

Dec. 29, 1925.

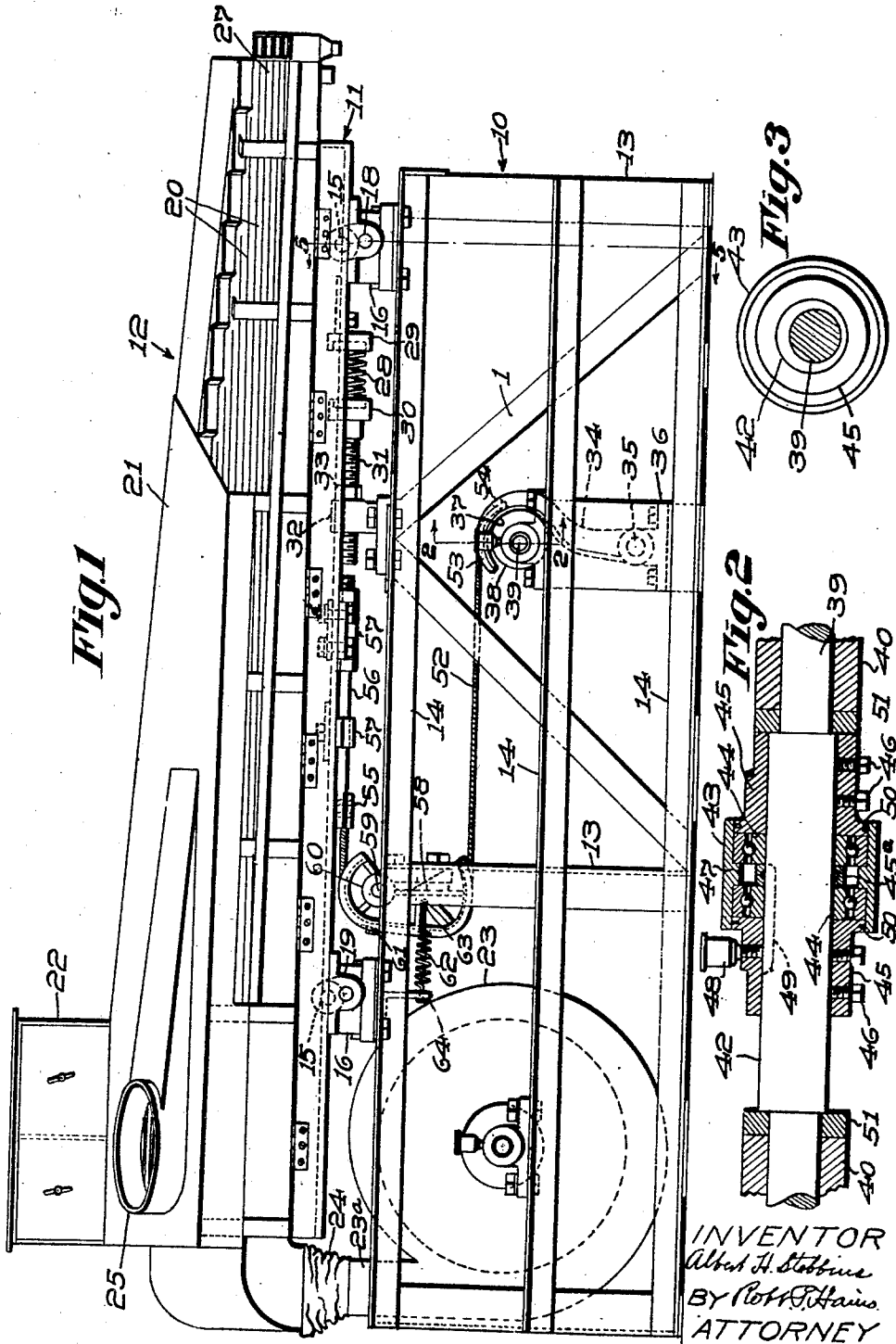
A. H. STEBBINS

1,567,548

TABLE CONCENTRATOR

Filed March 13, 1924

3 Sheets-Sheet 1



