No. 882,512. PATENTED MAR. 17, 1908.

G. E. WOODBURY.

DRIVE MECHANISM FOR ORE CONCENTRATORS.

APPLICATION FILED JUNE 5, 1907.

3 SHEETS—SHEET 1.

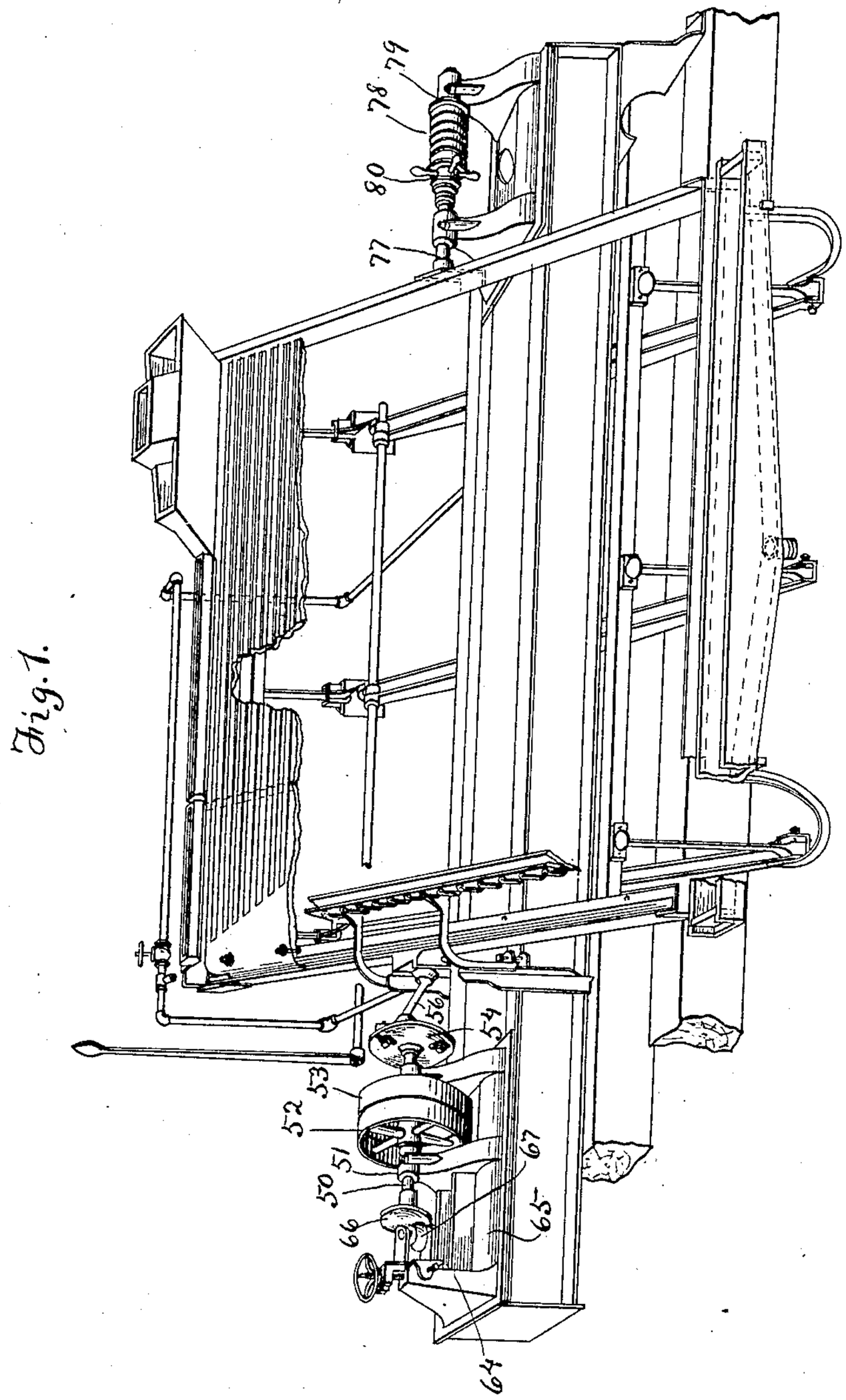

Fig. 1.

