

R. L. MARTIN, JR.
COAL WASHING APPARATUS.
APPLICATION FILED MAY 15, 1905.

4 SHEETS—SHEET 1.

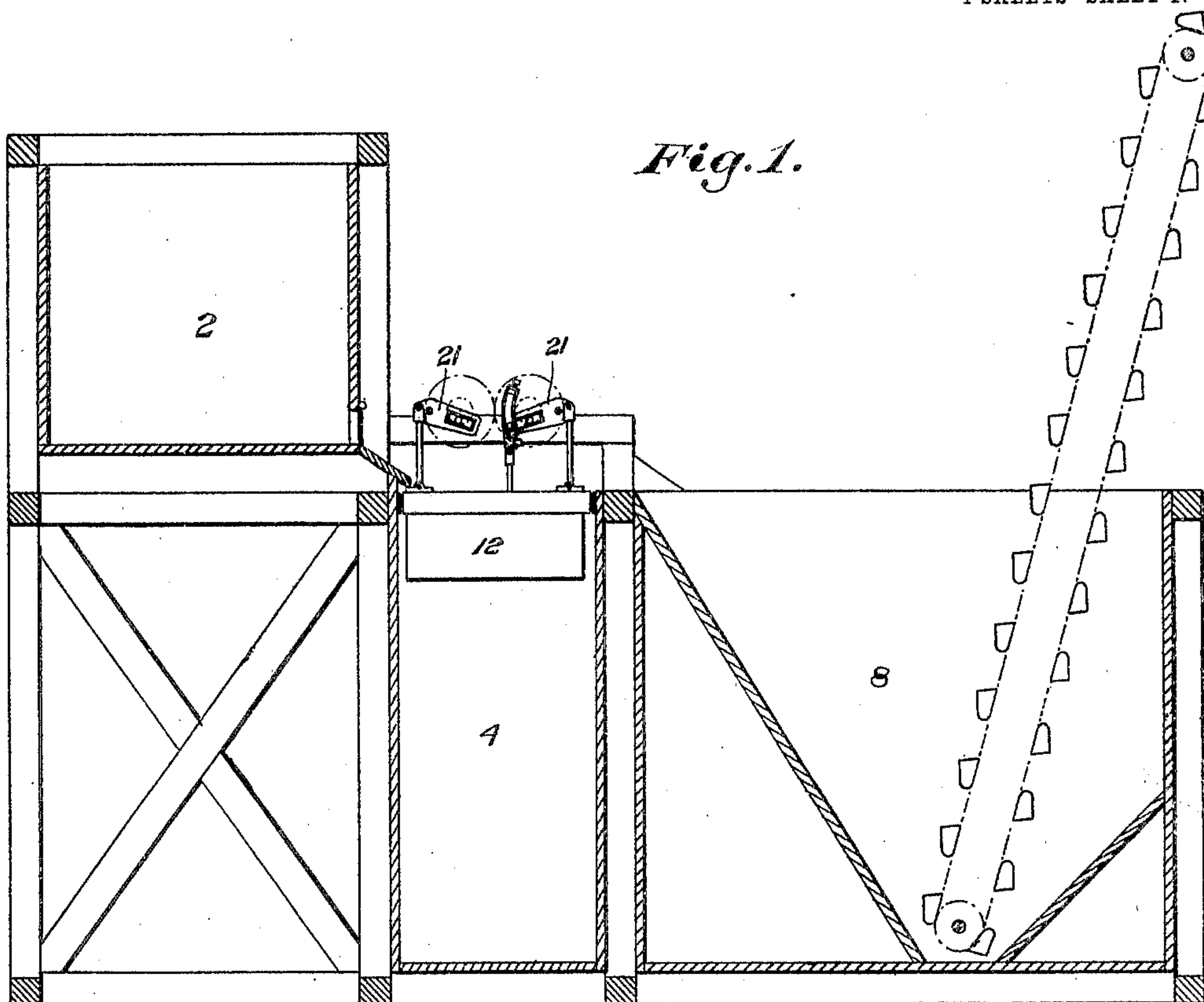


Fig. 1.

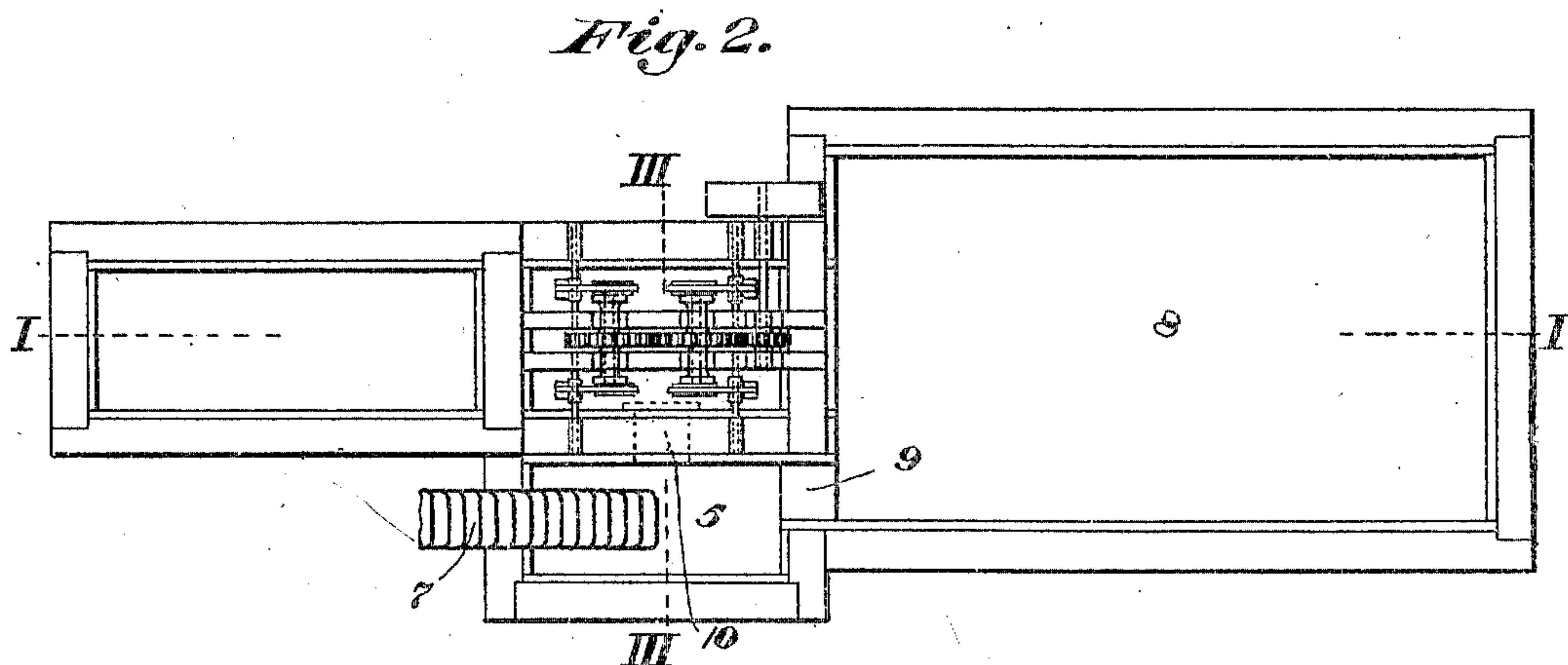


Fig. 2.

