Aug. 10, 1926. 1,595,583

R. O. STOKES

CONVEYER

Filed Feb. 18, 1926 2 Sheets-Sheet 1

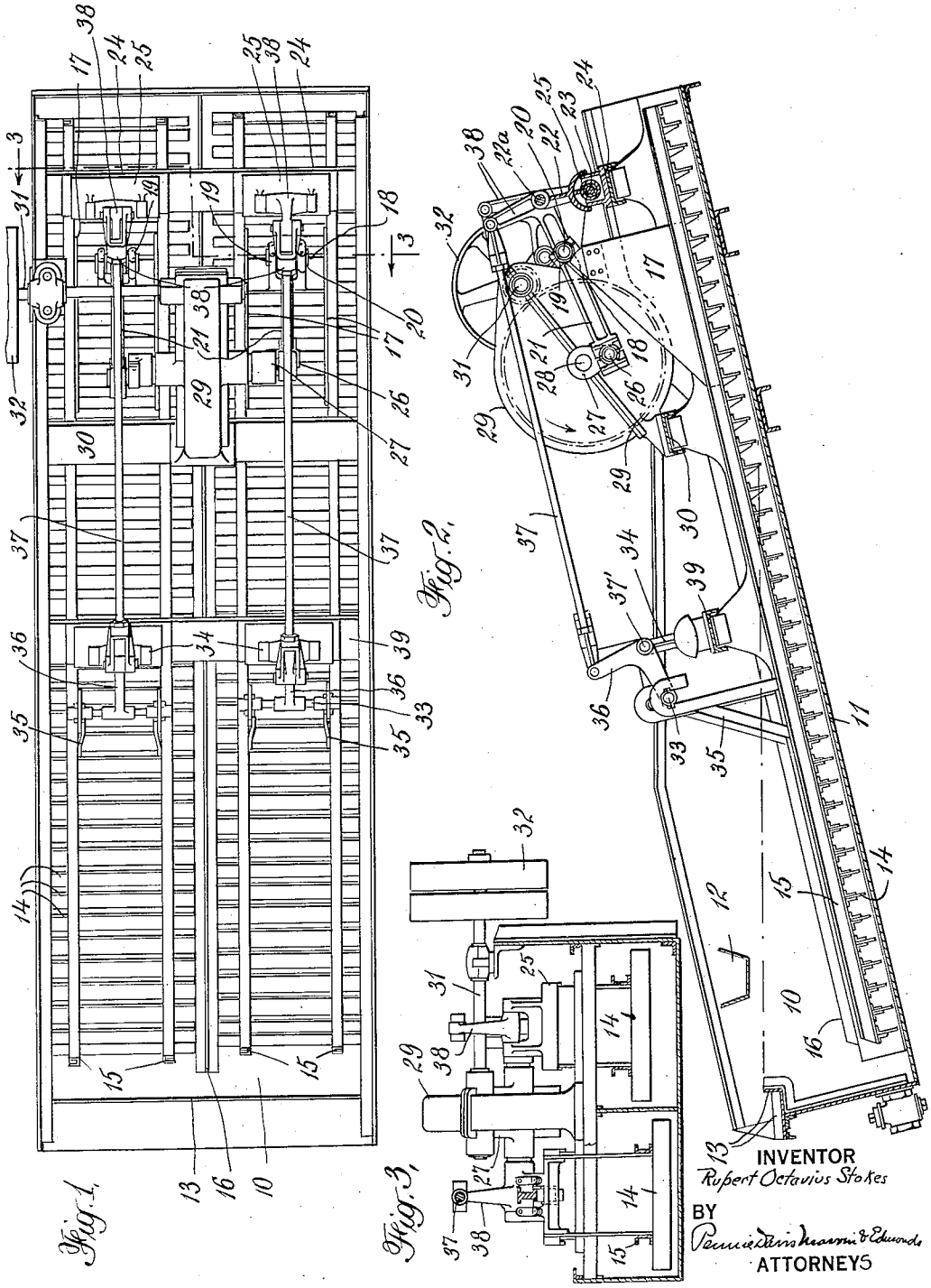


Fig. 1.

