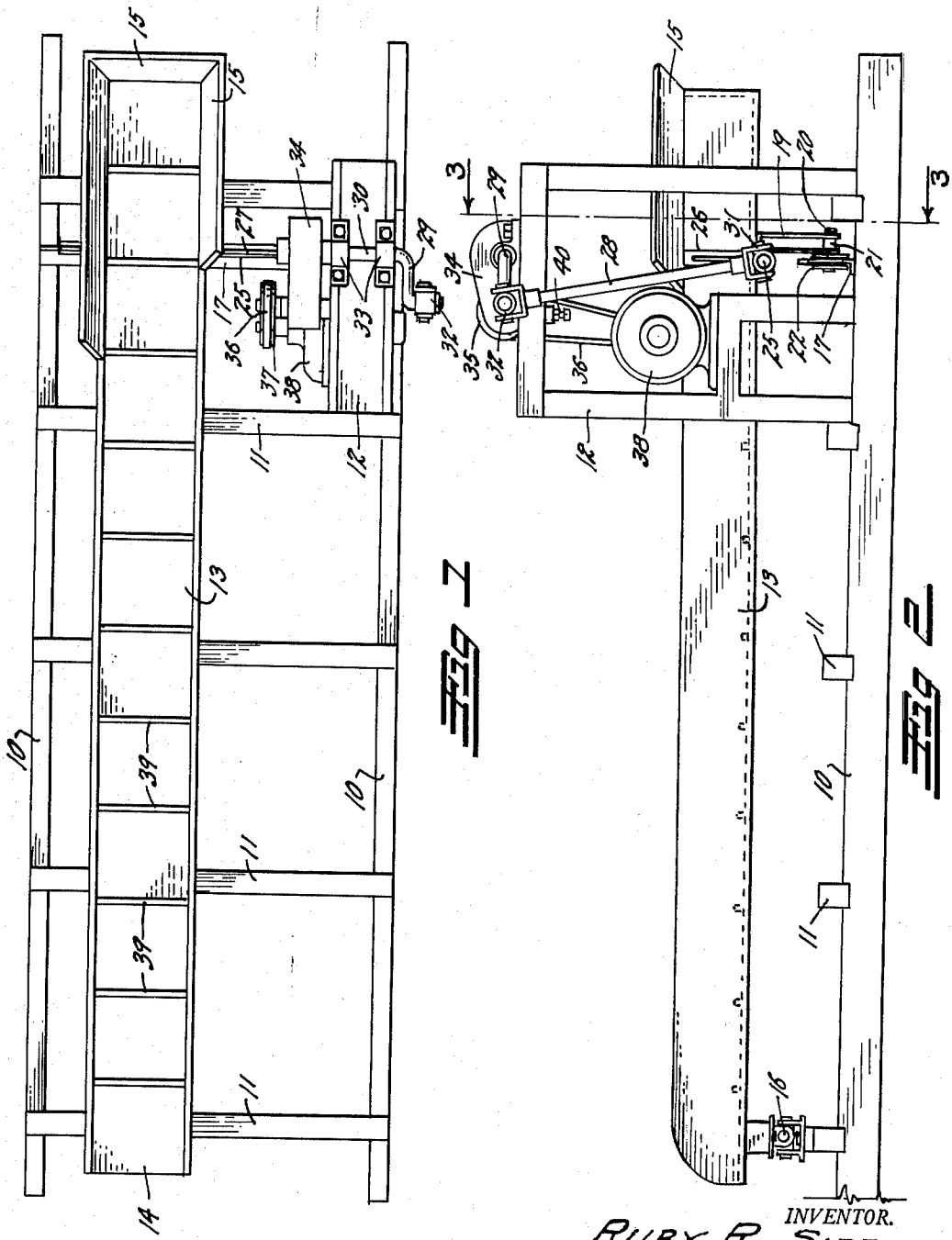
Aug. 9, 1955 R. R. SIDES 2,714,962

ORE SEPARATORS AND CONCENTRATORS

Filed July 23, 1952 2 Sheets-Sheet 1



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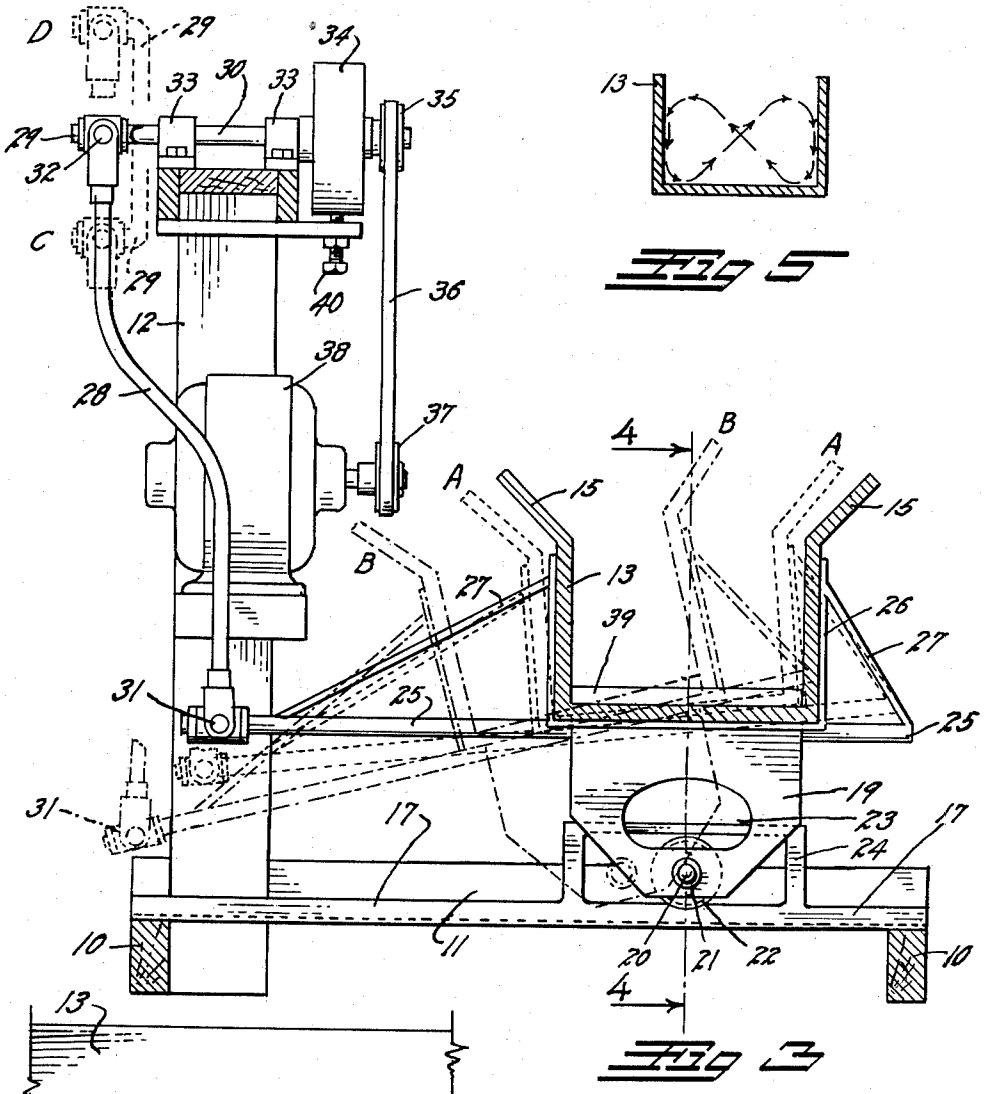


FIG. 3

FIG. 5

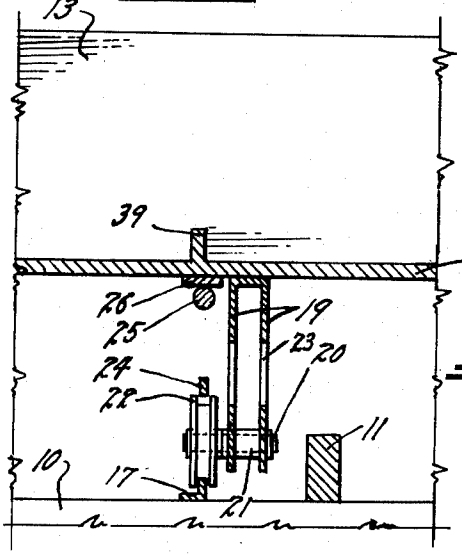


FIG. 4

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ORE SEPARATORS AND CONCENTRATORS

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3 Claims. (Cl. 209—437)

This invention relates to an ore separator or concentrator, and has for its principal object the provision of a simple and economical device of this character which will have a relatively high ore capacity in proportion to its size and power requirements, and which will be highly efficient in the recovery and separation of the values in ore and sand.