Witnesses

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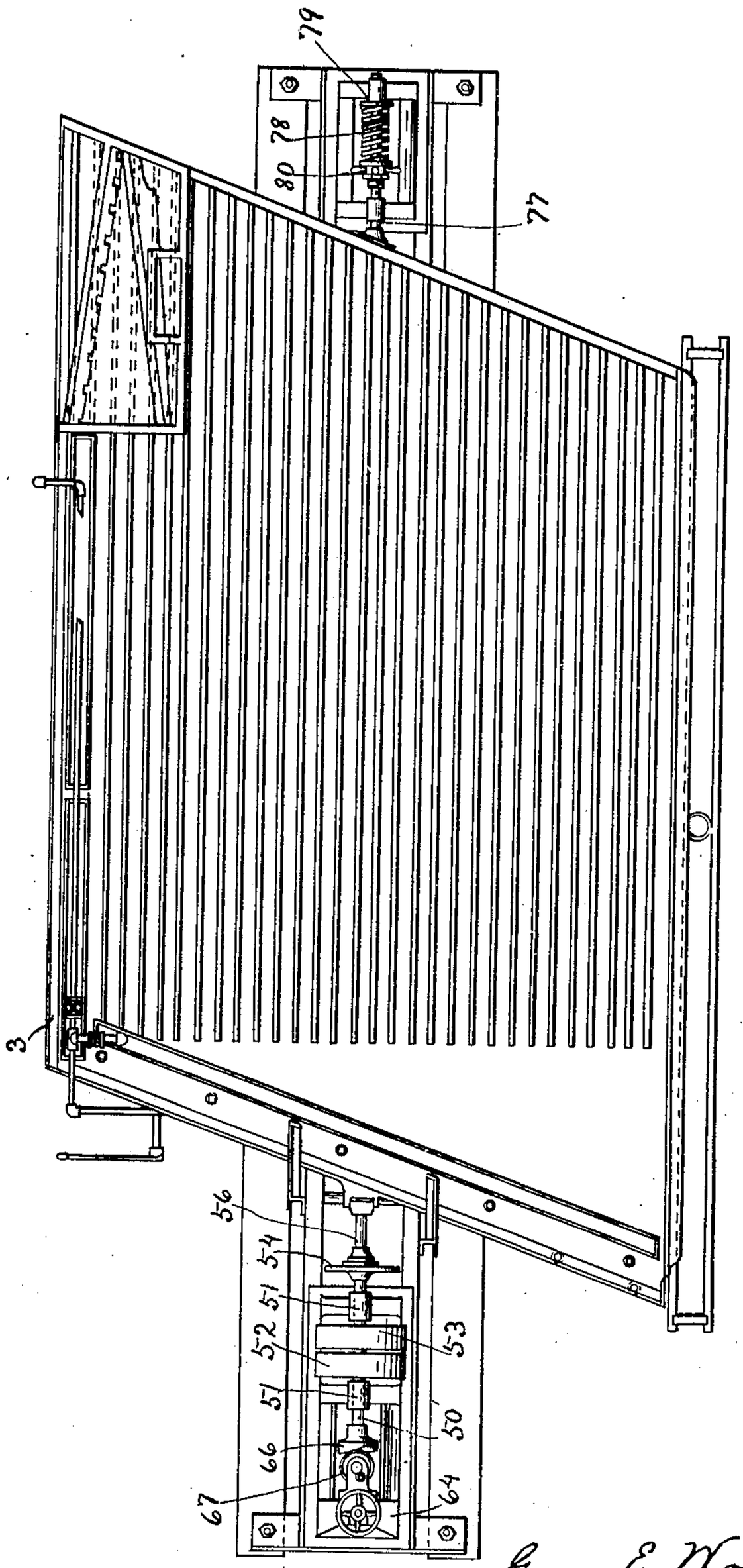

Fig. 2.

Witnesses.

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3 SHEETS—SHEET 3.

Fig. 5.

