UNITED STATES PATENT OFFICE

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FINE GOLD RECOVERING MACHINE

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1 Claim. (Cl. 209—426)

1. This invention relates to a machine of the rotary endless belt type adapted to separate by concentration such minerals as gold, from an ore mass.

An important object of the invention is to provide a machine of the type stated, that is adapted to convey a mass of ore to an endless belt, concentrate in pores of the belt, by means of spray jets, the minerals contained in the ore, wash off the waste portion of the ore, and dislodge the concentrated minerals from the belt, for gravitation to a concentration trough.

Another important object of the invention is to provide a machine of the type stated, wherein adjustments are possible within a wide range, as to the force and distance of travel of the spray jets, selection of belts of relatively differing weaves or porosity, pitch of the spray jets relative to the belt, and selective use of the spray jets.

Still another important object is to provide a machine of the type stated that will be exceptionally durable, of great capacity as to the amount of ore that can be handled within a given time, and of unusual efficiency in discharge of its function of separation of precious minerals from ore.

Yet another important object is to provide a machine of the character described that will automatically act upon a mass of ore to carry it to the point at which the concentrating action is to take place, separate the minerals from the mass, discharge the waste, and deposit the minerals remaining in a trough for ready removal by an operator.

Other objects of the invention will appear from the following description and accompanying drawings and will be pointed out in the annexed claim.

In the accompanying drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claim which follows.

In the drawings:

Figure 1 is a side elevational view of a machine constructed in accordance with the invention;

Figure 2 is a plan view, portions of a conveyor and wash tank being broken away;

Figure 3 is a side elevational view showing one of two upper rollers and an adjusting means therefor;

Figure 4 is a transverse section through the other upper roller and a spray tube associated therewith;

Figure 5 is a side elevational view of a lower roller and concentrating trough, a spray tube associated therewith being shown in transverse section;

Figure 6 is an end elevation of the lower roller and spray tube, taken from the left of Figure 5;

Figure 7 is an elevation of a roller device for retaining in elevated position an edge of the upper course of the endless belt;

Figure 8 is a side elevational view of a mounting for a floating roller;

Figure 9 is a side elevation, portions being broken away, of one of the upper spray tubes;

Figure 10 is an end elevation thereof;

Figure 11 is a fragmentary longitudinal section through said tube, showing one of a plurality of jet units that are mounted thereon; and

Figure 12 is a plan view of said unit.

Referring to the drawings in detail, pedestals 5 are provided, which may be of concrete or the like. These support an iron rectangular supporting frame generally designated as 6.

There connection of the frame to the pedestals is preferably adjustable, as at 7, to permit vertical adjustment of the frame as necessary.

Adjacent the frame 6 is a wash tank 8, which contains the material to be acted upon by the machine. A bucket-type conveyor 9 has its lower end, carried by shaft 10, positioned within the tank, so that it can feed the material continuously to the machine. The upper end is supported by spaced arms 11 rigid with the frame 6 and extended upwardly from one end of the frame. The material is deposited by the conveyor on a feed chute 12 inclined downwardly toward the center of the frame.

The upper shaft 13 of the conveyor has fixedly connected thereto a pulley 14. A V-belt 15 passes around the pulley, and also around a pulley 16 rotated by a drive shaft 17. The drive shaft is journaled in the top of the frame at one end thereof. Drive shaft 11 is powered from a suitable source, not shown.

A pulley 18 is also mounted on the drive shaft, adjacent pulley 16, and carries a V-belt 19, that also passes around a pulley 20, carried by and rotating a roller shaft 21. These drive connections are best seen from Figs. 1 and 2.

From the above, it is seen that the drive shaft 17 actuates the conveyor, and also the other roller shaft 21. The drive shaft itself constitutes a roller shaft at the other end of the frame.

Adjustment of the distance between the roller
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shafts is desirable, and for this purpose, the bearings 22 in which the roller shaft 21 is journaled are mounted on the frame slidably. Each of these is threaded at one end to receive an adjusting screw 23, one end of which is formed as a crank, this being journaled in the frame. By rotation of the crank, adjustment of the shaft 21 is adjusted as necessary. This construction is best shown in Fig. 3.

