E. S. McKINLAY.

CONCENTRATING APPARATUS.

APPLICATION FILED JAN. 31, 1908.

951,964. Patented Mar. 15, 1910.

Fig. 1.

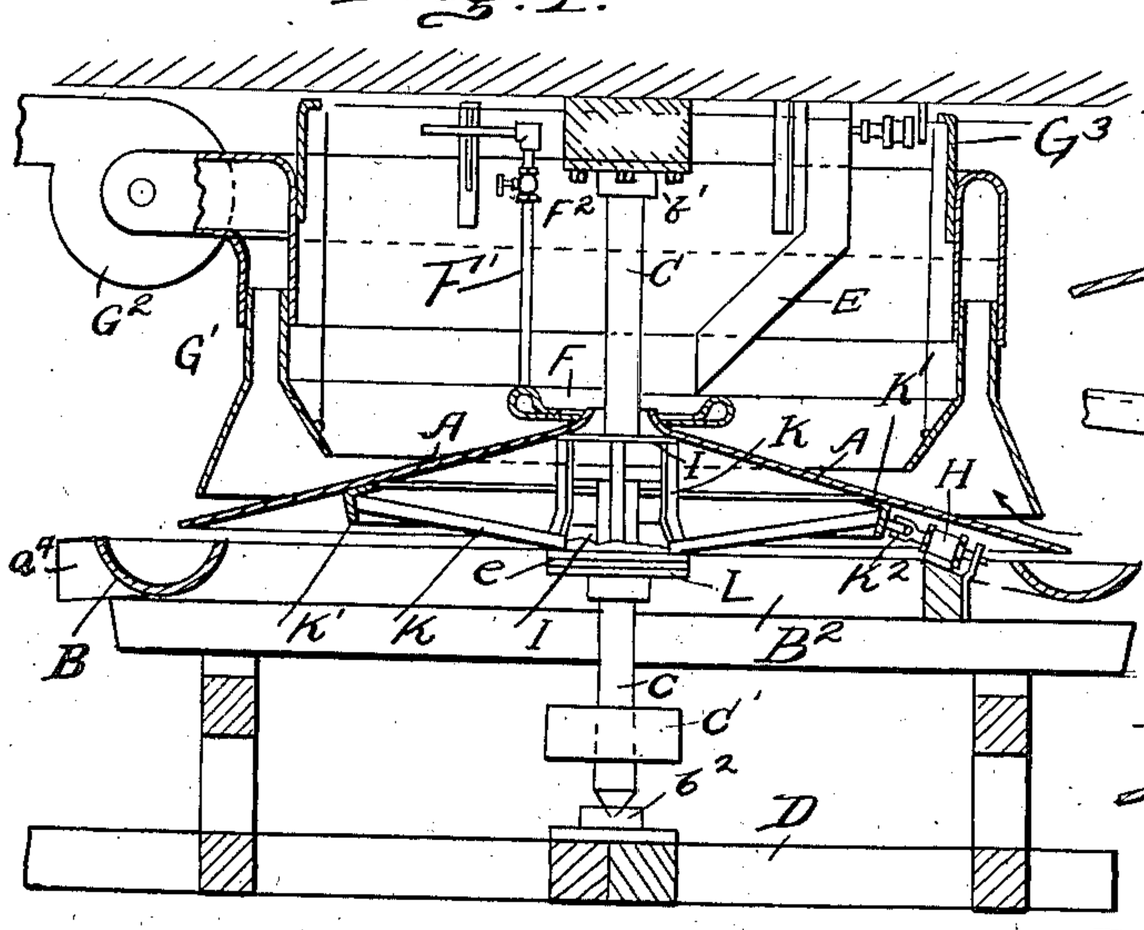


Fig. 2.

