G. C. KIDDER.

ORE CONCENTRATOR OR SEPARATOR.

APPLICATION FILED FEB. 3, 1909.

974,395. Patented Nov. 1, 1910.

2 SHEETS—SHEET 1.

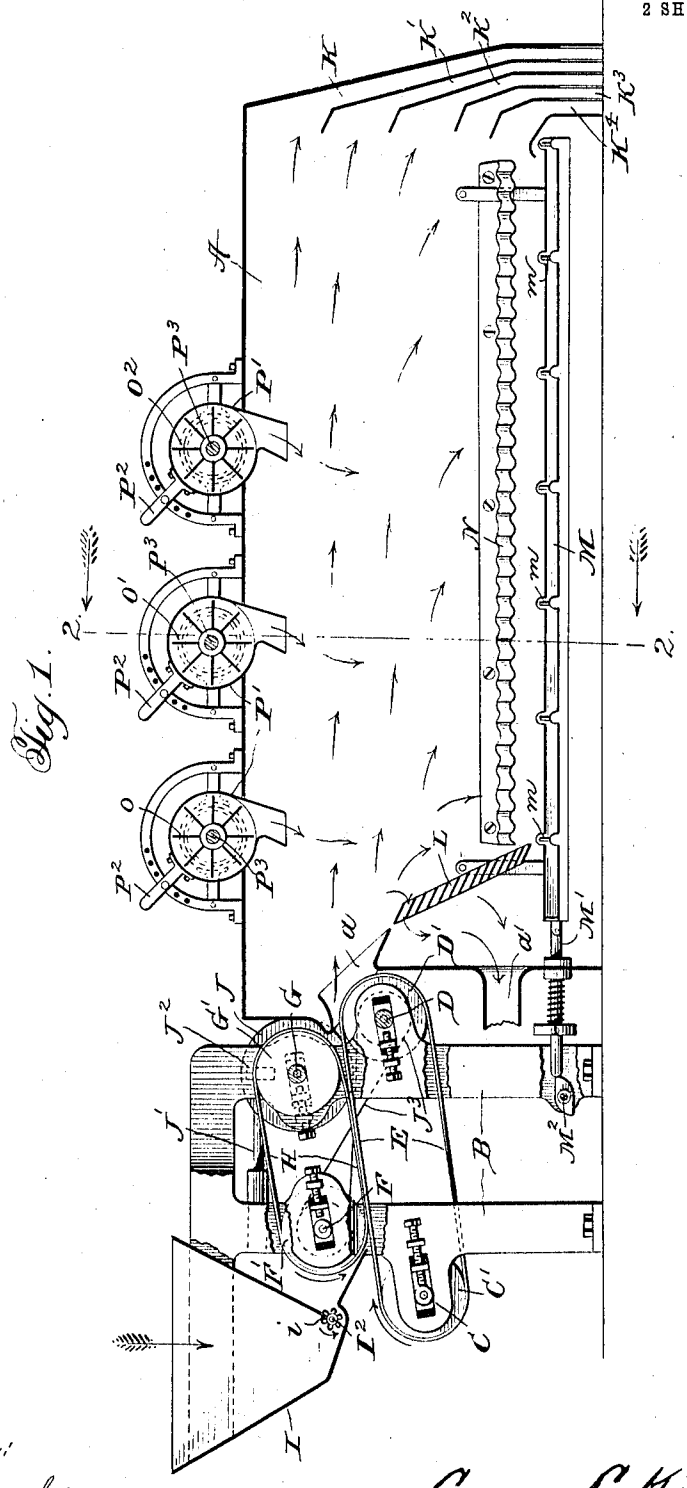


Fig. 1.

Witnesses:

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Thos. P. Steark.

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2 SHEETS—SHEET 2.

Fig. 2.

