

H. EGGERS.  
 HEAD MOTION FOR ORE CONCENTRATORS.  
 APPLICATION FILED FEB. 15, 1910.

1,038,322.

Patented Sept. 10, 1912.

4 SHEETS—SHEET 1.

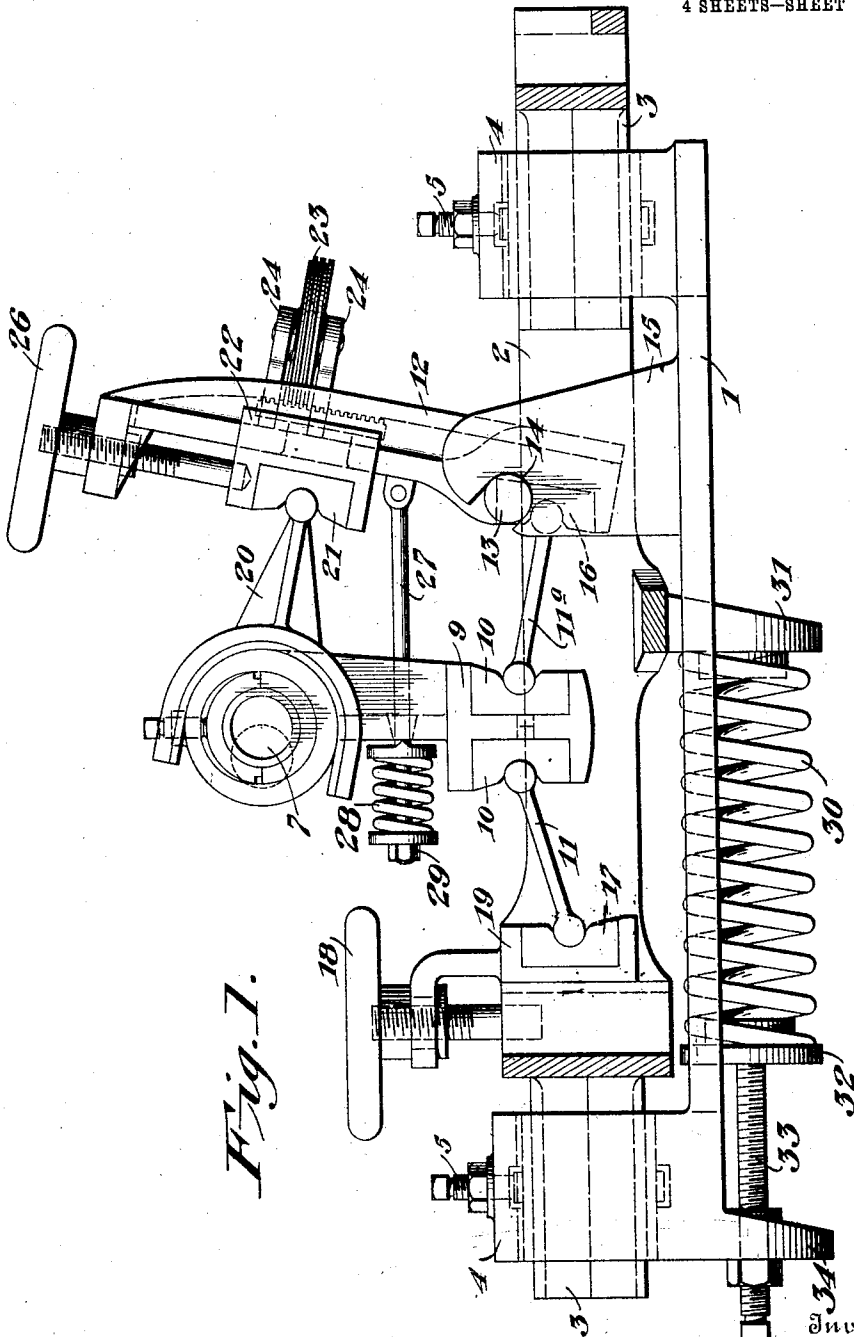


Fig. 1.