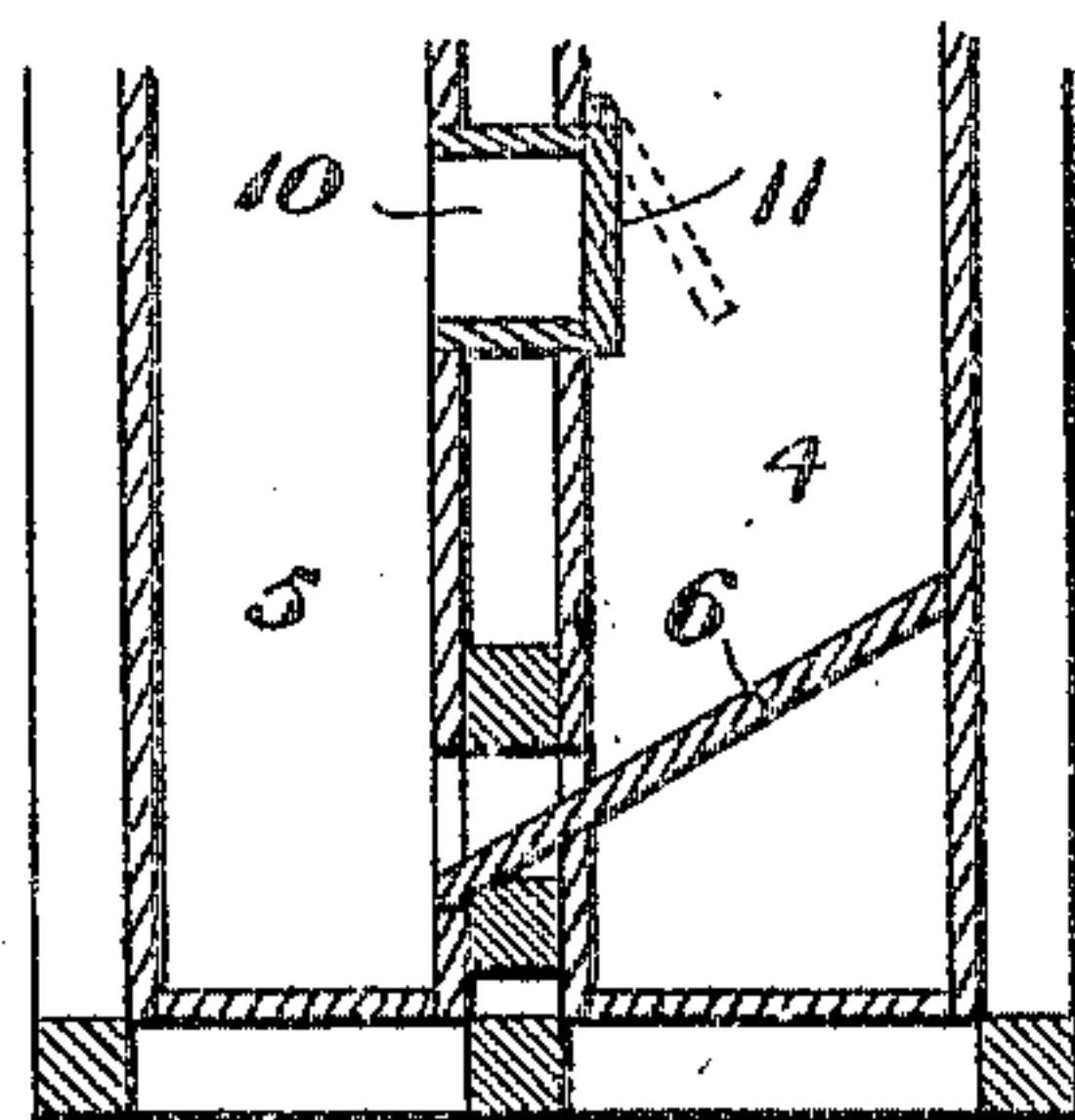


Fig. 3.

Witnesses:
E. R. Rodd.
Chas. S. Spley

Inventor,
Robert L. Martin Jr.
by C. M. Clarke
his attorney

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4 SHEETS—SHEET 2.

Fig. 3.