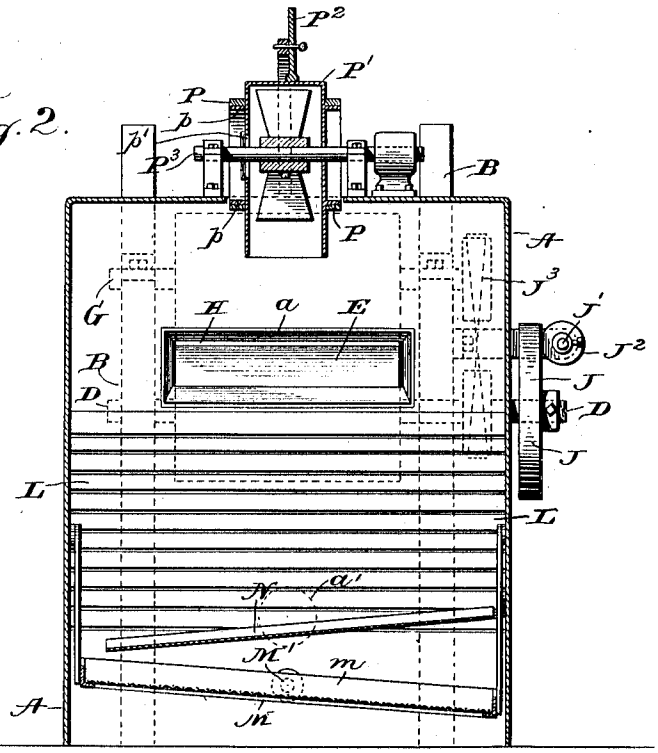


Fig. 3.

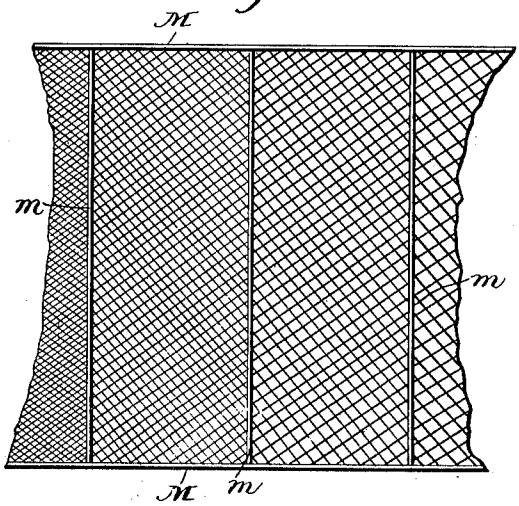
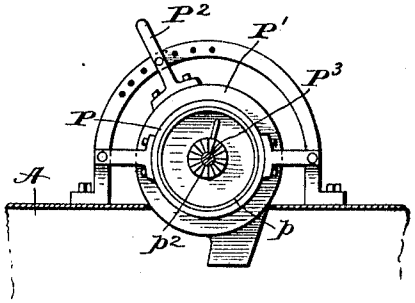


Fig. 4.



Witnesses:

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UNITED STATES PATENT OFFICE.

GEORGE CHANDLER KIDDER, OF SALT LAKE CITY, UTAH.

ORE CONCENTRATOR OR SEPARATOR.

974,395. Specification of Letters Patent. Patented Nov. 1, 1910.

Application filed February 3, 1909. Serial No. 475,897.

To all whom it may concern:

Be it known that I, GEORGE C. KIDDER, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Ore Concentrators or Separators, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to an improvement in ore concentrators or separators and more particularly to apparatus of this character designed to effect the concentration or separation of dry ores.

The primary object of the present invention is the provision of an apparatus of this character which will more thoroughly effect the separation of the ore into its constituent materials than the devices heretofore used for this purpose.

A further object of the invention is the provision of an apparatus of this character which is so constructed that it may be readily adapted to effect the complete separation of dry ores of different characteristics.

Other objects of the invention will be apparent from the detailed description herein when read in connection with the accompanying drawing forming a part hereof, wherein a preferable embodiment of the invention is shown, and wherein like numerals of reference refer to similar parts in the several views.

In the drawings, Figure 1 is a longitudinal section of my improved apparatus, Fig. 2 is a cross section on line 2—2 of Fig. 1, Fig. 3 is a detail view of the reciprocating screens, and Fig. 4 is a detail view of one of the fans.

