No. 763,785. PATENTED JUNE 28, 1904.

G. A. OVERSTROM.

ACTUATING MECHANISM FOR CONCENTRATING TABLES.

APPLICATION FILED JULY 19, 1901. RENEWED MAR. 20, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

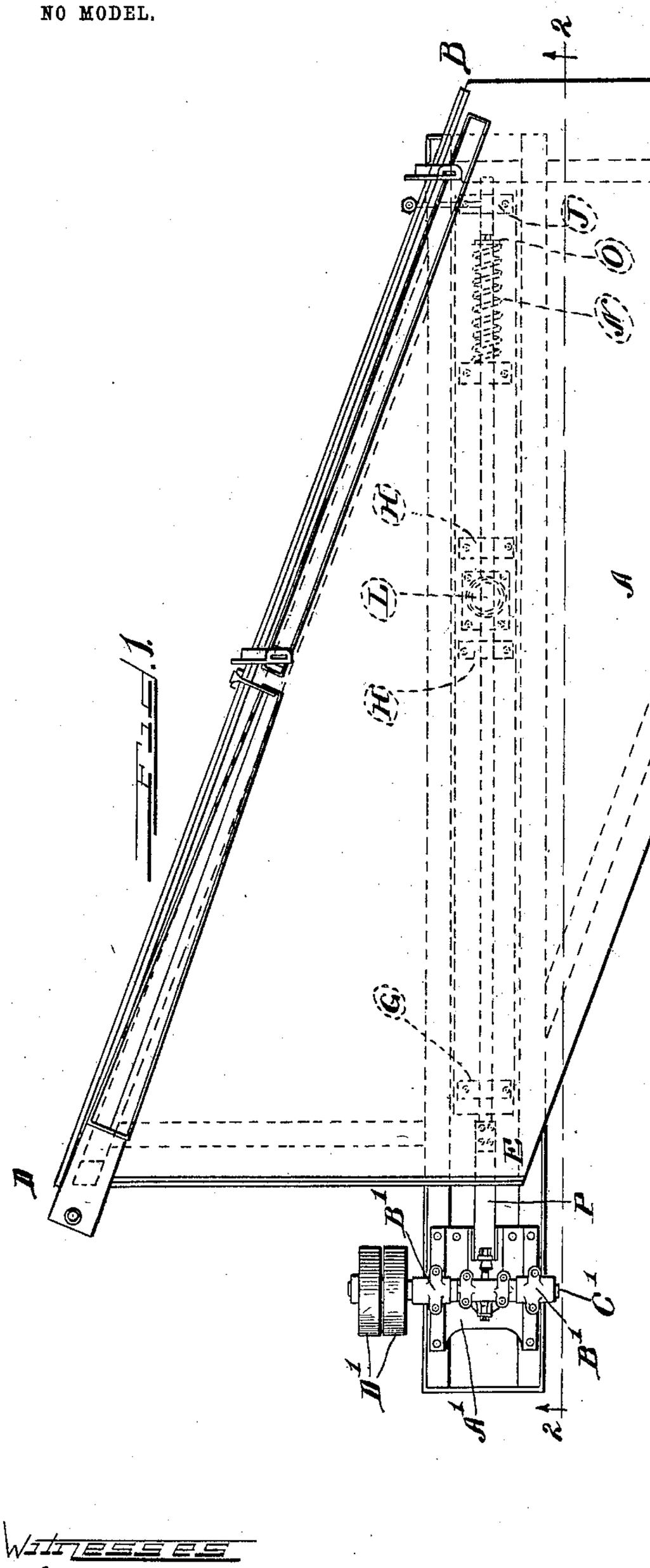


Fig. 1.

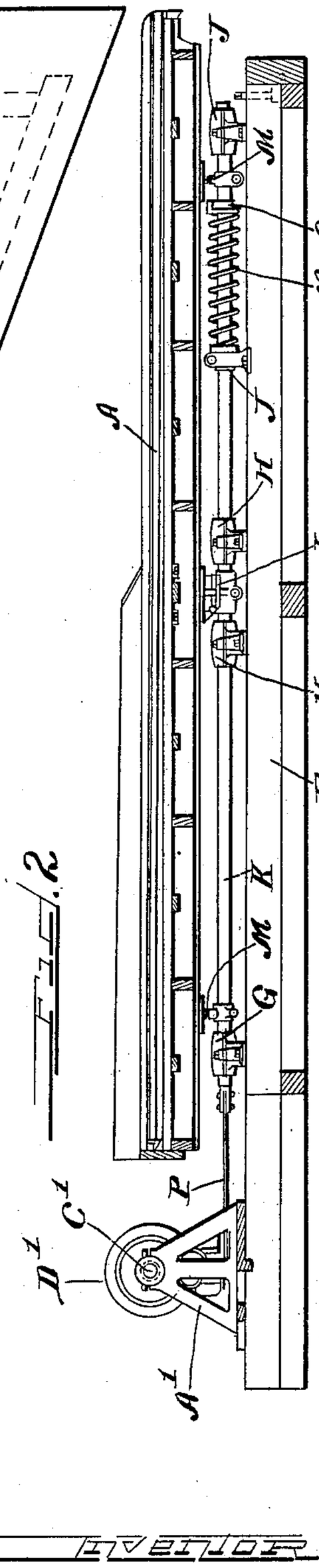


Fig. 2.

Witnesses
Ira D. Perry
J. B. Weir

Inventor
Gustave A Overstrom
By Brown & Darby
Attys

No. 763,785. PATENTED JUNE 28, 1904.

G. A. OVERSTROM.

ACTUATING MECHANISM FOR CONCENTRATING TABLES.

APPLICATION FILED JULY 19, 1901. RENEWED MAR. 20, 1903.

NO MODEL. 4 SHEETS—SHEET 2.

Fig. 3.