Witnesses  
 Lloyd W. Patch  
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Inventor  
 Henry Eggers  
 By Vernon C. Rogers  
 his Attorney

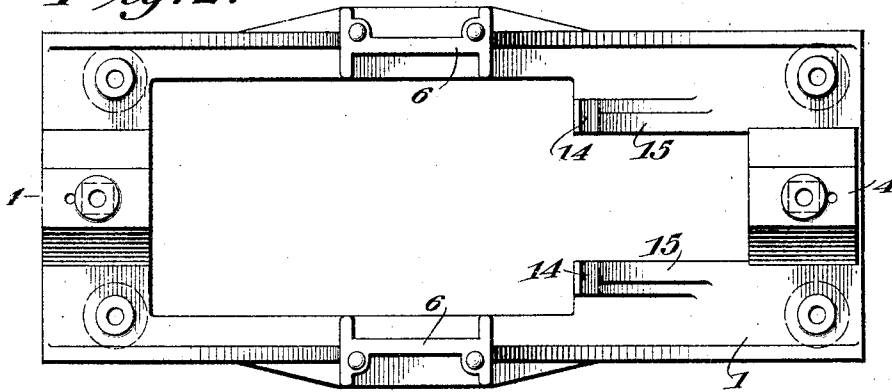
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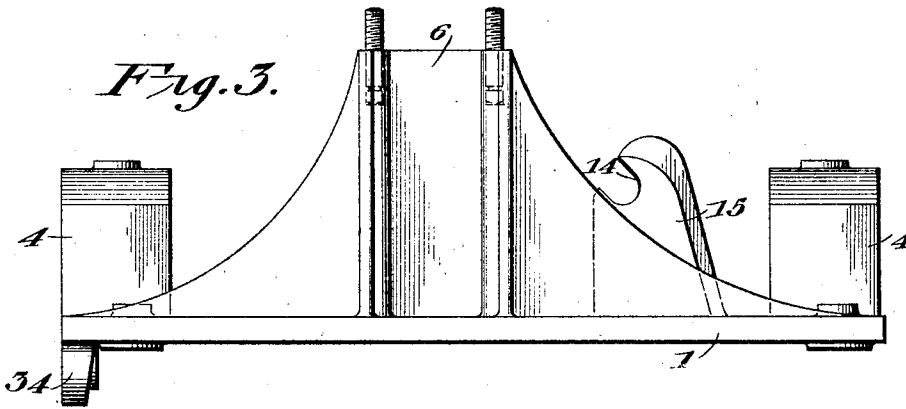
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4 SHEETS—SHEET 2.

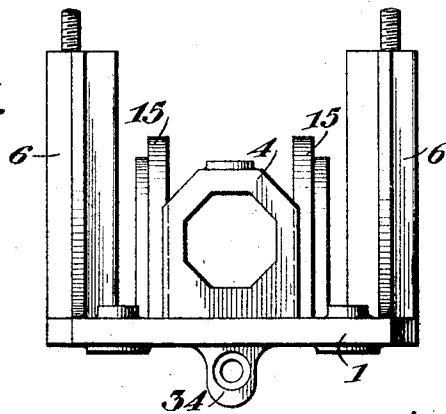
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



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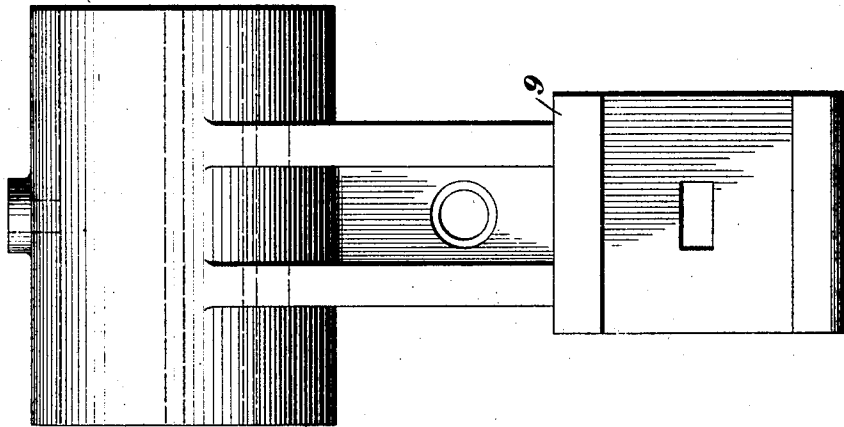


