

No. 622,517.

Patented Apr. 4, 1899.

W. MCCLAVE.
FURNACE.

(Application filed July 2, 1898.)

(No Model.)

11 Sheets—Sheet 1.

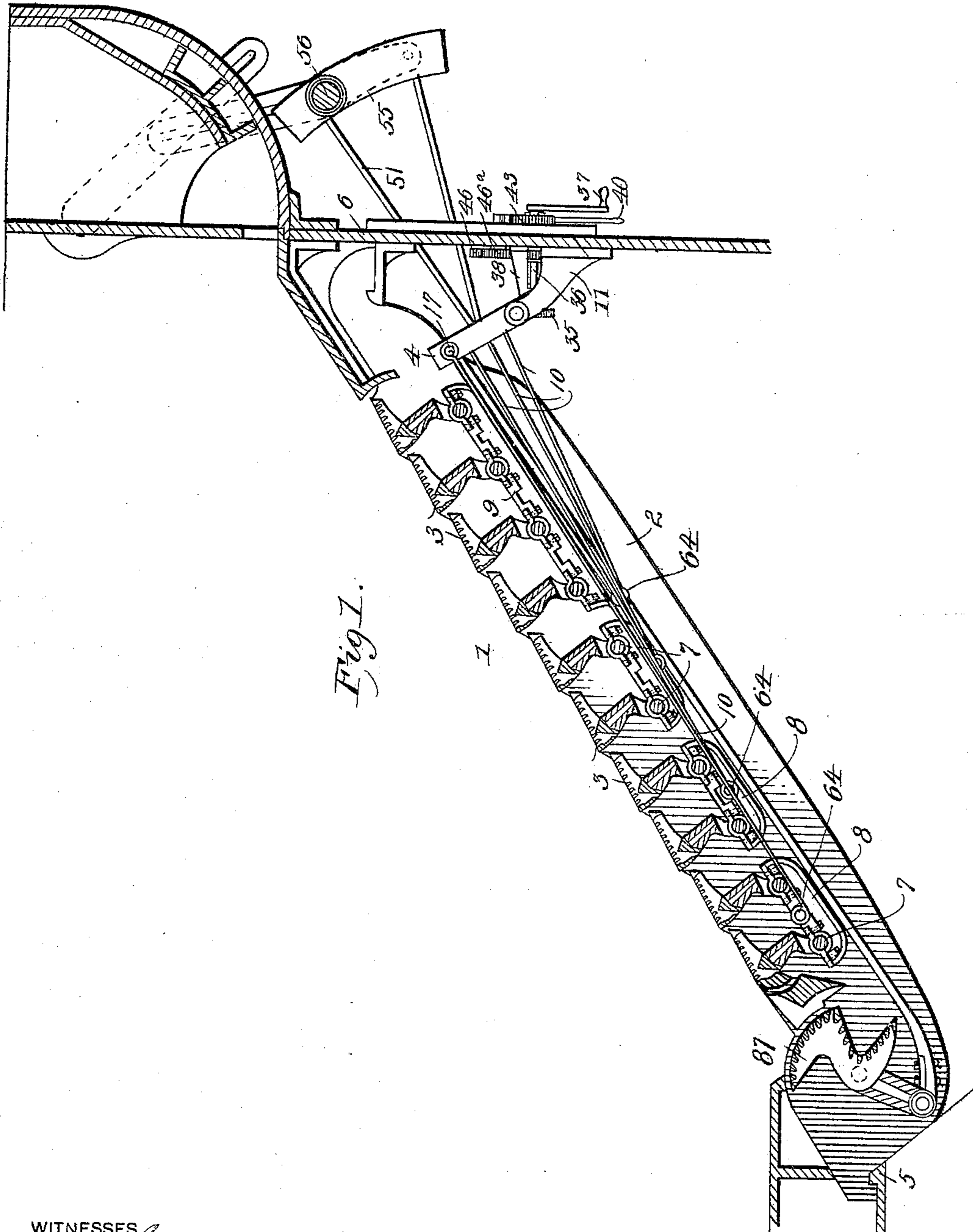


Fig. 1.

WITNESSES

W. J. LaTarré
W. McCabe

INVENTOR

William McClave
by his Atty
Marion French

No. 622,517.

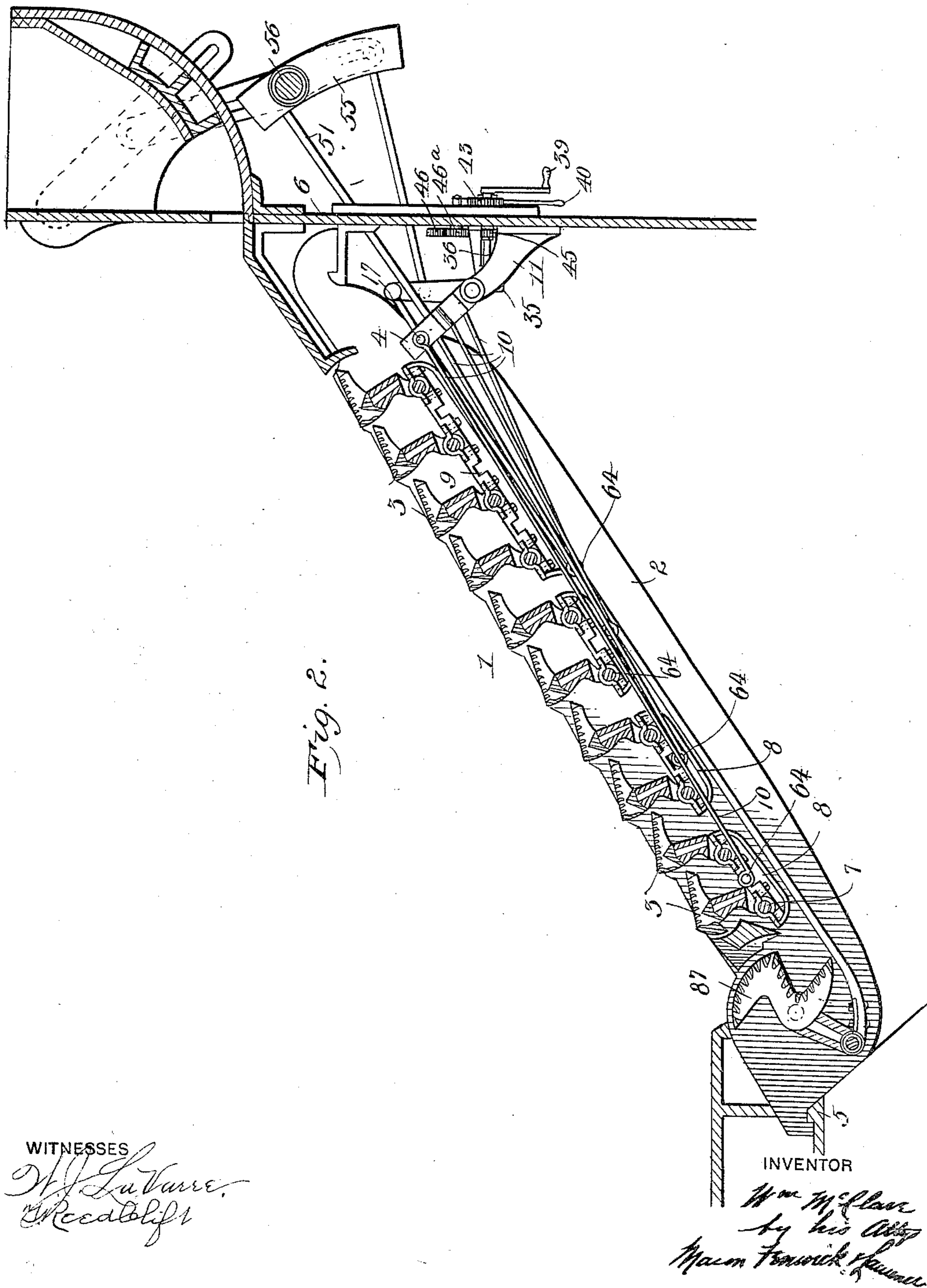
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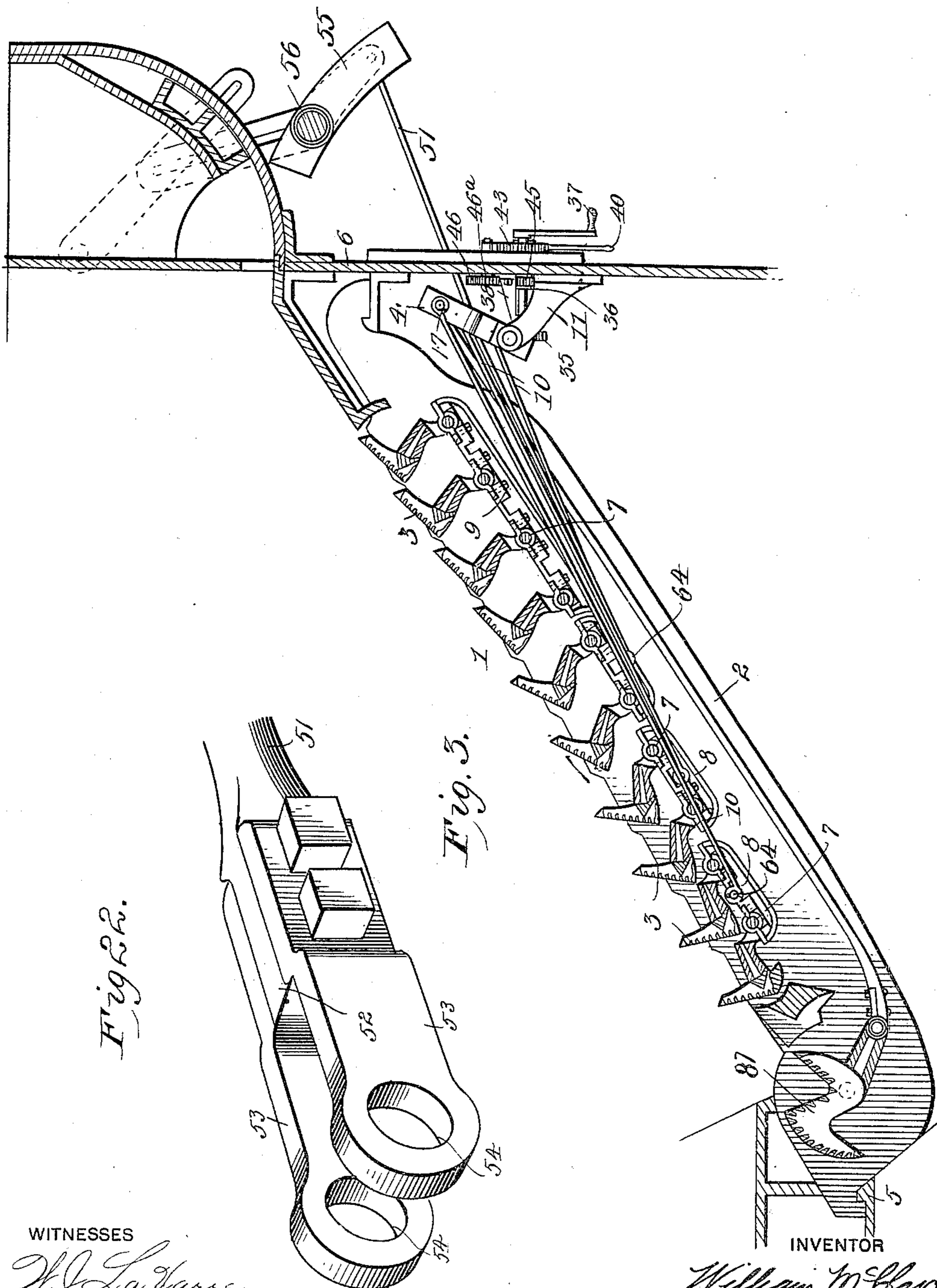
Patented Apr. 4, 1899.