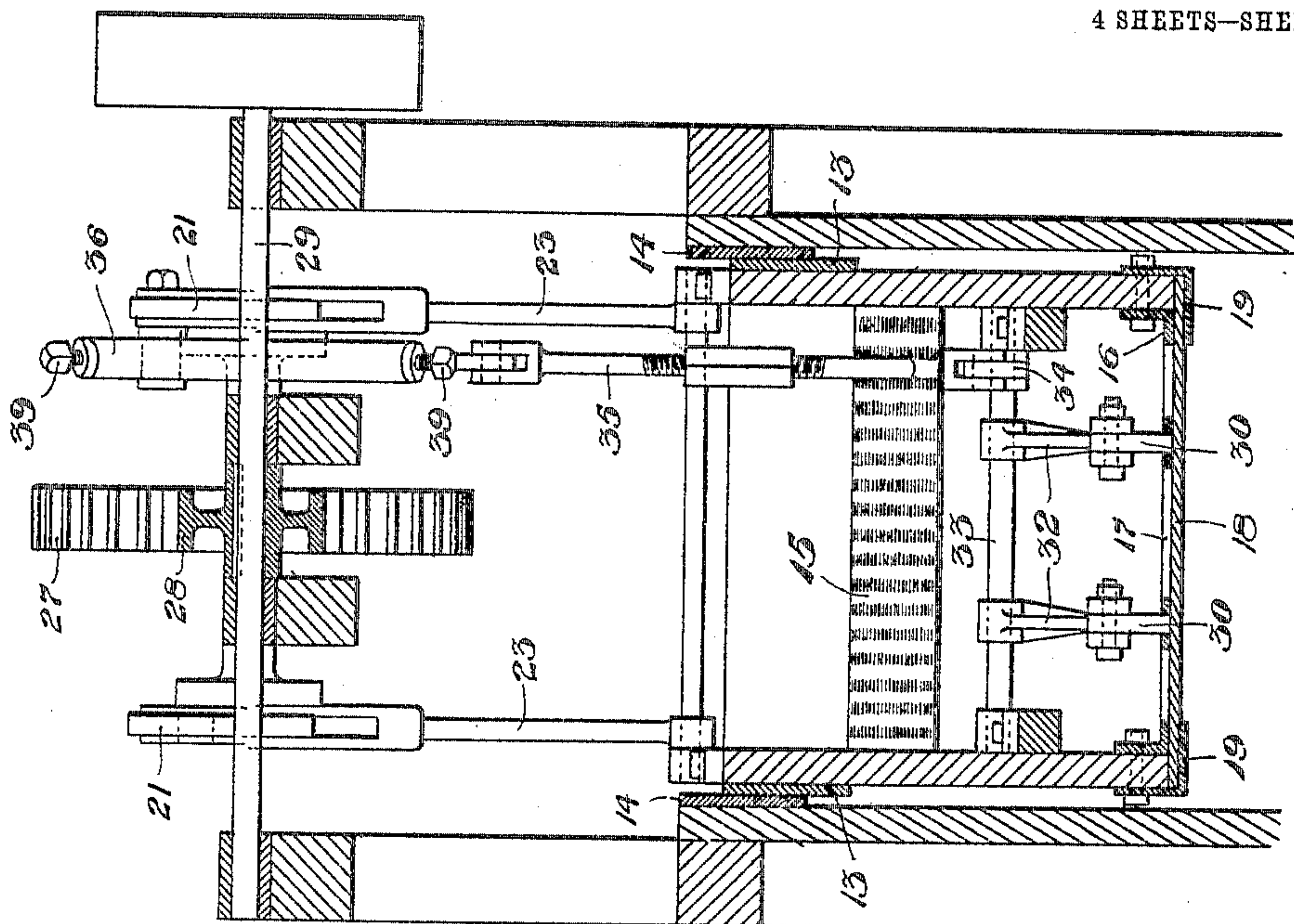
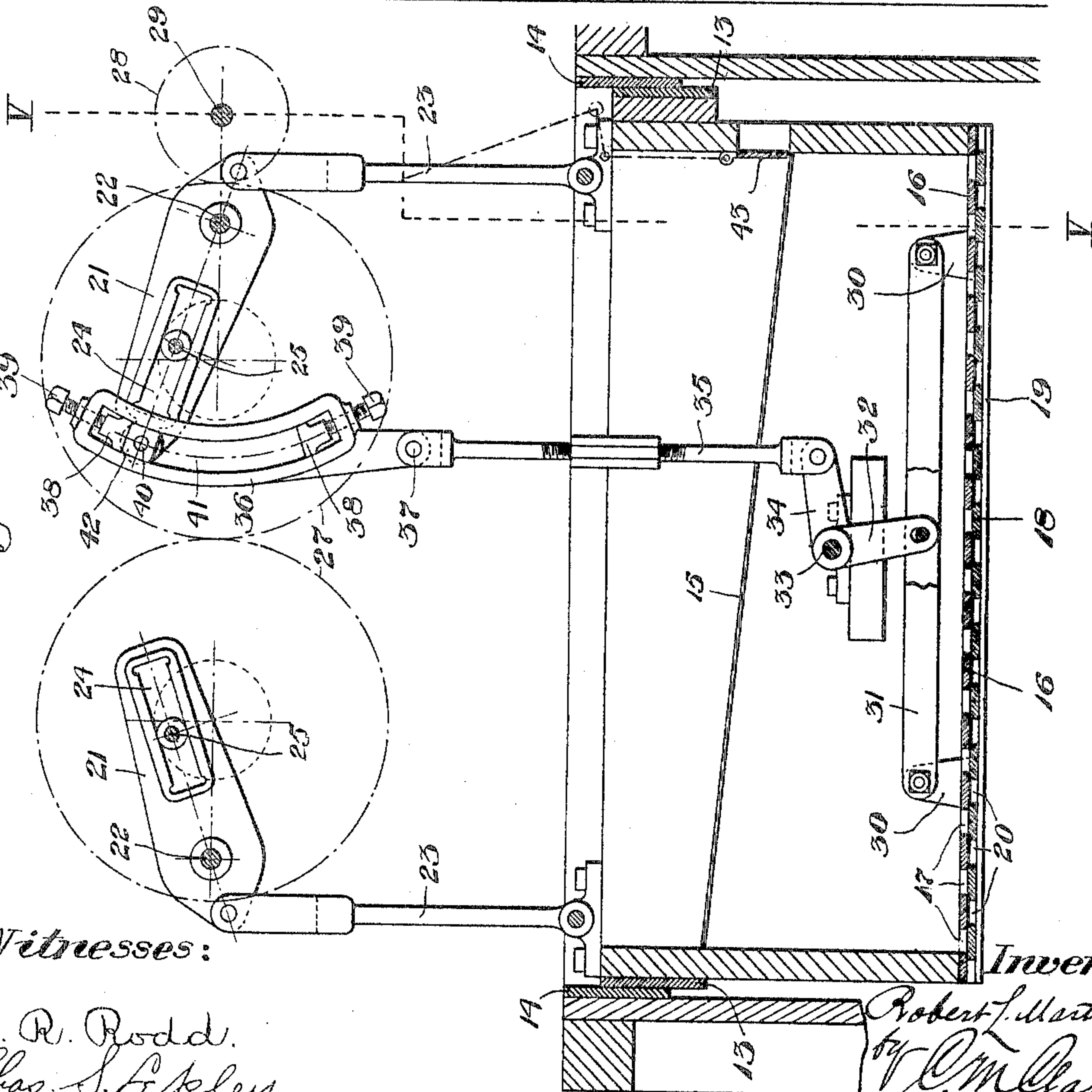


Fig. 4.



Witnesses:

