No. 740,027. PATENTED SEPT. 29, 1903.

M. S. LEVÉ.

DRIVING MECHANISM FOR ORE CONCENTRATORS.

APPLICATION FILED MAY 13, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

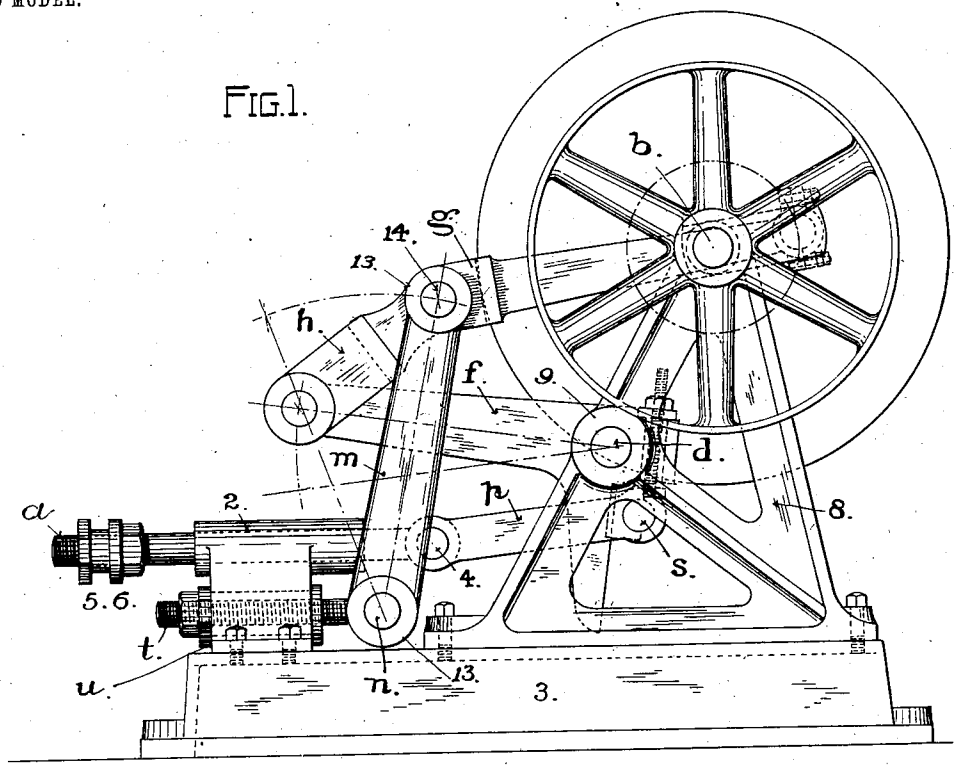
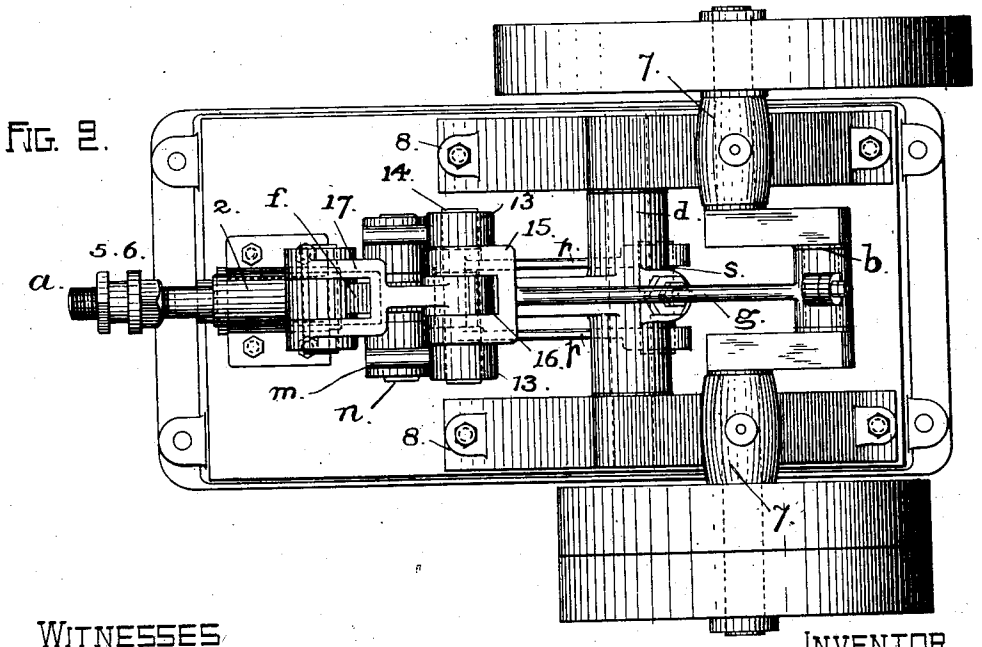


FIG. 2.



