Oct. 20, 1942. E. BIGNELL 2,299,298

DRY ORE CONCENTRATOR

Filed Jan. 15, 1940 2 Sheets-Sheet 1

Fig. 1.

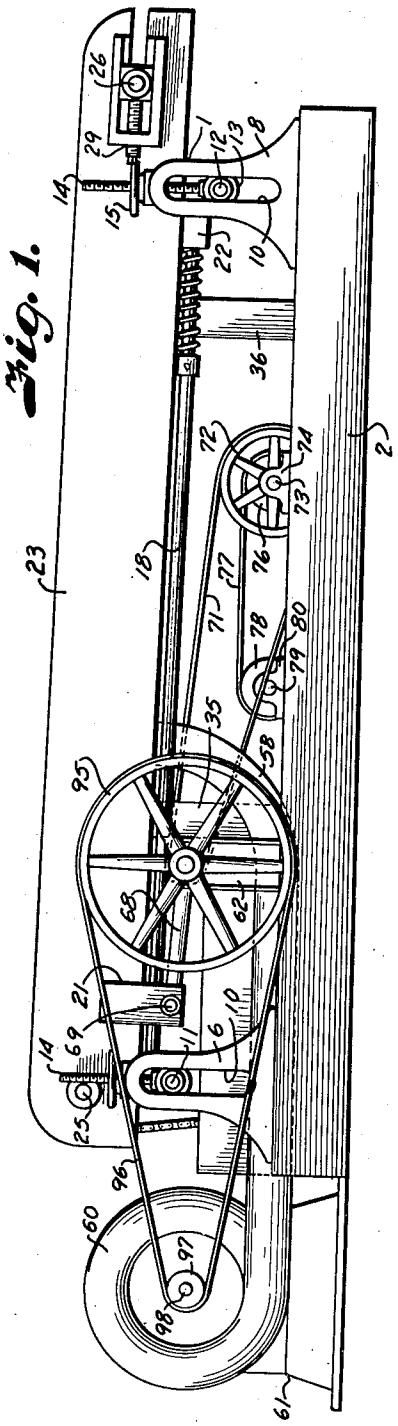
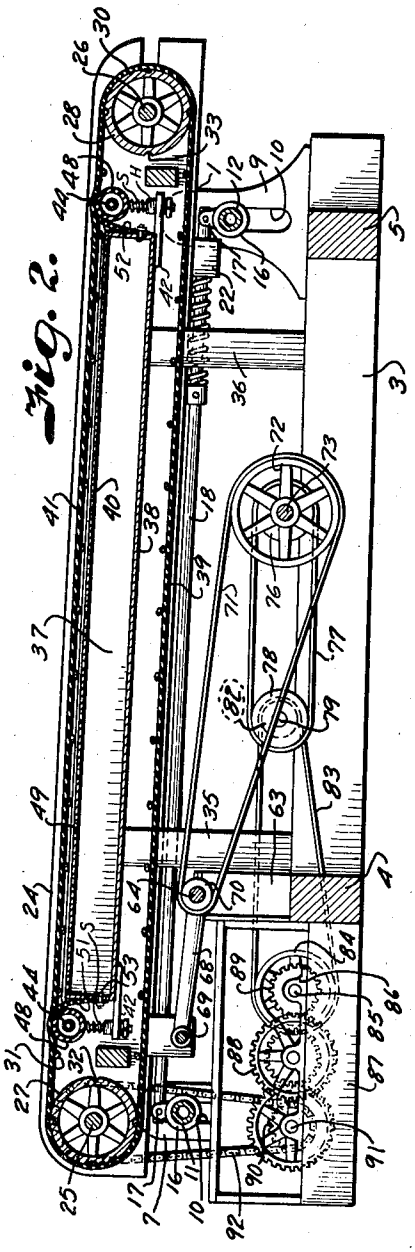


Fig. 2.