A further object of the invention is to provide an ore separator or concentrator which will act to impart kinetic energy to the ore particles which will assist gravity in separating the heavier minerals from the lighter gangue in the feed material, and which will operate on a continuous flow of feed material.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawings:

Fig. 1 is a plan view of the improved ore separator and concentrator;

Fig. 2 is a side view thereof;

Fig. 3 is an enlarged cross-section, taken on the line 3—3, Fig. 2, illustrating in broken lines various operative positions of the mechanism, to be later described;

Fig. 4 is a similarly enlarged, fragmentary, longitudinal section, taken on the line 4—4, Fig. 3; and

Fig. 5 is a diagrammatic cross-section through a sluice box employed in the invention, illustrating the lateral directions of flow of fluids therein.

The improved ore concentrator is supported on a base frame consisting of longitudinally extending side frame members **10** supporting spaced-apart cross frame members **11**. A supporting framework **12** is erected adjacent one of the side frame members **10** adjacent one extremity of the latter.

An elongated, open-topped sluice box **13**, which may be provided with a plurality of transversally extending, spaced-apart bottom riffles **39**, is supported longitudinally of the base frame and over the latter. The box **13** is preferably, but not necessarily, substantially level throughout its length, but may in some instances, depending upon the particular ore being worked, be inclined upwardly from its feed extremity to its discharge extremity. The feed extremity is closed and is provided with outwardly inclined hopper boards **15** to form a feed hopper at the latter extremity. The discharge extremity is open to provide an overflow lip **14**.

The box **13** is supported adjacent this discharge extremity upon one of the cross frame members **11** through the medium of a universally movable supporting hinge **16** which allows the box to freely tilt in any desired direction, but prevents sideward or endwise movement thereof.

The feed extremity of the box **13** is supported on a transversally extending, angle iron track member **17** supported from the side frame members **10**. Two parallel bracket plates **19** are secured to the bottom of the box and extend downwardly therefrom adjacent the track member **17** and at right angles to the longitudinal axis of the box.

A roller shaft **20** is mounted in a bearing sleeve **21** supported by the bracket plates adjacent the bottoms of the latter, to provide an axle for a grooved roller **22**. The roller **22** is positioned on, and arranged to roll along, the track member **17**. The plates **19** may be cut away, as shown at **23**, to allow access to the roller and to reduce the weight of the plates. The length of travel of the roller **22** is limited by means of an elongated roller frame **24** which is secured to, and supported from, the track member **17** about the roller **22**. The track frame also acts to prevent the roller from bouncing on the track member.

It can be seen that the above mounting allows the box **13** to tilt freely to the right or left about the axis of the roller shaft **20**. It also allows the feed extremity of the box to swing freely to the right or left as the roller **22** rolls back and forth along the track member **17**. The above movements occur in combination and simultaneously, and are imparted to the box through the medium of a tilting lever **25** which extends rigidly outward to one side of the feed extremity of the box to a position beneath the supporting framework **12**.

The tilting lever is secured in a U-shaped yoke **26** in which the box rests, and the yoke is securely braced from the lever by means of suitable angle braces **27**. The projecting extremity of the tilting lever **25** is supported by means of a connecting rod **28** which is suspended from a crank **29** on a crank shaft **30**. The connecting rod **28** is connected to the tilting lever **25** through the medium of a suitable universal joint **31**, and is similarly connected to the crank **29** by means of a similar universal joint **32**. The joints **31** and **32** allow the lever **25** to move parallel to the axis of the crank shaft **30**, and also allow the lever **25** and the crank **29** to rotate within their respective joints.

The crank shaft **30** is mounted in suitable pillow blocks **33** on the supporting framework **12** and terminates in any conventional speed reducer contained within a speed reducer housing **34**. Power is applied to a driven pulley **35** on the speed reducer through the medium of an endless transmission belt **36** extending about a drive pulley **37** on any suitable power device, such as an electric motor **38**. The tension in the belt **36** can be regulated by any suitable means, such as by means of a jack screw **40**, acting against the speed reducer housing **34** to rotate the latter about the axis of the shaft **30**.

The ore or sand from which the values are to be separated or concentrated is fed into the feed extremity of the box **13**, together with a continuous flow of water, as is customary in this class of ore concentrating devices. The suspended solid materials in the water tend to pocket back of each of the riffles **39**. The water successively overflows the riffles and discharges from the overflow lip **14**.

