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MACHINE FOR SEPARATING MINERALS FROM ORE BEARING MATERIALS.

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1,319,790.

Patented Oct. 28, 1919.

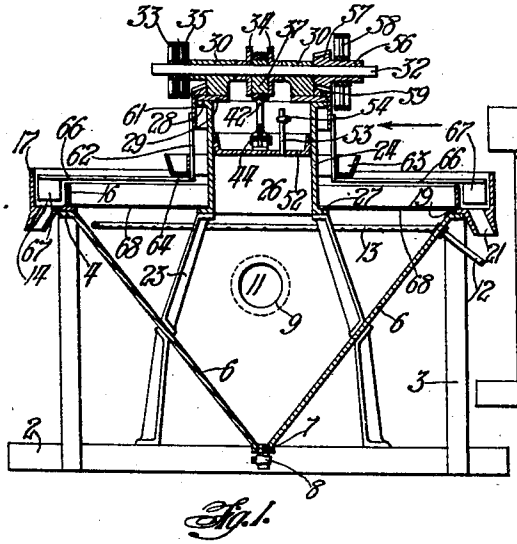


Fig. 1.

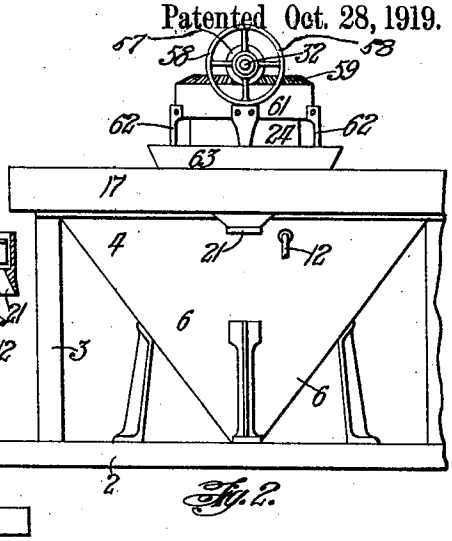


Fig. 2.

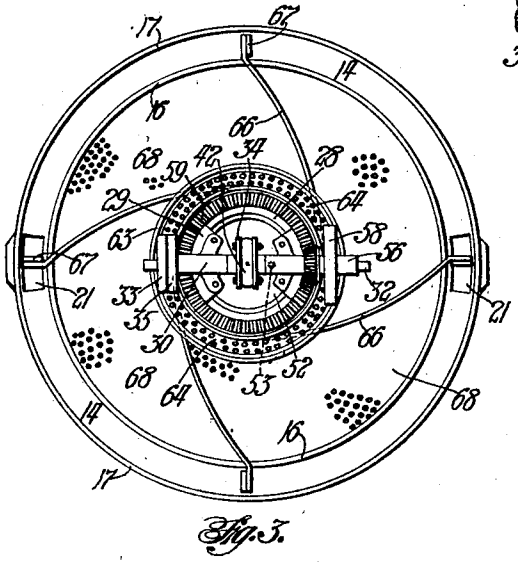


Fig. 3.

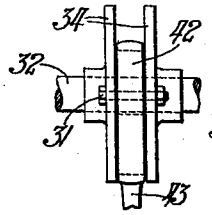


Fig. 4.

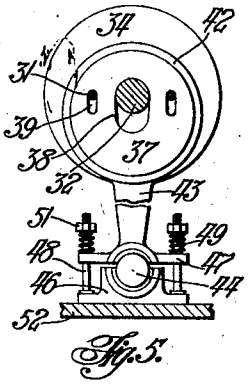


Fig. 5.

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MACHINE FOR SEPARATING MINERALS FROM ORE-BEARING MATERIALS.

1,319,790. Specification of Letters Patent. Patented Oct. 28, 1919.

Application filed April 9, 1919. Serial No. 288,836.

To all whom it may concern:

Be it known that I, RICHARD PICKUP PARK, a subject of the King of Great Britain and Ireland, and a resident of the city of South Melbourne, a suburb of the city of Melbourne, in the county of Bourke, State of Victoria, Commonwealth of Australia, (whose post-office address is 317 City road, in the said city of South Melbourne,) have invented a certain new and useful Improved Machine for Separating Minerals from Ore-Bearing Materials, of which the following is a specification.