Fig. 6.

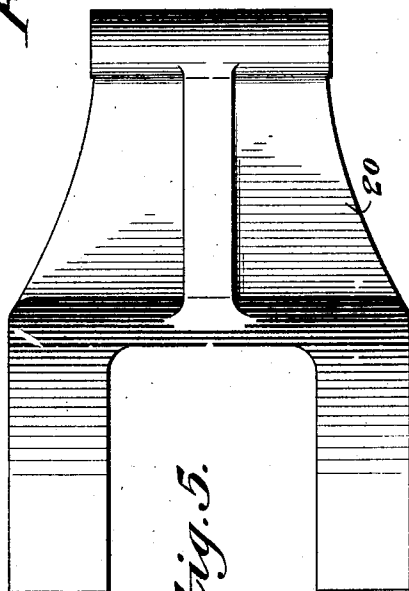
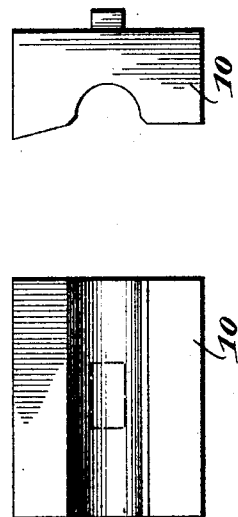


Fig. 5.

Fig. 11.



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4 SHEETS—SHEET 4.

Fig. 9.

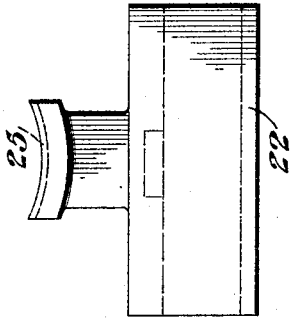


Fig. 12.

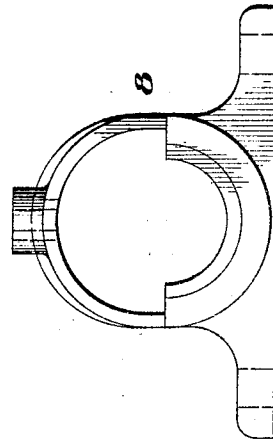


Fig. 8.

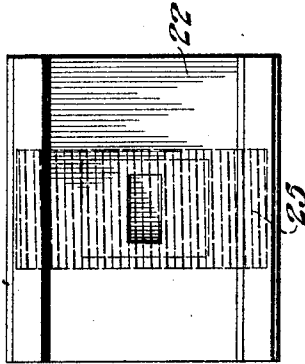


Fig. 10.

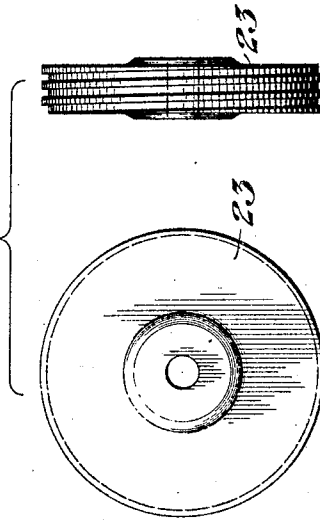
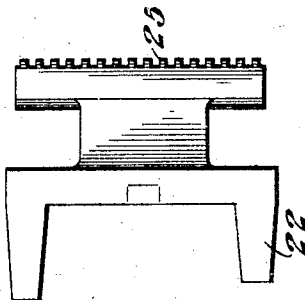


Fig. 7.