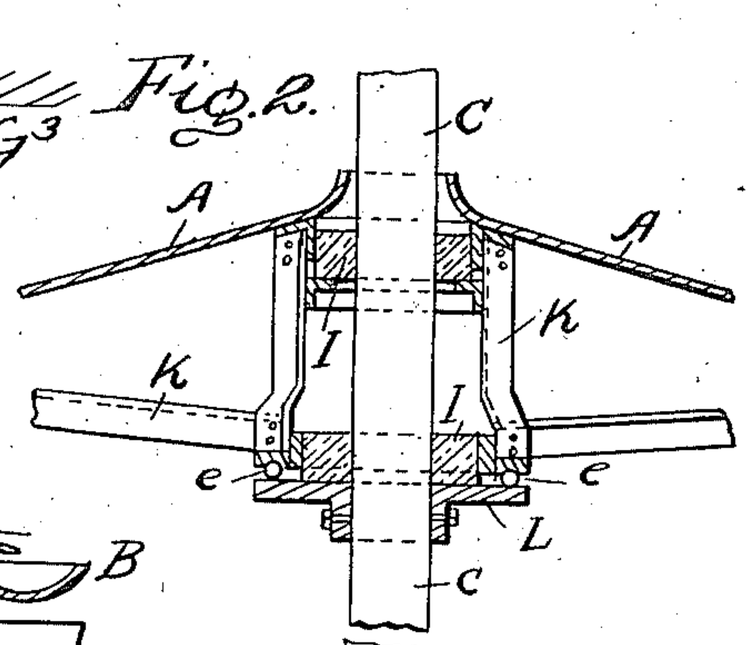


Fig. 4

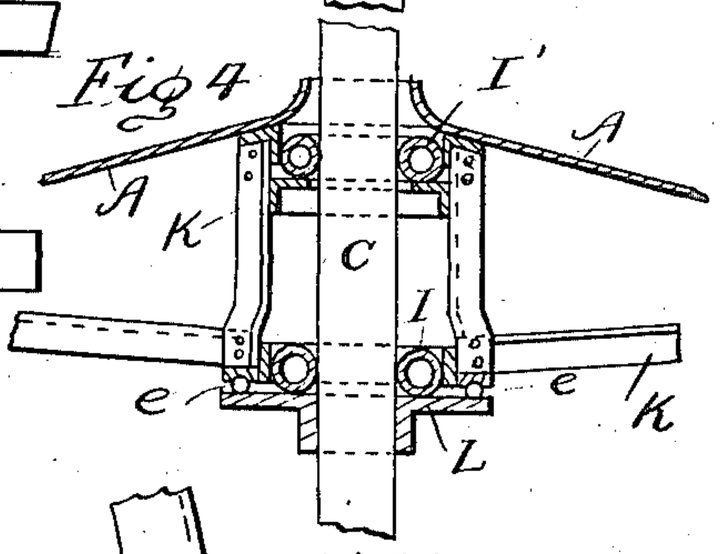


Fig. 3.