W. McCLAVE.
FURNACE.

(Application filed July 2, 1898.)

(No Model.)

11 Sheets—Sheet 3.



WITNESSES
W. J. LaVarre
C. Reedblift

INVENTOR
William McClave
by his Atty
Marion Smith Remond

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W. McCLAVE.

FURNACE.

(Application filed July 2, 1898.)

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Fig. 5.

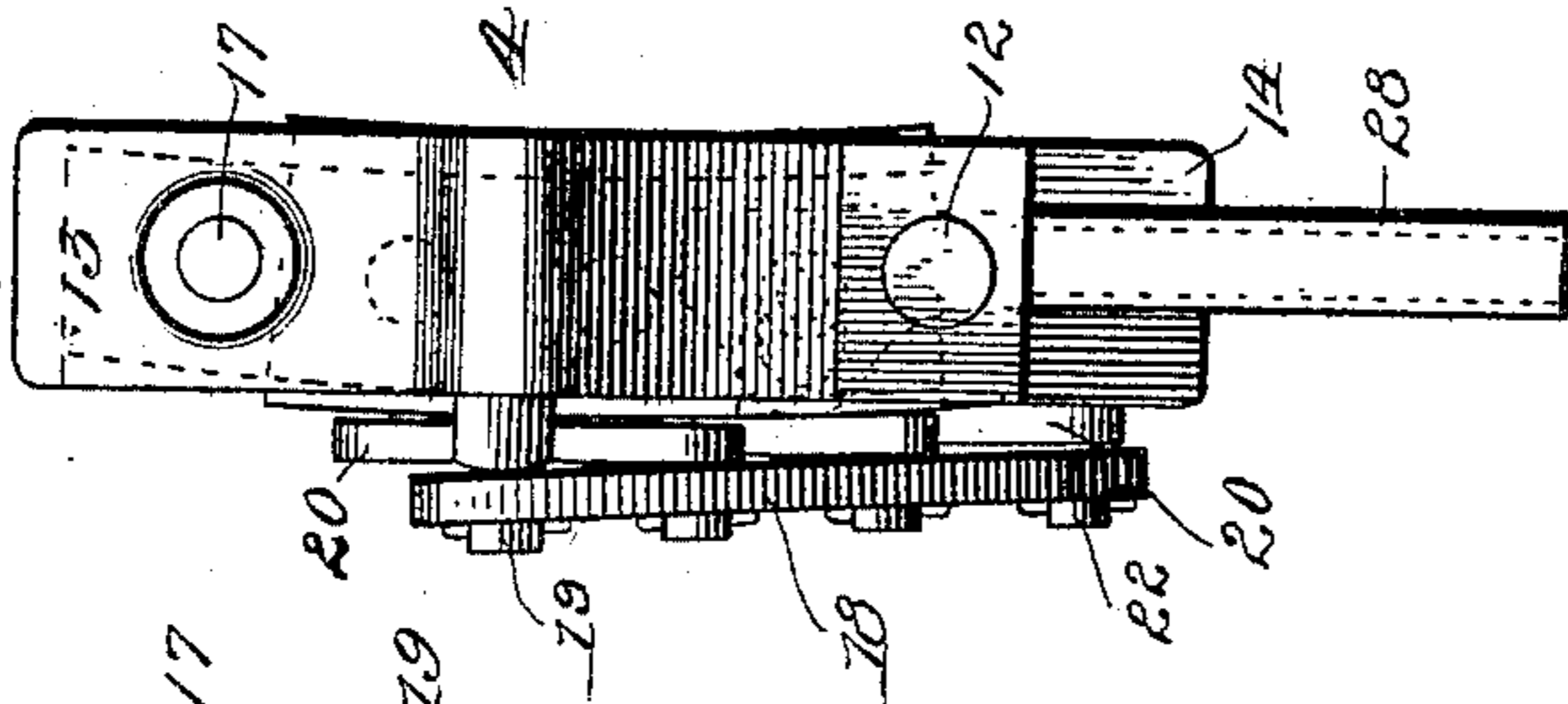
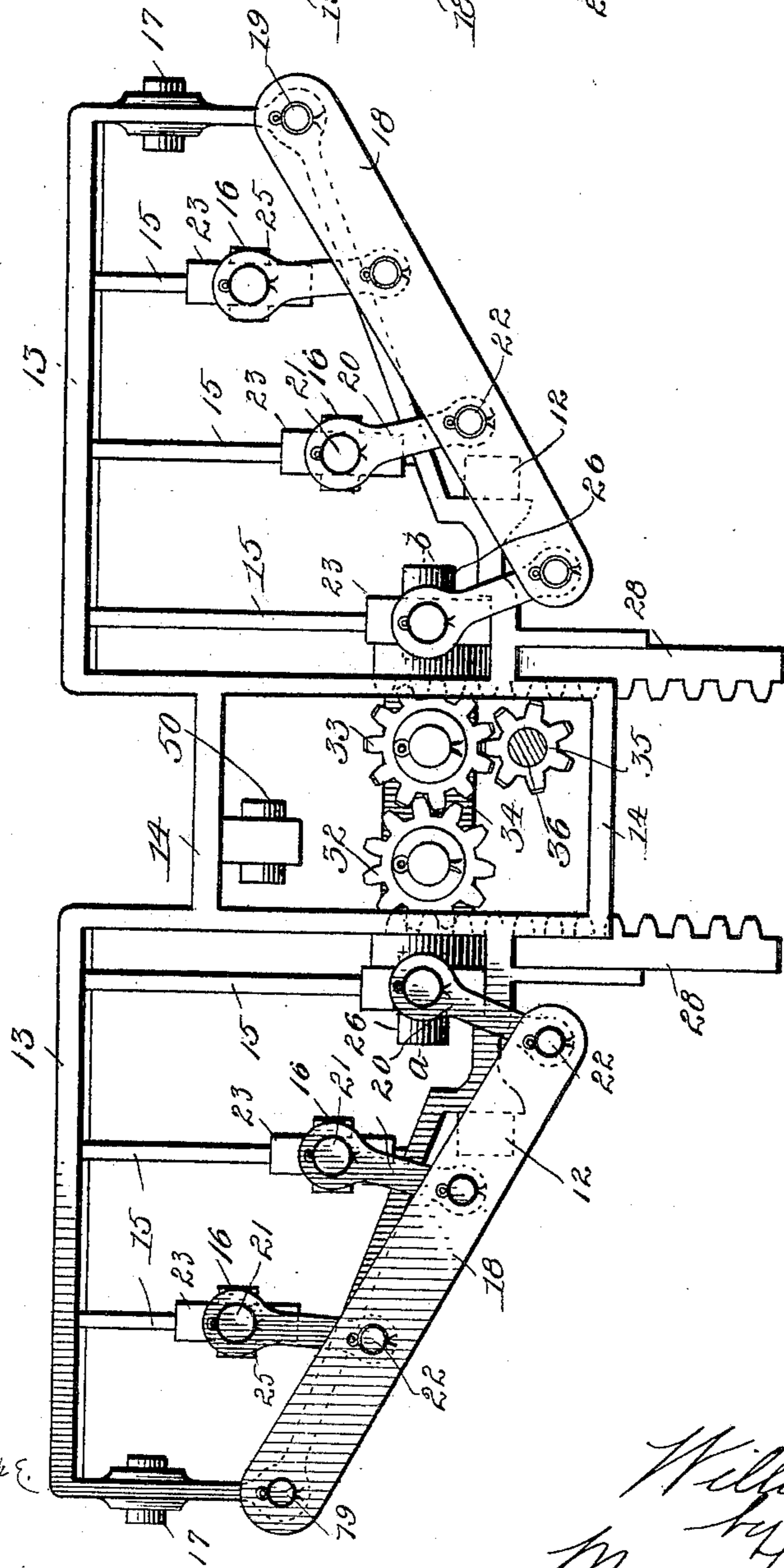