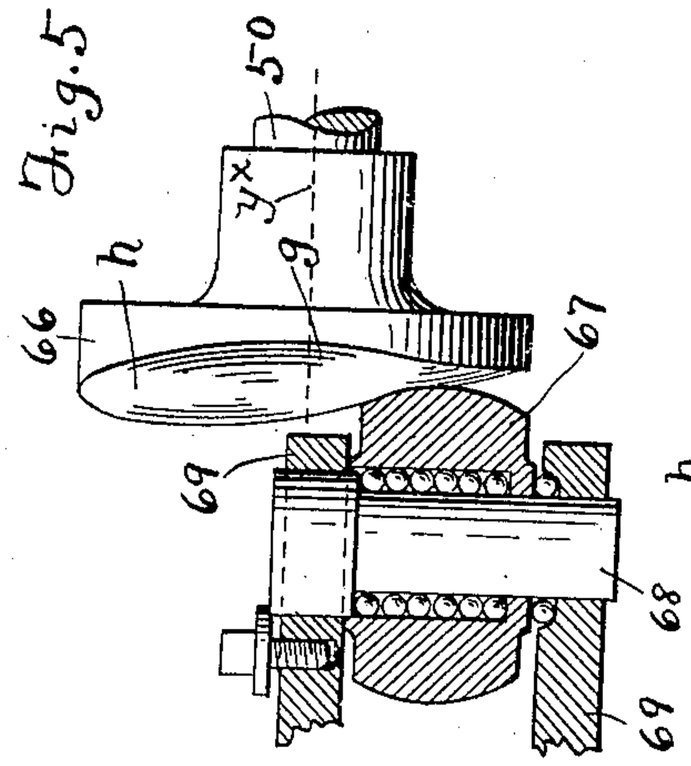


Fig. 6.

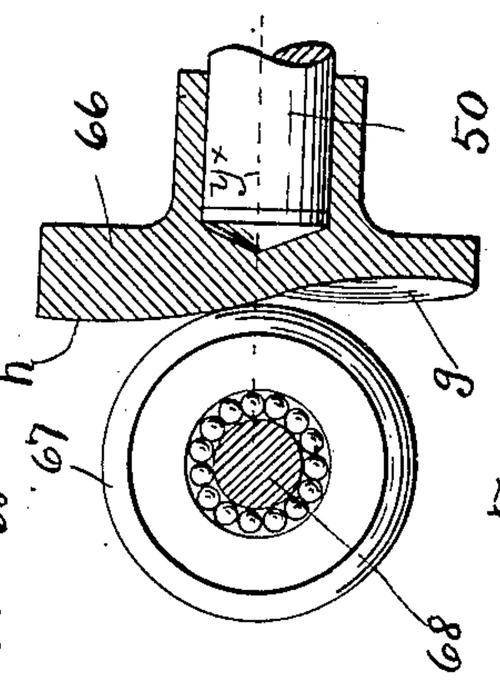


Fig. 3.