Referring now more particularly to the drawing, A designates a closed chamber in which the separation of the ore is effected, said chamber being provided at its forward end adjacent the top thereof with an inlet opening *a*, through which the ore is projected by means hereinafter described. Positioned in front of the chamber A is a frame B in which are journaled transversely disposed shafts C and D, which shafts carry rollers C′ and D′ which support an endless belt E, preferably formed of rubber or leather. The roller D′ is positioned slightly above the roller C′ and directly at the inlet opening *a* of the chamber A, so that the belt E is inclined upwardly slightly and so that in the operation of the device the material carried by the belt will be projected into the chamber A, in a path extending longitudinally thereof. The shafts C and D are mounted in movable bearings of any convenient form so that the belt E may be maintained at any desired tension.

Journaled in the frame B above the shafts C and D are two transversely disposed shafts F and G which carry rollers F′ and G′ upon which is mounted an endless belt H, which is preferably of softer material than the belt E heretofore described. The shafts F and G are mounted in movable bearings of any convenient type so that the tension of the belt H may be readily regulated. The rollers C, D, F and G are so positioned relatively to each other that in the operation of the device the belts H and E are in contact for substantially the full length thereof, and the belt E, which is the carrying belt, is preferably maintained taut, while the belt H is maintained somewhat slack in order to preserve a better contact between the belts during the travel thereof.

I designates a hopper which is adapted to receive the crushed ore which is to be separated and which is provided at its lower end with a transverse outlet opening *i* from which extends a downwardly extending apron, the lower end of which extends into close proximity to the upper surface of the belt E adjacent the forward point of contact of the belt H therewith.

Journaled in the hopper I at the inlet opening *i* thereof is a feed roller I^2, which is provided with a plurality of radial wings or projections and which serves to deliver the ore from the hopper onto the apron in an even stream. Any convenient means may be employed for actuating the feed roller I^2. The shaft D, heretofore described, is provided at one end with a fly wheel J, the outer surface of which is turned true so as to constitute a friction disk.

J′ designates a drive shaft, which is journaled in bearings of any convenient type and extends across the outer face of the fly wheel J, said shaft being driven from any suitable source of power. Slidably mounted upon the drive shaft J′ and keyed thereto so as to rotate therewith, is a friction pulley J^2, which is adapted to frictionally engage the outer face of the fly wheel J. Any convenient and well known means may be employed for shifting the friction pulley J^2 across the

face of the fly wheel J to vary the speed of rotation of the shaft D. Motion is transmitted to the belt H by means of a cross belt J^3 which extends from a pulley on the shaft D to a pulley on the shaft F.

The end of the casing or chamber A opposite the inlet opening *a* is provided with a plurality of compartments K, K′, K^2, K^3, and K^4 which are positioned directly in front of each other and extend directly across the chamber for the full width thereof, the inlet opening of the first compartment K being located adjacent the bottom of the chamber and the inlet openings of the other compartments each being positioned above the inlet opening of the compartment immediately in front thereof, the inlet opening of the last compartment being positioned at the upper end of the chamber. From this construction, it will be seen that the entire end of the chamber A is covered by the inlet openings to the several compartments, so that any material which is thrown to the rear end of the chamber will enter one of said compartments, the particular compartment which the material enters being determined by its position in the chamber due to its density, the more dense particles going into the last compartment and the less dense particles going into the other compartments. The compartments, K, K′, K^2 and K^3 are open at the bottoms thereof and any convenient means may be employed for collecting the materials which fall therein.

The chamber A is provided at the front thereof adjacent its lower end with an opening *a′* with which is connected an exhaust fan of any convenient type and positioned within the chamber in rear of said opening is a slatted partition L which extends transversely across the chamber, the upper end of said partition extending in close proximity to the inlet opening *a* of the chamber A, and the lower end of the partition extending in proximity to the bottom of the chamber A. Positioned within the lower portion of the chamber A and extending substantially the entire length thereof, is a screen M, which is suspended by suitable links pivoted at their upper ends to the sides of the chamber so that the screen is capable of a vibratory movement in a direction lengthwise of the chamber. The screen slopes transversely of the chamber A and is divided by a plurality of low partitions *m* into a plurality of sections, said sections being provided with screening material of varying mesh, the section at the rear end of the chamber being of comparatively coarse mesh and the sections in front thereof gradually diminishing in mesh, the section at the front of the chamber being of very small mesh. Fixedly secured within the chamber A and directly overlying the screen M, is a plate N of substantially the same area as the screen M, said plate being adapted to receive the material as it settles in the chamber and direct the same onto the screen, said plate being inclined transversely of the chamber in a direction opposite to the screen M, so that as the material passes from off the plate, it will fall upon the high side of the screen. The plate or apron N which is positioned above the screen M is preferably provided with corrugations extending transversely thereof, said corrugations being of sufficient depth to effectually counteract any tendency the falling particles of material may have to ricochet along the apron and fall upon the screen out of their proper order.