Fig. 4.



WITNESSES
H. J. Lavarre
W. Reedblift

INVENTOR
William M. McClave
by his Attorney
Mason Fenwick Lawrence

No. 622,517.

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W. McCLAVE.
FURNACE.

(Application filed July 2, 1898.)

(No Model.)

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Fig. 6.

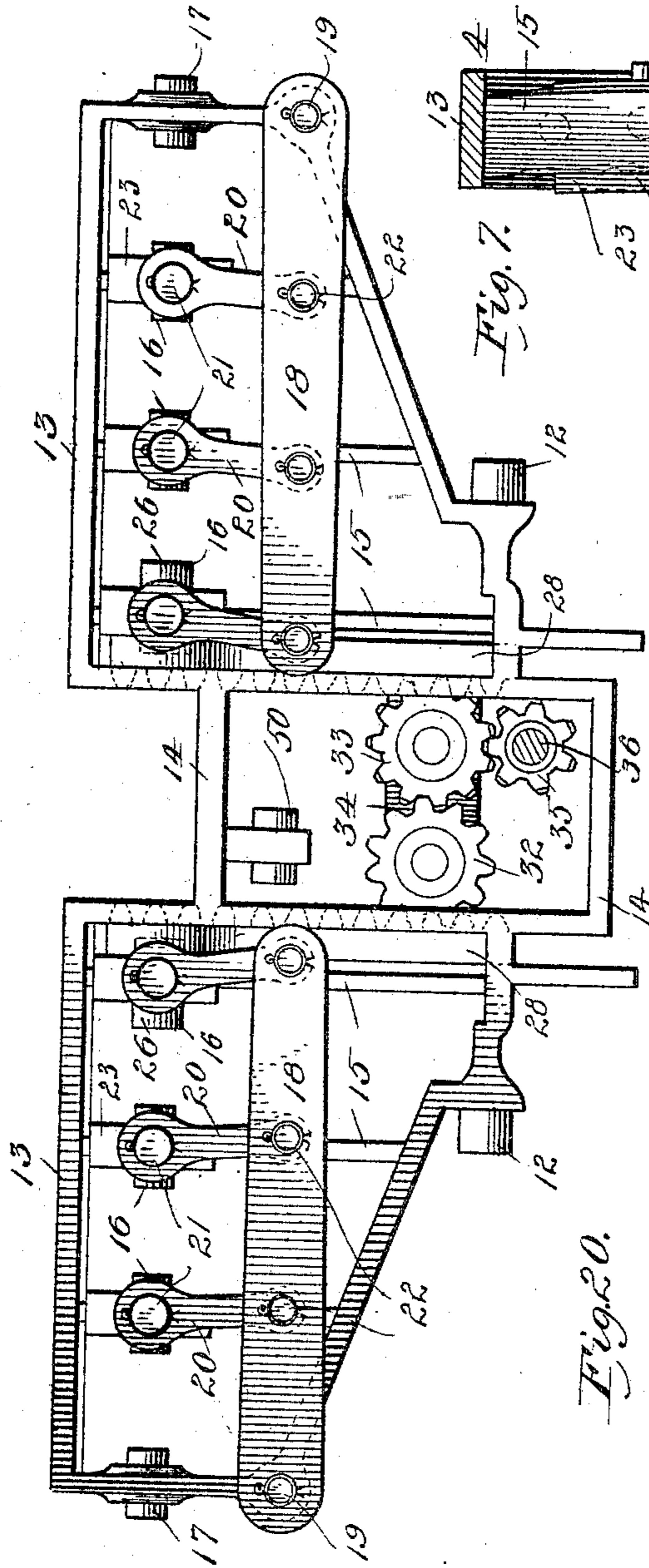


Fig. 7.

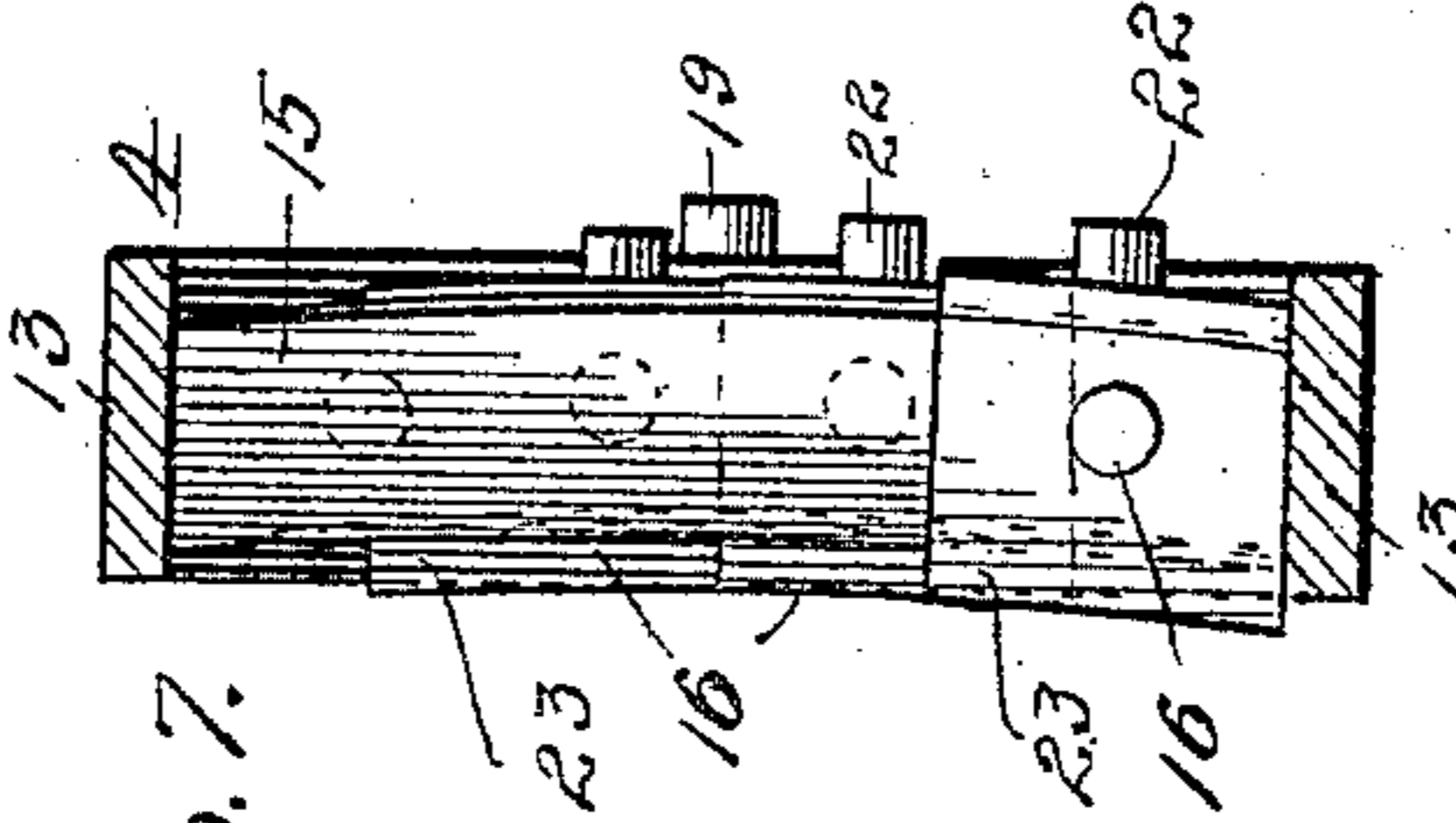


Fig. 21.