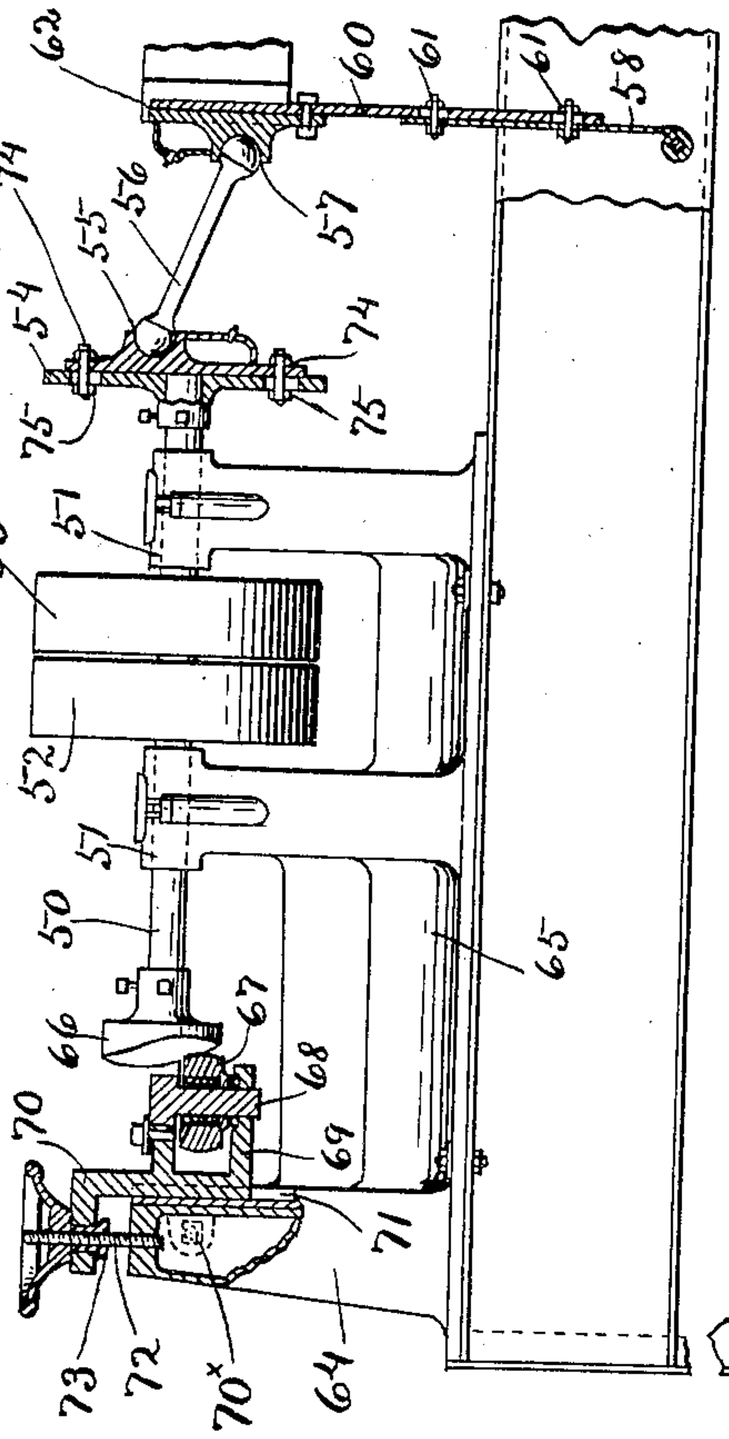
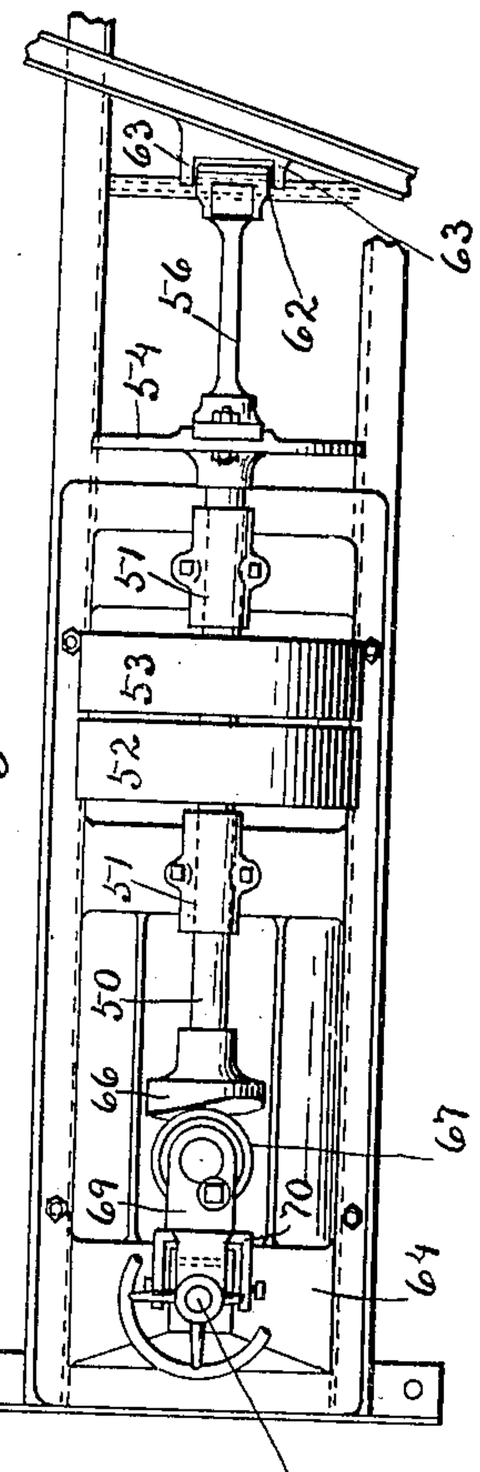


Fig. 4.