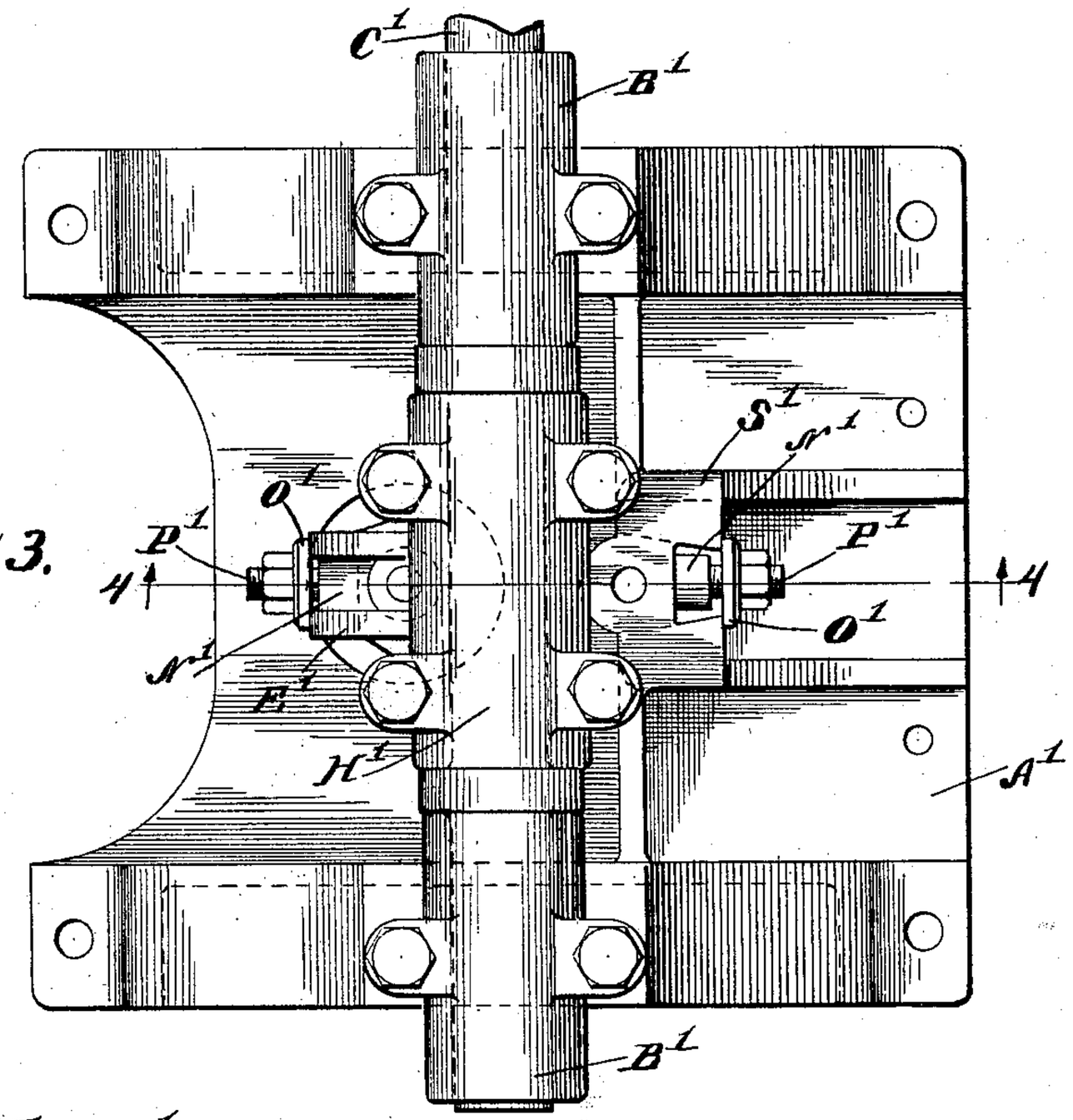


Fig. 7.

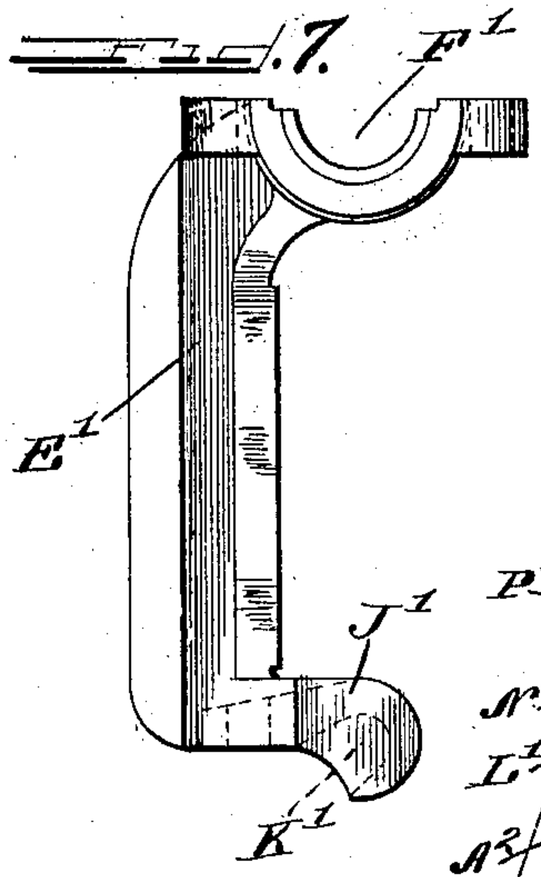


Fig. 4.