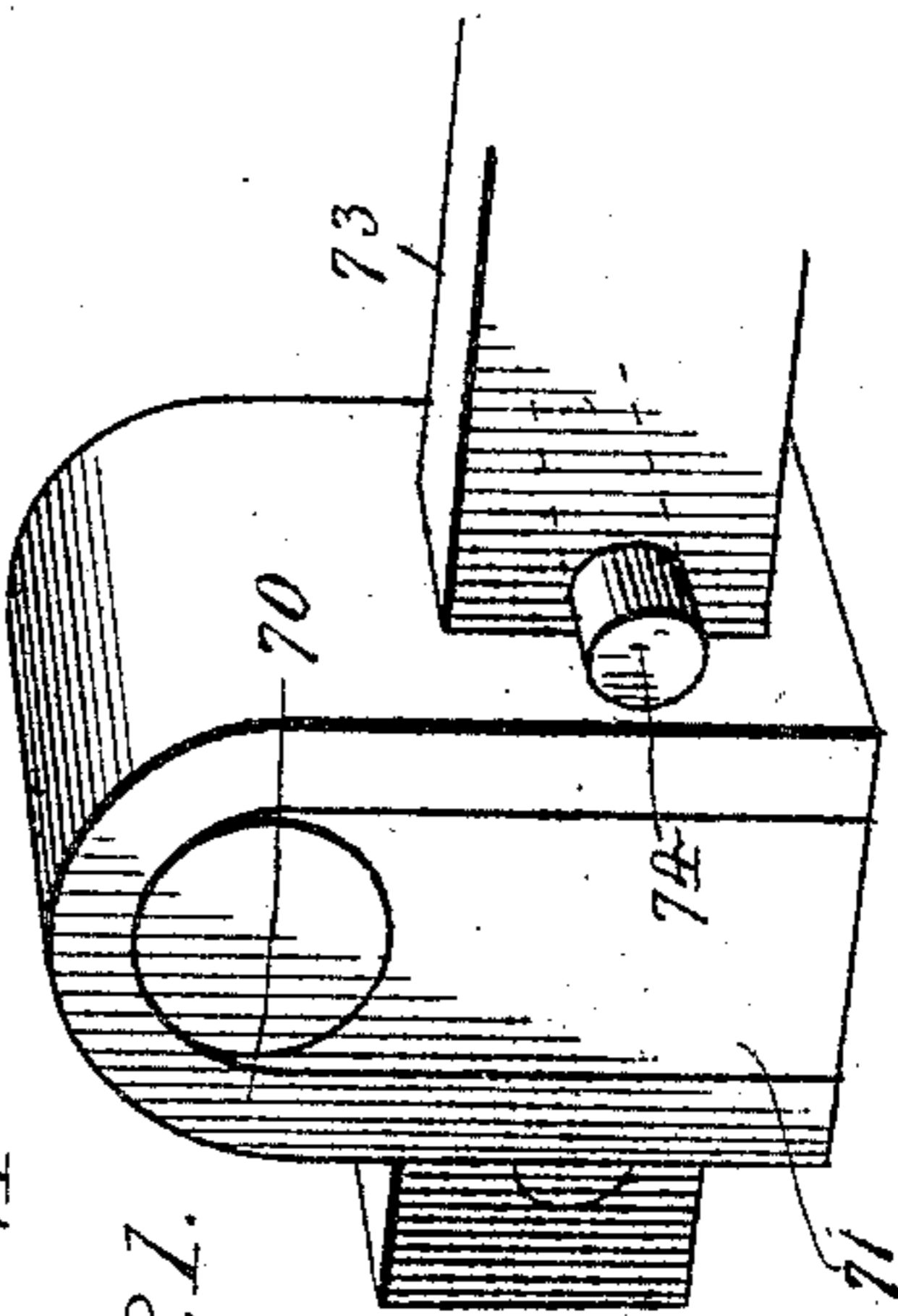
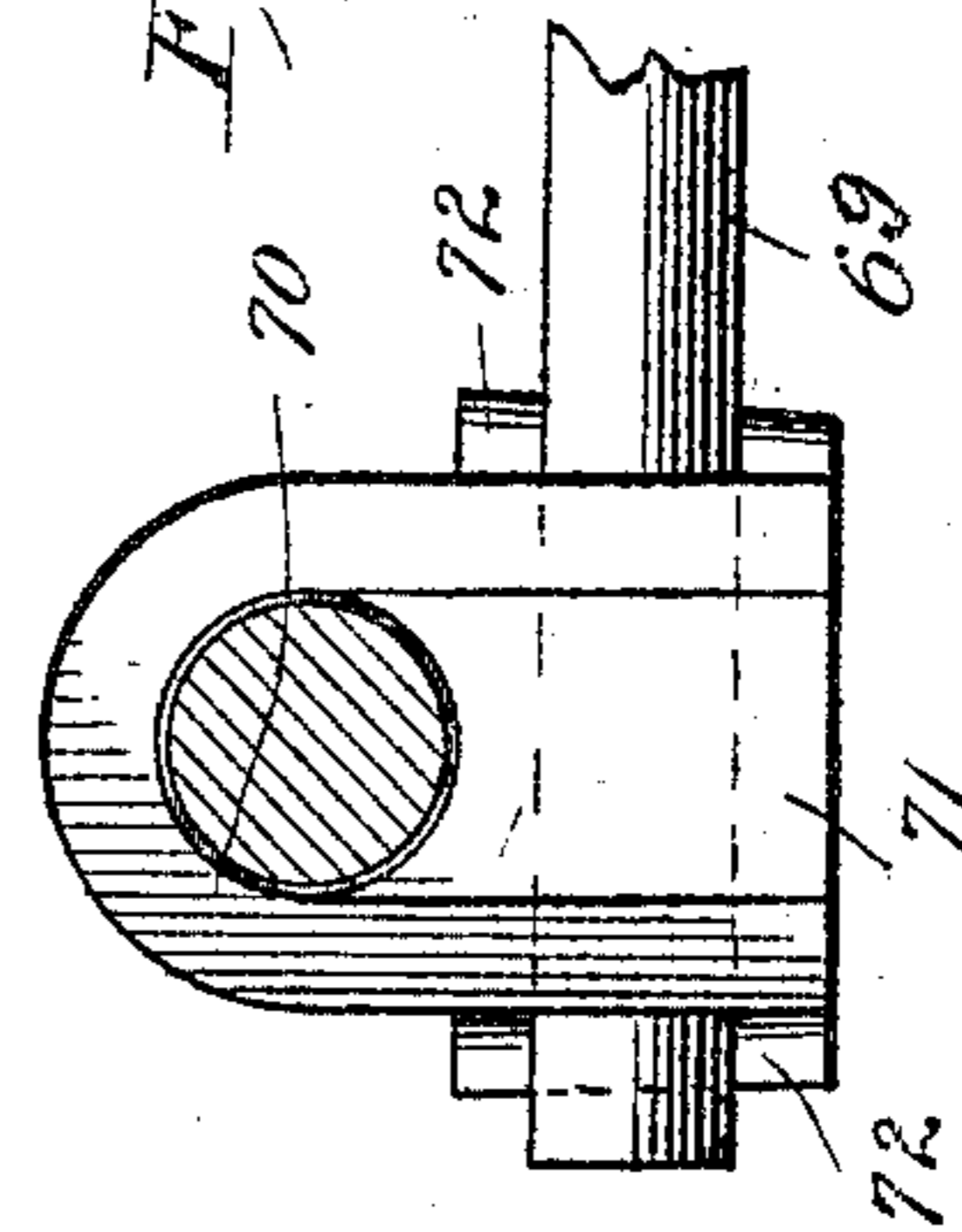


Fig. 20.



WITNESSES

W. L. Lane
J. Reed

INVENTOR

William McClave
by his Attor
Mason Smith

No. 622,517.

Patented Apr. 4, 1899.

W. McCLAVE.
FURNACE.

(Application filed July 2, 1898.)

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Fig. 8.

