To all whom it may concern:

Be it known that I, James B. Ballantine, a subject of the King of Great Britain, residing at Silver Plume, county of Clear Creek, and State of Colorado, have invented certain new and useful Improvements in Dewatering and Screening Apparatus; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in dewatering and screening apparatus, my object being to remove the water from the coarser material which must be reground after having passed through an apparatus for classifying or sizing the material under treatment.

In the process of ore milling where the ore is sorted into different sizes entirely by water classifying, it has been found impossible to recrush the oversize, effectively, owing to the presence of a large amount of water which has to be drawn from the classifier along with the oversize material.

In order to remove this excess of water, I have invented a shaking-screen having a certain motion, whereby it is possible to remove all of this excess of water at a minimum cost. In practice, I have passed fifty tons of broken ore per hour over a screen of this type two feet square, and obtained an ideal product for recrushing.

The entire apparatus consists of crushing rolls, a classifier, a dewatering screen and an elevator, a second screen being employed having sections of different mesh for removing the finer material which is sized by the different screen sections, the coarser product being finally discharged from this screen and returned for recrushing together with the material from the dewatering screen proper.

Having briefly outlined my improvement, I will proceed to describe the same in detail, reference being made to the accompanying drawing, in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a sectional side elevation of the complete apparatus. Figure 2 is a sectional view of the sizing screen member of the apparatus. Figure 3 is a cross section taken on the line 3-3. Figure 2, Figure 4, is a view similar to Figure 2 but showing a modified form of construction. The same reference characters indicate the same parts in all the views.

Referring first to Figures 1 to 3 inclusive, the numeral 5 designates the rolls employed in crushing the ore, the crushed material passing through an outlet 6 at the bottom of the roll casing, into a water containing tank 7 in which is located a vertically disposed partition 8 which separates the larger part of the space within the tank into two compartments. The fans or arms 70 9 of a paddle wheel 10 extend into the water 12 of this tank on one side of the partition. It will be noted (see Figure 1) that this partition is of less length than the tank, leaving spaces between the end walls of the tank and the adjacent ends of the partitions, to permit the circulation of the water in the tank, under the influence of the rotary action of the paddle wheel, which is fast on a shaft 13 which may be rotated through the medium of any suitable power.

On the side of the partition opposite that into which the paddles 9 extend, is located a series of oppositely inclined baffle plates 14, arranged one above another and over which the material passes as it descends into the tank from the crusher. The coarsest material or that which must be reground, passes successively over all of these baffles and finally enters a hopper 15 set into an opening in the bottom of the tank and terminating in a discharge spout 16 which delivers this coarse material to the dewatering member 17 of the apparatus. The next coarser grade of material enters a hopper 18 to the right of the hopper 15, the walls of the hopper 18 being arranged to direct the material which enters this hopper into an opening 19 in the bottom of the tank and thence to a discharge chute 20 which delivers this coarser grade of material or middlings to a screening and dewatering member 21 which is operated in substantially the same manner as the dewatering member 17 as hereinafter more fully described.

The bottom of the tank in addition to the discharge openings heretofore described is provided with a series of openings 22, 23, 110...
24, 25, etc., any desired number being employed as may be deemed requisite or necessary for removing the various grades or sizes of the classified material. Each of these openings including the opening 19 at the bottom of the hopper 18, is equipped with a controlling valve 27.

In the operation of the classifier, the rotation of the paddle wheel 10 produces a current whereby a circulation of the water in the tank results. This wheel rotates in the direction indicated by the arrow a (see Fig. 1) and under its influence the water begins to travel toward the left extremity of the tank on one side of the partition 8, and after reaching such extremity, it passes around the adjacent end of the partition 8 and thence toward the right on the side of the partition 8 where the baffles 14 are located, thus producing a circulation of the water through the tank on opposite sides of the partition 8 and around the extremities of the partition as indicated by the arrows in Fig. 1. The action of this current of water upon the crushed or pulverized material performs the classifying function, and the material settles in the tank according to its size, the largest particles being the heaviest. Consequently the coarsest portion of the product is first deposited and falls into the hopper 15 and passes thence to the dewatering apparatus 17; while the next coarser product settles in the hopper 18 and passes to the dewatering and screening member 21; while the other grades which do not require to be recrushed, pass through the openings 22, 23, 24, 25, etc.

So far as the present invention is concerned I only need consider the two grades of product which enter the hoppers 15 and 18. The grade which enters the hopper 15 is so coarse that it must all be returned to the rolls for recrushing; while the grade which enters the hopper 18 may be termed middlings, since it contains a considerable quantity of material sufficiently fine that it need not be recrushed, but it must be first separated from the coarser grade and this is accomplished through the instrumentality of a shaking-screen 28 forming a part of the screening and dewatering apparatus 21. This screen 28 is a box-like structure having side walls 29, an upper end wall 30 and a bottom composed of screen members 31, 32 and 33 of different mesh, the member 31 being the finest, the member 32 coarser and the member 33 coarsest. The grades of material which will pass through these screen members are drawn off from the shaking-screen through the medium of hoppers 34, 35 and 36 having outlets 37, 38 and 39 which deliver the sized material to other launder 40, 41 and 42; while the grades of material which is discharged at the open extremity 43 of the shaking-screen, passes into the upper extremity of the hopper or launder 44 and is carried downwardly through a chute 45 and delivered into the boot 46 of an elevator 47 which carries it upwardly and discharges it into the hopper 48 of the rolls 5 for retreatment.