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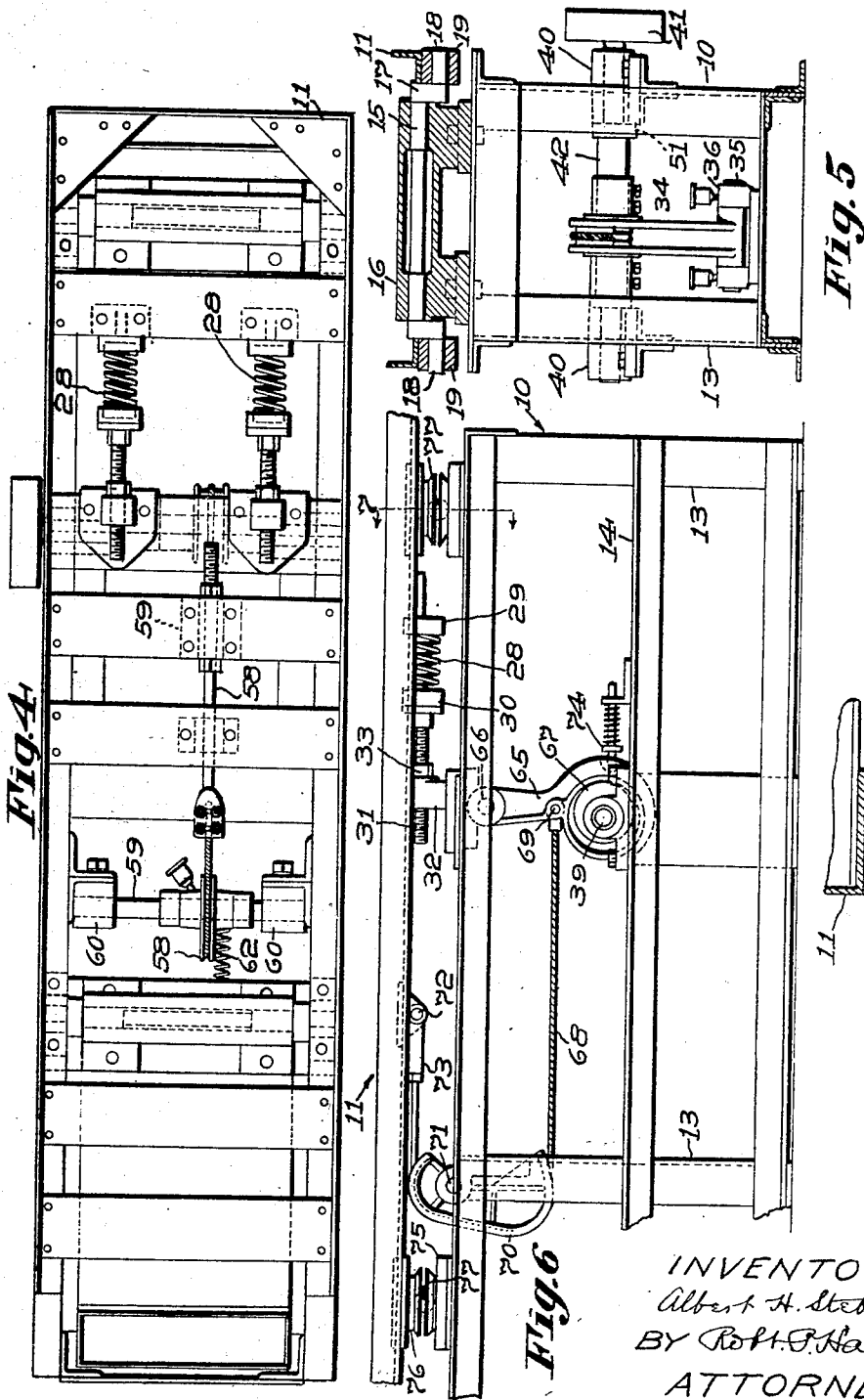
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TABLE CONCENTRATOR