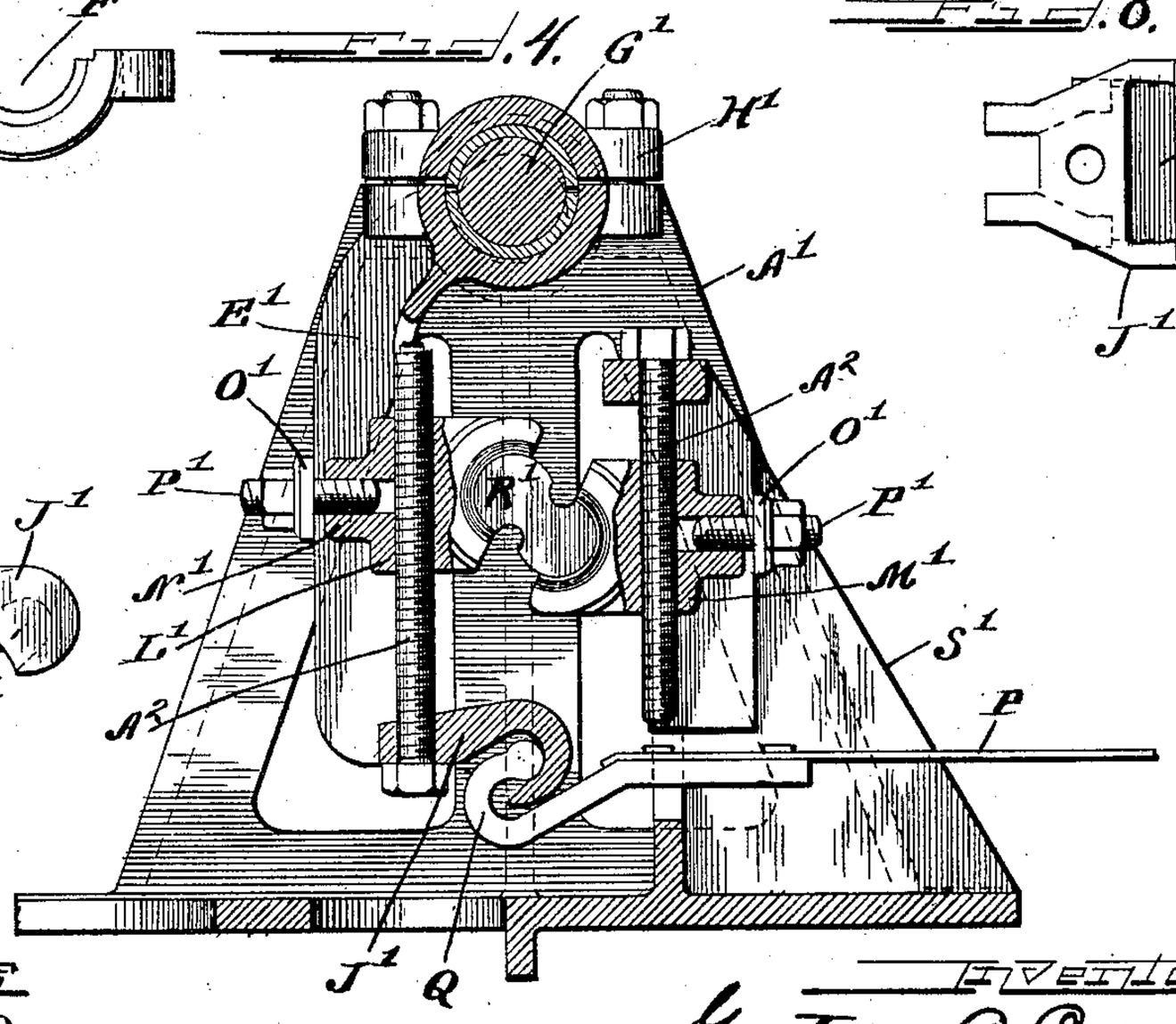


Fig. 8.

Witnesses
Ira D. Perry
Robert H. Weir

Inventor
Gustaor A. Overstrom
By Brown & Darby
Atty's

No. 763,785. PATENTED JUNE 28, 1904.

G. A. OVERSTROM.

ACTUATING MECHANISM FOR CONCENTRATING TABLES.

APPLICATION FILED JULY 19, 1901. RENEWED MAR. 20, 1903.

NO MODEL. 4 SHEETS—SHEET 3.

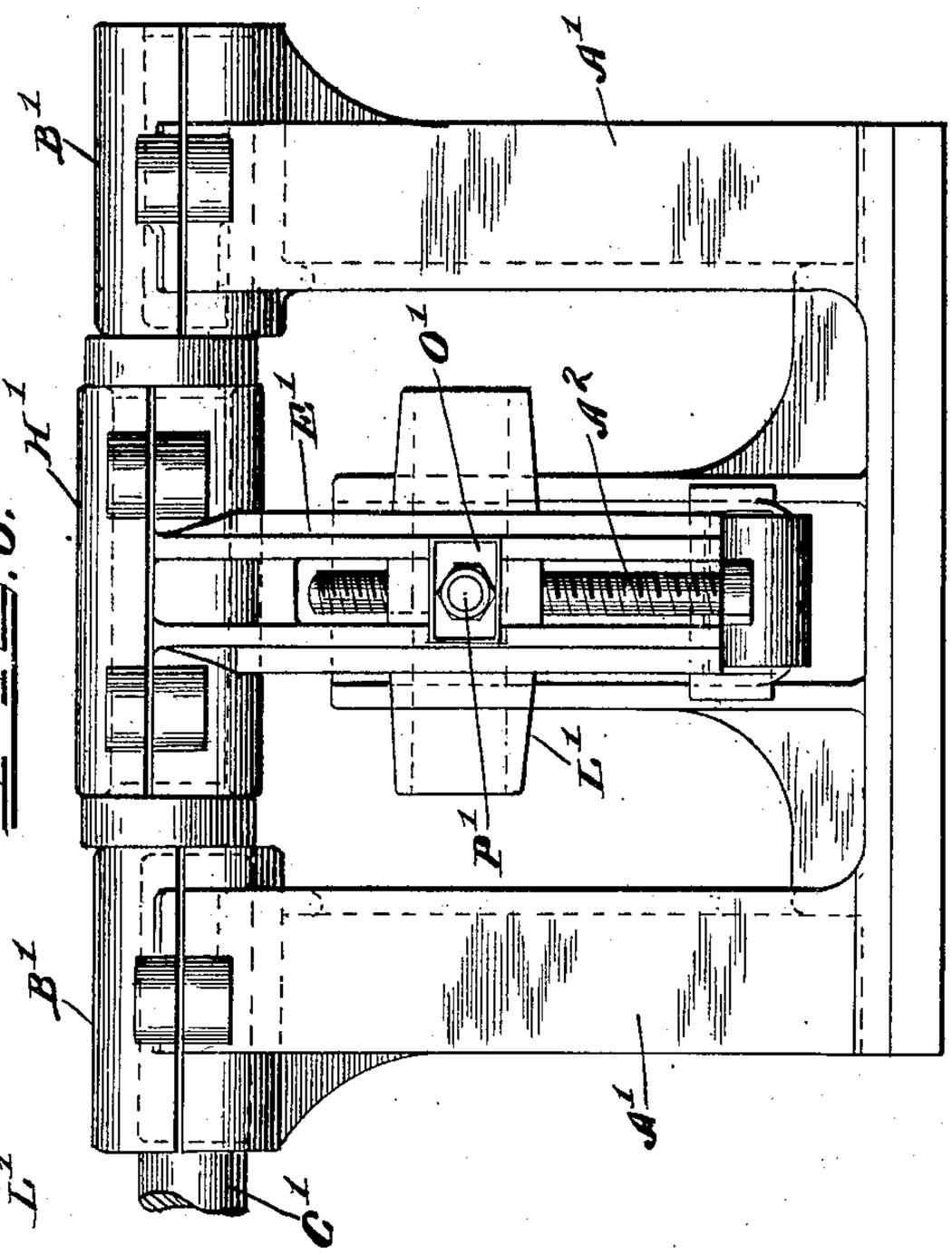


Fig. 6.