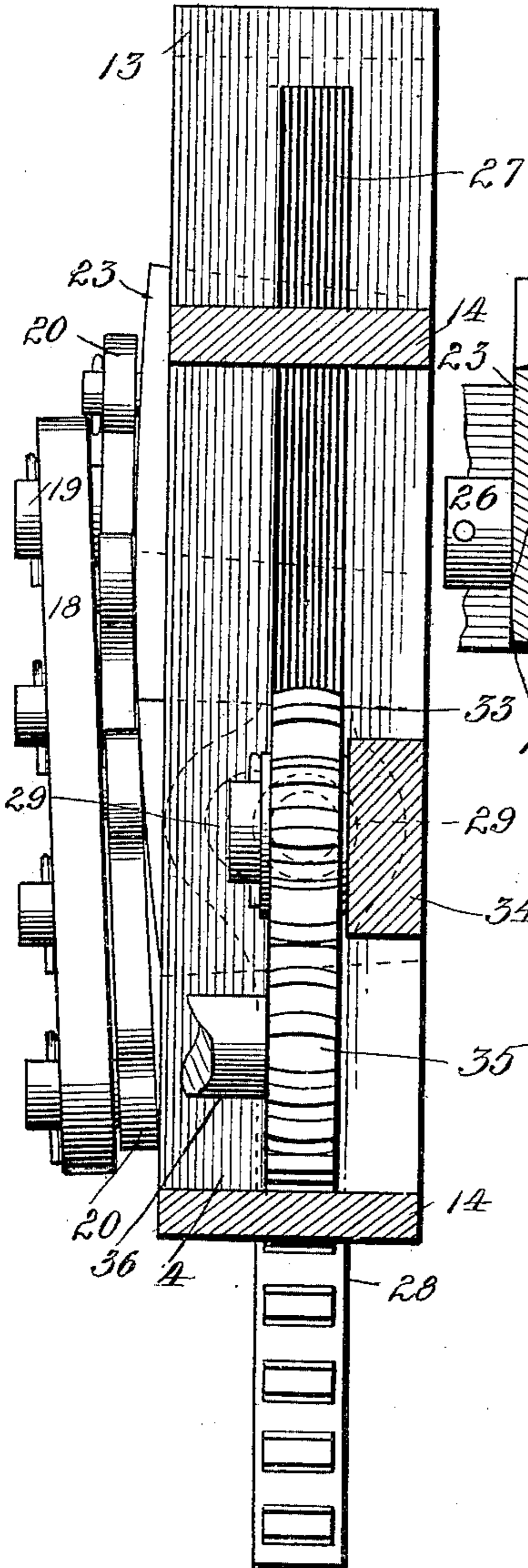


Fig. 9.

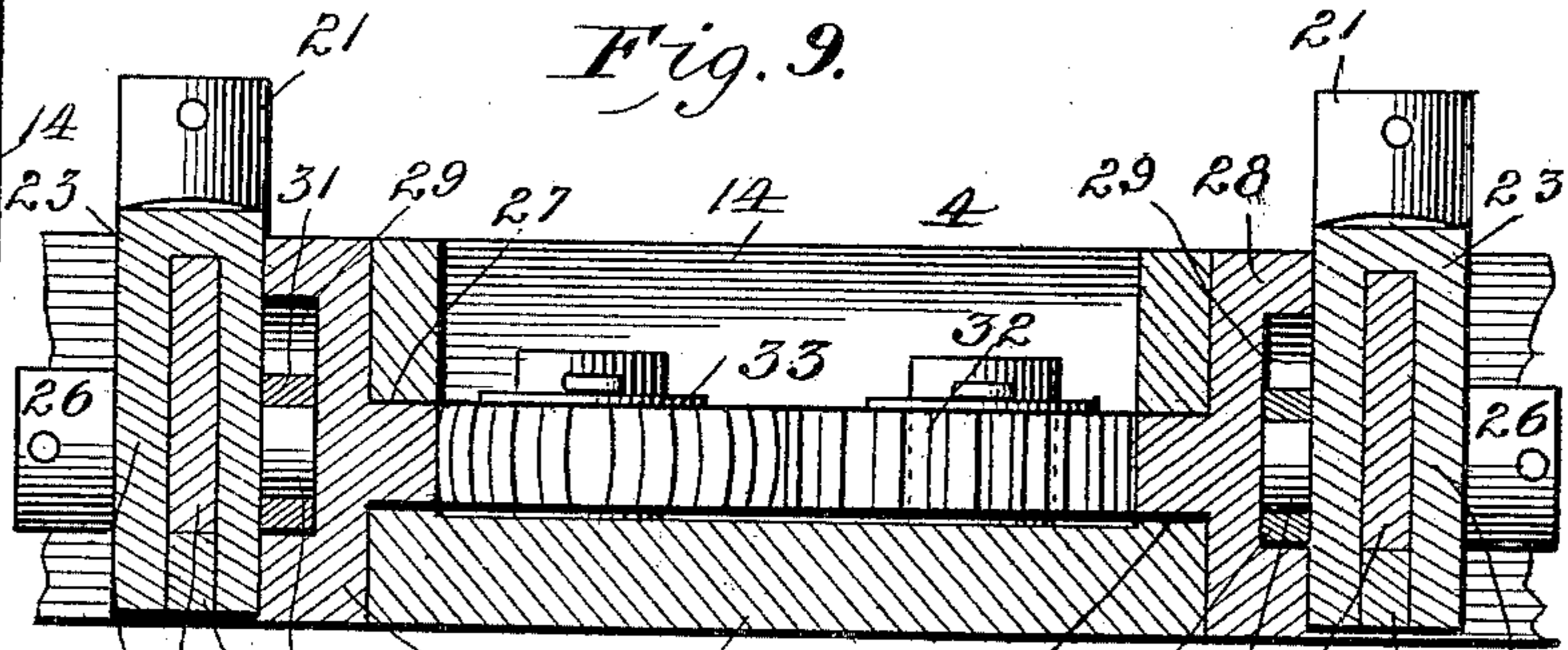


Fig. 10.

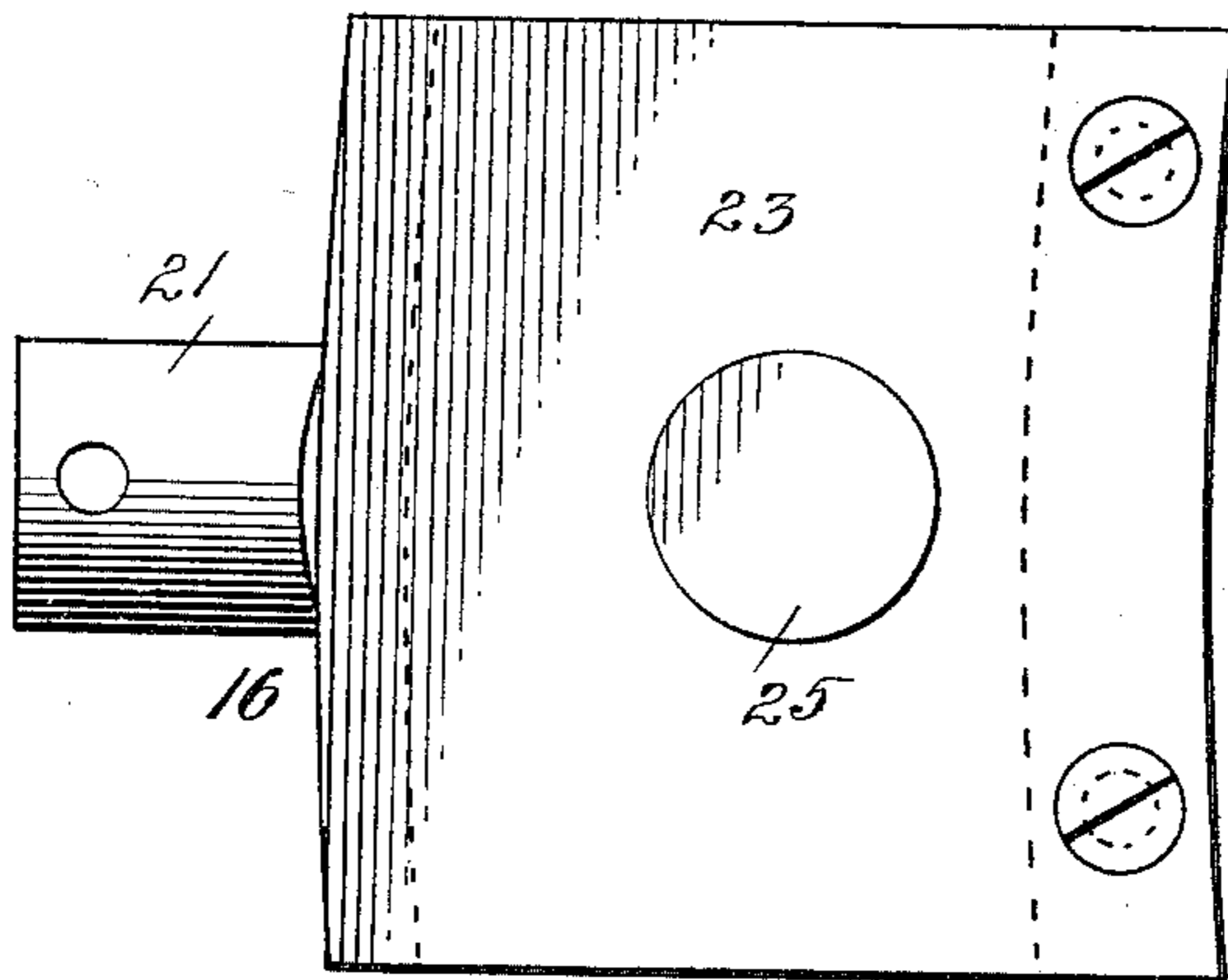
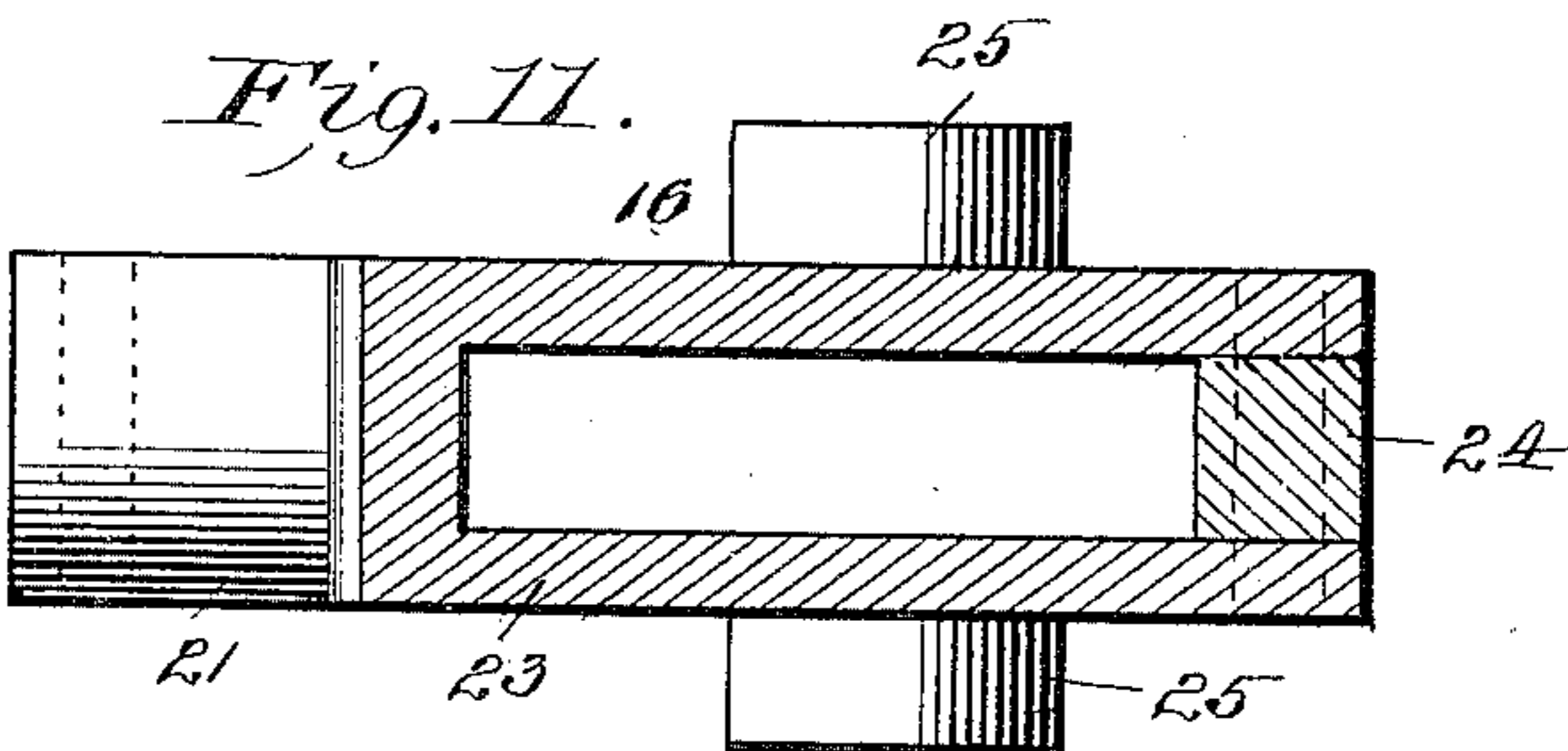