So that the V-belt 19 will remain taut regardless of adjustments so made, I provide a lever 24 (Fig. 1) fulcrummed intermediate its ends on the frame 6, this having at one end an idler wheel 25 that is in continuous engagement with the belt. A spring 26 is connected to the other end of the lever, and also to a fixed bracket 27 extended upwardly from the frame. Spring 26, tending to compress, presses the idler wheel against the belt continuously, so as to take up any slack in the belt that would otherwise result from adjustment of the relative distance between the roller shafts.

Mounted in the top of the frame at one end therefor for rotation by the drive or roller shaft 17, is an upper roller 28, that extends substantially the width of the frame. Another upper roller 29 is similarly mounted at the top of the frame, at the other end, this rotating on the opposite roller shaft 21. Intermediate the ends of the frame, and at the lower roller 30 is journaled for rotation in suitable bearings carried by the frame. The rollers are all parallel and of the same length, and as best seen from Fig. 1, their mounting as described provides a roller arrangement that defines, substantially, an inverted isosceles triangle, with the lower roller 30 as the apex.

Around the rollers passes an endless separator belt 31, preferably of canvas material, and substantially as wide as the rollers are long. It is pointed out that other fabrics can as well be used, this depending on the particular type of metal, which is to be concentrated through use thereof. According to the type of metals to be recovered, the material of the belt will be selected with due regard to its particular porosity or coarseness of weave.

That course of the separator belt 31 extending between the upper rollers is to be depressed during operation of the machine, and to this end, I provide a floating roller 32, shorter in length than the width of the belt 31 or the length of the upper or lower rollers (see Fig. 2). This is pressed against, and thus depresses, the upper course of the belt, at a point substantially midway between the upper rollers, as best seen from Figures 1 and 2. One end of the floating roller, shown at the right in Fig. 2, is substantially flush with the adjacent edge of the separator belt, with the result that the other end is spaced well inwardly from the opposite edge.

Referring now to Figures 2 and 8, the floating roller 32 is supported at its ends by depending brackets 33, preferably L-shaped. These are formed with slots 34, providing bolts 35 are tightened to the free ends of the hanger arms 36, curved downwardly adjacent their other ends as shown. Said other ends of the hanger arms are pivoted to the frame 6 at 37. Adjacent the pivotally connected ends of the hanger arms, a rod 38 is pivotally connected to each hanger arm, and is spring-pressed toward the hanger arm by a spring 39. Thus, the floating roller 32 is continuously pressed against the belt 31, and depresses the upper course thereof. If the position of the floating roller relative to the upper rollers needs adjustment, bolts 35 are loosened so that the depending hangers 33 can be adjusted longitudinally of the hanger arms 36.

When the separator belt is depressed as described, the edge of the belt at the left in Fig. 2 should rest on roller 32, so that water sprayed thereagainst (in a manner to be described) will run toward the center of the belt and off the right edge. This edge elevation is provided for by extending the fixed bracket 21 angularly so that it is behind the belt, and mounting on the end of the bracket a pair of small rollers 40 (see Fig. 7). The edge portion of the separator belt is passed between these rollers, and to retain the belt therebetween, the edge can be formed with a filled loop 41.

The invention embodies means for supplying water for spray purposes. Leading from a pump 42 positioned adjacent the frame 6 are hose lines 43, 44, and 45. Conventionally manually operated gate valves 46, 47, and 48 respectively control the flow through the hose lines. The flow through any of the hose lines is open, the line 43 discharging through a spray tube or pipe 49, line 44 through a spray tube 50, and line 45 through a spray tube 51.