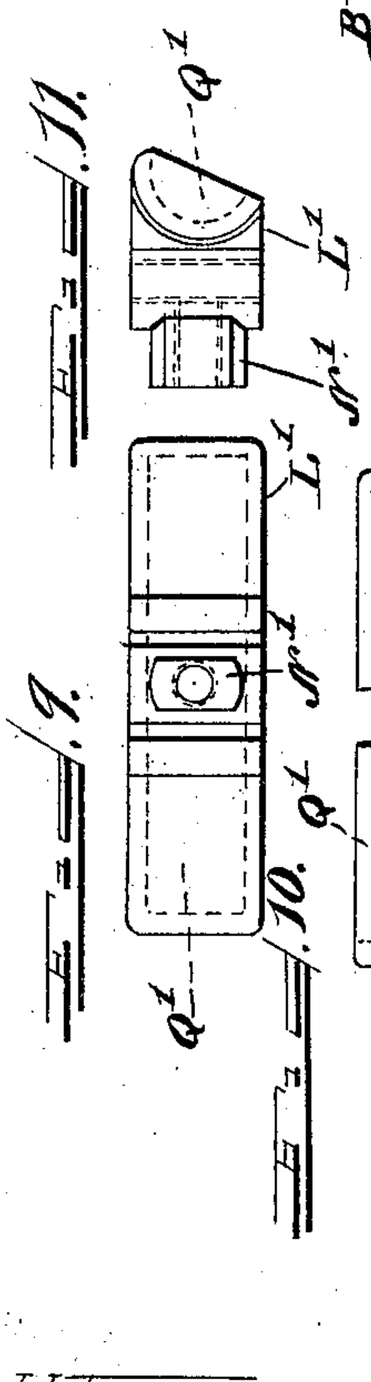


Fig. 11.

Fig. 10.

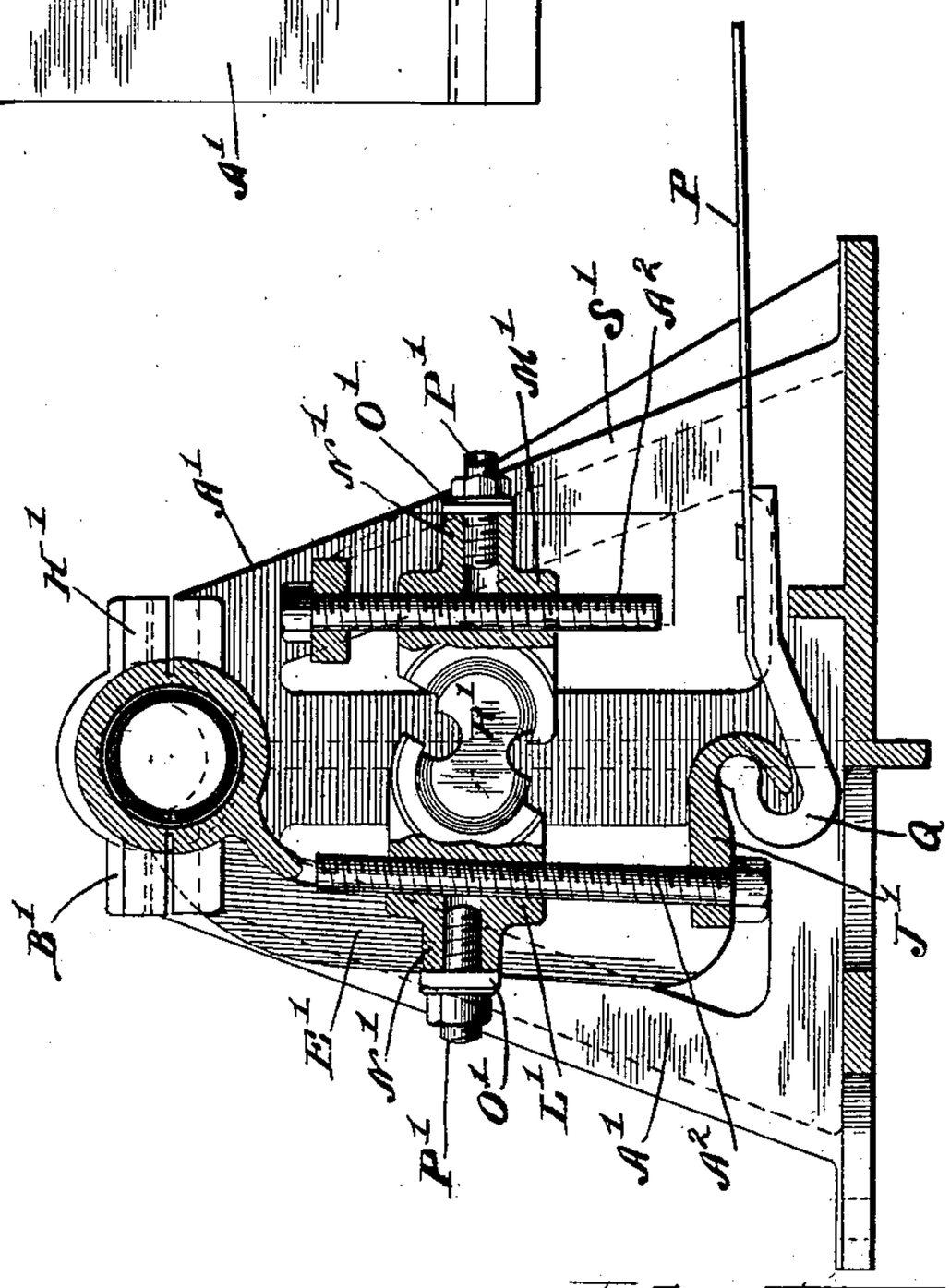


Fig. 5.

Witnesses
Ira D. Perry
J. B. Weir

Inventor
Gustaor A. Overstrom
By Bacon & Darby
Attys

No. 763,785. PATENTED JUNE 28, 1904.

G. A. OVERSTROM.

ACTUATING MECHANISM FOR CONCENTRATING TABLES.

APPLICATION FILED JULY 19, 1901. RENEWED MAR. 20, 1903.

NO MODEL. 4 SHEETS—SHEET 4.