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3 Sheets-Sheet 2



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TABLE CONCENTRATOR

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Fig. 8

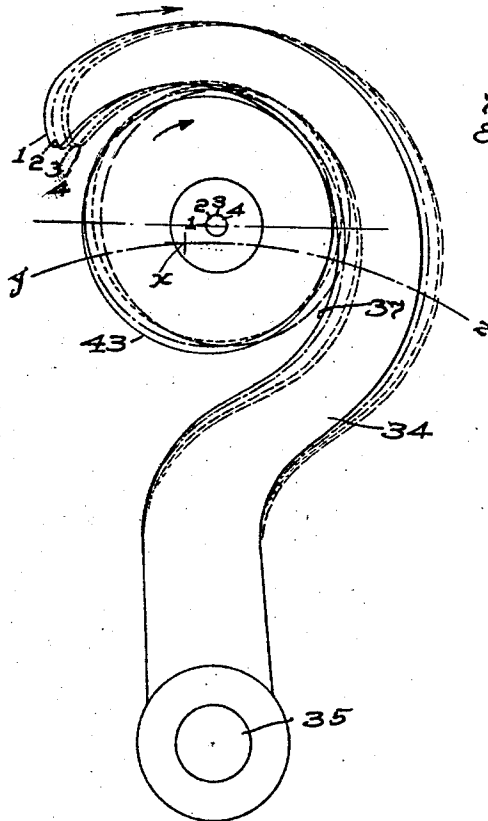


Fig. 9

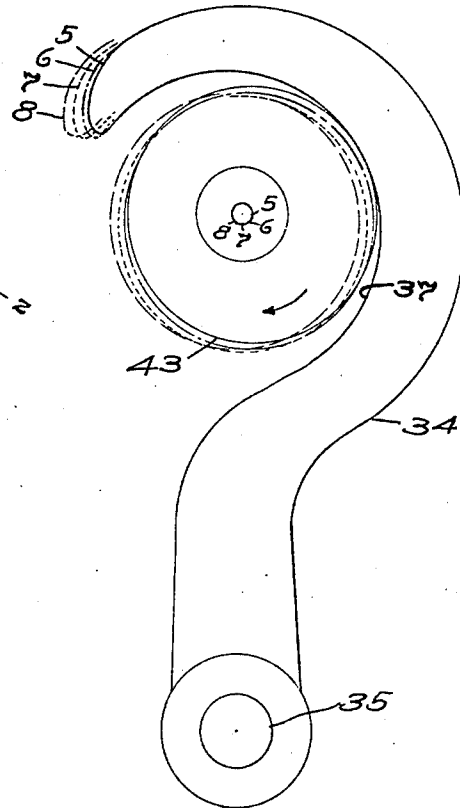


Fig. 10

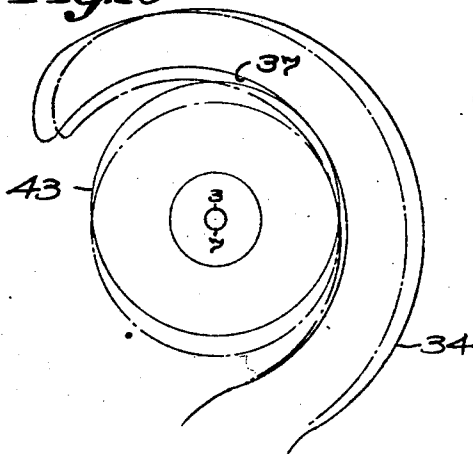
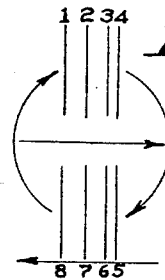


Fig. 11



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UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA.

TABLE CONCENTRATOR.

Application filed March 13, 1924. Serial No. 698,877.

To all whom it may concern:

Be it known that I, ALBERT H. STEBBINS, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented an Improvement in Table Concentrators, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to concentrators and more particularly to means for imparting back and forth movement to the concentrator deck.

Table concentrators are commonly provided with a deck having a deck surface upon which the materials to be treated are delivered, and the deck surface is usually provided with riffles which promote separation of the materials. A back and forth movement is imparted to the deck to advance the materials over the deck surface, and the nature of this movement should be such that it will cause the materials to advance step by step along the deck and at the same time promote stratification of the materials.

The movement commonly used to advance materials along a deck is a progressive movement whereby as the deck is moved back and forth it is actuated more quickly in one direction than the other and as a result the materials are shifted step by step lengthwise of the deck.

The deck with the materials being treated thereon is relatively heavy and a substantial amount of force is required to actuate the deck with the desired quickness. The actuating mechanism is therefore subjected to severe wear, and difficulty has been experienced heretofore in securing simple operating means which will impart the desired movement to the deck and will withstand the severe wear to which the operating parts are subject. Furthermore considerable dust escapes from the materials being treated and this dust is of granular nature that rapidly cuts the bearings if not excluded therefrom.

Having the above matters in mind the present invention relates to improved means for imparting a back and forth movement of the desired progressive nature to a deck, bed or other supporting surface.

One feature of the invention relates to simple means for reducing the amplitude of

the back and forth movement imparted to the deck or bed by a rocking lever.

Another feature of the invention relates to operating means for producing a progressive movement, wherein the operating parts are simple in construction, are strong and durable, and in which friction between the operating parts is reduced to a minimum.

Still another feature of the invention resides in the construction whereby the lubricant supplied to the operating means serves to exclude dirt and dust from the operating parts.