These spray tubes are positioned to direct spray jets directly against the canvas separator belt 31. The spray tube 49, in this connection, is disposed parallel and adjacent the upper roller 23 to direct spray jets against the upper surface of the belt (Fig. 4). Spray tube 48 can be formed from a length of pipe material, the ends of which are closed, since it is desired that the water sprayed therefrom be directed through its side wall against the belt. To this end, the tube may have a longitudinal slot 52 extending substantially from end to end thereof, through which the water is forced. As the water issues under pressure through the slot, it strikes a curved baffle plate 53 secured along one edge to the spray tube as by braising or a weld. Thus, the water is deflected against the belt at an angle, striking the belt near the top of one of the opposite sides defined by depression of the upper course. The water thus washes downwardly, against the direction of movement of the belt, and while causing the particles of metal to be caught and concentrated in the pores of the belt, washes the sand and other waste to the bottom of the depression, in a continuous flushing action. The sand and water move off the belt at the right in Figure 2, dropping to a catch pan 54 positioned below the belt at the bottom of the depression formed therein, and thence through an inclined discharge trough 55 leading to the sump (not shown). An overflow pipe 56 that extends from the wash tank 5, also leads to the sump.

Extending substantially from end to end of the spray tube 50 are spaced jet units. Each of these, as best seen from Figures 9, 11, and 12, include nozzles 57 threadedly engaged by an opening 58 of the tube. For the purpose of retaining the screw in positions of threaded adjustment, I form the circular head of the screw with a peripheral socket 58, any of which can engage one end of an L-shaped spring 60. The other end of the spring is permanently affixed by soldering or the like, to the belt. It is thus seen that the spring, engaging in a notch 61, will yieldably hold the screw in any position to which adjusted.
Carried by the inner end of the screw is a pointed stem valve 61 that extends across the bore of the spray tube. This is adapted to seat in a tapered valve seat 62, communicating with an angular passageway 63 formed in a block 64 welded or otherwise fixedly secured to the spray tube. Adjustment of the stem relative to its seat determines the velocity or pressure under which a jet will be forced from the passageway against the surface of the separator belt. It may be noted that the passageway is so arranged as to direct a jet against the belt laterally relative to the direction of movement of the belt. I have found that particularly where a belt of relatively open weave is used, this assists greatly in increasing the desired concentrating action imposed upon the mineral particles in cooperation with the jets issuing from the adjacent spray tube 49. Water forced from the spray tube 49 washes backward under the spray tube 50 against the direction of movement of the belt, and the lateral spray jets issuing from the spray tube 50, striking the agitated mass of sand and water under great pressure, further concentrates in the pores of the belt any minerals not previously concentrated by the spray jets from tube 49. Additionally, the spray jets from tube 50 assist in moving the whole mass of water and sand to the right in Figure 2, as is desirable since the mass is to move in that direction to proceed to the catch pan 54.

Both the spray tubes 49 and 50 are mounted above the belt for separate rotatable adjustment, so as to vary the angle of the spray jets relative to the belt, and also for separate vertical adjustment, so as to vary the distance of the tubes from the belt. To this end, the ends of the spray tube 50 are closed by caps 65, from which project studs 66 threaded at their free ends. The studs pass through longitudinal slots formed in vertical brackets 67 mounted upon frame 6. The studs also extend through small blocks 59 which are not fixedly attached thereto.

Wing nuts 69 are threadable on the ends of the studs. Thus, if it is desired to adjust the spray tube rotatably, wing nuts 69 can be loosened whereupon the spray tubes can be partially rotated and the wing nuts again tightened to secure the tube in its new position.

Threadable into the tops of the blocks 68 are cranck journalsed in the tops of the brackets 67. By this means, the elevation of the spray tubes can be adjusted. Either adjustment, it can be noted, is permitted by the hose line 44, because this is of flexible material such as rubber.

As to the spray tube 49, the same mounting is used, the cranks in this instance being designated 71, and the slotted brackets 72.

Referring now to the spray tube 51, the same mounting could of course be used, but I have found that in this instance, adjustment as to elevation is not important, and thus I prefer to confine the adjustment to a rotatable adjustment to vary the pitch of the spray jets relative to the belt. These spray jets can in this case be formed as openings in the side wall of the tube, that are directed against the spray tube, the pipe clamps 73 being bolted to the sides of the frame 6. If it is desired to adjust the spray tube, the pipe clamps are loosened, and the tube turned as necessary.