This invention relates to the separation of minerals from ore bearing materials and particularly to that method or process commonly known as separation by pulsation. Various means have been employed for carrying out such methods of separation by pulsation, the most popular apparatus consisting of a tank divided into a number of sections containing a grating and having a well beneath it. The material to be treated has been delivered onto the grating which has been submerged in water in the tank, the water being then agitated by means of pumps situated within the tank causing the water to pulsate through the material upon the gratings until the sand or foreign matter has been removed from the heavier mineral which falls through the grating into the tank and thence to the well where it may be recovered as desired. The sand and lighter matter has been removed by scrapers arranged to enter the top of the tank to assist the flow of such material over the edges of the tank which is caused as aforesaid by the pulsation or agitation of the water by the pumps and the admission to the tank of regular supplies of additional water.

The principal objection to such systems has been that the pumps have been detrimentally effected owing to the necessity of operating in impure water. The cost of the apparatus has also been a drawback and a further objection has been the loss of mineral due to the sand and lighter matter moved by the scrapers carrying a percentage of valuable ore with it when passing over the edges of the tank.

The object of the present invention is directed to removing the objections set out and to produce a compact and highly efficient machine whereby tin, gold and other minerals may be economically and effectively separated from granulated or pulverized ore bearing material, and to provide a machine in which the pump and its working parts are entirely free from water, sand and foreign matter during the operation of the machine.

The liquid used in separation is not according to the invention subjected to a violent or irregular pulsation, being on the contrary moved with a regular ebb and flow which has been found to be more effective in obtaining separation with the loss of a minimum of mineral. The regular ebb and flow movement is obtained by means of a cushion of air which is successively compressed and expanded between the piston of an air pump and the surface of the water within the tank so that on each outstroke of the piston the water or liquid is forced through the ore bearing material and on each instroke recedes with an even and regular ebb and flow which freely separates out the lighter material which is gradually suspended and then floated over the sides of the tank, the heavier mineral falling through a suitable grating into the tank where it may be recovered at will.

An important feature of the invention resides in the provision of a controllable air vent to the air chamber between the piston and the surface of the liquid whereby the degree of compression of the air cushion may be regulated as desired and the pulsation or displacement of the liquid within the tank thus varied to suit materials of different specific gravities.

In addition to the above features the invention includes the use of a rotary feed by which the delivery of mineral bearing material into the tank is facilitated. A further advantage resides in the use of scrapers to remove the sand and overflow material as the feed rotates which results in a constant and measured quantity of material being treated in a regular effective manner in a minimum of time. Other features of construction will be evident from the following description and claims.

Referring to the drawings which form part of this specification:—

Figure 1 is a cross sectional elevation of a machine embodying the invention. The piston is shown at the end of its downward or compression stroke.

Fig. 2 is a view looking in the direction of the arrow seen in Fig. 1.

Fig. 3 is a plan of Fig. 1.

Fig. 4 is an enlarged side view of the vari-

able throw eccentric and parts connected therewith.

Fig. 5 is a face view of the eccentric seen in Fig. 4 showing also the means of connecting the eccentric rod to the piston of the pump.

The invention includes a suitable foundation 2 from which arise standards 3. Resting upon the upper ends of these standards is the annular flange 4 of a tank 6 which is preferably of conical form as shown, and is adapted to contain the water or liquid used in the process of separation and to receive the heavier minerals as they are separated. At the bottom of the tank 6 is a discharge 7 having an outlet valve or cock 8 of any suitable character to permit the recovered material to be drawn off from the tank. The tank may also be provided with a hand hole 9 for access purposes, this hole being provided with a suitable watertight cover 11.

Leading into the upper part of the tank 6 is a water inlet pipe 12 which communicates with an annular pipe 13. This pipe extends around the upper part of the tank and is perforated as shown to allow the water or liquid to be introduced into the tank and to permit the sides of the tank being washed down after use.

Surrounding the top of the tank and resting upon the flange 4 thereof is an annular overflow channel 14 having an inner upstanding wall 16 and an outer and higher upstanding wall 17. The bottom of this channel is provided with an inwardly projecting lip 19 and a suitable number of exits 21 through which the tailings and light material are discharged with the water which overflows the inner wall 16. A suitable trough may be disposed beneath the exits 21 to receive the overflow material for further treatment if desired.

Upstanding from the interior of the tank 6 are a number of brackets or supports 23 upon the upper ends of which rests the lower end of a vertical air cylinder 24. Formed within the lower portion of this cylinder is an air chamber indicated at 26 in which a permanent volume of air is contained between the surface of the liquid within the tank 6 and the piston hereinafter described. The cylinder 24 is provided with a lower external flange 27 and an upper external flange 28.