Other features of the invention and novel combination of parts, in addition to the above, will be hereinafter described in connection with the accompanying drawings which illustrate practical forms thereof.

In the drawings:

Fig. 1 is a side elevation, with parts in section, of a table concentrator provided with the operating means of the present invention.

Fig. 2 is an enlarged sectional view of the eccentric shaft, taken on the line 2—2 of Fig. 1.

Fig. 3 is an end view of the parts shown in Fig. 2.

Fig. 4 is a top plan view of Fig. 1, the deck being removed.

Fig. 5 is a vertical sectional view, taken on the line 5—5 of Fig. 1.

Fig. 6 is a side elevation of a supporting frame and movable carriage, showing a modification in the carriage supporting means and deck operating mechanism.

Fig. 7 is an enlarged sectional view taken on the line 7—7 of Fig. 6.

Fig. 8 is a diagrammatic view showing four different positions which the eccentric and cooperating lever occupy as the latter is moved in a right-hand direction.

Fig. 9 is a similar view showing four different positions which the eccentric and cooperating lever occupy as the latter is moved in a left-hand direction.

Fig. 10 is a diagrammatic view showing the position occupied by the lever when the eccentric is in its uppermost position and when it is in its lowermost position; and

Fig. 11 is a diagrammatic view showing the amount of movement imparted to the lever by the rotation of the eccentric through successive angles of 45 degrees.

The operating means in the present inven-

tion is designed primarily for use upon table concentrators to impart the desired movement to the deck, but this movement is well adapted to operate various other beds or supporting surfaces to which it is desired to impart a non-uniform back and forth movement.

Referring to the drawings, and more particularly to Figs. 1 to 5 inclusive, the table concentrator is shown as provided with a supporting frame 10 upon which a carriage 11 is mounted for back and forth movement, and upon the carriage 11 is mounted a deck 12. The supporting frame 10 may have any suitable construction, and as shown is provided with uprights 13 connected by transversely extending rails 14. Various means may be provided for supporting the carriage 11 for back and forth movement upon the frame 10 and in the construction shown in Figs. 1 to 5 crank shafts 15 are provided near the opposite ends of the carriage, and these shafts are journaled in brackets 16 which are rigidly secured to the upper face of the supporting frame 10, and each shaft is provided near its end with a downwardly extending portion 17 in the nature of a crank arm and having a stub shaft 18 extending laterally therefrom, as best shown in Fig. 5. The stub shafts 18 at the opposite ends of the shaft 15 are journaled in brackets 19 rigidly secured to the under faces of the carriage 11, the construction being such that the weight of the carriage 11 is supported at a point below the axis of the shaft 15 and as the carriage moves back and forth the shafts 15 will rock in their supporting bearings 16.

The deck 12 may be given any preferred construction and is provided with the usual deck surface having the riffles 20 and the deck is preferably provided with a cover 21. Materials to be treated are supplied to the deck by a hopper 22. The deck surface upon which the riffles 20 are mounted is usually provided with apertures to permit air to pass upwardly thru the materials being treated, and in the construction shown air is supplied below the deck surface by a fan 23 which communicates with the deck thru the pipe 23^a and flexible connection 24. The air which has passed upwardly thru the deck surface and materials thereupon escapes from the deck thru the opening 25, which may be provided with a conduit not shown.

The construction so far described forms no part of the present invention, and it is believed therefore to be unnecessary to describe the same in further detail.

As stated, an important feature of the present invention resides in means for imparting a back and forth movement to the deck which will cause the materials being treated to travel lengthwise of the deck towards the delivery end 27, and at the same

time will promote stratification of the materials, and the means disclosed to this end will now be described.

It is desirable to provide means for yieldingly urging the carriage 11 and deck supported thereby in one direction and this is accomplished in the present case by providing the coiled springs 28, which springs are confined between brackets 29 rigidly secured to the under face of the carriage and adjustable sockets 30 supported by the fixed frame 10. Each bracket 29 is provided with a cup shaped socket to receive one end of a spring 28, and since it may be desirable to vary the tensions of the springs 28, the sockets 30 are secured to the ends of threaded shafts 31 which have threaded engagement with the upstanding brackets 32 and these shafts may be secured in the desired position of adjustment by tightening the lock nuts 33. As a result of the construction just described, it will be apparent that the carriage 11 and deck mounted thereupon are continuously urged in a right-hand direction by the coiled springs 28, and means is provided for moving the carriage in the opposite direction and then releasing the carriage to move in the right-hand direction under the action of the springs 28.