Fig. 2.

Fig. 3.

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Fig. 4,

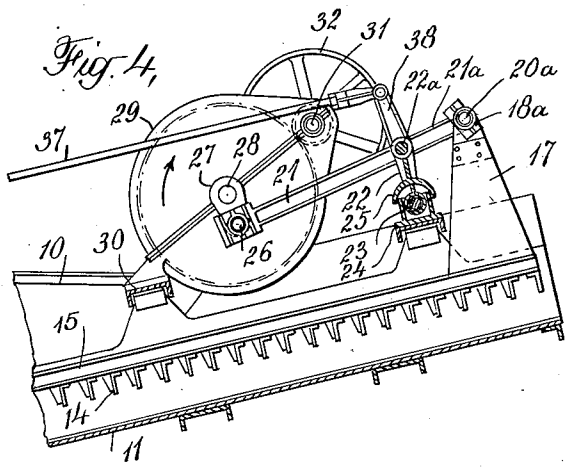


Fig. 5,

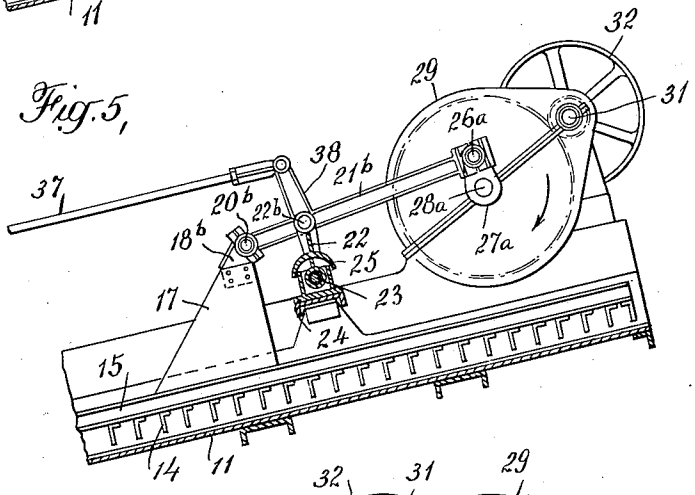
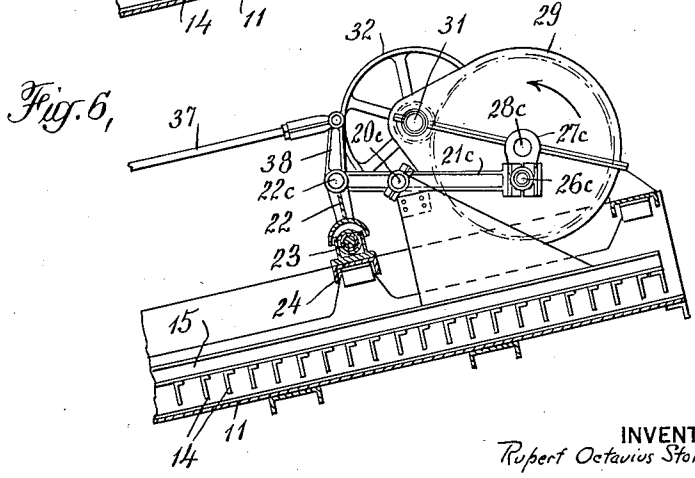


Fig. 6,



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Patented Aug. 10, 1926. 1,595,583

UNITED STATES PATENT OFFICE.

RUPERT OCTAVIUS STOKES, OF LONDON, ENGLAND, ASSIGNOR TO THE DORR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

CONVEYER.

Application filed February 18, 1926, Serial No. 89,055, and in England (Provisional) July 28, 1924.

This invention relates to improvements in classifiers of the type employed to separate solids suspended in liquids, and is especially directed to improvements in the mechanism for operating the rakes of classifiers of the Dorr type, as shown, for instance, in U. S. Patent No. 1,156,543, the present invention being disclosed in an application filed by me in England, July 28th, 1924.