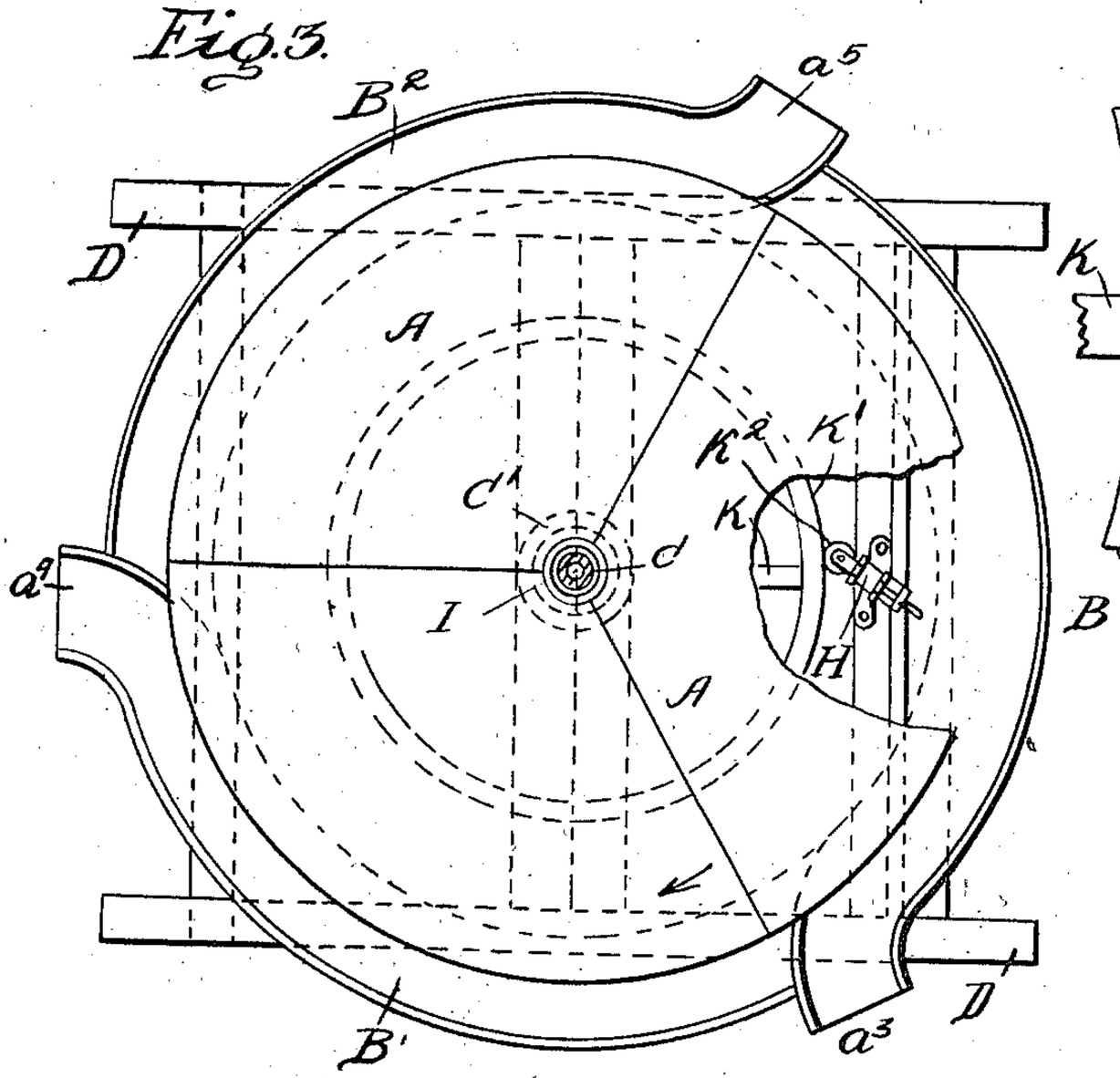


Fig. 5.

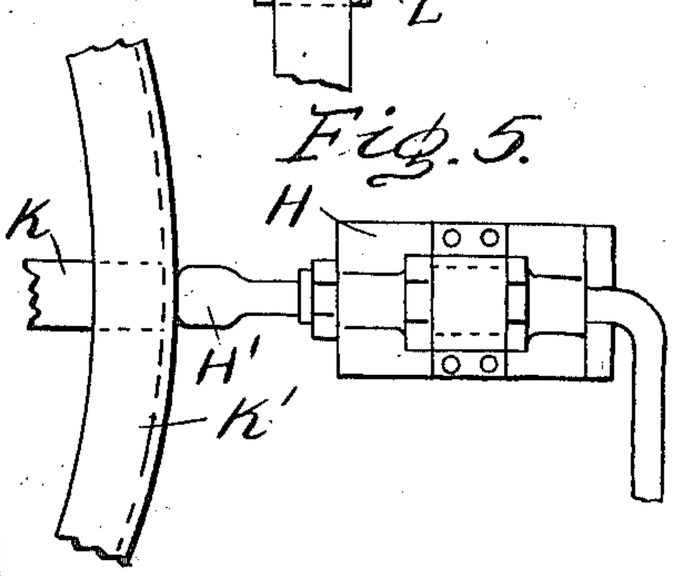
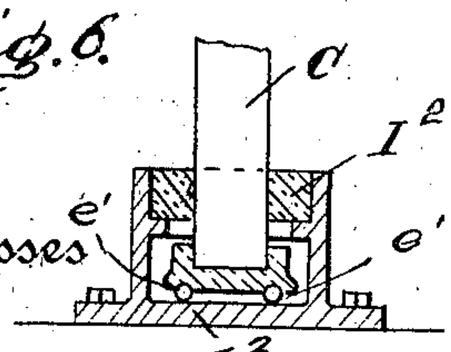


Fig. 6.