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UNITED STATES PATENT OFFICE.

GEORGE EDWIN WOODBURY, OF SAN FRANCISCO, CALIFORNIA.

DRIVE MECHANISM FOR ORE-CONCENTRATORS.

No. 882,512. Specification of Letters Patent. Patented March 17, 1908.

Original application filed April 19, 1907, Serial No. 369,186. Divided and this application filed June 5, 1907. Serial No. 377,457.

To all whom it may concern:

Be it known that I, GEORGE EDWIN WOODBURY, a citizen of the United States, and a resident of the city and county of San Francisco and State of California, have invented new and useful Improvements in Drive Mechanism for Ore-Concentrators, of which the following is a specification.

This invention relates to an improved mechanism for imparting reciprocating or "shaking" motion to an ore-concentrating machine of the type commonly known as a table-concentrator.

It has for its object to provide for readily adjusting the quality of the strokes or reciprocations while the table is working, and for varying the force or energy of the "kick" or return-throw with relation to the forward-throw imparted to the table.

A further object is to produce the desired variable reciprocating movement of the table from the rotation of a shaft running at uniform speed.

The nature of the said invention and the manner in which I proceed to conduct, produce and carry out the same are explained at length in the following description, wherein the accompanying drawings are referred to as a part of this specification.

Figure 1 is a perspective view of the table, looking from the front or lower side, with the principal portion of the concentrating-surface broken away and removed from the lower part of the table to expose the movable-frame and the stationary-frame and the bed-timbers beneath, and showing the reciprocating mechanism in position. Fig. 2 is a plan or top-view of the complete table. Fig. 3 is a view, on an enlarged scale, of the table-reciprocating mechanism, some of the parts being shown in elevation and others in vertical section. Fig. 4 is a plan or top view of Fig. 3. Figs. 5 and 6 are details, partly in section, of the parts that give longitudinal movement to the shaft; Fig. 5 being a front-elevation, and Fig. 6 a top-view of Fig. 5.

My improved reciprocating-mechanism consists of a shaft 50 mounted for rotation in bearings 51, in which it is also fitted or adapted for a limited reciprocating movement longitudinally, or in the direction of its length. Between the bearings 51 the shaft 50 carries fast and loose pulleys 52—53 for a belt by which rotating motion is given to the shaft 50 from a line-shaft, or other source of power.

On one end of the shaft 50 is secured a disk, or circular head 54 having on its front-face a socket 55 to receive and hold one end of a toggle-bar 56, the other end of which is similarly fitted to and held in a socket 57 on the end of the table. Instead of being fixed directly to or against the end-bar or member of the vibrating-frame, however, the socket 57 is attached to a spring-bar composed of a fixed part on the stationary-frame, and an adjustable member 60 which is so joined and secured to the fixed member by bolts and nuts 61, that it can be moved up or down and the position of the socket or bearing-point 57 of the toggle-bar 56 on the table can be raised or lowered with the table. The upper end of the adjustable member 60 sets in a recess 62 provided for that purpose on the front of the concentrates-trough, in which it is prevented from moving separately of the trough by being confined between the lugs or projections 63 on the side of the trough, which are grooved for that purpose.

In changing the pitch or inclination of the table it is necessarily raised or lowered at the head or end where the power is applied, and provision is thus made for shifting the bearing-point up or down to the required extent without detaching either the socket-bearing part, or the spring-bar.

In front of the opposite end of the shaft 50, and between it and a fixed-post 64 on the bed-plate 65 of the reciprocating-mechanism, is placed a variable thrust-bearing, consisting essentially of a cam-face disk 66 fast on the end of the shaft 50 and a roller 67 mounted and freely rotatable on an upright axis 68 held in fixed bearings 69. These parts being interposed between the end of the shaft and the fixed-post 64 on the frame 65 have the effect to produce from the revolutions of the shaft, and periodically therewith, a variable longitudinal movement of the shaft, the duration or length of which in time is greater in one direction of the movement than it is in the other direction. The movement is of peculiar character in being rapidly accelerated; the return or backward movement culminating in a sudden and somewhat abrupt reduction in speed at the end of the stroke and at the instant of the change in

direction of the longitudinal throw; and the character or quality of the movement is under such control that it can be varied and adjusted with considerable scope in the force and the delivery of the "kick", or energy of the return-throw, as well as in the length of such movement. These features of variability in the quality of the reciprocating movement are due to the peculiar form of the face of the disk 66 and the manner of setting and adjusting the fixed bearing-point 67 with relation to the axis of rotation.