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# UNITED STATES PATENT OFFICE.

HENRY EGGERS, OF DENVER, COLORADO, ASSIGNOR TO THE MINE & SMELTER SUPPLY COMPANY, OF DENVER, COLORADO, A CORPORATION.

## HEAD-MOTION FOR ORE-CONCENTRATORS.

1,038,322

Specification of Letters Patent.

Patented Sept. 10, 1912.

Application filed February 15, 1910. Serial No. 543,937.

*To all whom it may concern:*

Be it known that I, HENRY EGGERS, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Head-Motions for Ore-Concentrators, of which the following is a specification.

My invention relates to an improvement in head motions for ore concentrators, and the object is to provide mechanism for moving the table from a state of rest, in the direction of the discharge end with a constantly accelerating motion to the end of the stroke, then reversing as quickly as possible with a maximum of speed at the time of reversing, which speed gradually diminishes until the position of rest is reached, preparatory to the commencement of another forward stroke. This has the effect of carrying the material resting upon the table forward a certain distance at each forward stroke of the table by virtue of the momentum given the material by said forward movement of the table, and the rapid return causes the table to pull from under the material, as it were, owing to the inertia of the material thereon, thereby insuring a more or less progressive motion to the material, notwithstanding the fact that the motion of the table is reciprocatory. This effect has been produced by various forms of toggles, normally disposed at a more or less acute angle to each other, and the more acute this angle becomes, the longer is the stroke that is obtained by this means with the corresponding throw of the eccentric. For example, in the patent to Wilfley, No. 590,675, dated Sept. 28, 1897, the movement of the table caused by the toggles is greatest when the toggles are at the sharpest or smallest angle in relation to each other. Hence the movement of the table is greatest at the beginning of the stroke, and less at the end of the stroke. This may be termed a differential. It is evident in this movement, that when the stroke is shortened by increasing the angle between the toggles, that the differential—that is to say, the speed at the beginning as compared with the end of the stroke—is less than when the angle is smaller or more acute. It is impossible with this arrangement to shorten the stroke without causing a loss of differential in the stroke. In Wilfley Patents Nos. 719,401, patented January 27, 1903, and

733,342, patented February 21, 1905, the same conditions are present, as above, with the exception that the toggles are below the center line instead of above. Then there is the patent to Darragh and King, known as the "King-Darragh" head motion, disclosed in Letters Patent No. 506,035, October 3, 1893, in which the relative differential can be maintained, although the stroke be shortened, for the reason that the angle between the toggles at the commencement of the stroke is not changed. The length of throw is obtained by moving the part L' of the patent in either direction on the extended arm of the rocking lever D of the toggle. Otherwise this movement resolves itself into precisely the same motion as in the Wilfley head motion. Finally, I might call attention to the Boylan head motion, of Patent No. 901,535, of October 20, 1908. This head motion is similar to the second form of the Wilfley head motion in its main features; but in addition is provided with a rocking pitman which has an adjustment to shorten or lengthen the lever arm of the pitman. This adjustment of the lever length gives the table a variable stroke, while maintaining the same throw of the eccentric, and the same angle between the toggles, thus preserving the differential of the stroke, though the latter is shortened. The stroke, however, can also be shortened by the vertical adjustment of the toggle seat, and when so adjusted, a change in the differential will take place very similar to that of the first-mentioned Wilfley head motion.

My present invention takes advantage of the features of the Wilfley construction, and comprises in addition thereto a rocker arm or lever, which is positively controlled at one end by the main eccentric shaft while delivering, at the other end, a motion equivalent to the toggle motion of the Wilfley head motion; but the swing of the lever results in adding to the toggle motion on the return stroke, and takes from it on the forward stroke.

My present invention provides further for susceptibility of adjustment while the table is in motion, so that the operator can watch the results taking place upon the table, and adjust the head motion accordingly.