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NO MODEL. 2 SHEETS—SHEET 2.

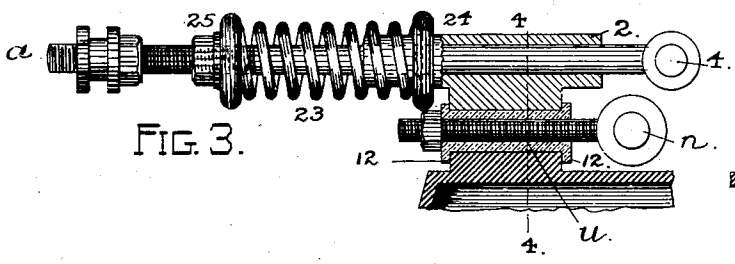


FIG. 3.

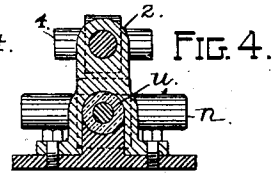


FIG. 4.

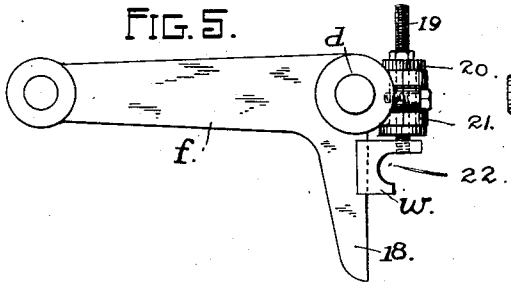


FIG. 5.

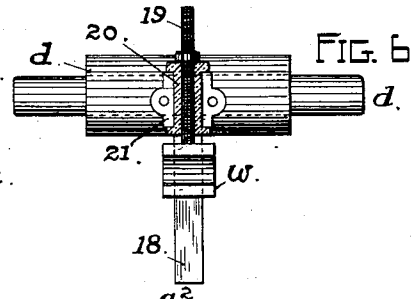


FIG. 6.

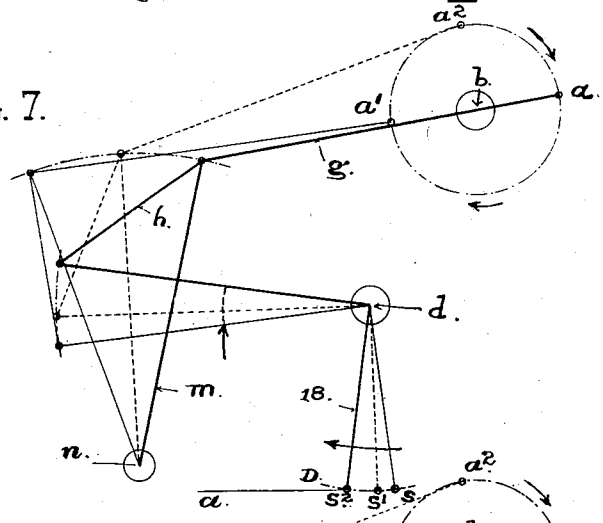


FIG. 7.

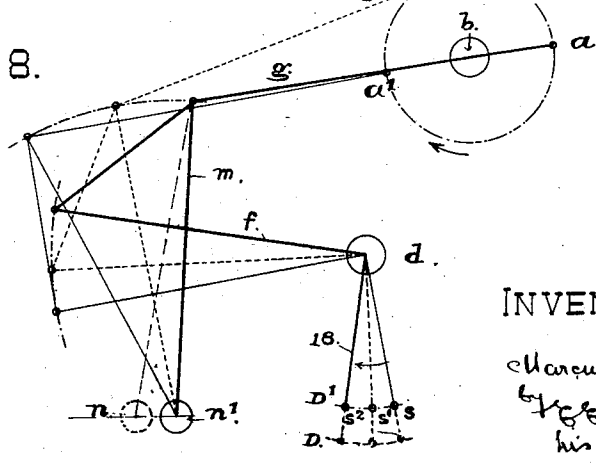


FIG. 8.

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No. 740,027. Patented September 29, 1903.

UNITED STATES PATENT OFFICE.

MARCUS S. LEVÉ, OF FRUITVALE, CALIFORNIA.

DRIVING MECHANISM FOR ORE-CONCENTRATORS.