Witnesses

B. F. Mann

George E. Edelin

Inventor

E. S. McKinlay

By H. A. Bliss

Attorney

UNITED STATES PATENT OFFICE.

EDWARD S. McKINLAY, OF OAK CREEK, COLORADO.

CONCENTRATING APPARATUS.

951,964. Specification of Letters Patent. Patented Mar. 15, 1910.

Application filed January 31, 1908. Serial No. 413,701.

To all whom it may concern:

Be it known that I, EDWARD S. McKINLAY, citizen of the United States, residing at Oak Creek, in the county of Routt and State of Colorado, have invented certain new and useful Improvements in Concentrating Apparatus, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to separators for ores, coal and similar products, and consists in an inclined movable table over which the material to be separated is caused to flow and be separated thereon into grades according to its specific gravity, and discharged therefrom into separate receptacles.

The invention further consists in imparting to the table rapid vibratory motion at the same time that it is moved whereby the separation is accelerated.

The invention further consists in the novel devices and mechanisms whereby the desired results are accomplished, all as hereinafter shown and described, and specifically pointed out in the claims.

One embodiment of my invention is shown in the accompanying drawings forming a part of this specification. I do not desire, however, to be limited to the exact construction shown and described, and it will be understood that many changes of detail and of arrangement of parts may be made within the scope of my invention.

Figure 1 is a view partly in vertical transverse section, illustrating one form of the apparatus embodying my invention. Fig. 2 is an enlarged sectional detail illustrating one form of the table support. Fig. 3 is a top plan view partially broken away of the form of concentrator table illustrated in Fig. 1. Fig. 4 is an enlarged sectional detail showing an alternate form of table support. Fig. 5 is an enlarged detail view showing a modification of the hammer, and hammer location. Fig. 6 is an enlarged detail view showing a modified form of shaft support.

Referring to the drawings, A represents a conical table, preferably formed of smooth sheet metal. This table is mounted in a horizontal position on the vertical shaft C. The shaft C is rotatable in suitable bearings b' and b^2. On the frame D the belt pulley C′ is provided and may be used for rotating the shaft if desired.

The spout or chute E is provided, by means of which the material to be separated is supplied to the table at a point somewhat removed from the axial center. Immediately below the outer edges of the table A, I provide a plurality of curved receiving troughs. In the drawings I have shown three of these troughs, marked B, B′, B^2, but it will be understood that any desired number may be used. These troughs are slightly inclined toward their discharge ends a^3, a^4, and a^5.

As an aid to the separation of material I provide the steam or pneumatic striker H. This striker is mounted upon the frame and may be of any usual or preferred form. It may be described broadly, however, as having a cylinder with suitable ports and a piston within the cylinder adapted to be rapidly reciprocated, carrying with it the hammer K^2, as shown in Fig. 1. This hammer consists of a pivotally attached disk or cylinder. The annular anvil ring K′ is secured to the under side of the plate A, and is adapted to receive the blows of the hammer K^2. In the preferred form of my machine, as shown in Fig. 3, the striker H is mounted so that the hammer K^2 will deliver its blows in a direction at an acute angle to the ring K′. The pivotal mounting of the hammer K^2 prevents undue friction against the ring K′, but at the same time the angularity of the blows tends to give a rotary motion to the ring and the table to which it is attached. In fact, in many cases the table may be driven by the hammer alone without the aid of a belt on the wheel C′. An alternate position of mounting for the hammer H is shown in Fig. 5. In this position the hammer strikes radially and there is no tendency to rotate the table. With the striker acting radially there is also less friction between the hammer and the ring K′, and the hammer may be made integral with the piston rod, as shown at H′.