Resting upon the upper flange 28 are plates 29 carrying bearings 30 which support a main driving shaft 32 carrying fast and loose pulleys 33, 35.

Surrounding the shaft 32 and adapted to rotate therewith are two concentric disks 34. Disposed between said disks is an eccentric sheave 37; this sheave is provided with an elongated opening 38 to accommodate the driving shaft 32. It is also provided with adjustment slots 39 through which pass holding bolts 31. These bolts connect the two disks 34, and permit the throw of the eccentric to be varied by moving the sheave into the desired position and clamping it in place between the disks by means of the holding bolts.

Surrounding the eccentric sheave 37 is a strap 42 to which is connected the upper end of an eccentric rod 43. Said rod is provided at its lower end with a divided bearing by which it is connected to a knuckle pin 44. The divided bearing comprises a base 46 and a cap 47 the two parts being united by studs 48 which are provided with springs 49 and adjusting nuts 51 whereby the two halves of the bearing may be drawn together to compensate for wear and tear on the pin 44. The springs 49 eliminate objectionable noise or chatter during operation of the machine owing to loose fitting of the knuckle pin in its bearing.

The base 46 of the divided bearing is attached to a piston 52 which works within the upper part of the cylinder 24. Passing through the piston and communicating with the air chamber 26 beneath the piston is the lower end of an air vent pipe 53, the upper end of which communicates with the atmosphere. This vent pipe is provided with a suitable control valve or cock 54 whereby the degree of compression of the air cushion beneath the piston and consequently the degree of pulsation or displacement of the liquid within the tank may be readily varied at will. Loosely surrounding the main driving shaft 32 is a sleeve 56 carrying a pinion 57. Fixed to the sleeve 56 is a pulley 58 by which said sleeve and the pinion 57 are driven independently of the main driving shaft and the piston. Engaging the pinion 57 is a toothed ring 59 from which depends a collar or band 61. Attached to this collar are a series of brackets or extensions 62 which support an annular feed trough 63 into which the pulverized material to be separated is fed for treatment. The feed trough 63 is provided with a perforated bottom 64 through which the material falls as the trough rotates. The size of the perforations in said bottom may, if desired be adjustable to suit different grades or classes of material.

Attached to the lower ends of the brackets 62 are a series of outwardly extending arms 66 and to the outer ends of these arms are attached scrapers 67 which depend into the overflow channel 14 and convey the overflow material therein to the discharge openings 21.

Resting upon the inwardly projecting lip 19 of the overflow channel and the lower flange 27 of the air cylinder is a perforated table or grating 68 of any suitable character to support the material to be treated. This

grating may, if desired, be formed in sections and the size, area, contiguity and conformation of the apertures in the same will depend upon requirements.

The invention operates as follows:—The tank 6 is filled with water or liquid through the inlet pipe 12 to the desired height above the lower end of the cylinder 24 which is thus sealed at its bottom by the water within the tank. The machine being started, the material to be treated is fed into the feed trough 63 which is rotated by the pinion 57 and toothed ring 59 the material falling through the perforations in the bottom of the trough and on to the grating 68. This rotary movement of the feeding trough is imparted by the pulley 58 which is driven independently of, and at any suitable speed relative to the main driving shaft 32. The rotation of the main driving shaft which is controlled by the fast and loose pulleys 33 causes the eccentric 37 to reciprocate the piston 52 within the cylinder 24. By opening the control valve 54 of the air vent pipe 53 to the desired extent the compression of the air within the air chamber 26 between the piston and the surface of the liquid in the tank may be regulated to a nicety. On the down stroke of the piston the air cushion beneath it is compressed causing the liquid within the tank to surge upwardly through the material upon the grating 68 and thus wash the lighter material over the inner wall 16 into the overflow channel where it is carried to the exits 21 by the rotating scrapers 67, the heavier mineral falling through the holes in the grating 68 into the tank 6 from which it may be recovered as desired by opening the valve 8. During the above operations the liquid within the tank is maintained at the proper height by means of the pipe 12 through which fresh supplies are continually admitted.