The novel means herein provided for moving the carriage 11 and deck thereupon in the left-hand direction includes a rocking lever 34, the lower end of which is pivotally secured by a pin 35 to a bracket 36 rigidly secured to the lower portion of the frame 10. In the construction shown this lever is provided with a curved face 37 which partly surrounds the operating eccentric 38. The eccentric operating means disclosed comprises a main shaft 39 journaled in spaced bearings 40 rigidly secured to the side portions of the frame 10 and this shaft may be rotated by a pulley 41. An intermediate portion of the shaft 39 is provided with a relatively long eccentric 42 which preferably is made integral with the shaft.

It is desirable to eliminate friction as far as possible between the eccentric shaft 42 and the rocking lever 34 operated by this eccentric, and in the present invention the eccentric shaft 42 does not directly engage the curved face of the lever 34, but the eccentric shaft is surrounded by a sleeve 43 against which the curved face 37 of the lever rests, and, in order that the eccentric shaft may rotate freely within the sleeve 43, anti-friction bearings are provided between the sleeve and the shaft 42. The anti-friction bearings may be of well known construction, and in the present case two anti-friction bearings 44 are provided which are mounted upon the eccentric shaft 42 and are spaced apart by a ring 45^a mounted on the shaft 42 between them. The anti-friction bearings 44 shown each consists of an inner ring

which snugly fits the eccentric 42 and an outer ring which snugly fits the inner diameter of the sleeve 43, and the usual ball bearings are provided between these two rings. In the present construction collars 45 are mounted upon the eccentric 42 upon each side of the sleeve 43, and these collars are rigidly secured to the eccentric by set screws 46. The inner faces of the collars 45 abut against the anti-friction bearings 44 and hold the latter in place to prevent them from moving longitudinally of the shaft 39. The sleeve 43 is preferably provided with an inwardly extending rib 47 which lies between the spaced anti-friction bearings 44 and the engagement of this rib with the bearings prevents movement of the sleeve 43 longitudinally of the shaft 39. The portion of each collar 45 which extends into the sleeve 43 is given a diameter which will fit the interior of the sleeve. This construction is desirable to exclude dirt and dust from the operating parts within the sleeve.

It is important that the operating parts within the sleeve 43 be properly lubricated and to this end a lubricant is supplied by the oil cup 48 secured to one of the sleeves 45, and which communicates with an oil groove 49 formed within a face of the eccentric 42. This oil groove leads to the spacing ring 45^a and serves to deliver oil or other lubricant to the anti-friction bearings 44. The construction is such that any excess lubricant supplied to the parts will tend to escape at each end of the sleeve 43 about the portions of the collars that extend into the sleeve, and the accumulation of a lubricant at this point will further exclude dust and dirt from the interior of the sleeve 43. An annular groove 50 may be provided about that portion of each collar 45 which projects into the sleeve and this groove serves as a pocket which will catch the lubricant.

From the lever operating means described it will be seen that the sleeve 43 does not rotate relative to the lever 34, and that friction between these two elements is eliminated. It will also be seen that the anti-friction bearings 44 reduce to a minimum friction between the sleeve 43 and the eccentric 42 rotating therein and it will be observed that the construction is such that parts are firmly retained in place and that dirt and dust are excluded from the same.

In the construction shown movement of the main shaft 39 axially within its bearing 40 is prevented by providing a ring 51 upon the shaft 39 at each end of the eccentric 42 which ring is confined between the inner face of a bearing 40 and an adjacent shoulder formed by the eccentric 42.

Various means may be provided for imparting movement from the rocking lever 34

to the carriage 11 and deck supported thereby and in the construction shown in Figs. 1, 4 and 5, a flexible cable 52 is provided which has one end that lies in the groove formed in the upper curved end 53 of the lever 34 and this end of the cable is secured in the groove at 54. The opposite end of the cable 52 is secured to the carriage 11, and in order to vary the active length of the cable, this end of the cable is secured at 55 to a threaded bolt 56 extending thru eye brackets 57, secured to the carriage 11 and the bolt is adjustably secured in these brackets by nuts.

The eccentric 38 and lever 34 cooperate in such a manner that the lever is actuated more energetically in one direction than the other, as will be hereinafter described, and in practice, to impart the variable-speed movement to the lever 34 it is found desirable to employ an eccentric that will impart a greater rocking movement to the lever than should be imparted to the carriage 11. In other words the amplitude of the back and forth movement imparted to a concentrator deck usually should be not more than a fraction of an inch, whereas it is desirable to employ an eccentric that will impart a much greater movement to the lever 34.