BY

INVENTOR
Edward Bignell.
Arthur C. Brown
ATTORNEY

Oct. 20, 1942. E. BIGNELL 2,299,298

DRY ORE CONCENTRATOR

Filed Jan. 15, 1940 2 Sheets-Sheet 2

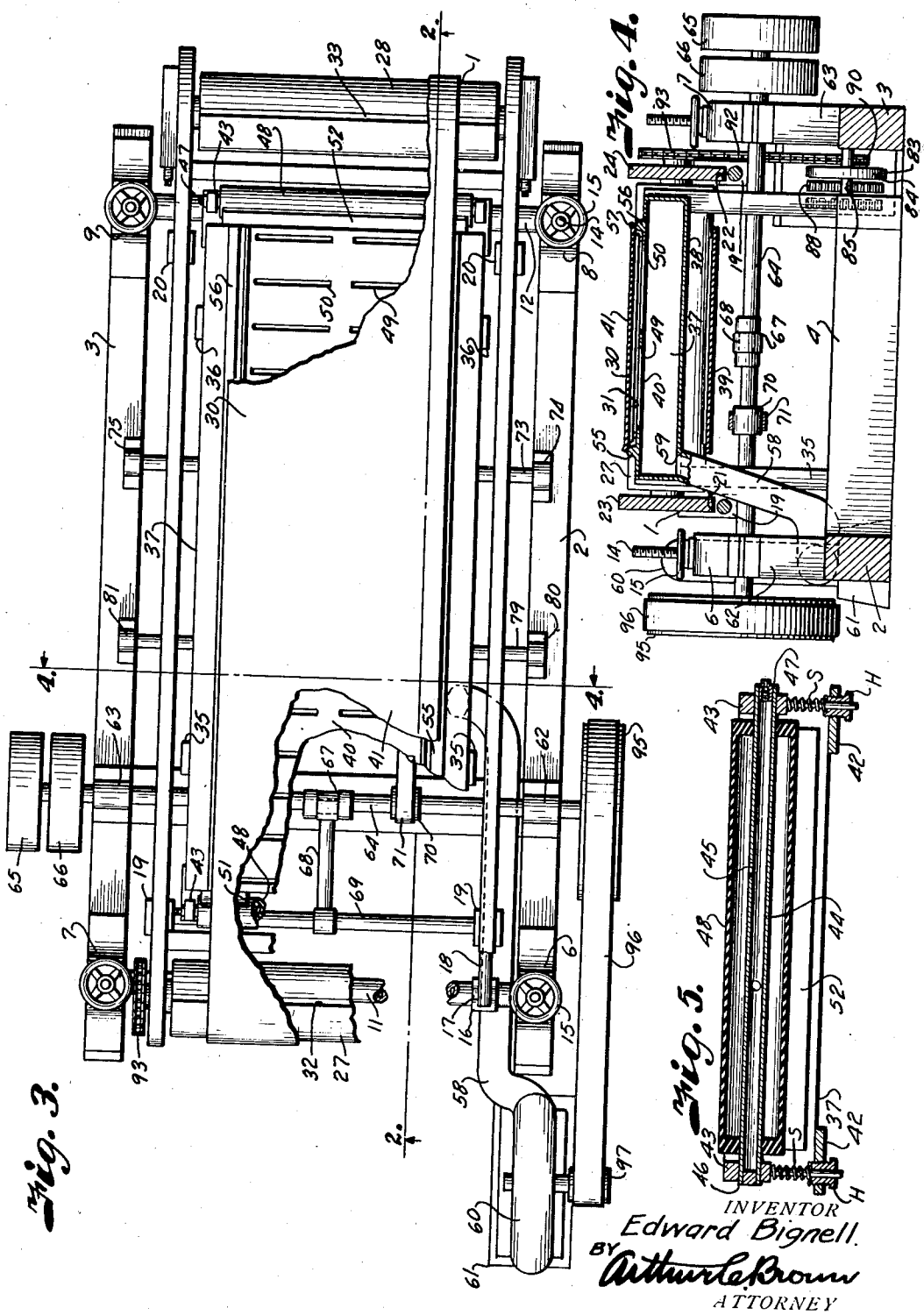


Fig. 3.

Fig. 4.

Fig. 5.

INVENTOR
Edward Bignell
BY Arthur L. Brown
ATTORNEY

Patented Oct. 20, 1942 2,299,298

UNITED STATES PATENT OFFICE

2,299,298

DRY ORE CONCENTRATOR

Edward Bignell, Los Angeles, Calif., assignor to John C. Gillham, Los Angeles, Calif.

Application January 15, 1940, Serial No. 313,840

5 Claims. (Cl. 209—470)

This invention relates to dry ore concentrators, and more particularly to a device of that character adaptable for separating values from gangue in crushed ore, the principal object of the invention being to provide an efficient, convenient, and relatively economical dry ore concentrator for such a purpose.