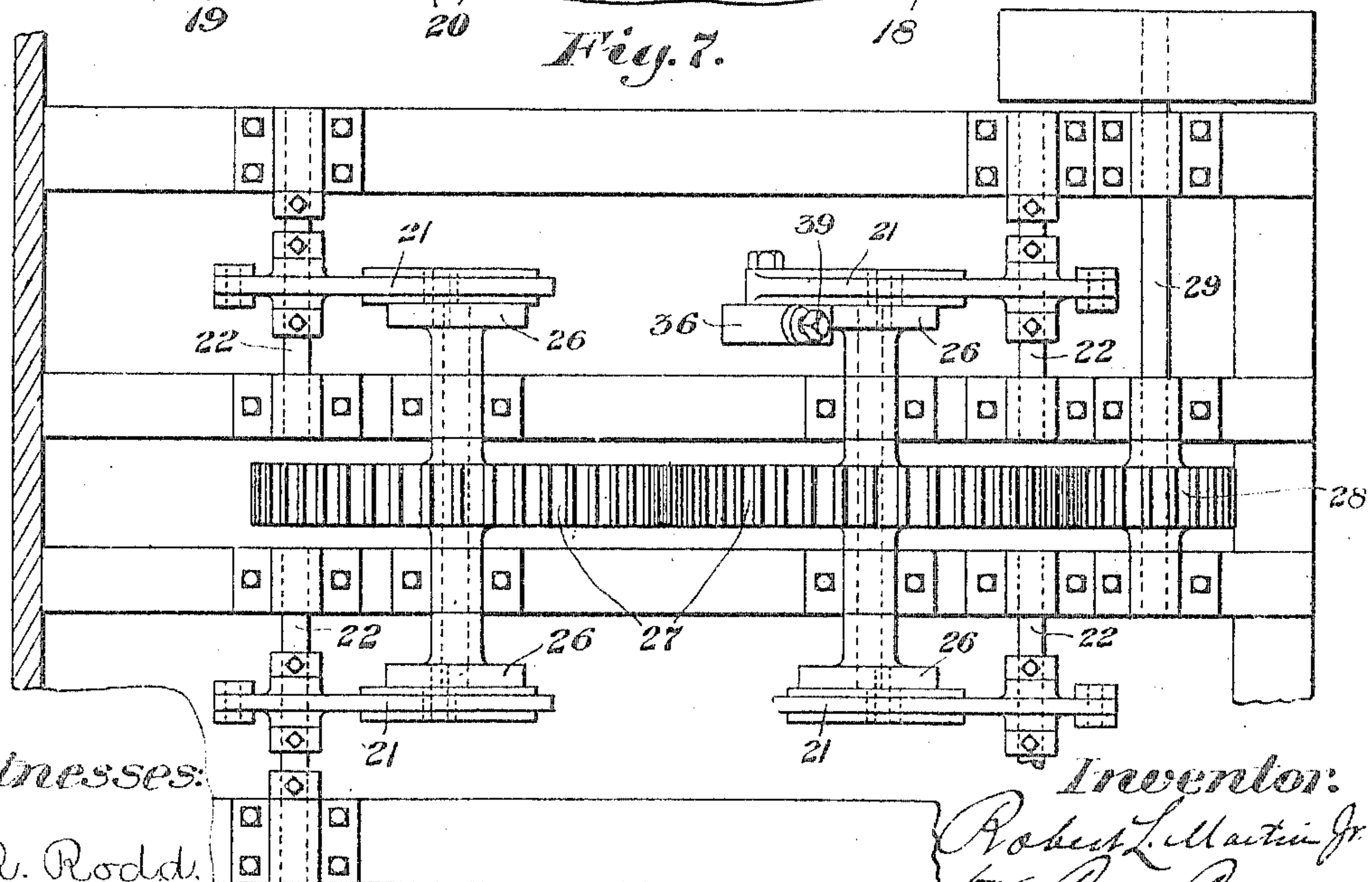
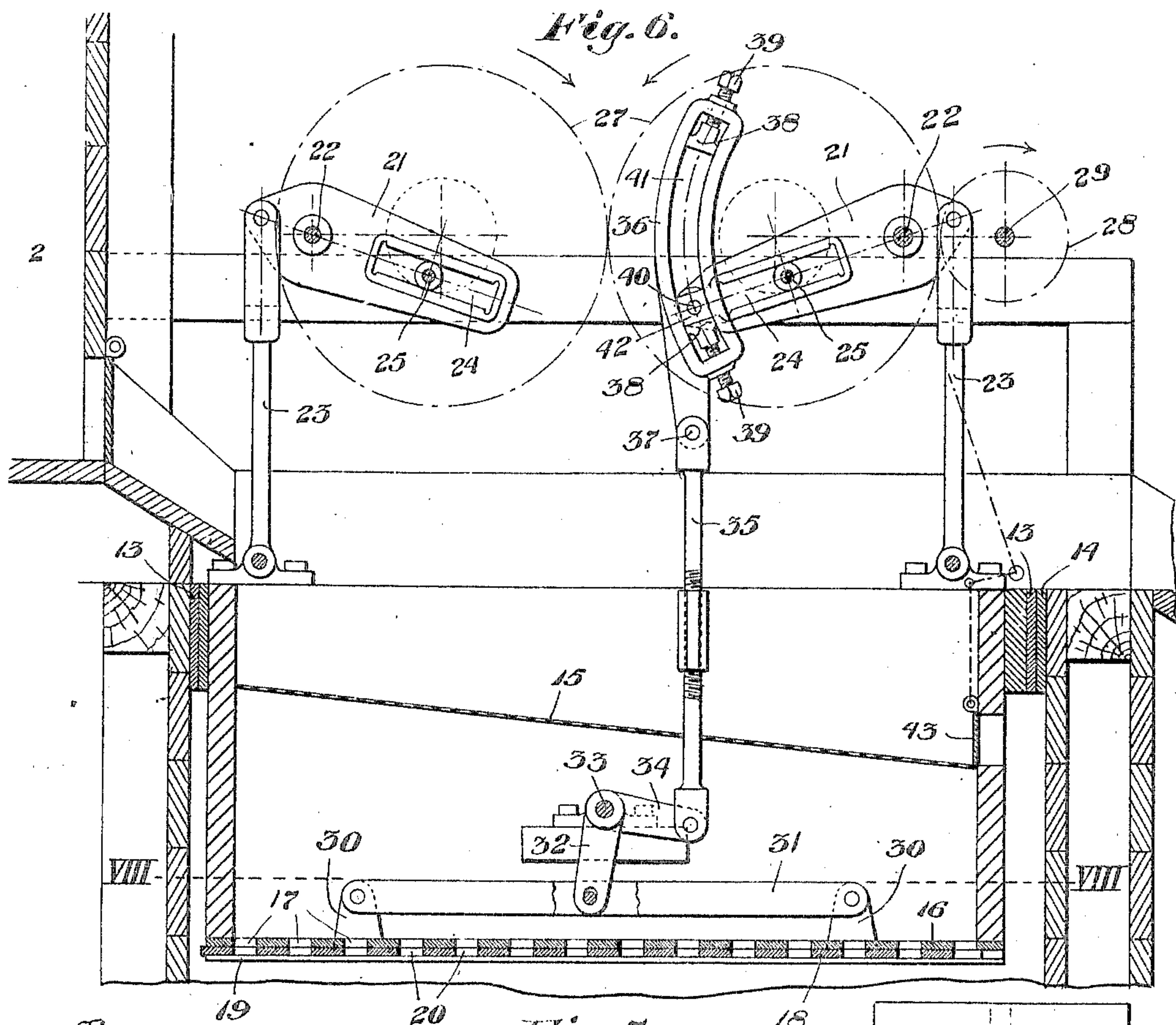
C. R. Rodd.
Geo. S. F. Spley.

Inventor:

Robert L. Martin Jr.
by C. M. Clarke
his Attorney

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4 SHEETS—SHEET 3.



Witnesses:

C. R. Rodd.
Chas. S. Spley

Inventor:

Robert L. Martin Jr.
by A. M. Charles
his Attorney

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4 SHEETS—SHEET 4.

Fig. 8.