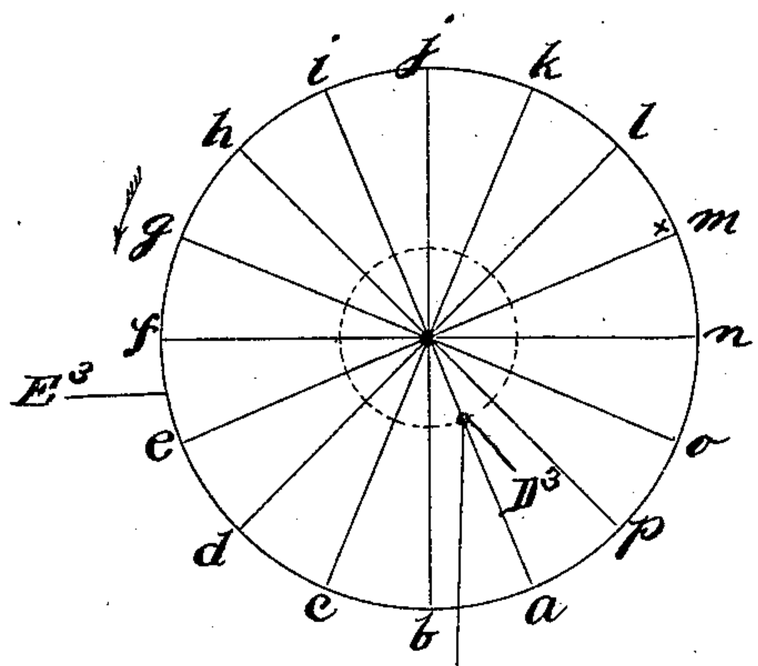
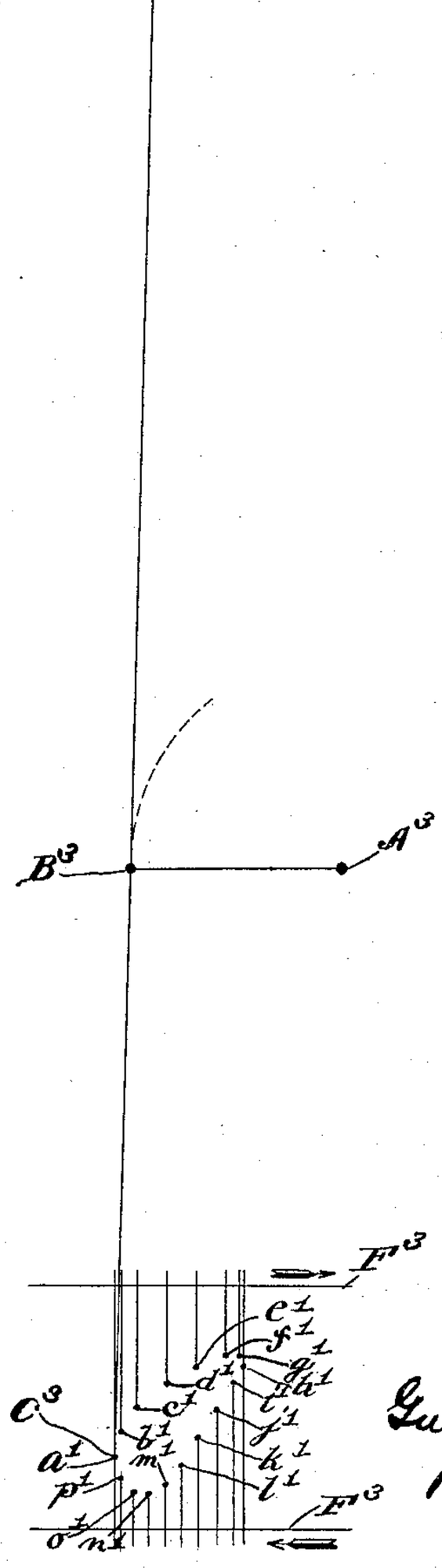


Fig. 12.



Witnesses
Ira D. Perry
J. B. Weir

Inventor
Gustaf A. Overstrom
By Brown & Darby
Att'ys

No. 763,785. Patented June 28, 1904.

UNITED STATES PATENT OFFICE.

GUSTAVE A. OVERSTROM, OF ANACONDA, MONTANA, ASSIGNOR TO OVERSTROM CONCENTRATOR COMPANY, OF BUTTE, MONTANA, A CORPORATION OF MONTANA.

ACTUATING MECHANISM FOR CONCENTRATING-TABLES.

SPECIFICATION forming part of Letters Patent No. 763,785, dated June 28, 1904.

Application filed July 19, 1901. Renewed March 20, 1903. Serial No. 148,794. (No model.)

To all whom it may concern:

Be it known that I, GUSTAVE A. OVERSTROM, a citizen of the United States, residing at Anaconda, in the county of Deerlodge and State of Montana, have invented a new and useful Actuating Mechanism for Concentrating-Tables, of which the following is a specification.

This invention relates to actuating mechanism for concentrating-tables.

The object of the invention is to provide a construction and arrangement of actuating mechanism for concentrating-tables which are simple and efficient.

A further object of the invention is to provide an actuating mechanism for concentrating-tables wherein the movement of the table in one direction consumes less time than its movement in the opposite direction.

A further object of the invention is to provide an actuating mechanism for concentrating-tables wherein the stroke or extent of movement of the table may be varied.

Other objects of the invention will appear more fully hereinafter.

The invention consists, substantially, in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference-signs appearing thereon, Figure 1 is a view in plan of a concentrating-table and actuating mechanism therefor embodying the principles of my invention. Fig. 2 is a sectional view of the same on the line 2 2, Fig. 1, looking in the direction of the arrows. Fig. 3 is a top plan view of the table-actuating mechanism. Fig. 4 is a vertical section of the same on the line 4 4, Fig. 3, looking in the direction of the arrows. Fig. 5 is a view similar to Fig. 4, showing a displaced position of the parts. Fig. 6 is a rear elevation, looking from the left-hand side of Fig. 3. Fig. 7 is a detached detail view of the table-actuating pitman. Fig. 8 is a detached detail view, in bottom plan, of the pitman shown in Fig. 7. Fig. 9 is a detached detail view, in rear elevation, of one of the adjustable bearing-blocks. Fig. 10 is a top plan view of the same. Fig. 11 is an end view of the same. Fig. 12 is a diagram illustrating the motion and operation of the apparatus.

The same part is designated by the same reference-sign wherever it occurs throughout the several views.