Any suitable means may be employed for imparting a vibratory movement to the screen M. In the form shown in the drawings, however, a rod M′ extends from the front end of the screen and projects through the front wall of the chamber A, which rod is surrounded by a coil spring which is interposed between a collar secured on the outwardly projecting portion thereof and the front wall of the casing. Positioned adjacent the outer end of the rod M′ is a shaft M^2 which is provided with a plurality of tappets thereon adapted to intermittently engage the rod M′ and force the same inwardly against the tension of the coil spring. Any convenient means may be utilized for continuously rotating the shaft M^2.

Secured upon the top of the chamber A and along the medial line thereof are a plurality of fans, three being shown in the present instance, O, O′, and O^2, the outlets of which extend downwardly into the casing, so that said fans will successively deliver a blast of air upon the material as it passes through the chamber, the outlet openings of the fans being angularly adjustable so that the blasts of air may be directed onto the material at any desired angle. The fans O, O′ and O^2 are similar in construction and but one of them need therefore be described for the purposes of this specification. Rigidly supported in any suitable manner upon the upper portion of the casing A are a pair of rings P which are arranged side by side and in axial alinement. Positioned between the rings P is a casing P′ for the fan O which is provided with the usual discharge opening which projects through the top of the chamber A. The casing P′ has secured to the sides thereof circular members *p* which fit within the rings P, so that the fan casing may be shifted bodily to vary the angle of the discharge opening thereof. The fan casing is provided with a handle P^2, which plays over a quadrant secured to the top of the chamber A, any convenient means being employed for locking the handle to the quadrant to hold the fan casing in any desired position of adjustment. The

fan proper may be of any well known construction and is carried by a shaft P^3 journaled in suitable bearings mounted upon the chamber A. The fan casing P′ is provided with the usual opening p' in one side thereof through which the air is drawn in and said opening is provided with a shutter p^2 to permit its area to be increased or diminished so that the strength of the blast of air from the fan can be regulated to a nicety. The fans O, O′ and O^2 are preferably provided with independent driving means so that they can be adjusted independently of each other.

In the operation of the device, the ore which is to be separated is first crushed and placed in the hopper I and through the medium of the feed roller I^2 fed between the belts E and H. The belt E is rotated at a sufficient speed to cause the material to be projected with considerable force in a thin even layer into the chamber A. Immediately after leaving the belt E and entering the chamber A, the material will encounter a blast of air from the first fan O, which will cause the lighter and finest particles to fall upon the plate or apron N and from thence onto the proper section of the screen M, any extremely light particles such as dust being drawn by the exhaust fan through the partition L and out the opening a'. As the material proceeds it encounters first the blast from the fan O′ and then the blast from the fan O^2, which will cause the particles of different densities to be graded to a nicety and to fall upon the proper sections of the screen M or into one of the compartments K, K′, K^2, K^3, K^4. The mass of material which is projected into the chamber consists of metallic and non-metallic particles which will be delivered onto the inclined apron and screen sections according to their respective weights. Of the material delivered on any particular screen section, the non-metallic particles will of course be much larger than the metallic particles of the same weight and each screen section is of a size that the metallic particles which are deposited thereon will pass therethrough, while the larger non-metallic particles will remain on the top of the screen. The metallic particles which pass through the screen may be collected in any suitable manner and are then ready for the blast furnace. The non-metallic particles are from time to time taken off the screen and either thrown away, or, what is preferable, subjected to treatment in a second machine, as these non-metallic particles will be found to contain a small per cent. of metal which can be recovered in this way.