Referring more particularly to the details, Figs. 5 and 6, it will be seen that the face of the disk is a warped surface composed of a segment or portion *g* of relatively low elevation, and a portion *h* of relatively high elevation, both extending circumferentially and merging one into the other without an abrupt drop from the higher to the lower portions of the surface. The portions of high elevation and low elevation also increase in extent or degree from the center or axis $y^{\times}$ of rotation radially towards the circumference, thereby affording as many different circles of contact varying in relative lengths of elevated and depressed surfaces as it is possible for the bearing-roller 67 to travel on under all the positions nearer to or farther from the axis of rotation which it is capable of occupying. Accordingly, provision is made for shifting the working-position of the bearing-roller 67 nearer to or farther from the axis of rotation, by mounting the spindle 68 of the roller 67 in a slidable bracket 70 confined between guides 71 in the post, and adjusted therein by means of a screw-threaded shaft 72 and a nut 73. When the roller 67 is set for action farther away from the axis of the disk the return-throw will be accelerated, and the energy of its "kick" will be increased accordingly—on the other hand, by setting the bracket 70 upward in its guides the quality of the movement will be modified or reduced in greater or less degree, according to the adjustment of the roller in that direction. The extent of the contact-surfaces between the roller and the disk is reduced to a minimum by making the periphery of the roller convex; thus securing greater range and delicacy of adjustment with a relatively small disk, than it would be possible to obtain from a roller with a flat rim. The movement imparted to the table by these means is further varied or modified by changing the position of the bearing-point of the toggle-bar 56 with relation to the axis of rotation; for which purpose the socket-plate for the head *m* of the toggle-bar is secured in place on the face of the disk 54 by bolts 74 taking through slots in the disk, and fitted with nuts 75, as a means for permitting the socket-plate to be shifted on the disk.

The toggle-bar exceeds in length the shortest distance measured horizontally between the socket 55 on the disk and the opposite one 57 on the end of the table, and the angular position of the toggle-bar is accordingly varied in degree as the distance of the socket 55 on the disk from the axis of rotation is varied by shifting the socket-plate in the required direction outward or inward, as may be desired, thereby giving that bearing-point greater or less degree of eccentricity. From the position of greatest angularity which it attains when the bearing-point 55 is perpendicularly over the axis of rotation the toggle-bar is brought by the semi-rotation of the disk into a horizontal position, or one approximately parallel to the shaft; thus moving the opposite end of the toggle-bar in substantially a horizontal direction.

Acting in opposition to the thrust of the toggle-bar against the table and with a degree of pressure sufficient to keep the cam-disk 66 against the roller 67, as well as to take up lost motion resulting from wear, is a buffer-rod 77, and a coiled-spring 78 bearing at one end against a fixed point 79 and having the opposite end setting against a collar 80 on the rod 77; the rod being so placed as to exert constant pressure upon or against the table longitudinally of it and in a direction opposed to the thrust of the toggle-bar. This spring is best arranged to act against the foot of the table, or at the opposite end to where the reciprocating-mechanism is situated; I wish it to be understood that my invention is not limited to the particular place where these parts may be located. For adjusting the spring to vary the force opposed to the thrust of the toggle-bar, the rod 77 is provided with a threaded-portion for the threaded-collar 80 which has a capstan-head for turning it by hand.

With the shaft 50 running at a uniform rate of speed, the accelerated motion imparted to the table in the return-throw, or movement, is changed and varied in relative rapidity by shifting the point of contact of the roller 67 with the face of the disk 66 nearer to or farther away from the axis of rotation $y^{\times}$. This is done by moving the bracket 70 up or down on its support 64, after loosening the clamp-screws $70^{\times}$ in the sides of the bracket. These screws are provided for fastening the bracket on the support 64, after the working position of the roller is changed.