The operation as thus far described is somewhat similar to that of the usual sluice box. In this invention, however, a complex movement is imparted to the feed extremity of the box, very closely simulating the movement of a prospector's pan during the act of panning sand for the ore values.

Let us assume that the motor is operating and that the water and ore are being fed into the feed extremity of the box **13**, and, for the purpose of description, let us assume that the box is in the solid-line position of Fig. 3. Rotation of the crank shaft **30** will move the crank **29** downwardly toward the broken-line position C of Fig. 3.

The initial downward movement of the crank laterally tilts the feed extremity of the box **13** toward the dotted-line position A—A in the latter figure and simultaneously swings the entire feed extremity to the left in Fig. 3 toward the dash-dot position B—B of Fig. 3 as the roller **22** rolls along the track member **17**. This causes the fluid contents and the suspended solids in the box to flow or swish toward the lowering side of the box, striking the latter above the bottom of the box, as indicated in the flow diagram of Fig. 5.

When the box reaches the position B—B, the roller reaches the extremity of travel in the roller frame **24**, thus abruptly stopping the movement of the box and causing the heavy particles in the feed to continue on under the influence of their kinetic energy added to the influence of gravity. This throws or forces the heavier mineral values into close contact with the side of the box.

The crank shaft **30** continues to rotate toward the broken-line position D of Fig. 3 and quickly lifts the lowered side of the box to force the heavier materials against the bottom thereof, thence tilts it in the opposite direction to a position opposite to the position A—A of Fig. 3 to cause the fluid contents to rapidly flow against the opposite side above the bottom as the box is brought to an abrupt stop at the opposite termination of the travel of the roller **22** and in a position opposite to the position B—B of Fig. 3. The abrupt lifting of the filled side of the box and the abrupt stopping of the flow against the opposite side continues to cause a transverse figure **8** flow of the fluid, as shown in Fig. 5, which deposits the heavier materials in a medial pile or ridge **18** along the middle of the box throughout the entire length thereof.

This combination of tilting, rolling, stopping and lifting motion is most extreme at the forward or feed extremity of the box, and gradually tapers out as the discharge extremity is approached. The discharge extremity is subjected only to a gentle, forward-and-back, tilting motion which will not disturb the retention of the fine values adjacent the discharge.

The retention of the values is assisted by, but is not dependent upon, the riffles. The action of the combined motions tend to force the water in a direction opposite to the direction in which the heavier values are forced to obtain a highly efficient, hydraulic separation. This appears to be due to the fact that the swinging of the entire length of the box about the vertical axis of the universal joint **16** creates a centrifugal effect on the water, causing it to flow along the bottom of the box toward the feed extremity, where it will rise against the descending ore until a sufficient water head is created to overflow toward the discharge extremity and over the overflow lip **14**. While the above water action is taking place, the heavies

are being thrown back and forth between the box sides on an alternating, zig-zag, step-by-step course toward the discharge extremity until they settle in the comparatively quiescent zone along the middle of the box bottom, as shown at **18** in Fig. 5.

While a specific form of the improvement has been described and illustrated herein, it is to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:

1. An ore separating device comprising: a supporting frame; a substantially level, elongated box having a feed extremity and an open discharge extremity; a universal joint supported from said frame and being medially secured beneath the discharge extremity of said box whereby the latter may be tilted and swung in all directions; a straight, horizontal track member supported by said frame beneath the feed extremity of said box and extending transversally of the long axis of the latter; a roller positioned on, and arranged to roll freely along, said track member; a roller shaft in said roller; bracket means mounting the mid-portion of said feed extremity on said roller shaft; and means for tilting said box about the axis of said roller, said roller being free to roll along said track so that the said roller will be caused to roll along said track member in consequence of the impact of the material rushing to the low side of said box when the latter is tilted.

2. An ore separating device as described in claim 1 having a tilting lever rigidly affixed to said box adjacent the feed extremity thereof and extending sidewardly therefrom; a crank rotatably supported from said frame above the outer extremity of said tilting lever; and a connecting member suspending the outer extremity of said tilting lever from said crank, said connecting member being free to swing in all directions relative to the axes of said crank and said tilting lever so as not to impede the independent, free travel of said roller along said track member.

3. An ore separating device as described in claim 2 having an elongated roller frame supported from said supporting frame about the path of movement of said roller and acting to limit the vertical and horizontal movements of said roller.

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