It is therefore desirable to employ means for reducing the amplitude of the movement imparted to the deck by the lever. To this end, in the construction shown an intermediate portion of the cable 52 is passed about a differential lever 58 pivotally mounted between its ends on a shaft 59 journaled in bearings 60. The differential lever has curved cable receiving grooves at its opposite ends and along one side to receive the intermediate portion of the cable and the cable is secured in the side groove by clamps 61. One arm of the differential lever 58 is longer than the other, as shown in Fig. 1 and the portion of the cable extending from the operating lever 34 engages the long arm, while the portion of the cable secured to the carriage 11 extends from the short arm. As a result the amplitude of the movement imparted to the carriage 11 will be much less than the movement of the end of the lever 34 to which the cable is secured. A spring 62 having one end secured to the differential lever at 63 and its other end anchored at 64 serves to urge the differential lever in a clockwise direction viewing Fig. 1 and this serves to tension the lower stretch of the cable and to hold the active face of the lever 34 against the eccentric sleeve 43.

An important feature of the present invention resides in novel means for operating the lever 34 so that the deck will be moved by its springs in the direction of flow with a gradually increasing speed until it is suddenly checked at the end of its stroke, and is then quickly and positively moved in

the opposite direction by the eccentric, and makes a slow turn at the opposite end of its stroke, thus imparting a progressive movement to the deck that will advance the materials along the same, and the present construction by which this is accomplished will now be described.

Referring to Figs. 1, 8, 9 and 10, it will be seen that the curved face 37 of the operating lever is not concentric with the axis of the shaft 39 but is shown as constructed in the arc of a circle having the point x (Fig. 8) as its centre, and it should be noted that the sleeve 43 while in most of its positions engages only the upper portion of the curved surface 37. The arrangement preferably is such that the sleeve 43 while in most or all of its positions engages only that portion of the curved surface 37 that lies above the arc $y-z$ (Fig. 8) drawn about the axis of the lever 34 as a center and passing through the point x . The sleeve 43 under the action of its eccentric 42 rolls a short distance along that portion of the curved surface 37, that lies above the arc $y-z$, or in other words, engages only that portion of the curve 37 which is remote to the axis about which the lever 34 rocks.

This disposition of the active curved surface 37 with respect to the eccentric is important, because, as the eccentric rotates in the direction indicated by the arrow in Fig. 8 to the respective positions indicated by 1, 2 and 3, the eccentric moves both laterally and vertically, and the lever is moved to the right by the lateral movement of the eccentric and it receives an additional movement due to the rolling movement of the sleeve 43 upwardly along the overlying or inwardly extending surface 37 of the lever. The movement imparted to the lever 34 by the vertical movement alone of the eccentric is clearly illustrated in Fig. 10 wherein the eccentric is shown in full lines in its uppermost position indicated by 3 and in dotted lines in its lowermost position indicated by 7. It will be noted from Fig. 10 that the vertical movement alone of the eccentric produced by rotating the eccentric thru 180 degrees imparts a substantial lateral movement to the lever 34 due to the engagement of the sleeve 43 with different portions of the laterally inclined surface 37. This movement may be increased or decreased by varying the lateral inclination of the active face upon which the sleeve 43 rolls, or by varying the location of the pivot point x .

From the foregoing it will be seen that the movement imparted to the lever under the conditions best illustrated in Fig. 10 serves to modify the movement imparted to the lever by the lateral movement of the eccentric. This varying movement may be observed by examining Fig. 8 wherein the

relation of the eccentric and lever is shown when the former occupies the angular positions indicated by 1, 2, 3 and 4, and as the lever moves in the opposite direction the relation of the parts may be seen from Fig. 9, where the eccentric is indicated as occupying the positions 5, 6, 7 and 8.

The distance the lever 34 travels when the eccentric rotates successively thru angles of 45 degrees is best shown in Fig. 11 where the numerals 1 to 8 inclusive indicate on an enlarged scale the position of the lever for each angular position indicated by 1 to 8 in Figs. 8 and 9, and the different distances through which the lever 34 moves during equal intervals of time will be apparent from Fig. 11.

The action of the eccentric upon the lever 34 is such that as the eccentric 42 rotates away from the curved surface 37 of the lever to the successive portions 6, 7, 8, the deck 12 moves in the direction of flow under the action of the compressed springs 28 with a gradually increasing speed until its movement in a right-hand direction (viewing Fig. 1) is suddenly checked by the eccentric reaching the position 1. The deck is then quickly and positively forced in the opposite direction by the eccentric moving successively to the positions 2, 3 and 4 against the overlying curved surface 37 of the lever. This quick movement in the direction of flow and sudden checking of the movement at the end of the stroke serves to slide the materials along the deck, and the quick and positive movement of the deck in the opposite direction serves to jerk the deck from under the materials.