In order to permit greater freedom of vibration of the table A, I connect it to the shaft C by means of the frame work K, in the form shown in the drawings. This framework consists of a number of radially extending braces and an inner annular cage surrounding the shaft. The framework, as a whole, rests on the anti-friction balls *e*, which, in turn, are supported on the collar L, which is rigidly secured to the shaft C. Between the shaft and the cage of the framework K, I provide cushions, preferably two in number, of rubber or similar material.

As shown in Fig. 2, these cushions are solid rings I. In Fig. 4 the cushions are hollow tubes I′, which may be filled with air under pressure. These cushions form a frictional connection between the shaft and the table, by means of which the table may be rotated, when power is applied to the shaft. At the same time, the cushions permit the table to be knocked slightly out of its central position by the striker H but immediately return it to its central position. It will be understood that the balls *e* merely serve to prevent friction of vibration between the frame K and the flange L, there being, of course, no relative rotation of these two parts.

Another device for permitting the vibratory movement of the table is shown in Fig. 6. In this construction the bearing b^2 is made a ball step bearing having the balls *e′*. A rubber cushion I^2 surrounds the shaft and serves to hold it in its central position. At the same time, this cushion makes it possible for the shaft to vibrate slightly with the table.

My machine is adapted to be used for either a wet or a dry process of separation. To facilitate the wet process I provide the circular split tube F, which is connected to any suitable water supply by means of the pipe F′ and the valve F^2. The hood G′ is provided for use with the dry process. This hood is angular in form and is connected to a suitable suction fan G^2. The receiving part of the hood is made adjustable so that it may approach closely to the plate A, but may be lifted to give ample clearance when a wet process is used. The space within the hood G′ is entirely inclosed by means of the walls G^3. In this way all dust is entirely confined and cannot escape into the surrounding atmosphere. When a wet process is used, mineral pulp is supplied to the table A by means of the chute E. If sufficient water is applied with the mineral from the chute, no further water need be added. If, on the other hand, the pulp is too thick, so that it will not flow readily, an additional amount of water may be introduced by means of the tube F. The diluted pulp flows gradually downward over the conical surface of the table. The action of the water, together with gravity and the vibratory movement of the table, causes the lighter particles to move more rapidly. The table is rotated slowly at a constant speed, the speed being so adjusted that all of the lighter particles of a certain grade will reach the outer edge of the table at points above one of the spouts, as for instance B^2. The heavier particles of an intermediate grade will move less rapidly toward the outer edge of the table and will reach the outer edge when above the trough B′. The pure mineral being heavier than either of the foregoing grades will move still less rapidly and will not reach the outer edge of the table until above the trough B. In this way, there will be a continuous separation, the lighter particles being removed from the outlet a^5, the middlings from the outlet a^4 and the mineral from the outlet a^3.

The operation of the machine for a dry process is very similar to that for the wet process. The pulverized material is supplied from the chute E and distributes itself from the plates in grades according to its specific gravity and of the vibratory movement of the plate. The different grades of material are removed as before through the outlets a^5, a^4 and a^3. The hood G′ prevents any of the finer material from escaping into the atmosphere, as dust.

I am aware of the fact that in various screens and concentrating devices, use has been made of cams and springs for imparting movements to the table or sieve. The purpose of these cams and springs was to produce a relatively prolonged motion of the table in one direction and an equally long one in the opposite direction. That is to say, they were intended to project the material step by step over the surfaces of the table or screen. It was practically impossible to produce more than a few such movements per minute, even with rapidly revolving parts. But with the device which I employ I produce movements which are of the nature of a constant trembling rather than prolonged reciprocation, and in this respect I believe it is, in this art, entirely novel. I am further aware that it has been proposed to lift weights vertically above a concentrating table and let them drop a few times per minute at points near the edge on lines parallel to the vertical axis. But in such a case the results attained would be materially different from those attained by imparting to the table the exceedingly rapid impacts which I provide. The movement of the table at each blow is exceedingly short, it being of the nature of a throb rather than a marked reciprocation. The effect of this is merely to jostle the particles of different specific gravity and insure that they shall move a minute distance downward or outward, the blows causing, not so much an advance of each particle as a separation of it from those of different specific gravities, which at successive instants are adjacent to it.