SPECIFICATION forming part of Letters Patent No. 740,027, dated September 29, 1903.

Application filed May 13, 1902. Serial No. 107,094. (No model.)

To all whom it may concern:

Be it known that I, MARCUS S. LEVÉ, a citizen of the United States, residing at Fruitvale, in the county of Alameda and State of California, have invented a new and useful Improvement in Driving Mechanism for Ore-Concentrators, of which the following is a specification.

This invention relates to improvements made in crank-operated driving mechanism for ore-concentrators of that class known as "table-concentrators," in which the pulp is carried forward on the concentrating-surface by the peculiar reciprocating motion imparted by the driving mechanism.

The present improvements have for their object chiefly to obtain from the motion of a crank driven at uniform speed a variable reciprocating motion slowly increasing in velocity during the first portion of the forward reciprocation and for a greater or less portion of the forward movement of the table and in the remaining portion changing the velocity by a relatively rapid retarding motion to the end of the forward stroke, from which point the reverse movement back to the starting-point has relatively rapid acceleration for a portion of the return stroke followed by a slowly-retarding movement to the starting-point. These variations are effected through novel construction, combination, and arrangement of links and levers connecting the table with the crank, and in the construction provision is made for regulating by adjustment both the length of the reciprocation and the ratio of the accelerated and retarded portions in each reciprocation, whereby the same can be varied from time to time as the character or conditions of the material may seem to require and while the concentrator is in operation without having to stop or throw off the power from the driving mechanism.

To such ends and object my invention consists in certain novel construction and combination of crank, reciprocating head, and connections, as hereinafter described, and set forth in the claims at the end of this specification, wherein reference is had to the accompanying drawings.

Figure 1 of the drawings is a side elevation of a driving mechanism embodying these improvements. Fig. 2 is a top view of Fig. 1. Fig. 3 is a detail view, in longitudinal section, on an enlarged scale, of the reciprocating head, showing a slight modification in which a coiled spring is placed on the rod to take up lost motion as the parts wear. Fig. 4 is a transverse section at 4 4, Fig. 3. Fig. 5 is a side view of the principal oscillating lever; and Fig. 6, a rear view of the same part, taken from the right in Fig. 5. Figs. 7 and 8 are diagrams representing the length of strokes and movements of the individual members connecting the crank and reciprocating head and illustrating the relation and the ratio of the accelerated and retarded periods or portions in the forward and backward reciprocations in every revolution of the crank.

The part *a*, herein termed the "reciprocating head," is a rod fitted to slide longitudinally in a box 2 on the bed-plate 3 and having on one end trunnions 4 4 on opposite sides and at right angles to the rod and on the opposite end a means for attaching it to the table, such as nuts 5 5, working on a screw-threaded portion of the rod.

Bearings 7 7 are provided in the standing sides 8 8 of the stationary frame to carry the crank-shaft *b* and support it at right angles to the movements of the reciprocating head. At a point between the crank and the reciprocating head a rock-shaft *d*, having bearings 9 9 in the frame, forms a center of oscillating movement for an arm or lever *f*, to the outer end of which the crank is connected by a long connecting-rod *g* and a relatively short link *h*. The point of connection between the short link *h* and the connecting-rod *g* is connected by a second and longer link *m* to a center of oscillation *n*, situated below the line of the rock-shaft *d*, so that the common point of attachment between the connecting-rod and the intermediate link, which is controlled by the long link *m*, is made to travel in an arc of constant radius having for its center the point *n*, with a length of movement governed by the length of the crank, while the point of connection between the end of the member *f* and the link *h* moves in a plane coincident with the plane of rotation of the arc and in an arc having for its center the rock-shaft *d*. Connection of the reciprocating head with the rocking member *f* is made by a link *p*, one end of which is attached to the head by the