Other important objects of the present invention are to reduce the amount of work required in concentrating ore values; to provide for sealing and cushioning an air chamber relative to an ore carrying belt; to provide for oscillating an ore carrying belt in a highly effective manner; to provide for vibrating the belt as an incident to travel over the air chamber; and to provide improved elements and arrangements of them in a dry ore concentrator of this character, particularly in the air chamber and cooperable belt portions of the apparatus.

In accomplishing these and other objects of the present invention, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevational view of a dry ore concentrator embodying the features of the present invention.

Fig. 2 is a longitudinal vertical cross-section through my improved dry ore concentrator on the line 2—2, Fig. 3.

Fig. 3 is a plan view of my improved dry ore concentrator with certain of the parts being broken away to better illustrate the construction and relation of the various parts.

Fig. 4 is a detail vertical cross-section on the line 4—4, Fig. 3.

Fig. 5 is a detail vertical cross-section through one of my improved cushioning elements for the ore carrying belt.

Referring more in detail to the drawings:

1, Fig. 1, generally designates a dry ore concentrator embodying the features of the present invention, and which preferably includes a main base frame consisting of side sills 2 and 3, Fig. 3, connected by transverse bracing elements 4 and 5, Fig. 2.

Aligned pairs of standards 6—7 and 8—9 are mounted in vertical position and in spaced relation on the side sills 2 and 3 respectively, which standards are provided with longitudinally arranged slots 10 for slidably mounting the extremities of transverse shafts 11 and 12. Suitable collars 13 are mounted on the shafts 11 and 12 in which jack screws 14 are mounted and project upwardly through the upper ends of the standards. Jack nuts 15 are also provided for the jack screws 14, which may be turned up or down on the screws to manipulate and vary the elevation of the shafts 11 and 12 relative to the standards.

Fixed to the shafts 11 and 12 are suitable collars 16 having upstanding ears 17 to which the opposite ends of connecting rods 18 are attached, the collars and connecting rods being spaced apart adjacent the ends of the shafts within the side sills, as shown in Fig. 3.

Mounted on each of the connecting rods 18 are spaced bearing members 19 and 20, which are so shaped as to provide seats 21 and 22 for side auxiliary frame members 23 and 24. The side frame members 23 and 24 are arranged on edge in the seats and extend longitudinally in parallel inwardly spaced relation to the side sills 2 and 3 of the frame.

The side frame members 23 and 24 have bearing elements provided therein for receiving transverse shafts 25 and 26 on which drums 27 and 28 are fixed. One end of the side frames 23 and 24 may be provided with a tensioning device 29 engageable with the shaft 26 to shift it longitudinally relative to the side frames for adjusting the tension on an endless belt 30 mounted on the drums between the side frame members.

The endless belt may be of suitable character, the principal requirement being that it have sufficient porosity for allowing jets of forced air to pass therethrough. A series of spaced transversely arranged cross rods 31 is also provided in the inner face of the belt for imparting sufficient rigidity to the belt to sustain substantial quantities of ore on the belt, the cross rods 31 being spaced in such a manner as to mate with spaced grooves 32 and 33 in the peripheries of the drums so that the runs of the belt will have no difficulty passing over the drums at the extremities of the belt.

35 and 36 designate vertically arranged standards which project upwardly from the main frame at spaced points between the side frame members 23 and 24. The standards 35 and 36 support an air chamber 37 at their upper ends in fixed position longitudinally of the frame between the frame members 23 and 24, as particularly shown in Fig. 2. The standards 35 and 36 are also of a height sufficient to position the bottom wall 38 of the air chamber above the lower run 39 of the belt and the upper wall 40 of the air chamber substantially immediately below the upper run 41 of the endless belt, the air chamber further being of a length less than the distance between

closest points of the drums 27 and 28 to provide space for laterally extending brackets 42 which project outwardly from opposite ends of the air chamber in spaced relation on opposite sides thereof, as shown in Fig. 5. The brackets 42 are preferably provided with threaded bearing openings for receiving threaded heads H having bores therethrough for passing bolts, the upper ends of which are suitably fixed to bearing blocks 43. The lower ends of the bolts are adapted for slidable mounting in the heads H under control of springs S, the ends of which bear against the heads H and blocks 43 respectively. It is apparent that the threaded mountings of the heads H provide for adjusting tension on the springs to control the degree of possible reciprocation of the blocks 43 relative to the air chamber 37. The blocks 43 are provided with bearing openings for rotatably seating a hollow shaft 44 having apertures 45 therein, a closed end 46, and an open end provided with a valve 47, for example, of the type used in inflating and deflating pneumatic tire inner tubes.