As the fans are independently driven, it will be apparent that they may be driven at any desired speed and that any one of them or all of them may be stopped should it be found advisable to do so in the treatment of certain classes of ore, and this together with the fact that the amount of blast and the direction of each blast can readily be controlled, renders the machine adaptable for use with dry ores having widely differing characteristics.

While a preferred embodiment of the invention is illustrated in the accompanying drawings, it will be obvious that many minor changes may be made to the form and construction therein shown without departing from the spirit of the invention as defined in the appended claims.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In an ore separator, a chamber, a screen in the lower portion thereof, said screen sloping transversely of the chamber and increasing in mesh from the front to the rear of the chamber, and means for projecting ore into said chamber from the front thereof toward the rear thereof above said screen.

2. In an ore separator, a chamber, a screen in the lower portion thereof, said screen sloping transversely of the chamber and increasing in mesh from the front to the rear of the chamber, means for vibrating said screen longitudinally of the chamber, and means for projecting ore into said chamber from the front thereof toward the rear thereof above said screen.

3. In an ore separator, a chamber, a screen in the lower portion of said chamber increasing in mesh from the front to the rear of the chamber, a transversely inclined apron positioned above said screen, and means for projecting ore into said chamber from the front thereof toward the rear thereof above said apron.

4. In an ore separator, a chamber, a screen in the lower portion of said chamber increasing in mesh from the front to the rear of the chamber, a transversely inclined apron positioned above said screen and provided with channels extending transversely thereof so as to deliver material to the screen, and means for projecting ore into the front of said chamber toward the rear thereof above said apron.

5. In an ore separator, a chamber, a screen in the lower portion of said chamber formed of a plurality of sections increasing in mesh from the front to the rear of the chamber, a transversely inclined apron positioned above said screen, and means for projecting ore into said chamber from the front thereof toward the rear thereof above said apron.

6. In an ore separator, a chamber, a screen in the lower portion of said chamber formed of a plurality of sections increasing in mesh from the front to the rear of the chamber, means for imparting a vibratory movement to said screen longitudinally of the chamber,

a transversely inclined apron positioned above said screen, and means for projecting ore into the front of said chamber toward the rear thereof above said apron.

7. In an ore separator, a chamber, a screen in the lower portion of said chamber, said screen being inclined transversely of the chamber and formed of a plurality of sections increasing in mesh from the front to the rear of the chamber, means for imparting a vibratory movement to the screen, a reversely inclined transversely corrugated apron positioned above said screen, and means for projecting ore into the front of said chamber above said apron.

8. In an ore separator, a chamber, a plurality of compartments at the rear end of said chamber, the inlet openings of said compartments being at different elevations and extending completely across the end of the chamber, separating devices extending from the front to the rear of the chamber in the main portion thereof and adapted to receive materials of different weights, and means at the front end of the chamber for projecting a stream of ore toward the rear thereof.

9. In an ore separator, a chamber, a plurality of compartments at the rear end of the chamber having their inlet openings at different elevations, a screen in the lower portion of said chamber increasing in mesh from the front to the rear of the chamber, and means at the front end of the chamber for projecting a stream of ore toward the rear of the chamber above said screen.

10. In an ore separator, a chamber, a plurality of compartments at the rear end of the chamber having their inlet openings at different elevations, a screen in the lower portion of the chamber extending substantially the full length thereof and inclined transversely of the chamber, said screen increasing in mesh from the front to the rear of the chamber, and means at the front end of the chamber for projecting a stream of ore toward the rear end of the chamber above said screen.

11. In an ore separator, a chamber, a plurality of compartments at the rear end of the chamber having their inlet openings at different elevations, a screen in the lower portion of said chamber increasing in mesh from the front to the rear of the chamber, a transversely inclined apron positioned above said screen, and means at the front of said chamber for projecting a stream of ore into said chamber and toward the rear thereof and above said screen.

12. In an ore separator, a chamber, a plurality of compartments at the rear end of the chamber having their inlet openings at different elevations, a transversely inclined screen in the lower portion of said chamber formed of sections increasing in mesh from the front to the rear of said chamber, and a reversely inclined apron positioned above said screen, and means at the front of said chamber for projecting a stream of ore into said chamber and toward the rear thereof and above said screen.