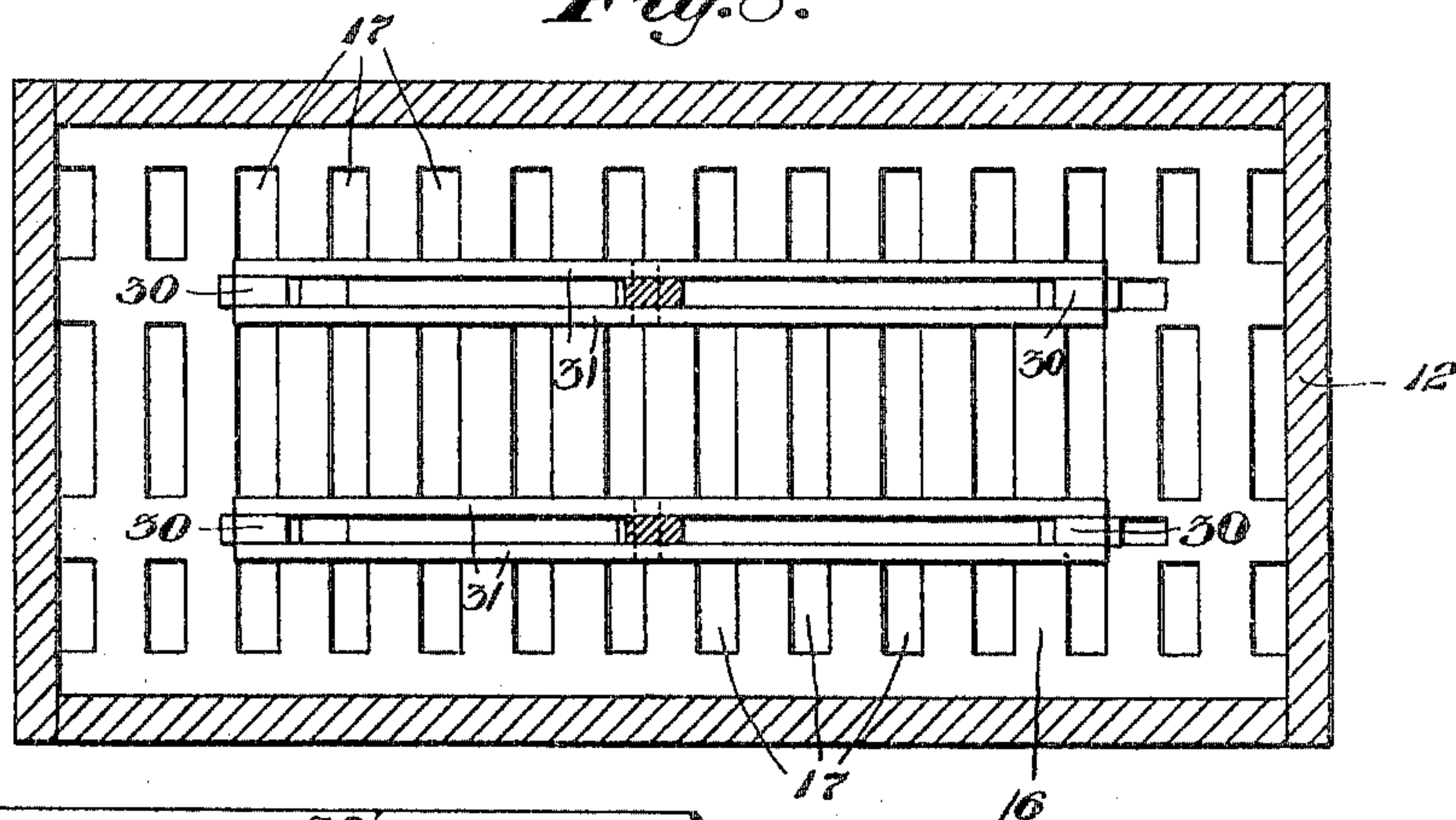


Fig. 10.

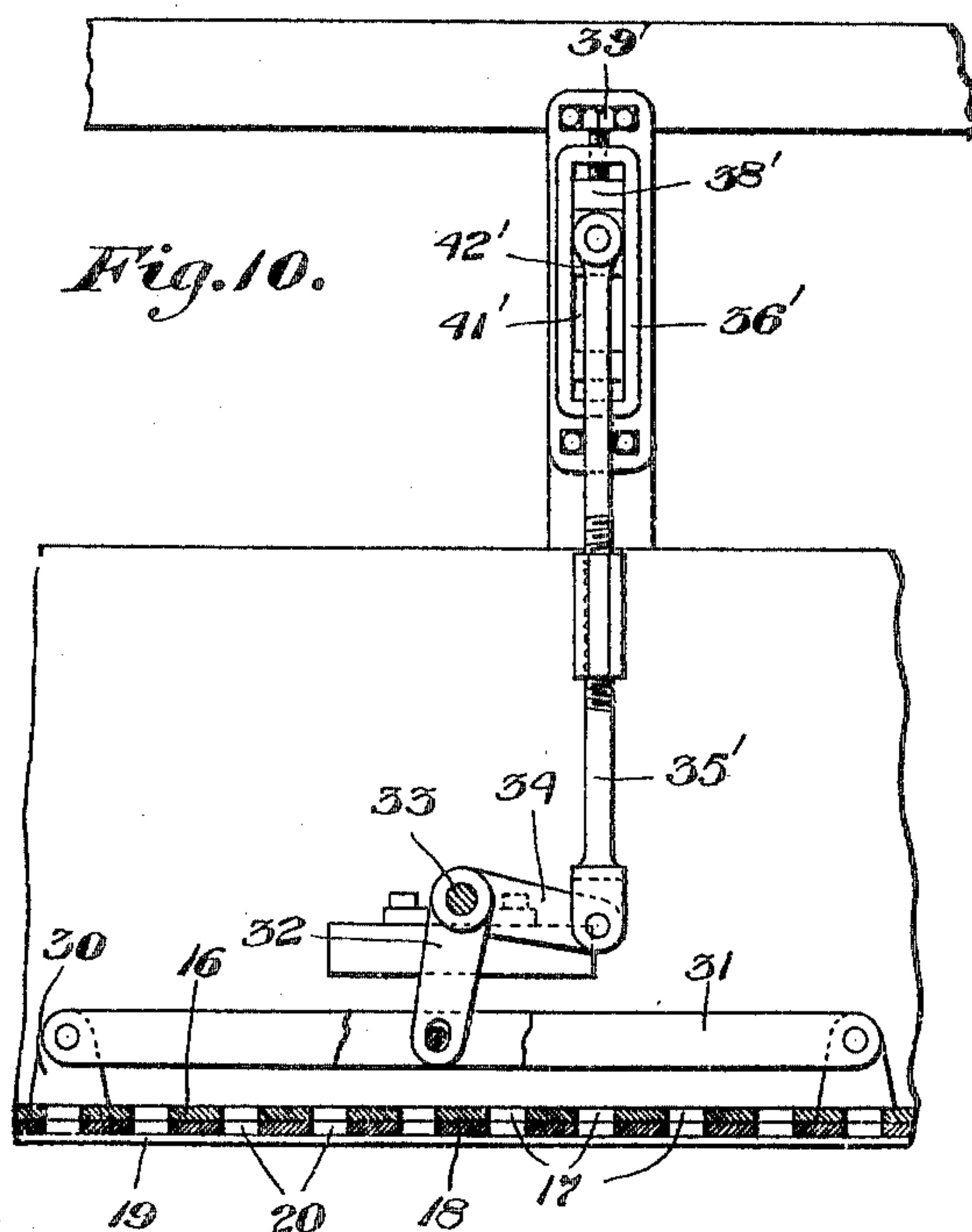


Fig. 11.