Fig. 11.



WITNESSES

W. L. Larre.
M. Reedleliff.

INVENTOR

William McClave
by his Attorney
Mason F. M. F. F.

No. 622,517.

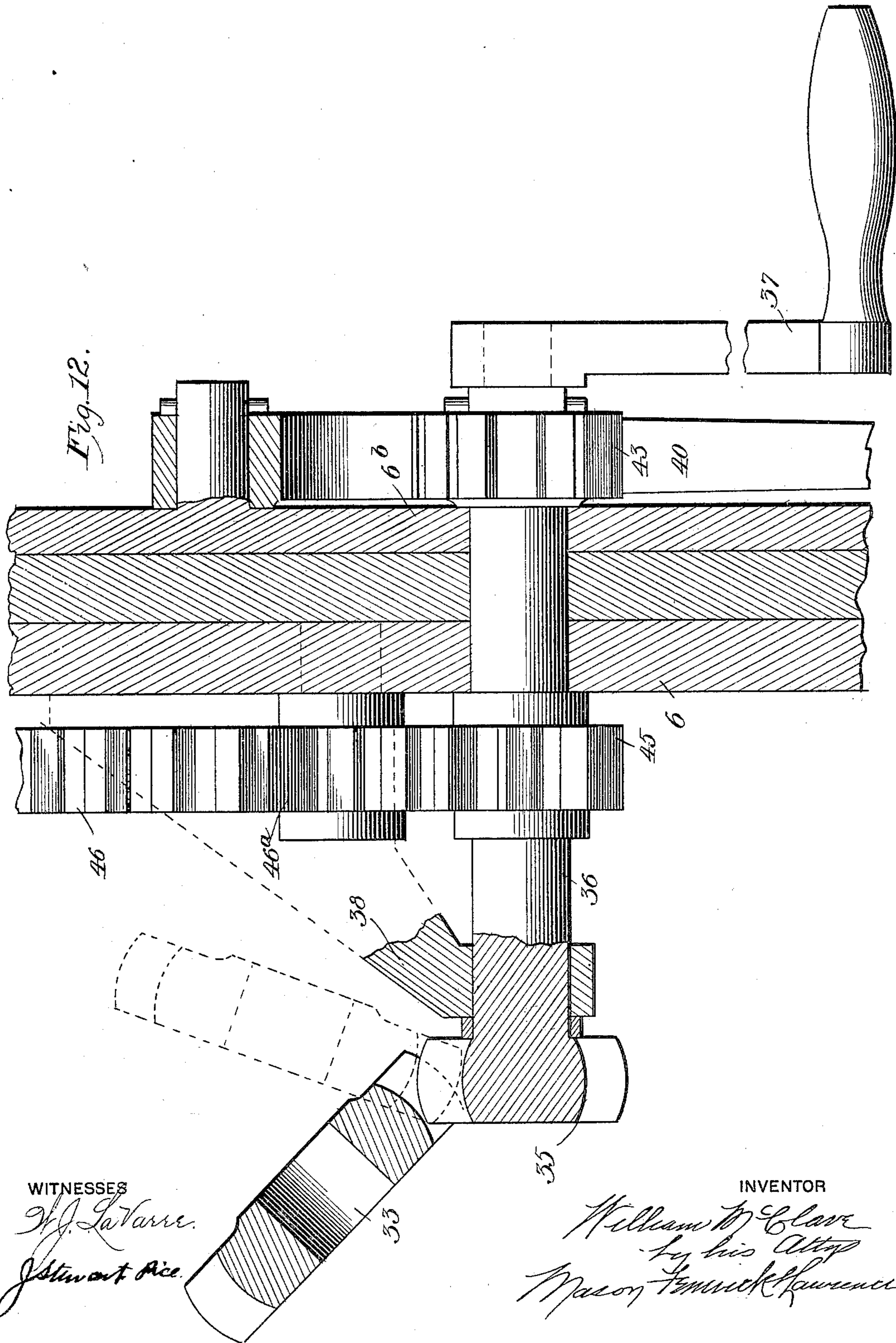
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FURNACE.