In the accompanying drawings:—Figure 1 is a view in side elevation on an enlarged scale, Fig. 2 is a top plan view of the base, 110

Fig. 3 is a view in side elevation of the latter, Fig. 4 is an end view, Fig. 5 is a top view of the connecting pitman, Fig. 6 is a view of the main pitman taken at right angles to the view shown in Fig. 1, and Figs. 7, 8, 9, 10, 11 and 12 are details.

The numeral 1 indicates the base, and 2 is a thrust-bar, the ends 3, 3, of which are fitted and adapted to reciprocate in boxes 4, 4, provided therefor at opposite ends of the base 1, set-screws 5, 5, being provided to take up wear in these boxes 4, 4. At each side of the base, the pillow blocks 6, 6, are erected, they preferably being cast integral with the base, and their function being to afford support for the crank shaft 7, which rotates in suitable journal boxes, 8, 8. The main pitman 9 is journaled at its upper end upon the crank of shaft 7, and extends downwardly, as shown in Fig. 1, where it is provided with the toggle seats 10, 10, in which the inner ends of the toggles 11, 11<sup>a</sup>, bear.

A rocker arm 12 is fulcrumed through the trunnions 13, 13, in the bearings 14, 14, formed in the pillars 15, 15, extending upwardly from the base. The outer or forward end of the toggle 11<sup>a</sup> has its bearing in a toggle seat 16 carried in this rocker arm at a point below its fulcrum, whereas the outer or rear end of the other toggle 11 has its bearing in a toggle seat 17 supported in a stroke-adjusting block 19 in the rear end of the thrust bar, where its position and elevation may be adjusted and regulated by means of the stroke-adjusting hand-wheel 18, if need be, while the machine is in motion.

A connecting rod 20 extends from the crank shaft 7 to some point on the rocker arm 12, this latter point preferably being variable. In the form of connecting rod illustrated in Fig. 5 it is forked or bifurcated at one end to straddle the main pitman, and the outer end of the connecting rod bears in a seat 21 constructed and adapted to receive it. This seat 21 is held in a block 22, which latter is slidably and adjustably connected with the rocker arm, a hand-screw 23 mounted to turn between the jaws 24, 24, on the rocker arm, being provided for this purpose. That is to say, the threads of the hand-screw 23 register with threads 25 (see Figs. 7 and 8) on the forward edge of the block 22. By turning this hand-screw 23, the block 22 may be raised or lowered, while the machine is in motion, to regulate the stroke of the rocker arm, and a hand-wheel 26 in the upper end of the rocker arm is turned to lock the block 22 when adjusted to the required position. This also is so located and arranged that it may be turned while the machine is in motion.

A tension rod 27 extends from the rocker arm 12 to the pitman 9, and has a spring

28 thereon, and a nut 29 is provided for varying the tension of the spring. The purpose of the tension rod 27 and its spring 28 is to keep the rocker arm or lever 12, connecting rod 20, and pitman 9 in flexible conjunction with one another. A stiff spring 30 is interposed between a lug 31, depending from the thrust-bar, and the washer 32, which latter is adjusted by means of the set screw 33 turning in a nut 34, depending from the base, through the medium of which screw the tension of the spring 30 is adjusted.

While I have shown but one means of varying the stroke of the thrust bar, it is obvious that the same results might be obtained by an adjustment either at the fulcrum, or at the bearing point of the toggle 11<sup>a</sup>, and I have merely selected the most convenient of the three, because of the facility with which the stroke may be regulated, while the machine is in motion, which is a desideratum, because it enables the operator to watch the results taking place upon the table, and to adjust the head motion accordingly, without continually stopping and starting the machine to do it.