In the operation of separating mineral from ore it is the usual custom to crush the ore to a desirable degree of fineness and then to deliver the crushed ore upon a table or other machine for separating the mineral from the gangue, silica, or barren rock. If desired, after the ore is crushed it may be subjected to hydraulic or other sizers, by which it is separated or divided according to the size of the particles.

The present invention relates to a machine or table for thus separating and concentrating the crushed ore, and particularly to the actuating mechanism, whereby reciprocatory movements are imparted to the table. The effect of the reciprocatory movements imparted to the table is to tend to cause the particles of mineral, gangue, silica, rock, and the like to progress or move along the table in the direction of the reciprocatory movements thereof. Wash-water is supplied along one edge of the table in a direction to flow transversely across the line of reciprocatory movement, thus providing a component of forces through the resultant of which the desired separation of the mineral from the gangue, rock, silica, or the like and the concentration of the mineral is effected. The mineral portion of the ore being heavier will readily gravitate to the bottom of the mass of ore supplied upon the surface of the table during the operation thereof, while the silica, barren rock, gangue, or the like, being larger as well as lighter, remains upon the upper surface of the mass and hence is more readily washed or carried away by the wash-water in a line transverse to the line of reciprocatory movement of the table, while the heavier particles of mineral are progressed along the table in

the direction of the reciprocatory movements thereof. It is customary in the construction of concentrating-tables to provide riffles upon the upper surface of the table to aid in effecting the desired separation and concentration, and various constructions and arrangements of riffles have been proposed and employed practically; but inasmuch as the present invention does not relate to the construction or arrangement of the riffles I have not deemed it necessary to show or to describe any arrangement of riffle in this application, and therefore so far as the present invention is concerned any suitable or desirable arrangement of riffles may be employed. The reciprocatory movements of the table play an exceedingly important part in the separating and concentrating work by reason of the different coefficient of inertia of the particles of mineral as compared with the coefficient of inertia of the lighter rock, silica, dirt, or the like. Therefore a mechanism which will impart such a reciprocatory movement to the table as will enable the heavier particles of mineral to move faster in the direction of reciprocatory movement than the speed at which the lighter and larger particles of silica, rock, and the like move in the same direction will secure the best results of concentration and separation, because thereby the lighter particles of silica, rock, and the like will be subjected for a longer period of time to the action of the transversely-moving wash-water, and hence such particles of silica, rock, and the like will be separated from the mineral and will be carried by the wash-water over one of the sides or edges of the table in a line transverse or inclined with respect to the line of reciprocations of the table, while the mineral will be progressed over the extreme end of the table. Therefore a mechanism which will start the table from its rear limit of reciprocation forwardly at a comparatively slow speed and then rapidly increase that speed to practically the end of its forward stroke and then just as quickly begin the receding return movement, which return movement gradually decreases in speed until it again attains its extreme rearward limit, will effect the best results, and where the time consumed in making the forward stroke is less than the time consumed in making the return or rear stroke of the table the greatest possible advantage is secured from the differences in the coefficients of inertia of the mineral and rock, silica, dirt, and the like and a more thorough separation and concentration of the mineral is effected. My present invention is designed to embody these principles, and I will now describe a construction which I have found particularly advantageous in securing the desired objects.

Reference-sign A designates the table. As shown, this table is of quadrangular shape, with the sides or edges thereof parallel to each other and with the ends parallel to each other, but inclined with respect to the sides or edges, reference-signs B, C, E, and D designating the four corners of the table. The ore is delivered upon the table adjacent to the corner D, and wash-water is supplied along the edge D B and in a direction of flow transversely across the table toward the edge E C thereof. Reciprocatory movements are imparted to the table about on the diagonal line of the corners E B, and consequently from the foregoing description and as will be more fully hereinafter explained the rock, silica, dirt, gangue, and the like will be discharged from the table over the edge E C, while the mineral concentrates will be discharged or delivered from the table over the end B C.

Of course it is to be understood that the present invention does not reside especially in the construction and arrangement of the table, and hence such construction and arrangement may be varied or altered throughout wide limits without departure from the spirit or scope of my present invention, which refers particularly to the operating mechanism by which the reciprocatory movements are imparted to the table. I have found in practice, however, that remarkably good results are secured from a table constructed and arranged in the manner above set forth in connection with the actuating mechanism, which I will now describe.

Reference-sign F designates a foundation or framing upon which table A is supported. Mounted upon the foundation-framing are bearing-blocks G, H, and J, through which reciprocates a rod or pipe K. Intermediate the bearing-blocks H said pipe is suitably connected in any convenient manner, as indicated at L, to the bottom of the table A, whereby when reciprocatory movements are imparted to the rod or pipe K said movements effect similar movements of the table. If desired, supports M may be carried by the rod or pipe K adjacent to the bearing-blocks G and J, upon which the table A may rest. Mounted upon the rod or pipe K is a spring N, said spring being interposed between one of the bearing-blocks J and a collar or washer O upon pipe or rod K. The tension of said spring is constantly exerted in a direction to maintain said rod or pipe in one limit of its movement.

To the end of pipe or rod K is connected a flexible or spring bar P, said bar being provided with a hook Q at the rear end thereof, through which the desired reciprocatory movements are imparted to the rod or pipe K and the table.

Reference-sign A′ designates a casting or framework suitably mounted upon the sills of foundation-frame F and having journal-bearings B′, in which is journaled the shaft C′. Said shaft may be rotated in any suitable or convenient manner—as, for instance, by means of belt connections to pulleys D′—from any

convenient source of power, one of said pulleys being fast and the other loose, in the usual manner. Between the bearings B′ the shaft is provided with a crank having an eccentricity of about three-eighths of an inch, more or less, thereby imparting a stroke or throw of three-fourths of an inch.

E′ designates a pitman-casting having a hollowed-out seat F′ arranged to fit the crank portion G′ (see Fig. 4) of shaft C′, said pitman-casting being secured to the crank by means of a cap H′. At its lower end the pitman-casting E′ is provided with a hook-shaped portion J′, having a hollowed-out seat K′ on the under surface thereof, as shown in dotted lines in Fig. 7 and in full lines in Fig. 8, said seat adapted to receive the hook Q of bar or flexible connection P.