The dewatering apparatus 17 includes a shaking-screen 49 having a mesh bottom 50 of such fineness as to reject the coarse material which is delivered to the screen, while it allows water to pass freely therethrough into a tank 51 whence it is drawn through a downwardly extending conduit 52. The material which passes over the discharge extremity 53 of this screen, enters the upper extremity of a launder or trough 54 which carries it to the boot 56 of the elevator 47 which carries it to the rolls for retreatment in the same manner as heretofore described when referring to the coarse product which escapes from the lower extremity of the shaking-screen 28.

In order to remove the material from either the screen 49 or the coarse product from the screen 28, a peculiar shaking action is required. Referring to the dewatering member 17, the screen 49 is mounted on wheels 55 which engage tracks 56 which are supported on opposite sides of the tank 51 and suitably inclined for the discharge of the material at the lower extremity of the screen member. Rigidly secured to the upper extremity of the screen 49 is a rod 57 which is pivotally connected as shown at 58 to a rod 59 which is rigidly connected with the rim 60 of an eccentric 61 whose disk 62 is fast on a rotary shaft 63. As shown in the drawing when the point of maximum eccentricity of the disk is in its lowest position, the rod 59 of the eccentric rim is in a horizontal position. Hence this rod never passes below the horizontal but fluctuates between the horizontal and a higher position, the rear extremity of the rod reaching its highest position when the point of maximum eccentricity of the disk is highest. It should be explained however that the axis of the rod 59 is always at an angle to the axis of the rod 57, the result being that the reciprocating movement imparted to the screen 49 is of such a nature that the ore passing over the screen does so with a jerky motion which breaks up the even flow which the ore would otherwise have, and greatly facilitates the process of separating the water from the ore.

The operation of the screen member 21 is the same in principle. In other words the box 28 of this screen is equipped with wheels 64 which engage tracks 65 composed of angle irons which are secured to the opposite sides of a supporting structure 66. The upper extremity of the box 28 is equipped with a rigid rod 67 which is pivotally connected as shown at 68 with a rod 69.
which is rigidly secured to the rim 70 of an eccentric 71 whose disk 72 is fast on a shaft 73. As this shaft is rotated the necessary reciprocating movement is imparted to the screen box 28, the strokes of the rod 69 in imparting this movement always being in lines forming an angle with a line passing longitudinally through the center of the rod 67 of the box. The rear extremity of the rod 69 however never passes below the horizontal position illustrated in Fig. 2, since the point of maximum eccentricity of the disk is shown lowest in said view. As the disk 72 changes its position, the rear extremity of the rod 69 moves upwardly and again downwardly, its travel fluctuating between a high point (see dotted lines in Fig. 4) and the position shown in full lines in both Figs. 2 and 4, the result being that the peculiar jerky movement is obtained which facilitates the process or operation of separating the water from the ore which is the object of my present invention.

In the form of construction shown in Fig. 25 the screen box 28 is suspended by chains 74 whose lower extremities are secured to the box on opposite sides as shown at 75 while their upper extremities are connected as shown at 76 with the lower extremities of eye bolts 77 which are made fast to cross beams 78 of a stationary frame 79. In this case the screen box instead of being supported upon wheels engaging a stationary track, simply oscillates in response to the action of the eccentric, the result being similar to that obtained where the other form of construction is employed.

Additional water may be employed in connection with the dewatering and screening member 29 (see Figs. 2 and 4), in order to keep the screen sections 81, 82 and 83 from possible clogging while the material is treated thereon. This water is supplied from a pipe 80 which communicates with a pipe 81 extending longitudinally of the screen and provided with perforations 82 through which the water is sprayed upon the screen bottom.

In either form of construction the de-watering and screening member is adjustable whereby its inclination may be changed at will. In the form of construction shown in Figs. 2 and 3, the frame structure 66 is hinged at its upper extremity as shown at 83, and by adjusting the nute 85 upon the upper threaded extremity of the suspension rod 84, the inclination of the supporting tracks 65 and consequently of the screen itself may be regulated at will.

Attention is called to the fact that the six valves for controlling the openings 22, 23, 24 and 25 in the bottom of the classifying tank, are shown closed. If they are closed in practice, the classifying material is drawn off intermittently after suitable quantities have been collected in the hopper shaped receptacles above. If desired these valves may be so set as to draw off the material continuously from the tank. In any event this is a feature with which my present improvement is not concerned except in an indirect way, the construction of the complete classifying apparatus being illustrated in order that the advantages of the novel features heretofore described may be fully understood.

Having thus described my invention, what I claim is—

The combination of a crushing means, a hydraulic classifier receiving from the crushing means and adapted to subdivide the material into a series of classes, a draining device adapted to receive the material of the coarsest grade and drain the same, a draining and screening device adapted to receive an intermediate grade from the classifier and to drain and size the material of said grade, and means for returning the material of the draining device and oversize material from the draining and screening device to the crushing means.

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

JAMES B. BALLANTINE.

Witnesses:

Grace Huston,
A. J. O'Brien.