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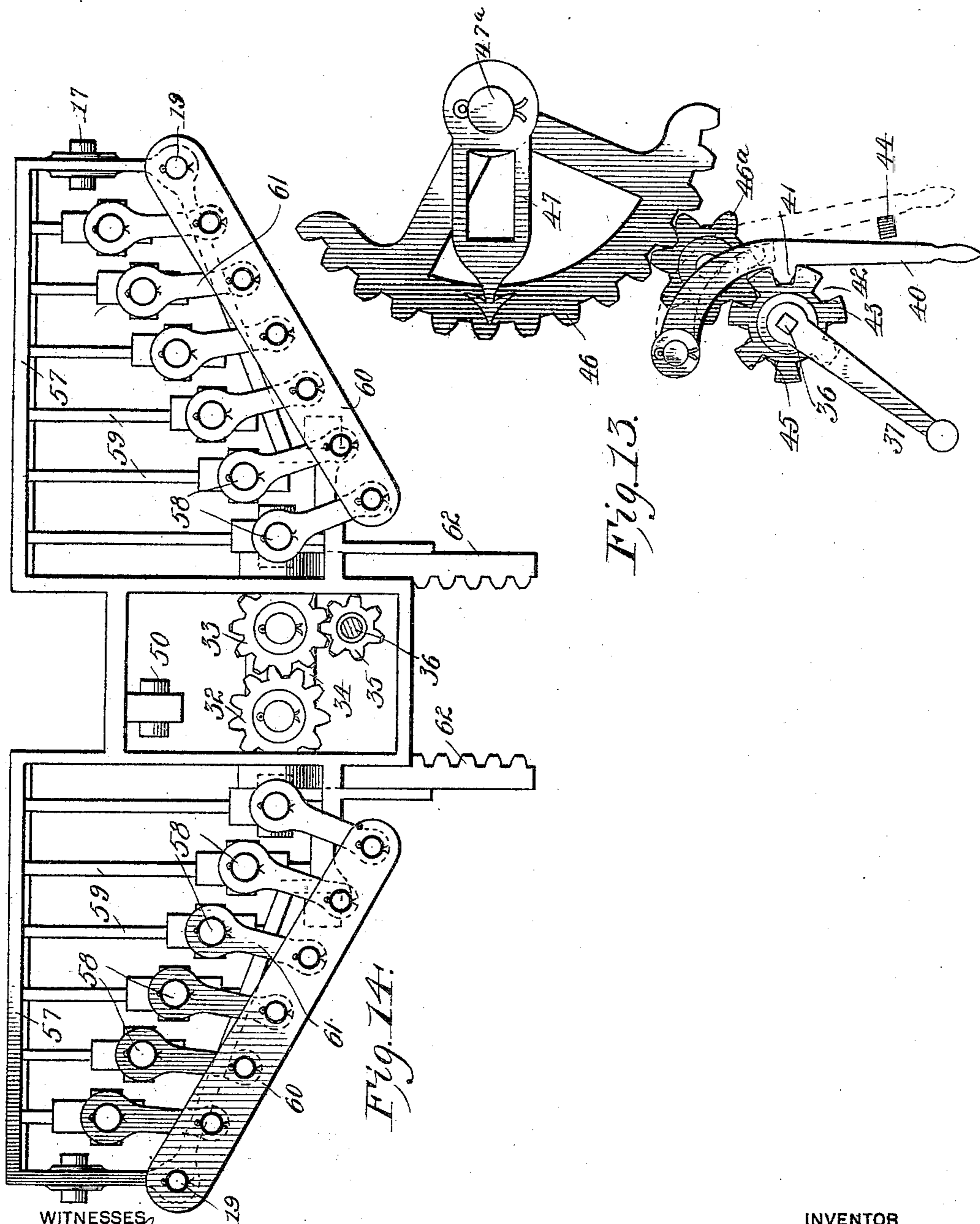
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W. McCLAVE.
FURNACE.

(Application filed July 2, 1898.)

(No Model.)

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WITNESSES
W. L. Larrar
John W. Rice

INVENTOR
William McClave
By his Attys.
Mason Farnick Lawrence

No. 622,517.

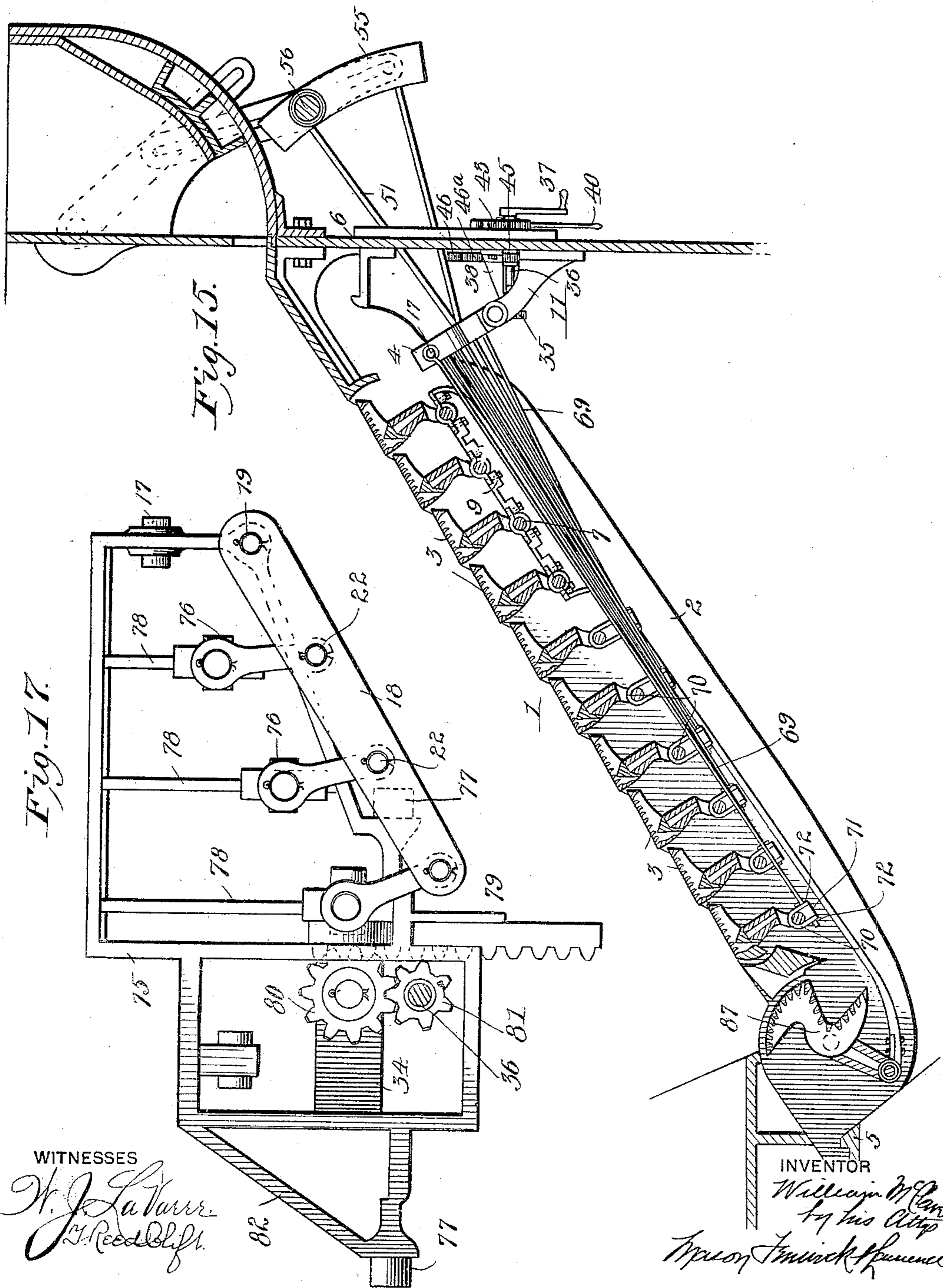
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Fig. 16.

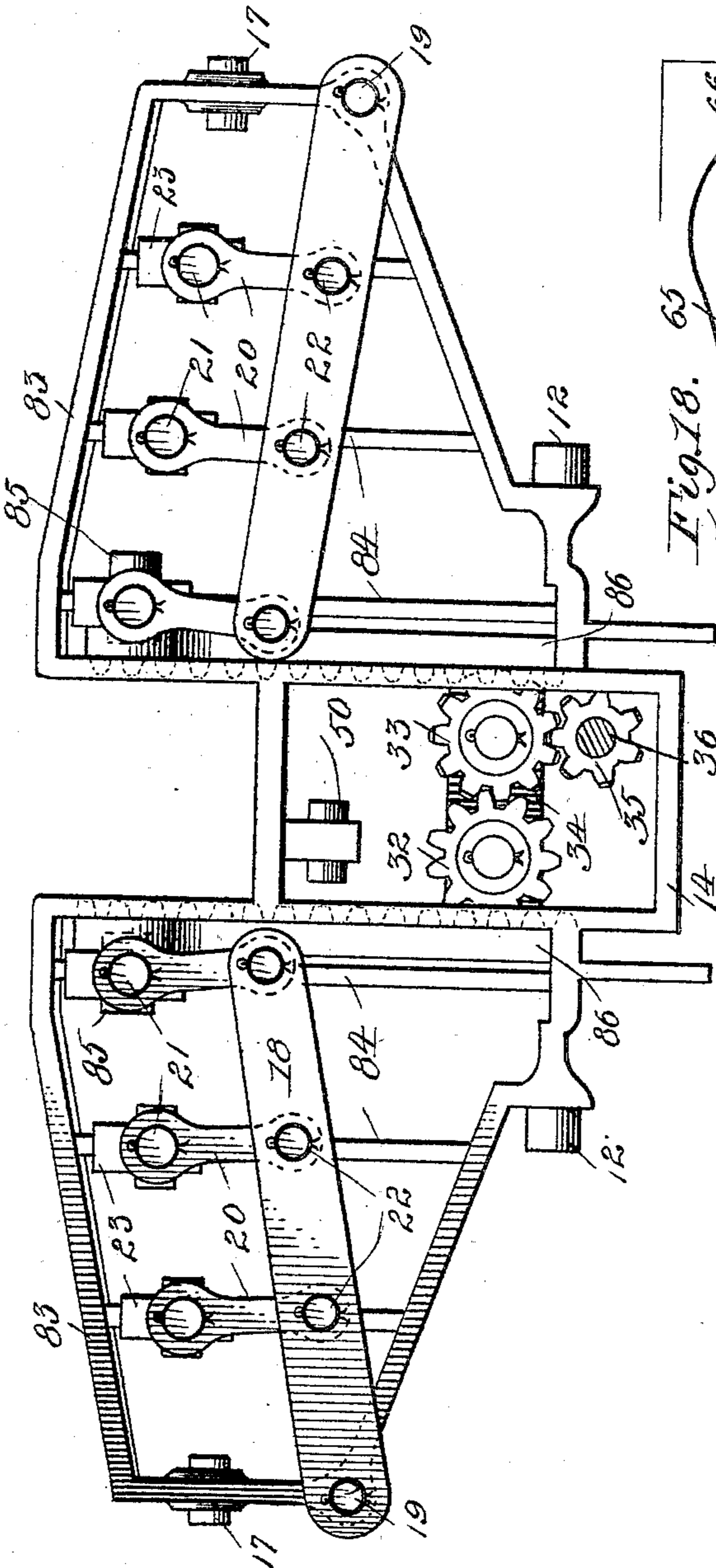


Fig. 18.