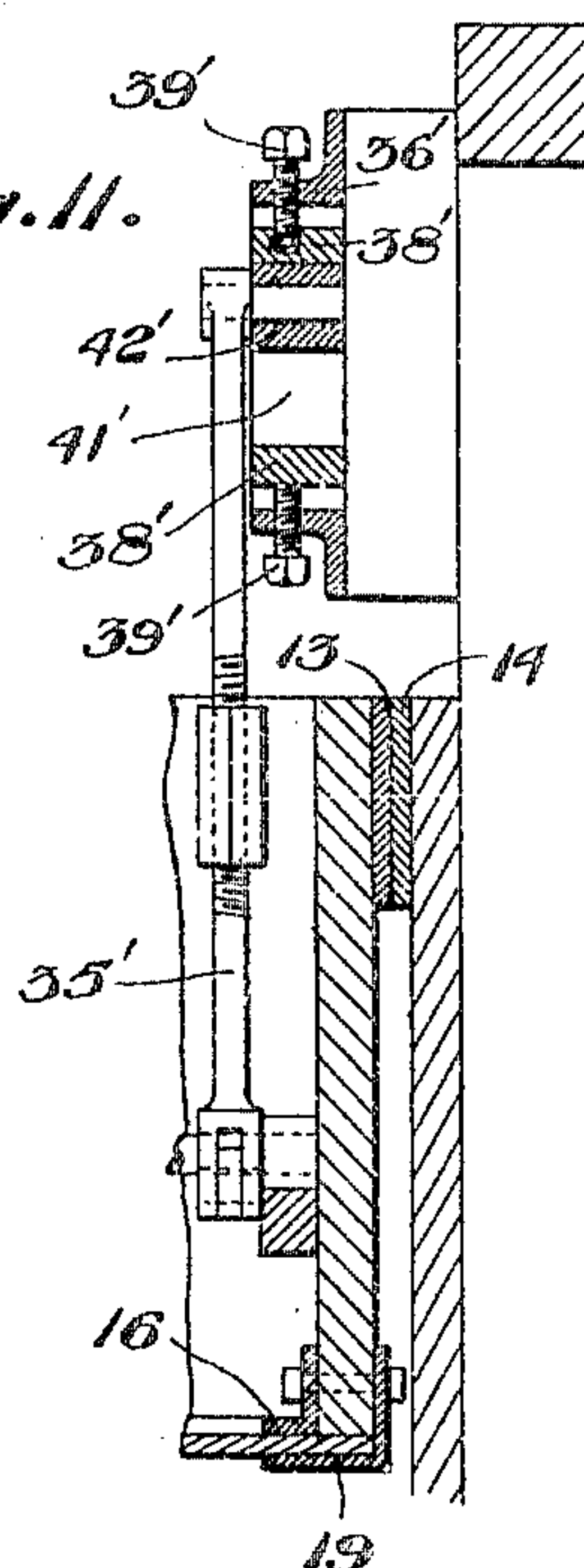
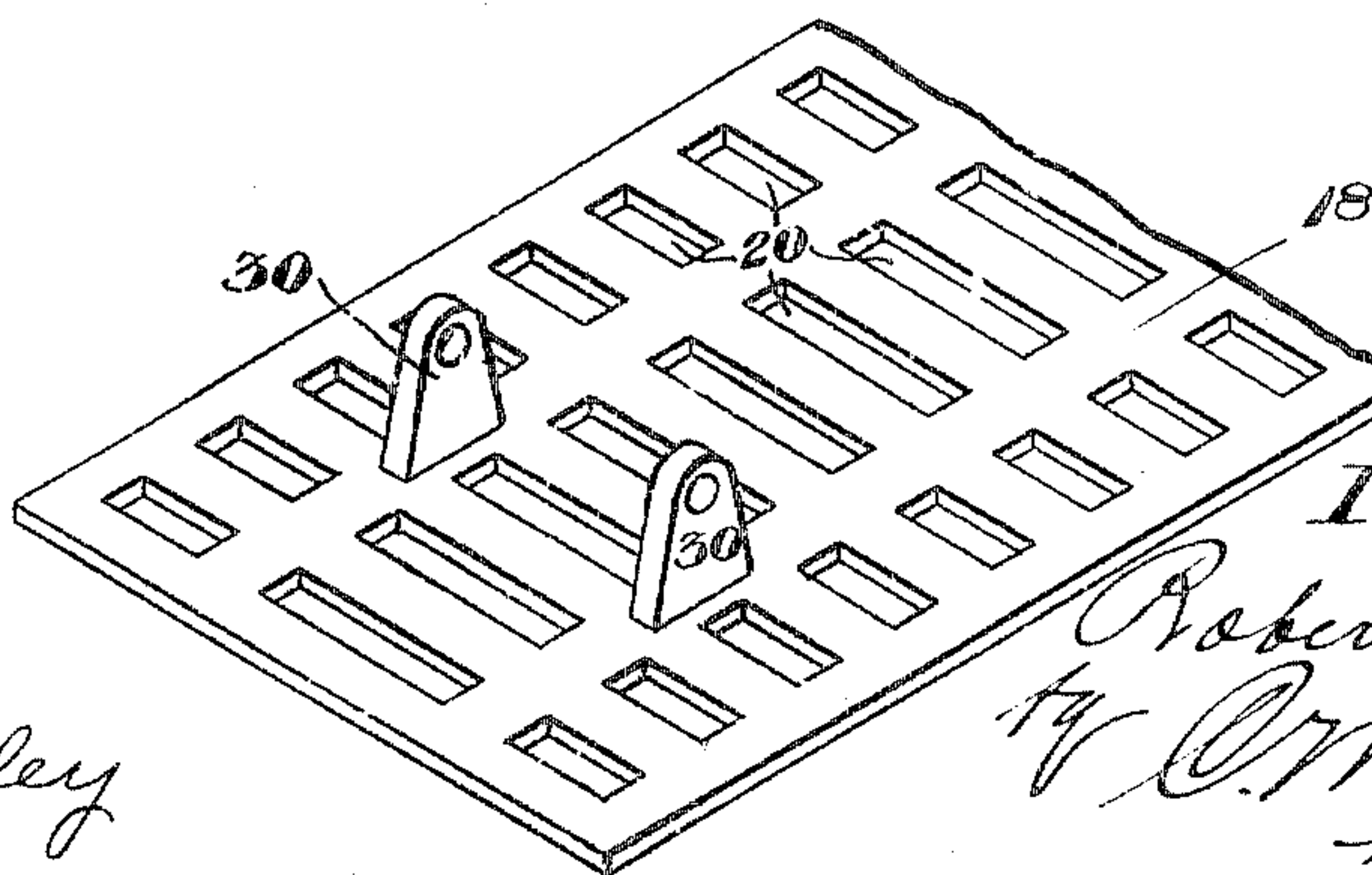


Fig. 9.



Witnesses:

E. R. Rodd.
Chas. S. Pley

Inventor:

Robert L. Martin Jr.
by O. M. Charles
his Attorney

UNITED STATES PATENT OFFICE.

ROBERT L. MARTIN, JR., OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO
THE PITTSBURGH COAL WASHER COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

COAL-WASHING APPARATUS.

No. 804,488.

Specification of Letters Patent.

Patented Nov. 14, 1905.

Application filed May 15, 1905. Serial No. 260,474.