As the eccentric approaches the position 4, it begins to move downwardly away from the overhanging curved surface 37, thus slowing down the movement of the lever, and very little movement is imparted to the lever as the eccentric moves from 4 to 5, makes the turn at 5, and moves to the position 6. The operation just described causes the deck to reverse its direction of movement much more quickly at one end of its stroke than at the other, so that the materials will slide along the deck as its movement is quickly reversed at one end of its stroke, but will not slide along the deck when its movement is slowly reversed at the opposite end of its stroke, and this progressive movement is obtained by a smooth continuous rotation of the main shaft 39.

The construction just described not only produces an extremely satisfactory movement but the nature of the progressive movement produced may be varied within wide limits in accordance with the present invention by varying the curvature and position of the active curved face 37 relative to the axis of the shaft 39 and the pivot 35 of the lever 34, and the operation of the

parts may be further modified by shifting the lever pivot 35 in either a right or left hand direction viewing Fig. 8.

In some cases it may be desirable further to reduce the amplitude of the movement imparted to the deck by the operating lever, and to this end in Fig. 6 the operating lever 65 is pivotally mounted upon and extends downwardly from the pivot shaft 66 toward the operating eccentric 67, and the operating cable 68 is secured to the lever 65 at a point 69 between the shaft pivot and eccentric. An intermediate portion of the cable passes around the differential lever 70 pivotally mounted at 71 and the other end of the cable is secured to the carriage 11 at 72 by an adjustable connection 73.

The lower portion of the lever 65 is shown as entirely surrounding the eccentric 67 as this may increase the strength of the parts, but the cooperation between the lever and the eccentric operating means is the same as described in connection with lever 34. A spring operated plunger 74 is provided in Fig. 6 and abuts against the rear face of the lever 65 to urge this lever toward the eccentric.

The carriage supporting means shown in Figs. 1, 3 and 4 imparts a slight up-throw movement to the materials as the deck approaches the end of its movement. It may be desirable to support the carriage for movement back and forth along a straight line and this is accomplished by the construction shown in Figs. 6 and 7, wherein trough-shaped runways 75 and 76 secured to the frame 10 and carriage 11 respectively are provided, and in each runway is provided a ball 77. The arrangement is such that the carriage is supported by the balls 77 for free movement back and forth in the direction of its length and the trough construction confines the movement to a straight path.

What is claimed is:

1. Operating mechanism for imparting a vibratory movement to concentrator decks and other frames supported for reciprocatory movement, comprising in combination, a rotating shaft having an eccentric that is rotated at a uniform speed, a lever pivotally mounted for rocking movement and having a surface against which the eccentric acts and the greater active portion of which surface is located from the lever pivot at the far side of the axis of rotation of the eccentric to thereby effect a rocking movement of the lever which is more rapid in one direction than the other, and a connection between the lever and frame to actuate the latter.

2. Operating mechanism for imparting a progressive movement to concentrator decks and other frames supported for reciprocatory movement, comprising in combination,

a rotating shaft having an eccentric that is rotated at a uniform speed, a lever pivotally mounted for rocking movement and having a surface against which the eccentric acts and which entire active surface is located from the lever pivot at the far side of the axis of rotation of the eccentric to thereby effect a rocking movement of the lever which is more rapid in one direction than the other, and a connection between the lever and frame to be vibrated to actuate the latter.

3. Operating mechanism for imparting a vibratory movement to concentrator decks and other frames supported for reciprocatory movement, comprising in combination, a rotating shaft having an eccentric, a vertically disposed lever pivoted at its lower end and having a surface against which the eccentric acts and which entire active surface is located above the horizontal plane of the axis of the eccentric to thereby effect a rocking movement of the lever which is more rapid in one direction than the other, and means for imparting the movement of the lever to a frame to be vibrated to actuate the latter.

4. Operating mechanism for imparting a vibratory movement to concentrator decks and other frames supported for reciprocatory movement, comprising in combination, a rotating shaft having an eccentric, a lever pivotally mounted for rocking movement and having a curved surface that partly surrounds the eccentric and has a portion upon which the eccentric acts, said portion being disposed in its entirety at the far side of an arc of a circle having the pivotal mounting of the lever as a center and drawn thru the axis of the eccentric shaft so that the action of the eccentric upon this surface will cause the lever to reverse quickly at one end of its stroke and slowly at the other end of its stroke, and a connection between the lever and frame to be vibrated to actuate the latter.