What I claim is:

1. In a mechanism for separating materials, an inclined rotary table adapted to receive the material which is to be separated, a series of receptacles for the various separated materials, means for actuating said table relative to said receptacles and a reciprocating impacting device arranged to strike said table with rapid direct blows,

delivered in a direction substantially parallel with the material supporting surface of the table, substantially as set forth.

2. In an apparatus for separating materials, the combination of a rotary table having a continuous substantially conical and smooth surface, a series of stationary receptacles arranged near the edge of said table to receive the different grades of materials successively, and an impacting device arranged to strike said table with rapid direct blows, said impacting device acting in a plane substantially parallel with the surface of the table, substantially as set forth.

3. In an apparatus for separating material, the combination of a rotary receiving table, a resilient cushioning device acting to centralize the table, and a reciprocating impacting device arranged to strike the table with rapid direct blows, substantially as set forth.

4. In an apparatus for separating material, the combination of a rotary conical smooth table, means for supplying material to be separated to the table at a point adjacent the center thereof, means for receiving the separated material from the periphery of the table, and an impacting device arranged to strike the table with rapid direct blows and thereby impart to it a constant trembling motion, substantially as set forth.

5. A concentrator for ores and similar products comprising a rotatable table having an inclined material supporting surface along which all of the material moves radially outward, a vertical shaft for the table, means for yieldingly connecting the table to the shaft, a series of separate receptacles arranged around the delivery end of the table, and the impacting device disconnected from the table and arranged to deliver its impacts to the table, substantially as described.

6. In concentrators or separators for ores and similar products, a rotatable conical table adapted to receive a mass of several separable reduced materials and to permit said material to move downward across the line of movement of the table to cause said several masses to separate, a vertical shaft upon which the table is yieldably and elastically mounted, means for conducting each separated mass separately from said table, a series of separated receptacles arranged around the delivery edge of the table to receive the various grades of material progressively according to the gravitation of said grades, and an impacting device adapted to impart vibratory motion to said table, substantially as set forth.

7. In concentrators and separators for ores and similar products, a rotatable conical table, a vertical shaft, an elastic support between the shaft and the table, and an impacting device disconnected from the table and arranged to deliver its impacts to the table in a non-radial direction, whereby a rotary and vibratory motion is communicated simultaneously to the table, substantially as described.

8. In concentrators and separators for ores and similar products, a rotatable conical table, a vertical shaft, an elastic support between the shaft and the table, an annular member rigid with the table, and an impacting device disconnected from the table, consisting of a cylinder, a reciprocating piston, and means for actuating the piston, said piston being arranged to deliver its strokes on the perimeter of the annular member non-radially, whereby the table is rotated and a vibratory motion communicated thereto, substantially as described.

9. In concentrators and separators for ores and similar products, a rotatable conical table, a supporting shaft for the table, elastic cushions between the table and its shaft, a series of separated receptacles around the delivery edge of the table adapted to receive materials according to their gravity, and an impacting device disconnected from the table and arranged to deliver its impacts to the table to impart vibratory motion thereto, substantially as set forth.

10. In concentrators and separators for ores and similar products, a rotary table, a laterally yielding and elastic support for the table as a whole, and an impacting mechanism disconnected from the table and arranged to deliver abrupt blows or impacts to the table, substantially as described.

11. In concentrators and separators for ores and similar products, a rotary table, a yielding and elastic support for the table, and an impacting mechanism disconnected from the table arranged to deliver its impacts or blows on the table non-radially thereto, whereby the table is rotated and a vibratory motion simultaneously communicated thereto, substantially as described.

12. In a mechanism for separating materials, the combination of a substantially conical table, means for imparting motion to the same, a feeder for delivering material to be separated near the middle and higher part of the table, a circular hood situated with its entrance opening around the table and above the same, and means for producing an exhaust in said hood to remove lighter materials from the table, said hood being extensible to adjust its receiving opening relative to the table, substantially as set forth.

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

EDWARD S. McKINLAY.

Witnesses:
J. H. Burroughs,
L. P. Miller.