To all whom it may concern:

Be it known that I, ROBERT L. MARTIN, Jr., a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Coal-Washing Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings, forming part of the specification, in which—

Figure 1 is a vertical longitudinal sectional view through my improved coal-washing apparatus, indicated by the line I I of the plan view of Fig. 2. Fig. 2 is a plan view of the apparatus. Fig. 3 is a vertical sectional view of the lower portion of the apparatus on the line III III of Fig. 2. Fig. 4 is an enlarged sectional view of the jig-tank and jig, showing the actuating mechanism for the jig and its valves, the jig being shown at the limit of its downward travel, the valve openings having just been closed. Fig. 5 is a vertical sectional view on the line V V of Fig. 4. Fig. 6 is a view similar to Fig. 4, showing the jig at the limit of its upward travel, the valves having been just opened. Fig. 7 is a plan view of the driving mechanism of Fig. 6. Fig. 8 is a horizontal sectional view on the line VIII VIII of Fig. 6, showing the jig-valves opened. Fig. 9 is a perspective detail view of a portion of the movable valve-plate of the jig. Figs. 10 and 11 are sectional views at right angles to each other, showing a modified construction of valve-shifting mechanism.

My invention relates to improvements in coal or ore washing machinery or apparatus wherein the coal is washed in a reciprocating jig arranged to be moved vertically within a jig-tank, the coal being separated from the heavier impurities, as slate, sulfur, &c., by the floating action of water carrying the coal over into a settling-tank, the impurities falling by gravity to the bottom of the jig. The present invention refers particularly to the means for opening and closing the bottom of the jig at the end of its upward and downward stroke, respectively, and to an improved valve construction adapted to maintain free circulation-openings for the water through the bottom of the jig during practically its entire downward stroke and to close the bottom openings during practically

the entire upward stroke of the jig. The construction provides means for positively opening and closing the valves of the jig-bottom, so as to insure certainty of operation, while providing for the passage of an ample volume of water upwardly through the contents of the jig on its downward stroke and preventing the backward escape of such water on the upward stroke, thereby carrying the water and contents in a floating condition to facilitate their outward passage from the jig-tank to the settling-tank.

Referring now to the drawings illustrating the invention, 2 represents a dry coal-bin to which coal is delivered in any suitable manner, as by an elevator 3, the bin 2 being located at a suitable elevation above and in convenient proximity to the jig-tank 4, into the jig 12, in the upper portion of which coal is delivered, preferably by gravity, through a suitable opening at the base of the coal-bin. Adjacent to the jig-tank, and preferably at one side thereof, is a slate-tank 5, to which slate and other impurities discharged from time to time from the bottom of the jig are conveyed, an inclined bottom 6 of the jig-tank sloping toward the slate-tank, as shown, while a suitable elevator or conveying mechanism 7 conveys away the slate from the slate-tank to any suitable point of discharge.

8 is the settling-tank, into which the washed coal is discharged over from the jig by the buoyant action of the water, which carries it through a suitable chute or opening communicating between the jig-tank and the settling-tank. In the construction shown in the principal figures of the drawings circulation from the water backwardly from the settling-tank 8 to the jig-tank 4 is provided for by a communicating conduit 9, communicating between the settling-tank and the slate-tank, from whence, through a similar conduit 10, the water passes inwardly to the jig-tank underneath the jig, said opening being provided with a flap-valve 11, arranged to close the conduit 10 against back flow of the water on downward motion of the jig, but to freely open to admit a supply of water upon up-travel thereof. By this construction the water is so confined that it will pass upwardly through the open parts of the jig upon its downward travel, as stated.

12 is the jig, consisting of a rectangular

framework of any suitable construction provided with suitable guiding-bearings 13, arranged to make an approximately water-tight fit around its sides within a corresponding surrounding bearing 14, located in the inner portion of the jig-tank, said bearings being conveniently made of cast-metal plates having finished meeting surfaces. Extending across the area of the jig between its top and bottom 15, of perforated metal, woven wire, or other suitable construction having sufficient strength to suspend the body of coal contained in the upper portion of the jig and providing a multiplicity of closely-adjacent small perforations or openings adapted to permit a free copious upward circulation of water as the jig descends. Below said primary bottom 15 is a secondary bottom 16, conveniently made of a casting secured to the lower portion of the jig in any suitable manner, as by laterally-arranged flanges, as shown in Fig. 5, said bottom being provided with a series of openings or ports 17, through which the water may freely flow into the interior of the jig upwardly when these openings are uncovered. Slidingly mounted beneath said bottom plate 16 is a similar plate 18, slidingly mounted in suitable bearings 19, conveniently made of angle form and bolted along underneath the side edges of the jig and held thereto by bolts in any suitable manner, as shown in Fig. 5. Sliding plate 18 is so arranged that it may be moved forward or back longitudinally of the jig or laterally, if desired, and is provided with a series of openings 20, adapted in one position of the plate, as shown in Fig. 6, to register with openings 17 of the stationary plate 16 and when shifted, as in Fig. 4, to entirely cover said openings 17, so as to practically seal the bottom of the jig against passage of water. The operation of moving the sliding plate 18 may be performed in any convenient manner similar to the operation of a slide-valve; but for the purpose of securing the most efficient results in the present invention it is desirable that the valve-plate shall be suddenly shifted to uncover the circulating-openings immediately before the jig commences to descend and shall be again shifted to close said openings immediately before the jig commences to ascend, as has been already stated. For the purpose of securing these movements I have provided the actuating mechanism shown in the drawings arranged to shift the plate at the terminating of the up and down strokes, respectively, in conformity with the operation of the jig-actuating mechanism.

The jig-actuating mechanism is substantially similar to that shown in my prior application for similar apparatus filed February 4, 1905, bearing the Serial No. 244,072, and consists of levers 21, pivotally mounted upon

cross-shafts 22 and connected by pitmen 23 with the jig, preferably at the four opposite corners or along the sides adjacent to the ends. The levers 21 are provided with longitudinal slots 24, engaged by the crank-pins 25 of cranks or crank-disks 26, all of said cranks being driven together by means of suitable gearing 27 28 from a main shaft 29, driven by a belt or sprocket gearing from any suitable source of power. By this arrangement it will be seen that the rotation of the cranks is such as to impart the same movement to each lever 21, and by reason of the slotted engagement of the crank-pins therewith a variable stroke is imparted to the jig, so that its upward travel is comparatively slow and its downward travel comparatively fast, owing to the actuating relation of the cranks engaging the slots at different distances from the fulcrum-bearings 22. The upward travel by reason of such arrangement occupies a considerably greater time than the downward travel, thereby securing the advantageous results due to quick pressure against the water in the jig-tank and a comparatively slower upward rise. This construction is substantially the same as shown and described in the above application referred to and may be utilized in varying degrees and proportions of the up and down strokes, respectively, to suit conditions of use and application.