It may now be noted that the jets from two upper spray tubes drive, and thus concentrate, the minerals into the upper surface of the belt as it appears in Figure 1, while the jets of the lower tube strike the under surface of the belt as it appears in the same figure, this being, of course, the same belt surface previously acted upon. As the lower jets strike the belt in opposition to its path of movement, they dislodge the mineral particles previously concentrated in the pores of the belt, and wash them down into a concentrating trough 74 mounted below the lower roller 30. This, as best seen from Figure 6, has spaced vertical partitions in it, defining compartments, to prevent undue concentration of the mineral particles at one end or the other.

The mineral particles gravitate to the bottom of the trough, and at intervals, can be recovered through the provision of apertured stopper seats 76 in the bottom of the trough, that carry rubber stoppers 77 provided with depending handles 78. The operator is thus permitted to push the stopper upwardly, so that the minerals in the trough can be washed out through the openings, and then can pull the stoppers downwardly into the seats to close the openings.

An overflow pipe 79 leads from the trough 74 to the wash tank 6, so that water can move to the wash tank 6 when it reaches a predetermined level in the trough.

A point to be noted is that any minerals that may wash out with the water through the overflow pipe 79 would drop to the bottom of the wash tank 6, due to their relatively high degree of specific gravity, to be acted upon again by the conveyor and again passed through the machine.

I have found that the machine operates with great efficiency upon the ore, so as to recover an unusually high percentage of minerals from the sand and other waste. The capacity of the machine is high, and its distinguishing characteristic is the separation of mineral particles from the mass of ore by concentration. Thus, the mineral particles, that are of greater specific gravity than the sand, tend, when separated from the rest of the mass, by the heavy agitating and washing action, to gravitate whenever permitted to a lower level than the sand. This is of value, for example, in the trough 74, when at the completion of the operation, the minerals are washed out of the pores of the belt into which they were driven by the upper spray jets, and are thus permitted to gravitate to the bottom of the trough, while the water and any sand which may still remain will proceed through the overflow pipe 79.

In a fine ore recovering machine, the combination which comprises a supporting frame, a pair of spaced horizontally disposed rollers journaled in a horizontal plane on the upper end of the frame, a third roller positioned between the two former rollers and journaled in the lower part of the frame with the axis thereof in a plane parallel to the horizontal plane in which the upper rollers are positioned, an endless canvas belt trained over the said rollers substantially describing a triangle, an idler roller also positioned between the rollers in the upper horizontal plane, a pair of arms pivotally mounted on one end of the frame and extended over the belt in the ends of which the said idler roller is mounted, the axis of the roller being parallel to the axis of the spaced horizontally disposed rollers, sprung resiliently connecting the said arms to a pair of extended extensions of the frame whereby the said idler roller is urged upwardly, the length of the said idler roller being less than the width
of the belt whereby with the roller positioned with one end coinciding with one edge of the belt the opposite end is spaced inwardly from the opposite edge of the belt, a pair of idler rollers positioned to overlap the said opposite edge of the belt, a bracket for mounting the said pair of idler rollers whereby the rollers hold the edge of the belt in an upwardly extended position, whereby fluid in the section of the belt bowed downwardly by the idler roller flows toward the edge of the belt coinciding with the end of the idler roller, a drip pan positioned to receive fluid from the downwardly bowed section of the belt, a feed trough extended over one end of the belt, a wash tank positioned at one end of the frame, a bucket elevator for feeding material from the wash tank to the feed trough of the conveyor, a transversely disposed tube with spaced laterally disposed spray nozzles extended downwardly therefrom mounted above the upper course of the belt and positioned between the said idler roller and the upper horizontally disposed roller at the end of the belt opposite to that on which the feed trough is positioned, a second transversely disposed tube having a continuous slit in the lower side with an arcuate baffle carried by the tube and extended below the slit for directing fluid discharged through the slit against the surface of the belt, a concentrating trough positioned below the lower roller of the belt, and extended upwardly whereby the belt passing around the lower roller travels through fluid in the trough, a third transversely disposed tube with spray openings therein mounted on the side of the concentrating trough on which the belt leaves the trough for washing recovered ores from the belt, means for washing fluid to the transversely disposed tubes, and means driving the belt and conveyor.

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