13. In an ore separator, a closed chamber, means for projecting a stream of ore into the front of said chamber and toward the rear thereof, separating devices in the lower portion of the chamber adapted to receive materials of different weights and to separate the metallic from the non-metallic portions thereof, and means for directing a blast of air downwardly and onto the stream of ore during its travel in the chamber.

14. In an ore separator, a closed chamber, means for projecting a stream of ore into the front of said chamber and toward the rear thereof, separating devices in the lower portion of the chamber adapted to receive materials of different weights and to separate the metallic from the non-metallic portions thereof, and means for successively subjecting the ore during its travel through the chamber to downwardly directed blasts of air.

15. In an ore separator, a chamber, a graded screen therein, means for projecting a stream of ore longitudinally of said chamber above said screen, and a fan positioned in the upper portion of said chamber and adapted to direct a blast of air onto the ore during its travel in the chamber.

16. In an ore separator, a chamber, a screen in the lower portion of said chamber graded from the front to the rear thereof, means for projecting a stream of ore longitudinally of said chamber above said screen, and a plurality of independently operated fans positioned in the upper portion of the casing, and adapted to direct blasts of air onto the material during its travel in the chamber.

17. In an ore separator, a chamber, a screen in the lower portion of said chamber graded from the front to the rear thereof, means for projecting a stream of ore longitudinally of the chamber above said screen, and angularly adjustable means for directing a blast of air onto the top of the stream of ore during its travel in the chamber.

18. In an ore separator, a chamber, separating devices in the lower portion of the chamber adapted to receive materials of different weights and to separate the metallic from the non-metallic portions thereof, means for projecting ore into said chamber from the front thereof toward the rear thereof above said separating devices, and an exhaust fan communicating with the front end of said chamber below said projecting means.

19. In an ore separator, a chamber, means for projecting ore into the front of said

chamber, and a plurality of independently operated fans positioned in the upper portion of the casing and adapted to direct blasts of air onto the ore during its travel in the chamber, said fans being each provided with an angularly adjustable outlet nozzle.

20. In an ore separator, a chamber, separating devices therein, means for projecting a stream of ore longitudinally of the chamber, a fan in the top of the chamber, a casing for said fan provided with an outlet nozzle extending downwardly in the upper portion of the chamber, and means for oscillating said casing.

21. In an ore separator, a chamber, a screen in the lower portion of said chamber formed of a series of sections increasing in mesh from the front to the rear of the chamber, means for projecting a stream of ore longitudinally of said chamber, comprising an upwardly inclined endless belt having its delivery end positioned to deliver material to the front of the chamber, a second belt contacting with the upper surface of said first mentioned belt, and means for directing a blast of air onto the stream of ore during its travel in said chamber.

22. In an ore separator, a chamber, a screen in said chamber formed of a series of sections increasing in mesh from the front to the rear of the chamber, means for projecting ore into the front of the chamber, and means for subjecting the ore successively to a plurality of downwardly directed blasts of air during its travel in the chamber.

23. In an ore separator, a chamber, a screen in the lower portion thereof increasing in mesh from the front to the rear of the chamber, means for projecting ore into said chamber from the front thereof toward the rear thereof above said screen, and an exhaust fan communicating with the front end of said chamber below said projecting means.

24. In an ore separator, a chamber, a screen in the lower portion thereof, said screen increasing in mesh from the front to the rear of the chamber, means for projecting ore into said chamber from the front thereof toward the rear thereof above said screen, means for subjecting the projected stream of ore to a downward blast of air during its travel in the chamber, and an exhaust fan communicating with the front of said chamber below the ore projecting means.

25. In an ore separator, a chamber, a screen in the lower portion thereof, said screen increasing in mesh from the front to the rear of the chamber, a vertically disposed slatted wall in said chamber adjacent the front end of said screen, means for projecting ore into said chamber from the front thereof toward the rear thereof above said screen, and an exhaust fan communicating with said chamber in front of said slatted wall.

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

GEORGE CHANDLER KIDDER.

Witnesses:

PEARL DURNELL,

BLANCHE L. KIDDER.