From the foregoing it will be observed that the outer bearing of the toggle 11<sup>a</sup> is a variable point. That is to say, it is not fixed, and it commences to move at a time when the pitman is on its dead center, and the toggle under ordinary conditions, inactive; but through the medium of the connecting rod 20, a stroke is imparted to the rocker arm or lever 12 at a period when the pitman 9 is least active. This has the effect of advancing the support of the outer end of the toggle 11<sup>a</sup>, thus adding the movement of the lower end of the rocker arm or lever 12 to the movement created by the toggle joint through the pitman 9, the result of which is that the thrust-bar travels the major portion of the length of its stroke during approximately the first quarter revolution of the crank shaft. The remainder of the stroke takes place before the completion of the first half revolution of the crank shaft, after which the thrust-bar moves in its forward direction, first slowly, then accelerating in speed, and traveling the greater portion of its stroke toward the end of the revolution of the crank shaft, or in other words, the two strokes have the reverse effect upon the thrust bar, so that through the instrumentality of the rocker arm, or lever 12, the travel of its lower end is added to the regular stroke of the toggle joint, which produces the return motion of the table, whereas in the forward stroke of the table, the length of travel of the lower end of the rocker arm is deducted from the stroke of the toggle joint. The effect upon the table itself is readily appreciated, as it imparts a relatively slow initial outward or

forward movement to the table, so that the particles move with the table, after which, toward the end of the forward stroke, the motion is accelerated, whereas on the return stroke, the initial movement is quick and relatively long, thereby taking advantage of the inertia of the particles, which remain stationary while the table is quickly withdrawn, or pulled back from under them, which has the effect of progressively advancing the material of the greater specific gravities lengthwise over the surface of the table. While this motion is going on, the adjusting parts are so arranged and located that they are susceptible of manipulation while the table is doing its work, enabling the operator to watch the results going on, and to adjust the table accordingly.

In addition to the slight variations which have been suggested, it is evident that others might be made, and still come within the scope of the invention; and hence I do not wish to limit myself to the exact construction set forth, but:—

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

1. The combination with a base and a movable draw-bar supported thereon, of a lever fulcrumed on the base, and a drive shaft having a crank thereon which has direct connection with the lever at one point and indirect connection with the lever at another point and also, with the draw-bar, and means for shifting and adjusting the point of direct connection with the lever.

2. The combination with a base and a movable draw-bar supported thereon, of a lever fulcrumed on the base and a drive shaft having a crank thereon which has direct connection with the lever at one point, and indirect connection with the lever at another point, indirect means of connection between the shaft and draw-bar and means for shifting and adjusting the point of direct connection with the lever.

3. The combination with a base and a movable draw-bar, of a lever fulcrumed on the base, a crank-shaft, and a pitman and a connecting rod both extending from the crank-shaft, one directly and the other indirectly to the lever and draw-bar.

4. The combination with a base, and a movable draw-bar, of a lever fulcrumed on the base, a drive shaft, and means for connecting both the draw-bar and lever with the drive shaft, the connection with the lever being at two different points, and said points on opposite sides of the fulcrum.

5. The combination with a base, and a movable draw-bar, of a lever fulcrumed on the base, a drive shaft, and means for eccentrically connecting the drive shaft with both the draw-bar and lever, the eccentric connection with the lever being at two dif-

ferent points, said points at opposite sides of the fulcrum, one of these points of connection being adjustable.

6. The combination with a base, and a movable draw-bar, of a lever fulcrumed on the base, a drive shaft, and means for eccentrically connecting the drive shaft with both the draw-bar and lever, the eccentric connection with the lever being at two different points, said points at opposite sides of the fulcrum, one of these points of connection being adjustable while the lever is in motion.

7. The combination of a base, a draw-bar movably connected therewith, a yielding device for exerting pressure upon the draw-bar in one direction, a crank shaft, a lever fulcrumed on the base, toggles extending between one end of the lever and the draw-bar, two oscillating means extending from the crank shaft, one to a point between the inner ends of the toggles, and the other to the lever.