A cushioning housing 48 preferably of rubber or other resilient material, and preferably of cylindrical conformation, is mounted on the shaft 44 about the apertures 45 and between the blocks 43, the housings 48 being of a diameter sufficient for projection above the top wall 40 at the opposite ends of the air chamber.

As shown in Fig. 2, the cushioning housings 48 have sealing engagement with the belt 28, and the top wall of the air chamber is preferably provided with spaced transversely arranged slots 49 and 50 for allowing passage of air from the air chamber through the slots into contact with the bottom face of the upper run of the ore carrying belt.

In order to seal the ends of the air chamber in relation to the cushioning housings 48 and the belt 28, flaps 51 and 52 are preferably mounted on the end walls of the air chamber, as by fastening devices 53, these flaps extending into engagement with the housings 48 and sealing off the space between the peripheries of the housings and the ends of the air chamber.

The top wall of the air chamber is also provided with spaced runners 55 and 56, Fig. 4, that are arranged in spaced longitudinal relation to the air chamber and are spaced approximately the width of the ore carrying belt, the purpose of the runners being to curve the side edges of the belt, as shown at 57, in such a manner as to retain a layer of ore of a suitable depth on the belt.

In order to provide air with which to act on the ore carrying belt through the slots in the top wall of the air chamber, a duct 58 is suitably connected preferably with the bottom wall of the air chamber about an aperture 59 therein, which duct leads, as clearly shown in Fig. 1, to a blower 60, mounted on a frame 61 at one end of the main frame of the ore concentrating machine.

With the structure thus far described, it is apparent that a stationary air chamber is provided within the runs of an ore carrying belt, and that the belt is movable upon rotation of drums, and is sealed during such movement relative to the air chamber. It is also apparent that the frames carrying the belt and drums therefor are adapted for oscillation.

In order to oscillate the frames, and consequently the belt, standards 62 and 63, Fig. 3, are provided which have bearing members supporting a transversely arranged drive shaft 64. Conventional fast and loose pulleys 65 and 66 are mounted on one end of the shaft 64 exteriorly of the side rails 2 and 3 and may be employed for connecting the shaft by means of a belt, for example, with a prime mover, not shown.

The shaft 64 is provided with a crank portion 67, Fig. 3, to which one end of a pitman 68 is attached, the pitman having its other end connected with a shaft 69, the ends of which shaft 69 are mounted in the bearing elements 19, which support one end of the side frame members 23 and 24. Since, therefore, the bearing members 19 are engaged with the side frame members and are mounted on the connecting rods 18, connected in turn with the shafts 11 and 12, it will readily be seen that the side frames and belt may be oscillated at speeds depending upon the speed of rotation of the shaft 64.

In order to rotate the drums and move the belt during oscillation of the belt, the shaft 64 is preferably provided with a small pulley 70 connected by a belt 71 with a large pulley 72 fixed to a shaft 73 mounted in bearings 74 and 75, Fig. 3, on the side sills 2 and 3. The shaft 73 may also be provided with a small pulley 76 connected by a belt 77 with a pulley 78 on a shaft 79, the ends of which are rotatably mounted in bearing members 80 and 81 on the side sills. The shaft 79 may in turn be provided with a small pulley 82 engaged by a belt 83 with a pulley 84 mounted on a shaft 85, the ends of which are secured in bearings 86 in a suitable manner on a frame 87.

Reduction gearing 88 may be interposed between a pinion 89 on the shaft 85 and a pinion 90 on a shaft 91, the pinion 90 being connected by a chain or other suitable drive 92 with a sprocket 93 at one end of the drum 27 in fixed relation to the shaft 25 preferably on the outside of the side frame member 23.

The end of the shaft 64 opposite the fast and loose pulleys may be provided with a large pulley 95 connected by a belt 96 with a small pulley 97 on a shaft 98 mounted within the blower and having mounted thereon suitable air impellers for imparting a rapid movement to air in the blower upon a relatively slow movement of the pulley 95.