The spring-bar 58—60 carrying the socket 57 is made adjustable in length for the purpose of raising or lowering the bearing-point of the toggle-bar 56 relative to the table as the same is found necessary when changing the inclination of the table, which is done by raising or lowering the table-surface at the back or higher side 3.

This case is a division of my application, Ser. No. 369,186, filed April 19, 1907, in which application I have described and

claimed those novel features herein shown that relate to the concentrating table.

Having thus described my invention what I claim, is:—

1. In a drive-mechanism for an ore-concentrator, the combination with the concentrating table, of a rotatable and longitudinally movable shaft, a head on one end of the shaft, a toggle-bar interposed between said head and the end of the concentrator-table; a cam-faced disk on the opposite end of the rotatable shaft having a gradually increasing elevation of surface from a line of lowest depression both radially and circumferentially to a line of greatest elevation, a roller rotatably mounted and in working-contact with the face of said disk, and a spring adapted to apply its power in opposition to the thrust of the toggle-bar.

2. In a drive-mechanism for an ore-concentrator, the combination with the concentrating table, of a shaft movable longitudinally and also rotatable in its bearings, a toggle-bar having one end bearing against one end of the shaft at a point eccentric to the axis of rotation and at the opposite end bearing against the movable-frame of the concentrator; a face-cam on the opposite end of the shaft, a roller in contact with said cam, adjustably mounted in a fixed support; and means for adjusting the bearing-point of the said roller against the face of the cam more or less eccentrically with respect to the axis of rotation.

3. In a drive-mechanism for an ore-concentrator, the combination with the concentrating table, of a shaft rotatable and having also a limited movement longitudinally in its said bearings; a head on one end of said shaft, provided with a socket set eccentrically to the axis of rotation, a toggle-bar having one end seated in said socket and the opposite end bearing against the part to be driven, a cam-faced disk on the opposite end of the said shaft the surface of said disk gradually increasing in elevation from the center outward on radial lines and also circumferentially of the disk, the surfaces of greatest elevation being joined to the surface of least elevation by a continuous incline; a roller rotatably mounted and having peripheral contact with the face of the disk, and means for adjusting the roller to set the bearing-point of the roller against the face of the disk more or less eccentrically to the axis of rotation of the disk, consisting of the movable box and the adjusting screws.

4. In a drive mechanism for an ore concentrator, the combination with the concentrating table, of a shaft free to be rotated and to be reciprocated longitudinally, connections between one end of the shaft and the frame of the concentrator through which the reciprocations of the shaft are transmitted, a face cam at the opposite end of said shaft, an abutment against which the face cam is held and means for adjusting the said abutment radially across the face of the cam.

5. In a drive mechanism for an ore concentrator, the combination with a concentrating table, of power-transmitting devices for imparting to and fro motions to the table, devices independent of the said power-transmitting devices for imparting to the table through the said power-transmitting devices "kicking" motions, and means for adjusting the last mentioned devices to regulate the "kick" imparted to the table, substantially as set forth.

6. In a drive mechanism for an ore concentrator, the combination with a concentrating table, of power-transmitting devices for imparting to and fro motions to the table, a cam independent of the said power-transmitting devices for imparting to the table through the said power-transmitting devices "kicking" motions, a stationary abutment against which said cam works, and means for adjusting the said abutment to regulate the "kick" imparted to the table, substantially as set forth.

7. In a drive mechanism for an ore concentrator, the combination with the concentrating table, of a rotatable shaft free to be moved longitudinally and having its axis of rotation substantially parallel with the lines on which the concentrator table is reciprocated, connections between the concentrator frame and one end of the shaft through which the rotary movements of the shaft are converted into to and fro movements which are transmitted to the said table, and other means for imparting longitudinal movements to the shaft when it is rotated.

8. In a drive mechanism for an ore concentrator, the combination of a driven shaft free to be moved longitudinally, a head at one end of the shaft, a socket piece carried by the head and set eccentrically to the axis of rotation of the shaft, a toggle bar between the socket piece and the frame of the concentrator, means for adjusting the socket piece toward or from said axis of rotation, and means for imparting longitudinal reciprocations to the shaft when it is driven.

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