trunnions 4 and the other to a point *s*, situated off the center of oscillation *d* of the member *f*. The distance of this point *s* from such center *d* determines the length of the reciprocation or stroke of the head in one direction. The function of the part *f* in the combination of the parts *f g h m* is to change the direction of the motion as required by the position of the reciprocating head with respect to the crank-shaft and to provide for varying the length of stroke given to the head, for with the center *n* and point of attachment *s* both fixed or stationary the length of the reciprocation in every half-revolution of the crank and also the character of the motion from end to end of the stroke will not vary; but by shifting the point *n* with respect to its distance on a straight line from the center of rotation of the crank and by setting the point *s* nearer to or farther from the center of oscillation *d* both the length of the reciprocation and the ratio of the accelerated period to the retarded period of the stroke can be varied. The points *n* and *s* are therefore adjustable, and provision is made in the present construction for shifting these points with the greatest degree of delicacy required without stopping the machine or throwing off the power. For this purpose the end of the long link *m* is attached to a screw-threaded rod *t*, working in a nut or threaded sleeve *u*, having a socket or bearing in the block 2, that furnishes a guide for the reciprocating head, and being rotatable in this block the sleeve will move the rod longitudinally in either direction. Flanges 12 on the sleeve confine it in the block during such rotative movement, and one of the flanges is provided with holes to admit the end of a capstan-bar or is formed with polygonal faces to take a wrench. The long link is formed of two parallel bars *m*, having eyes at the ends fitted to trunnions *n* on the end of the threaded nut and to a cross-pin 14 in the outer end of the connecting-rod. That end of the rod is forked, as seen at 15, Fig. 2, and the end 16 of the short link is inserted in the fork, so that the parts at that point are connected by and work on the same cross-pin. The opposite end 17 of the short link is forked to take the end of the rocking lever *f*. By this construction all the parts are brought in line with and in true working relation to the connecting-rod and crank. The point of attachment for the link *p* is a slidable block *w* on an arm or member 18 of the lever *f* extending from the center *d* at right angles to the lever. The block is held by a screw-threaded rod 19, working in a threaded sleeve 20 of similar construction to that in the adjusting means at the center *n*, the sleeve being confined in a box 21 on the side of the rock-shaft and by its rotation acting to set the block either toward or away from the center of oscillation *d*.

In the present arrangement of the different members, with the lever *f* extending in the general direction of the reciprocating motion and approximately parallel therewith when the lever is midway of its stroke, the arm 18 depends perpendicularly downward from the center *d*, and the block *w* is shifted vertically to increase or diminish the length of the member. Changing the relative positions of the two members so that the lever *f* will be in a straight line with the arm 18 instead of at right angles to it will not affect the character of the movement imparted to the reciprocating head, and so long as the arcs in which the two points 14 and 26 are caused to travel by the joint operation of the crank and the controlling members *f* and *m* are approximately at right angles to each other, as shown in Figs. 7 and 8. The link connecting the reciprocating head to this movable block *w* is composed of parallel bars *p*, connected together at one end by a cross-pin *s*, fitted to a bearing 22 in the block and attached to the reciprocating head by the trunnions 4. A coiled spring 23, placed on the rod of the reciprocating head, as shown in Fig. 3, will take up any loose play at the joints and centers resulting from wear and insure smooth and even motion of all the members. One end of the spring has a bearing against a fixed collar 24 in the frame and at the opposite end against a movable collar 25, threaded to work on a screw-threaded portion of the rod. This spring also holds the cross-pin of the links *p* in the bearing on the block *w*, so that an open socket can be used, as shown in Fig. 5. As thus constructed this driving mechanism is capable of ready adjustment while the feeding and concentrating operation or process is going on. Variations in the length of the stroke or reciprocations increase or diminish the degree of the agitation, and as the periods of acceleration and retardation are varied with respect to the stroke the particles are caused to discharge with greater or less rapidity. The adjustment and regulation of these motions are always brought under the control of the operator, who by turning the threaded sleeves, which are both accessible and readily reached with the wrench, is able to effect such variations from time to time without interrupting the feed or stopping the mechanism.

The changes and variations in the length and character of the reciprocations produced by shifting the center *n* and the point *s* are illustrated by the two diagrams, Figs. 7 and 8.

In both diagrams the positions of the crank and the connections at the beginning of the forward reciprocation are indicated by light lines, at the end of the stroke by heavy lines, and at the quarter-revolution of the crank or midway of the the starting-point and end of the stroke by dotted lines.

The arc D represents the length of throw of the center *s*, where the reciprocating head is connected to the principal member *f*, and the points *s s'* s^2 indicate the respective position of the center *s* with the crank at the beginning and the end of the forward stroke

and also at a point midway of these two positions. In every forward stroke it will be seen that the velocity of the motion in the first portion of the stroke, or from s to s', will be smaller than in the remainder of the stroke during the travel from s' to s^2, and consequently the mean velocity during the first quarter of the crank or in traveling from a to a' will be less than the mean velocity for the remaining portion or from a' to a^2. By virtue of the peculiar arrangement or disposition of the connections between the crank and the part to be reciprocated the motion in the first portion of the forward stroke is a slow accelerated one; but in the remaining portion it changes in velocity, rapidly retarding from the point of change to the end of the forward stroke, while in the return throw of the crank these periods of acceleration and retardation follow each other in the same order, but with such change in their relative velocities that the motion is a rapidly-accelerated one followed by a slow retardation to the starting-point. During the travel of the crank from a to a' slow acceleration takes place, and in the remaining quarter, or from a' to a^2, the motion is rapidly retarded; but after passing the center the motion in the opposite direction becomes rapidly accelerated, and in the remaining quarter of the revolution the motion increases in velocity to the starting-point a.