In classifiers of this type the feed of finely divided solids suspended in liquid is introduced into a tank having a sloping bottom, the finer solids overflowing with the liquid while the more rapidly settling solids collect on the bottom and are raked upwardly to a discharge point above the liquid level by means of a reciprocating rake. This rake, in order to operate efficiently, must have a rectilinear movement during its forward or feed stroke adjacent the classifier bottom, followed by upward and return movements. Heretofore the rectilinear movement has been produced by combining the forward and return strokes imparted by a crank and pitman connected to the rake structure with corresponding vertical movement controlled through suitable suspending linkage by means of a cam, whereby the rakes could be given exactly the path of travel desired.

An object of the present invention is to provide a rake motion which will provide a suitable path of movement for the rakes by means of straight linkage controlled without the use of cams. Another object is to provide and arrange such linkage so that it will be simple, practical and sufficiently strong and durable to operate the rakes of large classifiers under heavy service conditions such as are frequently encountered in classifiers handling large amounts of ore in isolated mills where strength and durability are a prime requisite.

Other objects and advantages will be apparent from the following description taken in connection with the following drawings, in which—

Fig. 1 is a plan view of one form of the apparatus;

Fig. 2 is a side elevation thereof, parts being broken away;

Fig. 3 is an end elevation taken from the solids discharge end; and

Figs. 4, 5 and 6 are fragmentary views similar to Fig. 2 showing modifications in the arrangement of the rock arm and rake pivot.

In general the object is accomplished by supporting and driving the rakes from a drive bar which is journaled at one end to a crank and is pivotally supported at a point which may be called the fulcrum point on the upper end of a vertical rock arm extending downwardly from the drive bar. The rakes can be pivotally suported from the drive bar at a point which may be termed the pivot point and which may be either intermediate the fulcrum point and the crank pin or which may be at the far side of the fulcrum point from the crank pin. The relative proportions of the various members of this linkage arrangement are arranged so that during the advance or feed stroke of the rakes, while the crank is passing through the lower half of its path, the downward movement which the crank imparts to the drive bar is compensated by the upward movement due to the swing of the rock arm, so that the resultant, at the fulcrum point, is substantially a straight line. The motion imparted to one end of the rake is transmitted to the other end by a link and bellcrank mechanism, the bellcrank being supported on a rock arm in the manner hereafter described so that the entire rake has the desired movement.

Referring to Fig. 1 of the drawing, the classifier body and rakes are of the usual type shown in U. S. Patent No. 1,156,543, and comprise generally the classifier tank 10, having a sloping bottom 11, a feed trough 12 and an overflow lip 13 at the lower end of the tank. The rakes comprise a plurality of transverse blades 14 mounted on longitudinal bars 15 and perpendicular thereto. In the apparatus shown two rakes are employed operating in alternation and separated by a vertical partition 16, this arrangement permitting balance of the driving structure. Each rake is supported adjacent its upper end by a pair of hanger plates 17 connected at their upper ends by a block 18 carrying bearings 19 for pivot pin 20 extending transversely through and rigidly connected to the drive bar 21. In the apparatus shown in Figs. 1, 2 and 3 the end of drive bar 21 toward the upper end of the classifier is pivotally mounted on rock arm 22 which is pivoted at 23 to cross bar 24 mounted on the body of the machine.

If desired a shield 25 on the rock arm 22 may be provided to cover the pivot connection at 23 and prevent damage through splashing of the gritty materials generally handled by this machine.

The opposite end of the drive bar 21 is journaled on crank pin 26 carried by crank 27 mounted on crank shaft 28 supported by suitable bearings in casing 29 mounted on cross bar 24 and cross bar 30 which extend across the tank and are rigidly mounted thereon. Crank shaft 28 is connected with drive shaft 31 by suitable gearing in casing 29, the latter shaft being driven in any suitable manner as through pulley 32.