The operation of an ore concentrating machine constructed as described is as follows:

The side frames 23 and 24 of the machine being adjusted to the proper inclination by manipulation of the jack nuts 15, and the belt being properly tensioned by the tensioning device 29, power is applied to the fast pulley 65 to rotate the shaft 64, and, through the crank, oscillate the shaft 69 and consequently, the side frames under control of the connecting rods 18. Rotation of the shaft 64 is transmitted through the pulley 70, belt 71, pulley 72, shaft 73, pulley 76, belt 77, pulley 78, shaft 79, pulley 82, belt 83, pulley 84, shaft 85, pinion 89, gear reduction mechanism 88, pinion 90, and chain 92 through the sprocket 93 on the shaft 25 for rotating the drum 27.

As the belt rotates responsive to rotation of the drum 27, the cross rods thereon ride over the resiliently mounted cushioning housings 48 at the ends of the air chamber and cause a whipping action of the belt in addition to oscillation thereof responsive to oscillation of the side frames. An additional vibrating action is also imparted to the belt as the cross rods pass over

the apertures in the top wall of the air chamber, the rods, in effect, valving exit of air from the chamber and permitting the air to pound the bottom face of the top run of the belt as the air is intermittently released for aiding in separating the ore particles on the belt.

The gangue and values in the ore are thus loosened by the multiple action on them, and air forced through the apertures in the top wall of the air chamber separates such gangue and values, the gangue being blown to the top of the ore on the belt and the values settling to the bottom for travel to the end of the top run of the belt in the direction of movement of the belt where they may be suitably disposed of, the gangue, due to the inclination of the side frames, travelling to the opposite end of the side frames for suitable disposal.

It is apparent, therefore, that I have provided an improved ore concentrating machine which may be driven faster than ore concentrating machines in which air chambers are carried and themselves oscillated. It is further apparent that the oscillation, whipping and vibrating actions provided by my improved machine facilitates separation of ore in a facile, economical and efficient manner.

What I claim and desire to secure by Letters Patents is:

1. In an ore concentrating machine, a frame, an apertured air chamber mounted on said frame, an ore carrying belt mounted on said frame about said air chamber, means for moving said belt relative to said air chamber, cushioning means on the chamber, means on the under face of the belt cooperable with the cushioning means for whipping said belt during movement thereof, the apertures in the air chamber being cooperable with said means on the belt for vibrating said belt during movement thereof, and means for supplying the air chamber with air.

2. In combination with an ore concentrating machine comprising a frame having an apertured air chamber mounted thereon, an oscillatory belt movable in covering relation to the apertures of the air chamber, cushioning means mounted on the air chamber in engagement with said belt, said cushioning means comprising an apertured shaft rotatably mounted on said frame, a resilient housing mounted on said shaft in covering relation to the apertures therein, and means to apply fluid pressure medium to said shaft for inflating said housing.

3. In an ore concentrating machine, a frame, an apertured air chamber mounted on said frame, a support oscillatably mounted on the frame, an ore carrying belt on said support, means for moving said belt on said support and in covering relation to the apertures of the air chamber, means for oscillating said support for varying the speed of the belt relative to the air chamber, means for supplying air to said chamber, cushioning means mounted adjacent said air chamber in engagement with said belt, and means on said belt engageable with said cushioning member for causing whipping of said belt in response to movement thereof.

4. In an ore concentrating machine, a frame, an apertured air chamber mounted on said frame, a support oscillatably mounted on said frame, an ore carrying belt mounted on said support about said air chamber, means for continuously moving said belt relative to said support, means for oscillating said support for varying the speed of the belt relative to the air chamber, cushioning means on the chamber, means on the under face of the belt cooperable with the cushioning means for whipping said belt during movement thereof, the apertures in the air chamber being cooperable with said means on the belt for vibrating said belt during movement thereof, and means for supplying air to the air chamber.

5. In combination with an ore concentrating machine comprising a frame having an apertured air chamber mounted thereon, a support oscillatably mounted on said frame, pulleys adjacent the ends of said support, an ore carrying belt extending around said pulleys and about said air chamber, means rotating said pulleys for moving said belt in covering relation to the apertures of the air chamber, means for oscillating said support for varying the motion of the belt relative to the air chamber, cushioning means mounted on the air chamber in engagement with said belt, said cushioning means comprising an apertured shaft movably mounted on said frame, a resilient housing mounted on said shaft in covering relation to the apertures therein, and means for applying fluid pressure medium to said shaft for inflating said housing.

EDWARD BIGNELL.