5. Vibratory operating mechanism for reciprocatory frames, comprising in combination, a rotating shaft having an eccentric, a lever pivotally mounted for rocking movement and having a surface against which the eccentric acts and the greater portion of which active surface is disposed at the far side of a plane extending thru the axis of the eccentric at right angles to a line extending from the eccentric to the lever pivot to thereby actuate and control the lever so that it will reverse its direction of movement more rapidly at one end of its stroke than the other, and means for imparting the movement of the lever to a frame to actuate the latter.

6. Vibratory operating mechanism for reciprocatory frames, comprising in combination, a rotating shaft having an eccentric,

a lever pivotally mounted for rocking movement and having a surface against which the eccentric acts and which surface has the greater portion thereof disposed in its entirety at the far side of a plane extending thru the axis of the eccentric at right angles to a line extending from the eccentric to the lever pivot to operate the lever so that it will reverse its direction of movement more quickly at one end of its stroke than the other, and means for imparting the movement of the lever to a frame to actuate the latter.

7. In a device of the class described, operating means for moving a vibratory frame back and forth so that it reverses the direction of movement much more rapidly at one end of its stroke than the other, comprising a rotating shaft having an eccentric, a lever pivotally mounted and having a curved surface the active portion of which extends partly around the eccentric in an overhanging direction and is constructed and arranged so that the movement of the lever in one direction in response to the lateral movement of the eccentric is speeded up by the vertical movement of the eccentric in one direction along said overhanging surface and a moment later the movement of the lever is retarded by the vertical movement of the eccentric in the opposite direction along said overhanging surface.

8. In a device of the class described, operating means for moving a vibratory frame back and forth so that it reverses its direction of movement more rapidly at one end of its stroke than the other, comprising a rotating shaft having an eccentric, a lever pivotally mounted to be actuated by the eccentric and having a curved surface the active portion of which extends partly around the eccentric in an overhanging direction and is constructed and arranged relative to the eccentric so that the movement of the lever in one direction in response to the lateral movement of the eccentric is accelerated by the vertical movement of the rotating eccentric along said active surface and a moment later the movement of the lever is retarded by the vertical movement of the eccentric in the opposite direction along said overhanging surface.

9. In a device of the class described, operating means for imparting a progressive movement to a vibratory frame, comprising a rotating shaft having an eccentric, a pivotally mounted lever actuated by said eccentric and having an active face extending part way around the eccentric and disposed at the opposite side of the eccentric from

the pivotal axis of said lever, said surface being disposed so that the lateral movement of the lever in one direction under the action of the eccentric is accelerated by the movement of the eccentric approximately radially toward said surface and a moment later is retarded by the movement of the eccentric approximately tangentially of said surface.

10. Operating mechanism for imparting a vibratory movement to concentrator decks and other frames supported for reciprocatory movement, comprising a rotating shaft having an eccentric, a pivoted lever having a curved surface partially surrounding the eccentric and against which the eccentric acts and the active portion of said curved surface being disposed at the side of the eccentric away from the lever pivot so that during the entire rotation of the eccentric, the latter acts against the curved surface that is disposed at the side of the eccentric away from the lever axis.

11. In a device of the class described, operating means for moving a vibratory frame back and forth so that it reverses its direction of movement much more rapidly at one end of its stroke than the other, comprising a rotating shaft having an eccentric, a lever pivotally mounted to be actuated by the eccentric and having a curved surface that extends part way around the eccentric and has an active surface the major portion of which lies at the far side of a plane passing through the axis of the eccentric shaft at right angles to a line drawn from said axis to the axis of the lever shaft, and said surface being disposed so that the movement of the lever is accelerated by movement of the eccentric in a radial direction toward the curved surface and is retarded by movement of the eccentric in a direction tangential of said surface.

12. Operating mechanism for imparting a vibratory movement to concentrator decks and other frames supported for reciprocatory movement, comprising in combination, a rotating lever, means for actuating the lever, a flexible connection between the lever and reciprocatory frame to impart a back and forth movement from the former to the latter, and means for reducing the amplitude of the movement imparted to the frame by the lever, comprising a differential lever having an intermediate portion of the flexible member secured thereto and extending from its opposite ends.

In testimony whereof, I have signed my name to this specification.

ALBERT H. STEBBINS.