L′ M′ designate what I shall term "bearing-blocks." These bearing-blocks are identical in construction, and the specific details of construction thereof are shown in Figs. 9, 10, and 11. The bearing-block L′ is provided with an extension N′, arranged to project through a slot in pitman-casting E′, and is held in any desired position of adjustment lengthwise of said pitman-casting by means of a washer O′ and set-screw P′. The bearing-blocks L′ M′ are provided with seats or recesses (indicated in dotted lines at Q′, Figs. 9, 10, and 11) adapted to receive and to form a bearing for curved portions of a rocker-block R′. The bearing-block M′ is mounted for vertical adjustment in a slot in a bracket S′, formed in the frame-casting A′, and is held in adjusted position by washer O′ and screw P′ in the same manner as above described with reference to bearing-block L′, and the blocks L′ M′ are so relatively arranged that the seats or depressions therein which receive the rocker-block R′ face each other, said rocker-block being placed therebetween and provided with curved surfaces struck from different centers, but of equal radius, adapted to be received in the bearing-seats of blocks L′ M′, as clearly shown in the drawings. The vertical adjustment of the bearing-blocks L′ M′ may be effected by means of screw-rods A^2, tapped through convenient parts of the frame-casting A′ and pitman E′. The rocker-block R′ and the bearing-blocks therefor are arranged between the hook portion J′ of the pitman-casting E′ and the crank G′, and by reason of such interposition and arrangement of the rocker-block R′ it will be seen that when longitudinal movement is imparted to the pitman when the crank-shaft C′ is rotated an oscillation is also imparted to the pitman, the bearing-surface of the rocker-block forming a movable fulcrum for said pitman, and consequently the hook J′ will describe an orbital movement, and the arrangement is such that a line drawn through the center of crank G′ to the point of connection of hooks Q and J′ will pass through the center of the circle from which the bearing-surface of rocker-block R′ is described, which bears against or in the seat of bearing-block L′.

Referring now to the motion diagram of Fig. 12, the point A^3 designates the center of the rocking surface of R′, which bears against the seat formed in the bearing-block M′. B^3 designates the corresponding point of the portion of the rocker which bears in the seat in bearing-block L′. C^3 designates the point of connection of hooks Q and J′. D^3 designates the crank; G′, the circle. E^3 designates the path of rotation of the shaft C′, and the lines F^3 designate the line of motion to be imparted to the table. Rotation is imparted to the shaft in the direction indicated by the arrow in Fig. 12. Suppose now the points *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, *l*, *m*, *n*, *o*, and *p* designate sixteen equal divisions of the circle E^3. Then the corresponding positions of the point of connection of the pitman with hook Q will be designated by points *a′*, *b′*, *c′*, *d′*, *e′*, *f′*, *g′*, *h′*, *i′*, *j′*, *k′*, *l′*, *m′*, *n′*, *o′*, and *p′*. An examination of this diagram will show that the parts are in the positions occupied thereby when the table is at its extreme rearward limit of movement. When the shaft C′ rotates from these positions through one-sixteenth of its revolution, the point of connection of the pitman to the hook Q will travel from the point *a′* to the point *b′*, and when the shaft C′ travels the next sixteenth of its rotation the point C^3 will travel to the point *c′*, and so on until the point C^3 reaches the point *h′*, which will be the position thereof when the table is in its extreme forward movement. In that position the crank D^3 will occupy a position on the radius *h*, thereafter the point C^3 will begin its return movement, and during the next succeeding sixteenth of the revolution of shaft C′ the point C^3 will travel from *h′* to *i′*, and so on to *g′*, *k′*, *l′*, *m′*, *n′*, *o′*, and *p′* back to the initial or starting point *a′*, these several points indicating the positions at each one-sixteenth of the rotation of shaft C′. It will be seen that the distances between the points *o′*, *p′*, *a′*, and *b′* are comparatively short, and from *b′* to *c′*, to *d′*, to *e′*, and to *f′* said distances are gradually increasing, and from *f′* to *g′* and thence to *h′ i′* the distance is very slight, and from *a′* the distance between the points increases to the point *o′* quite rapidly, and thence decreases on to the point *a′*. It will also be seen that during the return movement of the table—that is, while the point C^3 is traveling from point *h′* to the point *a′*, being the extreme limits thereof—the shaft E^3 will have traveled through nine-sixteenths of its rotation, while during the travel of point C^3 from *a′* to *h′* shaft C′ travels through only seven-sixteenths of its complete revolution. Consequently less time is consumed in the forward movement of the table than in the return movement, and this, as above described, is a most desirable feature of my invention.

Of course it will be understood that the point B^3 will rock about the point A^3, and the points D^3, B^3, and C^3 are constantly maintained in line with each other. Variations in the stroke may be secured by adjusting the points B^3 and A^3 with reference to each other or together, and this adjustment is secured in the machine by means of the screw-rods A^2, through which the bearing-blocks L′ M′ are adjusted.

From a consideration of the foregoing description it will be seen that the table in starting up from its rear limit of movement moves forward gradually and then increases its forward movement rapidly toward the forward limit of its movement, and without imparting too great a jerk it begins its return movement, and the return movement increases in speed rapidly until the table again nears the rearward limit of its movement, when it slows down. This motion imparted to the table exerts a most advantageous effect upon the mineral to advance or progress the same in the line of reciprocation or movement of the table, and during the rapid forward movement of the table the lighter silica, rock, gangue, and the like are left behind, while the heavier particles of the mineral are carried forward with the table, and on the return movement of the table the inertia or momentum of the heavier particles of mineral will cause the mineral to remain in its advanced position, but the lighter particles of silica, rock, gangue, and the like will be carried back with the table, and consequently a most efficient separation and concentration is effected, the lighter particles of rock, silica, and the like being retarded and held back and subjected to the action of the transversely-moving wash-water, while the heavier mineral is being constantly progressed or advanced and eventually being delivered over the front end of the table, while the silica, gangue, rock, and the like are eventually delivered over the edge E C of the table.

The function of spring N is to constantly maintain engaging relation between the hooks Q and J during the operation of the apparatus and to take up any lost motion.

Concentrating-tables constructed in accordance with the foregoing principles I have found to be exceedingly satisfactory and efficient in practical operation and to effect a most thorough and complete separation and concentration.

Many variations and changes in the details of construction and arrangement would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention. I do not desire, therefore, to be limited or restricted to the exact details of construction shown and described; but,

Having now set forth the object and nature of my invention and a construction embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. In an actuating mechanism of the character described, the combination with a drive-shaft having a crank, a pitman journaled at one end upon said crank, connections between the free end of said pitman and the part to be actuated, and a rocker pivotally mounted and forming a movable fulcrum for said pitman at a point between its journal-bearing and the free end thereof, as and for the purpose set forth.