For the purpose of shifting the sliding valve-plate 18 in conformity with the periods of travel of the jig this plate is provided with upwardly-projecting arms or lugs 30, extending through plate 16 or suitable slots therein and connected by bars 31 or otherwise with one or more crank-arms 32, secured to a rock-shaft 33, mounted on bearings in the inner side of the jig, as clearly shown in Figs. 4 and 5. For the purpose of intermittently partially rotating shaft 33 and of shifting the valve-plate 18 I provide a supplemental crank-arm 34, connected by a pitman 35, preferably adjustable as to length, by means of a turnbuckle, with a terminal element adapted to be engaged by a portion of one of the levers 21 at the termination of its up-and-down stroke, respectively, as in the principal figures of the drawings, or to make contact with an upper and lower abutment, as in Figs. 10 and 11. For this purpose I have provided a slotted link 36, connected with pitman 35 in any suitable manner, as at 37, said link being provided with abutting terminals 38, preferably adjustable by means of temper-screws 39, whereby their impact-faces may be accurately set or adjusted. One of the levers 21 is provided at its terminal with a wrist-pin 40, engaging the arc-like slot 41 of link 36, preferably by means of a sliding box 42, adapted to make square abutting contact with the terminals 38. When these abutments are

properly set, it will be seen that at or immediately before the termination of the up-and-down stroke of the jig the block 42 will come into contact with the terminal bearing portion of the link and will suddenly shift it either upwardly or downwardly, according to the directions of travel, imparting a corresponding quick closing or opening movement to valve-plate 18. It will be understood that the link itself is carried upwardly and downwardly at the upper end of pitman 35 in opposite directions to the travel of wrist-pin 40 and its box 42 and that the link is made sufficiently long to provide for such relative movement of both of these members and that the shifting action of the plate is accomplished as much by the movement of the link itself being impeded by the opposing wrist-pin and box as by the positive actuating force of the wrist-pin itself. These features of the construction should be accurately designed to provide for the exact point of contact and required travel of the valve-plate and are within the province of the builder or designing engineer. The adjustable bearings 38 by means of their temper-screws 39 will, however, compensate for considerable variation in the accuracy of the link. Substantially the same results may be accomplished by merely arranging stationary abutments, preferably adjustable, in the path of a terminal knocker device carried at the upper end of the valve-plate-actuating pitman 35, arranged to engage such terminal immediately before the termination of the up-and-down stroke, respectively, of the jig, thereby utilizing the movement of the jig itself to accomplish the shifting of the valve independent of the link 36 or other corresponding means. In Figs. 10 and 11 I have shown a stationary frame 36', secured to the framing above the jig at one side, provided with a vertical slot or slideway 41', in which is mounted a sliding terminal block 42', secured upon the upper end of the pitman 35' and adapted to make abutting contact with terminal blocks 38', preferably adjustable by means of temper-screws 39'. The terminal block 42' may, however, merely abut against the top and bottom of frame 36', assuming that the exact amount of travel of the jig and valve-plate is determined and no adjustment is required. With either arrangement there is sufficient friction to maintain the vertically-moving portions of the mechanism in a raised position independent of gravity.

The operation of the apparatus will be readily understood from the foregoing description, the washed coal passing over to the settling-tank, from which it is removed by the elevator. The jig is provided with a suitable gate-controlled opening 43, by which the slate and other impurities may be released from time to time.

Various changes or modifications may be made in the design, proportions, or various details of construction by the skilled mechanic; but all such changes are to be considered as within the scope of the following claims.

What I claim is—

1. A coal-washing jig comprising a vertically-reciprocable framework provided with a primary bottom of perforated material and a secondary bottom having openings there-through, with a slide-valve adapted to open and close said openings, substantially as set forth.

2. A coal-washing jig comprising a framework provided with a primary bottom of perforated material and a secondary bottom having openings therethrough, means for vertically reciprocating the jig, a slide-valve controlling said openings, and means for opening said valve at the termination of the upward stroke and closing it at the termination of the downward stroke, substantially as set forth.

3. In coal-washing apparatus, the combination with a vertically-movable jig provided with water-circulation openings, valves for said openings, and means for vertically reciprocating the jig; of means for positively opening and closing said valves at the termination of the upward and downward stroke respectively, substantially as set forth.

4. In coal-washing apparatus, the combination with a vertically-movable jig provided with water-circulation openings, opening and closing valves therefor, and means provided with a shifting pitman for positively actuating said valves; of a contacting abutment arranged to engage the pitman at the termination of its stroke, substantially as set forth.

5. In coal-washing apparatus, the combination with a vertically-movable jig provided with water-circulation openings, opening and closing valves therefor, means for reciprocating the jig, and means provided with a shifting pitman for positively actuating said valves; of contacting abutments arranged to engage the pitman at the termination of the upward and downward stroke respectively, substantially as set forth.

6. In combination with a vertically-reciprocating jig provided with water-circulation openings and valves therefor: mechanism for shifting the valves consisting of an actuating element mounted upon and reciprocable with the jig, and an abutment arranged in the path of travel of said element, substantially as set forth.

7. In combination with a vertically-reciprocating jig provided with water-circulation openings and valves therefor: mechanism for shifting the valves consisting of an actuating element mounted upon and reciprocable

with the jig, and an adjustable abutment arranged in the path of travel of said element, substantially as set forth.

8. In coal-washing apparatus, the combination with a vertically - movable jig provided with water-circulation ports, opening and closing valves therefor, and means provided with a shifting pitman for positively actuating said valves; of contacting abutments arranged to engage the pitman at the termination of the upward and downward stroke respectively, with means for adjusting said contacting abutments, substantially as set forth.

9. The combination with a vertically-reciprocating jig provided with a bottom having water-circulation ports and opening and closing slide-valves therefor; of mechanism arranged to vertically reciprocate the jig, and mechanism arranged to open and close the valves in operative engagement with said mechanism, substantially as set forth.

10. A reciprocating jig provided with a bottom having water-circulation openings and a sliding plate having corresponding openings, shifting-lever mechanism for the sliding plate provided with a vertically-arranged pitman, and means providing an abutting contact for said pitman at the termination of the up-and-down travel of the jig, substantially as set forth.

11. A reciprocating jig provided with a bottom having water-circulation openings and a sliding plate having corresponding

openings, shifting-lever mechanism for the sliding plate provided with a vertically-arranged pitman, a link connected with the pitman, and an actuating-lever for the jig arranged to make abutting contact with the link, substantially as set forth.

12. A reciprocating jig provided with a bottom having water-circulation openings and a sliding plate having corresponding openings, shifting-lever mechanism for the sliding plate provided with a vertically-arranged pitman, a link connected with the pitman and provided with adjustable contact abutments, and an actuating-lever for the jig arranged to make contact with said abutments, substantially as set forth.

13. A reciprocating jig provided with a bottom having water-circulation openings and a sliding plate having corresponding openings, shifting-lever mechanism for the sliding plate provided with a vertically-arranged pitman, a link connected with the pitman and provided with adjustable contact abutments, and an actuating-lever for the jig provided with a wrist-pin and block engaging a slot of the link and arranged to make contact with said abutments, substantially as set forth.

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

ROBERT L. MARTIN, JR.

Witnesses:

CHAS. S. LEPLEY,
C. M. CLARKE.