It will be seen from the foregoing that as the piston advances and recedes the air cushion in the air chamber 26 is compressed and expanded and the liquid in the tank caused to pass through the material on the grating 68 with a regular ebb and flow and without any shock or jar, thereby preventing loss of the valuable mineral and enabling a more perfect separation to be obtained. It will also be seen that none of the working parts of the pump come into contact with the liquid or material under treatment, and that besides the adjustment of the stroke of the piston which may be obtained by manipulating the adjusting bolts 41 of the eccentric thereby varying the capacity of the pump, the strength of the pulsations may be readily and minutely adjusted by opening or closing the control valve 54 of the vent pipe 53. This enables a perfect regulation of the air pressure to be obtained to adapt the action of the machine to various materials of different specific gravities without the necessity for altering the stroke of the piston.

When the tank 6 is being discharged, the whole of the material therein may be washed out by admitting water through the inlet pipe 12 and thus spraying the sides of the tank through the perforations in the annular pipe 13.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In a machine for separating mineral from ore bearing materials, a liquid tank, a perforated table or grating disposed immediately over said tank to support the material to be treated, an air pump or compressor having an air chamber within which a body or cushion of air is alternately compressed and expanded between the surface of the liquid in the tank and the pump piston to cause said liquid to pulsate or rise and fall through the material on the grating, a controllable air vent communicating with said air chamber, an annular feed trough surrounding the pump cylinder above the perforated support or grating to deposit material thereon, and means independent of the movement of the pump piston for rotating said feed trough relatively to said support or grating.

2. In a machine for separating mineral from ore bearing materials, a liquid tank, a grating disposed over said tank to support the material to be treated, means for alternately compressing and expanding a body or cushion of air against the surface of the liquid in said tank to cause the liquid to pulsate through said grating, an annular overflow channel surrounding the top of the tank, said channel having an inner upstanding wall over which the liquid and lighter material pass from the grating into said channel under the influence of the pulsations, and scrapers arranged to rotate within said channel for the purpose set forth.

3. In a machine for separating mineral from ore bearing materials, a liquid tank, a grating disposed over said tank, a vertical pump cylinder having an open lower end which is adapted to be submerged in the liquid at the top of the tank, a piston working within the upper part of said cylinder whereby a body or cushion of air is alternately compressed and expanded between the surface of the liquid and said piston, a controllable air vent passing through the piston, an annular feed trough surrounding said cylinder above the grating, said trough having a perforated bottom through which the material to be treated falls onto the grating, an overflow channel surrounding the top of the tank, and scrapers disposed within said channel and adapted to rotate with the feed trough.

4. In a machine for separating mineral from ore bearing materials, a liquid tank, a grating disposed at the top of said tank, an air pump adapted to compress a body or cushion of air against the surface of the liquid within said tank, a rotary feed trough surrounding the pump cylinder, an annular overflow channel surrounding the top of the tank, scrapers disposed within the overflow channel and attached to the rotary feed trough, a main driving shaft, means adjustably fixed to said shaft for reciprocating the piston of the pump, a sleeve loosely surrounding said shaft, a pinion and driving means fixed to said sleeve, and a toothed ring engaging said pinion and adapted to rotate the feeding trough and scrapers, substantially as described.

5. In a machine for separating mineral from ore bearing materials, a liquid tank of inverted conical form, an air pump having a cylinder, one end of which is adapted to be sealed by the liquid within the tank, a perforated table or grating extending around said cylinder to support the material to be treated, a piston working within the said cylinder and forming an air chamber between said piston and the surface of the liquid within the tank, a controllable air vent communicating with said air chamber, an annular feeding trough surrounding the cylinder above said perforated table or grating, means for rotating said feeding trough, a series of scrapers adapted to rotate with said trough, an annular overflow channel surrounding the upper part of the tank and the perforated table or grating and in which said scrapers are disposed, a liquid inlet pipe leading into the tank, and an annular perforated pipe arranged in the upper part of the tank and connected with the inlet pipe for charging the tank with liquid and washing down the sides thereof.

6. In a machine for separating mineral from ore bearing materials, a liquid tank, a perforated table or grating disposed immediately over said tank to support the material to be treated, an air pump or compressor having an air chamber within which a body or cushion of air is alternately compressed and expanded between the surface of the liquid in the tank and the pump piston to cause said liquid to pulsate or rise and fall through the material on the grating, a feed trough surrounding the pump cylinder above the perforated support or grating to deposit material thereon, and means independent of the movement of the pump piston for rotating said feed trough relatively to said support or grating.

In testimony whereof I affix my signature.

R. P. PARK.

Witness:
CECIL W. LE PLASTRIER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."