8. The combination with a base, a draw-bar movably connected therewith, and a crank-shaft, of a lever fulcrumed on the base, a pitman, and a connecting-rod extending from the crank-shaft, the latter to the lever, toggle mechanism, the outer ends of which rest on movable supports, one being the lever and the other the draw-bar, and the inner ends connected with the pitman whereby the motion of the lever is transmitted to the draw-bar, the point of connection of the connecting-rod with the lever being adjustable, said adjustable means comprising a bearing-block slidably connected with the lever and having screw-teeth, and a screw carried by the lever in position to engage said screw-teeth.

9. The combination with a base, a draw-bar movably connected therewith, and a crank-shaft, of a lever fulcrumed on the base, a pitman, and a connecting-rod extending from the crank-shaft, the latter to the lever, toggle mechanism, the outer ends of which rest on movable supports, one being the lever and the other the draw-bar, and the inner ends connected with the pitman whereby the motion of the lever is transmitted to the draw-bar, the point of connection of the connecting-rod with the lever being adjustable, said adjustable means comprising a bearing-block slidably connected with the lever and having screw-teeth, a screw carried by the lever in position to engage said screw-teeth, and means carried by the lever for locking the bearing-block in its set position.

10. The combination with a base, a draw-bar movably connected therewith, a spring extending between the base and draw-bar, and a drive shaft, of a lever, a toggle extending between one end of the lever and the draw-bar, two oscillatory devices extending

from an eccentric on the drive shaft, one connected with the toggle, and the other with the lever.

11. The combination with a base, a draw-bar movably connected therewith, a spring extending between the base and draw-bar, and a drive shaft, of a lever, a toggle extending between one end of the lever and the draw-bar, two oscillatory devices extending from an eccentric on the drive shaft, one connected with the toggle, and the other with the lever, and a tension device connected with the lever.

12. The combination with a base, a draw-bar movably connected therewith, a spring extending between the base and draw-bar, a drive shaft and a lever, a toggle extending between one end of the lever and the draw-bar, two oscillatory devices extending from an eccentric on the drive shaft, one connected with the toggle, and the other with the lever, and a tension device connecting the lever with one of said oscillatory devices.

13. The combination with a base, a draw-bar movably connected therewith, a spring extending between the base and draw-bar, and a drive shaft, a toggle extending between one end of the lever and the draw-bar, two oscillatory devices extending from an eccentric on the drive shaft, one connected with the toggle, and the other with the lever, the point of connection with the lever being adjustable.

14. The combination with a base, draw-bar, and shaft, of a rocker arm or lever fulcrumed on the base, devices extending from the shaft to the lever at opposite sides of its fulcrum, one of said connections with the lever being variable, and means for transmitting the motion of the shaft to the draw-bar.

15. The combination of a base, a draw-bar movably connected therewith, a yielding device for exerting pressure upon the draw-bar in one direction, a crank shaft, and a lever, toggles extending between one end of the lever and the draw-bar, two oscillating means extending from the crank-shaft, one to a point between the inner ends of the toggles, and the other to the lever, and a tension device connecting the lever with one of said oscillating means.

16. The combination of a base, a slidable spring-actuated draw-bar supported thereon, a crank-shaft, a lever fulcrumed on the base, a pitman actuated by the crank-shaft, toggles extending from the pitman to the draw-bar and the lever, and a connecting-rod extending from the crank-shaft to the lever for positively actuating the latter whereby to create a differential movement in the stroke of the draw-bar between beginning and end in each direction thereof.

17. The combination of a base, a draw-bar movably connected therewith, a spring interposed between the draw-bar and a part of the base, a crank-shaft, and a differential lever fulcrumed on the base, a toggle extending between an end of the differential lever and the draw-bar, two oscillating means extending from the cranks on the crank-shaft, one of which means is connected with the toggle and the other with the differential lever whereby to impart a series of unequal variable movements to the draw-bar during a single revolution of the crank-shaft.

In testimony whereof I affix my signature in the presence of two witnesses.

HENRY EGGERS.

Witnesses:

G. C. HITT,  
D. EDGAR WILSON.