The lower end of each rake is supported and moved vertically through hangers 35 on the rake pivoted to the end of the lower arm of bellcrank 36, which is in turn pivoted at 37 to the upper end of rock arm 34, which is pivotally mounted on cross bar 39 carried by the sides of the tank. The upper arm of bellcrank 36 is connected by a suitable link 37 to the upper end of lever arm 38 carried by drive bar 21 and preferably integral therewith. Since rock arm 34 and the upper arm of bellcrank 36 are located and proportioned symmetrically to rock arm 22 and lever arm 38 respectively, that is, the length of the upper arm of crank 36 is equal to that of 38, rock arms 22 and 34 are the same length, and the parts are so located that they will be in the same proportion as is their cycle of motion at all times.

In the operation of the machine shown in Figs. 1 to 3 the crank shaft 28 is rotated in counter-clockwise direction when viewed as in Fig. 2. As the crank revolves the advance and return motion of pin 26 will impart a corresponding motion to all parts of drive bar 21 and consequently to the rakes supported therefrom. During the lower half of the cycle of movement of the crank 27, that is, the cycle below a line drawn through the center of the crank shaft parallel to the bottom 11 of the classifier, a downward and then upward motion will be given to the lower end of drive bar 21; and during this portion of the cycle of movement rock arm 22 is swinging first upwardly and then downwardly as it passes across the uppermost point of its swing; and the relative parts are so proportioned that this upward and downward motion given to the upper end of the drive bar 21 compensates at the pivot point, the center of the pivot rod 20, for the reverse motion given by the crank pin 26. The resultant is an advance movement of the rakes adjacent and substantially parallel to the bottom 11 of the classifier. As the crank 27 reaches the end of the lower half of the cycle it swings upwardly; and this movement raises the rake away from the bottom of the classifier. A continuation of the crank movement upwardly and rearwardly is accompanied by an upward and rearward movement of rock arm 22 so that the rake is returned toward the lower end of the classifier substantially above the bottom; while toward the end of this part of the crank movement the crank pin 26 moves downwardly accompanied by a diminishing downward movement of the upper end of rock arm 22 which again lowers the rake into position for the rectilinear advance movement already described.

The longitudinal movement of the rakes is imparted entirely through the pivot 20; but this pivot imparts vertical movement only to the forward end of the rakes directly, the corresponding vertical movement being imparted to the lower end of the rakes through arm 34, crank 36, link 37 and lever 38. Since the pivot 33 by which hangers 35 are supported from bellcrank 36 is positively moved by these hangers by a forward and return movement corresponding to the forward and return movement of pivot 20, rock arm 34 will be correspondingly moved; and since the swinging movement of lever arm 38 about pivot 22^a is transmitted to link 37 through the upper arm of crank 36, the vertical movement of hangers 35 will correspond exactly to the vertical movement of the upper end of hanger 17, since the distance between the pivot or fulcrum rod 20 and the point of rotation in point 22^a is the same as the length between axes of rotation at the ends of the lower arm of bellcrank 36.

It will be apparent that the shape of the path through which any point in the rakes will travel during a complete rotation of crank 27 will depend upon the relative proportion of the parts of the linkage composed of the crank, drive bar 21 and rock arm 22. A substantial element of this invention consists in proportioning these parts so that the advance or rake movement will be in a straight line; and this is accomplished when the crank 27 is substantially one unit in length, the distance between center of crank pin 26 and fulcrum pin 20 is substantially four units, the distance between the center of fulcrum pin 20 and pivot pin 22^a is substantially two units, and the distance between pivot pin 22^a and pivot 23 is not substantially less than two units. In practice the latter may be substantially longer, up to at least four units without seriously affecting the contour of the rake path. The position of pivot 23 should also be determined carefully so that the center line of crank 27 will be parallel to the center line of rock arm 22 when the crank is at right angles to the bottom of the tank during its travel through the lower half of its cycle, and rock arm 22 swings an equal distance on either side of its position when thus parallel to the crank. The movement of the

rakes will, however, also be satisfactory if the pivot 23 is positioned so that a line between the positions of the pivot pin 22^a at the two extremes of its motion will pass through the center of crank shaft 28.