From the second diagram, Fig. 8, it will be seen that the ratio of the periods of acceleration and retardation is affected by the position of the center n, and by shifting that point of oscillation of the long link longitudinally to the right or left of the position indicated in Fig. 7 the mean velocity in the travel of the part s from the beginning of the stroke to the quarter-revolution of the crank will be increased, while in the remaining portion of the stroke, or from s' to s^2, the mean velocity will be relatively less than it is in Fig. 7; but as the change made in the position of the center n also increases the length of the reciprocation provision is made for controlling the length of the arc D, so that the change made in the character of the motion by shifting the center n shall not affect the length of the reciprocation when it is desired to maintain the same, and the center s is made adjustable toward and away from the center of oscillation d for that purpose. With the center n moved to the right, or from n to n', Fig. 8, the point s will be moved in an arc of greater length if that point be at the same distance from the center d as it is in Fig. 7; but by setting the point s nearer to the center d the arc D' will have the same length as the arc D in Fig. 7, and the length of the reciprocation will remain unaffected by the change made in the character of the motion. Such adjustments also are made without difficulty while the mechanism is working, because the adjusting means for the center n is situated on the stationary frame, and the means for changing the position of the point s is located near the center of oscillation d, where the movement is so slight that the adjusting-nut can be easily turned to shift the block.

Having thus fully described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a driving mechanism for converting uniform rotary motion into varying reciprocating motion, the combination with a part to be reciprocated, of a crank, a relatively long connecting-rod, a link having one end connected to said rod, means operating to guide said point of connection in an arc of definite length, means connecting the other end of said link with the part to be reciprocated, and arranged to guide that end of the link in an arc approximately at right angles to the arc in which the opposite end of the link attached to the connecting-rod travels, said means also operating to confine the link within the last-mentioned arc.

2. In a driving mechanism for converting rotary into varying reciprocating motion, the combination with a part to be reciprocated, of a crank, a relatively long connecting-rod, a link connecting said rod with a stationary center of oscillation and operating to guide the end of said rod in an arc of definite length, a second link connected to the end of said connecting-rod, a rocking lever connected to the other end of said second link and adapted to carry that end of the second link in an arc approximately at right angles to the arc in which the opposite end of the said link is caused to travel, and means connecting the rocking lever with the part to be reciprocated, the point of connection between the rocking lever and the part to be reciprocated being situated on the side of the fulcrum-point of said lever opposite to the point of connection between the said lever and the connecting-rod.

3. In a driving mechanism for converting rotary motion into a varying reciprocating motion, the combination of a reciprocating head, a crank, a relatively long connecting-rod, means connected to said rod operating to confine the movements thereof in an arc of definite length, a link having one end connected to the said rod, a rocking lever connected to the other end of said link and operating to guide and confine the movement of that end in an arc approximately at right angles to the arc traversed by the opposite end of said link, means connecting said rocking lever with the part to be reciprocated, and means for shifting said point of connection to adjust the same at varying distances from the fulcrum-point of the rocking lever.

4. In a driving mechanism for converting rotary into variable reciprocating motion the combination of a part to be reciprocated, of a crank, a relatively long connecting-rod, a guiding-link connecting said rod with a center of oscillation and operating to guide the

rod in an arc of definite length, means for shifting the center of oscillation of said guiding-link, a rocking lever, a link connected at one end to the connecting-rod and having its opposite end situated within the said arc of oscillation, the rocking lever being connected to that end of the last-named link, and means connecting the part to be reciprocated with the said rocking lever to one side of the fulcrum of said lever.

5. In a driving mechanism for converting rotary into variable reciprocating motion the combination with a part to be reciprocated, of a crank, a connecting-rod of definite length, a link connecting said rod with a center of oscillation and operating to guide the same in an arc, means for shifting said center of oscillation, a second link having one end connected to the connecting-rod and the other end situated within the said arc, a rocking lever connected to the last-named link, means connecting the part to be reciprocated with said rocking lever, and means for shifting said point of connection to adjust the same at varying distances from the fulcrum of said lever.

In testimony whereof I have signed my name in the presence of two subscribing witnesses.

MARCUS S. LEVÉ.

Witnesses:
EDWARD E. OSBORN,
M. REGNER.