2. In an actuating mechanism of the character described, the combination with a drive-shaft having a crank, a pitman journaled at one end upon said crank, connections between the free end of said pitman and the part to be actuated, a bearing-block mounted upon said pitman between said connection and said crank, and a pivotally-mounted rocker arranged to engage said bearing-block, as and for the purpose set forth.

3. The combination of a drive-shaft having a crank, a pitman journaled thereon, connections between the free end of said pitman and the part to be actuated, a bearing-block adjustably mounted upon said pitman between said connections and crank, and a pivotally-mounted rocker arranged to pivotally engage said bearing-block, as and for the purpose set forth.

4. The combination of a drive-shaft having a crank, a pitman journaled at one end upon said crank, connections between the free end of said pitman and the part to be actuated, a bearing-block mounted upon said pitman between said connections and crank, a coöperating stationary bearing-block and a rocker interposed between said bearing-blocks and arranged to pivotally engage the same and form a movable fulcrum for said pitman, as and for the purpose set forth.

5. The combination of a drive-shaft having a crank, a pitman journaled at one end upon said crank, connections between the free end of said pitman and the part to be actuated, said pitman being longitudinally slotted between the ends thereof, a bearing-block adjustably mounted in the slot in said pitman between said connections and said crank, and a rocker pivotally mounted and arranged to engage said bearing-block, as and for the purpose set forth.

6. The combination of a drive-shaft having a crank, a pitman journaled at one end upon said crank, flexible connections between the free end of said pitman and the part to be actuated, and a pivotally-mounted rocker arranged to form a movable fulcrum for said pitman at a point between the free end of said pitman and said crank, as and for the purpose set forth.

7. In an actuating mechanism of the char-

acter described, the combination with a casting or framework having bearings, a shaft journaled in said bearings and provided with a crank portion, a bracket carried by said framework, a bearing-block mounted upon said bracket, a pitman journaled at one end upon the cranked portion of said shaft, connections between the free end of said pitman and the part to be actuated, and a rocker journaled in said bearing-block and arranged to engage said pitman at a point between its free end and its bearing upon the cranked portion of said shaft, as and for the purpose set forth.

8. In an actuating mechanism of the character described, a framework having journal-bearings, a shaft journaled in said bearings and provided with a crank, a pitman journaled at one end upon said crank, a bracket formed on said framework, a bearing-block adjustably mounted upon said bracket, a rocker journaled in said bearing-block and arranged to form a rocking fulcrum for said pitman, and connections between the free end of said pitman and the part to be actuated, said rocking fulcrum being arranged between said connections and the crank, as and for the purpose set forth.

9. In an actuating mechanism of the character described, a framework including a longitudinally-slotted bracket, a shaft journaled in said framework and provided with a crank, a pitman journaled at one end upon the crank of said shaft, a bearing-block provided with an extension arranged to be adjustably received in the slot in said bracket, an adjusting-screw for adjusting said bearing-block upon said bracket, connections between the free end of said pitman and the part to be actuated, and a rocker journaled in said bearing-block and arranged to form a movable fulcrum for said pitman at a point between said connections and the pitman-actuating crank, as and for the purpose set forth.

10. In an actuating mechanism of the character described, a framework, a crank-shaft journaled therein, a pitman journaled at one end upon the crank of said shaft, connections between the free end of said pitman and the part to be actuated, bearing-blocks respectively mounted upon said framework and said pitman, the pitman bearing-block being between said connections and crank, and a rocker interposed between said bearing-blocks, as and for the purpose set forth.

11. In an actuating mechanism of the character described, a framework, having journal-bearings, a shaft journaled in said bearings and provided with a crank, a pitman journaled at one end upon said crank, connections between the free end of said pitman and the part to be actuated, bearing-blocks respectively mounted upon said pitman and said framework, the pitman bearing-block being arranged between said connections and crank, a rocker interposed between and journaled in said bearing-blocks, and means for adjusting said bearing-blocks, as and for the purpose set forth.

12. In an actuating mechanism of the character described, the combination of a drive-shaft having a crank, a pitman journaled at one end upon said crank, said pitman provided with a hook at the free end thereof, connections between said hook and the part to be actuated, a pivotally-mounted rocker arranged to form a movable fulcrum for said pitman at a point between said hook and the journal-bearing of said pitman upon said crank, and means for constantly maintaining the engagement between said hook and connections, as and for the purpose set forth.

13. The combination of a drive-shaft having a crank, a pitman journaled at one end upon said crank and provided with a hook at the free end thereof, connections between said hook and the part to be actuated, a pivotally-mounted rocker arranged to form a movable fulcrum for said pitman at a point between said crank and hook, and a spring arranged to constantly maintain engaging relation between said connections and hook, as and for the purpose set forth.

14. In an actuating mechanism of the character described, a framework having journal-bearings, a shaft journaled in said bearings and provided with a crank, a pitman journaled at one end upon the crank of said shaft, said pitman being longitudinally slotted, connections between the free end of said pitman and the part to be actuated, a slotted bracket formed on said framework, bearing-blocks having seats and respectively mounted for adjustment in the slots in said pitman and bracket, the seats of said bearing-blocks being presented toward each other, and the pitman bearing-block being located between the free end of said pitman and its journal-bearing upon said crank, and a rocker having curved surfaces arranged to be received in said seats respectively, as and for the purpose set forth.

15. In an actuating mechanism of the character described, a framework, a crank-shaft journaled therein, a pitman journaled at one end upon the crank-shaft, connections between the free end of said pitman and the part to be actuated, a bearing-block mounted on said pitman at a point between said connections and crank, said block provided with a seat, a coöperating bearing-block mounted upon said framework and also provided with a seat, said seats being presented toward each other, a rocker having curved surfaces respectively arranged to be received in said seats, and means for actuating said bearing-blocks, as and for the purpose set forth.

16. In an actuating mechanism of the character described, the combination with a drive-shaft having a crank, and a pitman connected to said crank, of a concentrating-table, a rod

connected to said table, bearings through which said rod reciprocates, connections between said rod and said pitman, and a swinging fulcrum for the pitman, said fulcrum arranged to form a bearing for said pitman at a point intermediate the actuating-crank and the point of connection of the rod to said pitman, for the purpose set forth.

In witness whereof I have hereunto set my hand, this 2d day of July, 1901, in the presence of the subscribing witnesses.

GUSTAVE A. OVERSTROM.

Witnesses:
CHAS. H. SEEM,
S. E. DARBY.