internal combustion engine or an electric motor, it is capable of continuous operation and will handle a large amount of material. The water is drained from the gangue or tailings before the latter leave the tank and therefore the consumption of water is very small compared to other methods of placer mining, and where the sand contains flour gold to such fineness that it will usually float off with the water when treated in the ordinary way with large amounts of water, the flour gold will accumulate in the tank in the form of a scum or as a sediment and can therefore be collected and saved. After the material has been run for a considerable length of time, the riffle boxes are cleaned and the tank may also be cleaned and the settlings therein subjected to further separation if desired.

It is sometimes desirable to agitate the mixture after it leaves the separator 11 and when such a construction is desired, the chute portion 14 is separated and a rotating drum 73 interposed between the two sections in the manner shown in Fig. 11. This drum may be mounted on grooved wheels 74 secured to a shaft 75. One end of this shaft is provided with a pulley 76 and this can be connected by means of a belt to any extent of the shaft 29, which construction has not been shown, but which can easily be understood from the present drawings without further explanation. Drum 73 has a discharge opening 77 through which the material passes onto the chute section 14b and from these onto the riffle boxes in the manner indicated. The inner surface of drum 73 may have longitudinally extending ribs 78 to facilitate the agitation of the material. A clean out opening provided with a cap 79 is preferably provided near the lower end of the drum and when the latter is to be cleaned, this opening is brought to the bottom of the drum and the cap removed.

In Figs. 12, 13 and 14, a modified form of feed hopper has been illustrated. The corner posts 5 and 6 on each side are joined by angle iron frame members 80 to the horizontal flange of each of these are secured to bearings 81. A shaft 82 is journaled in each pair of bearings. Each shaft has two flanged wheels 83 which support a drum shaped feed hopper 84. Drum 84 has an intake opening 85 and a discharge opening 86; the latter terminating in such a position that it will discharge into the upper end of chute section 7. The ends of shafts 82 are provided with sprocket wheels 87 that are connected by means of a sprocket chain 89. One shaft 82 has a sprocket wheel 90 that is connected by means of a chain 91 with the wheel 92 secured to the outer end of shaft 93. When the wheel 38 rotates, it will also rotate the drum in a manner quite apparent. The inner surface of drum 84 has a number of parallel ribs 94 that serve to break up and separate the gangue particles before they are delivered onto the chute 7. A hopper 95 is provided and serves to direct the material into the drum 84 in the manner shown in Fig. 12. Pipe 56 delivers water to the drum and this water passes over the chute and is finally returned to the storage tank.

The arrangement of parts shown in Fig. 12 is a substitute for the feed hopper 10 shown in Fig. 1 and is intended to be included where the broad term "feed hopper" is used.

From the above description it will be seen that the machine that forms the subject of this invention is of a simple substantial construction and is so built and designed that it can be readily loaded onto a truck and transported to any place desired. Due to the reemployment of the water, a small quantity of water will suffice for a long period of operation and therefore the machine is well adapted for use in dry regions.

This application is a continuation in part as to certain common features shown in application Serial No. 576,046, filed November 19, 1931.

Having described the invention what is claimed is:

A water recovery device for use with placer mining machines in which gangue and metallic particles are mixed with water, comprising a water storage tank, a water receiving tank located in the storage tank adjacent one end thereof for receiving the gangue and water to be separated, the receiving tank having a substantially flat, inclined bottom, vertical sides and an end member that is higher than the sides which are widened adjacent the end member, interconnecting means between the water storage tank and the end of the receiving tank that is located within the storage tank for supporting the latter with the upper edge of the end member below the top of the storage tank whereby water may overflow from the receiving tank into the storage tank, the bottom of the receiving tank extending over the end of the storage tank, and a conveyor device located in the receiving tank for removing gangue therefrom.

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