In Figs. 4, 5 and 6 are shown modifications of the construction heretofore described. In Fig. 4 the construction is the same except that drive bar 21 is extended beyond pivot 22^a and hanger block 18^a is carrying hanger 17 which is pivotally mounted on the extension 21^a of the drive bar 21 at a point substantially two units beyond the pivot 20, the crank being one unit in length, the drive bar from the crank pin to the pivot 20 being substantially six units long and rock arm 22 being not substantially less than two units in length, and preferably three units long, the latter length having been found preferable with this arrangement of linkage.

In the construction shown in Fig. 5, the arrangement is a reversal of drive in the construction shown in Fig. 4, the crank shaft 28^a being located at the upper side of rock arm 22, the drive bar 21^b being driven from crank 27^a through crank pin 26^a and fulcrumed on the upper end of rock arm 22 at 22^b, the hanger block 18^b being pivoted at 20^b to the lower end of drive bar 21^b. With this arrangement the length of the crank would be substantially one unit, the distance between 26^a and 22^b substantially six units, the length of rock arm 22 not less than two units and preferably three or more, and the distance between 20^b and 22^b two units.

The construction illustrated in Fig. 6 is a reversal of drive from that shown in Figs. 1, 2 and 3, the crank shaft 28^c being located at the upper side of the rock arm 22, and driving through crank 27^c and crank pin 26^c the drive bar 21^c pivotally connected at 20^c to the upper end of hangers 17 and fulcrumed at pivot 22^c to the upper end of the rock arm 22. The linkage proportions are the same as those first described, the crank being one unit in length, the drive bar from 26^c to 20^c being four units, the bar from 20^c to 22^c being two units in length, while the rock arm 22 is not less than two units.

Various changes can be made in the construction and arrangement of the parts without departing from the invention or sacrificing any of the advantages thereof.

I claim:—

1. In a conveyer, the combination of a drive bar, actuating means to impart reciprocating movement to the drive bar, a rake connected to the drive bar at a pivot point thereon and compensating means including a rock arm pivotally connected to the drive bar to direct movement of the pivot point on the drive bar in a substantially straight line during the major portion of the forward movement of the rake.

2. In a conveyer, the combination of a drive bar, a crank to impart reciprocating movement to the drive bar, a rake connected to the drive bar at a pivot point thereon and compensating means including a rock arm pivotally connected to the drive bar to direct movement of the pivot point on the drive bar in a substantially straight line during the major portion of the forward movement of the rake.

3. In a conveyer, the combination of a drive bar, actuating means to impart reciprocating movement to the drive bar, a rake connected to the drive bar at a pivot point thereon, compensating means including a rock arm pivotally connected to the drive bar to direct movement of the pivot point on the drive bar in a substantially straight line during the major portion of the forward movement of the rake, and means connected to the drive bar and compensating means to control the movement of the other end of the rake.

4. In a conveyer, the combination of a drive bar, a crank to impart reciprocating movement to the drive bar, a rake connected to the drive bar at a pivot point thereon, compensating means including a rock arm pivotally connected to the drive bar to direct movement of the pivot point on the drive bar in a substantially straight line during the major portion of the forward movement of the rake, and means connected to the drive bar and compensating means to control the movement of the other end of the rake.

5. In a conveyer, the combination of a drive bar, actuating means to impart reciprocating movement to the drive bar, a rake connected at one end to the drive bar at a pivot point thereon, compensating means to direct movement of the pivot point on the drive bar in a substantially straight line during the major portion of the forward movement of the rake, and means, including a bellcrank and link connected to the drive bar and compensating means to control the movement of the other end of the rake.

6. In a conveyer, the combination of a drive bar, a crank to impart reciprocating movement to the drive bar, a rake connected at one end to the drive bar at a pivot point thereon, compensating means to direct movement of the pivot point on the drive bar in a substantially straight line during the major portion of the forward movement of the rake and means, including a bellcrank and link, connected to the drive bar and compensating means to control the movement of the other end of the rake.

In testimony whereof I affix my signature.

RUPERT OCTAVIUS STOKES.