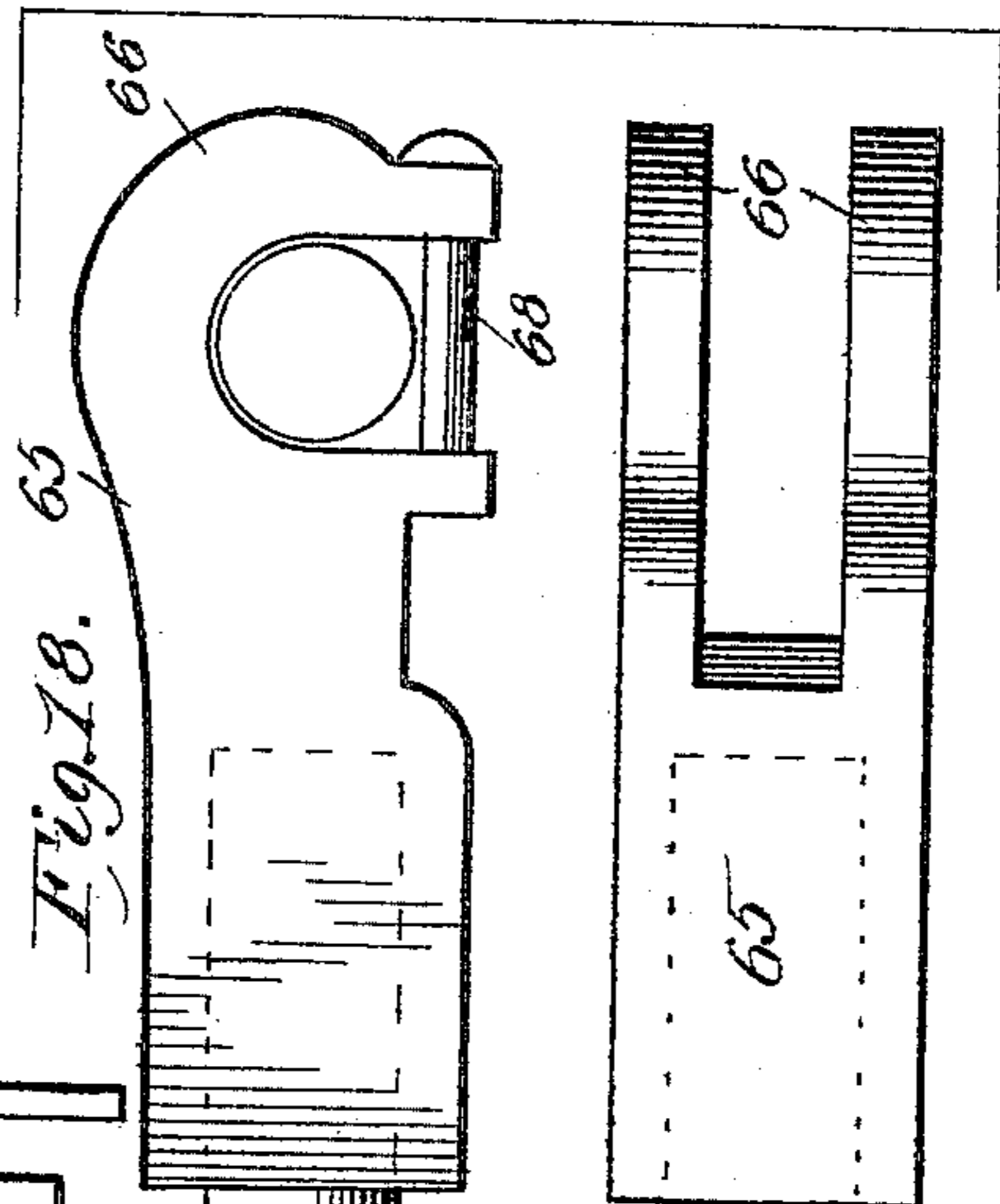
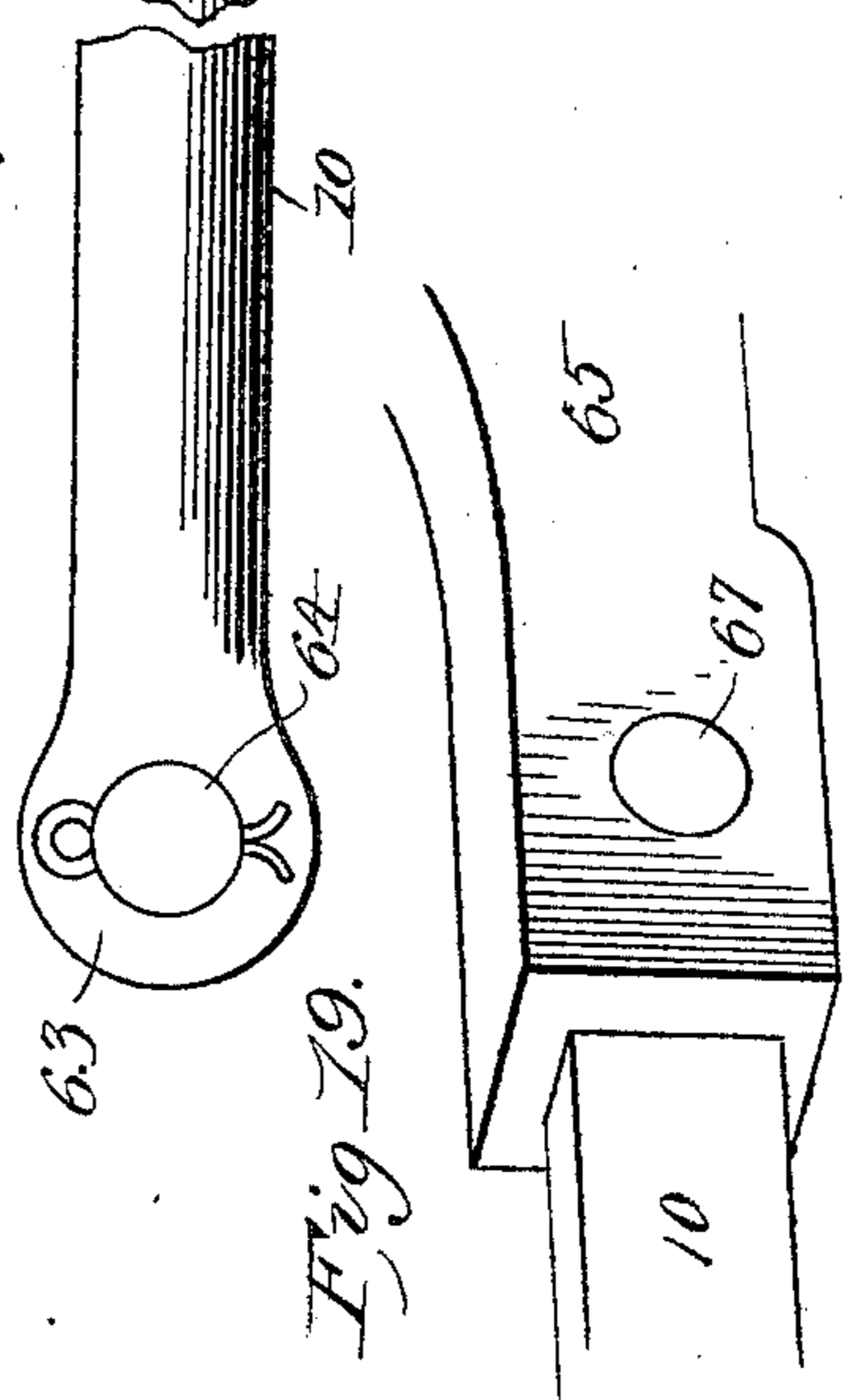


Fig. 19.



WITNESSES

W. J. L. L. L.
J. Reedblift.

INVENTOR

William McClave
by his Attys
Mason & Co.

No. 622,517.

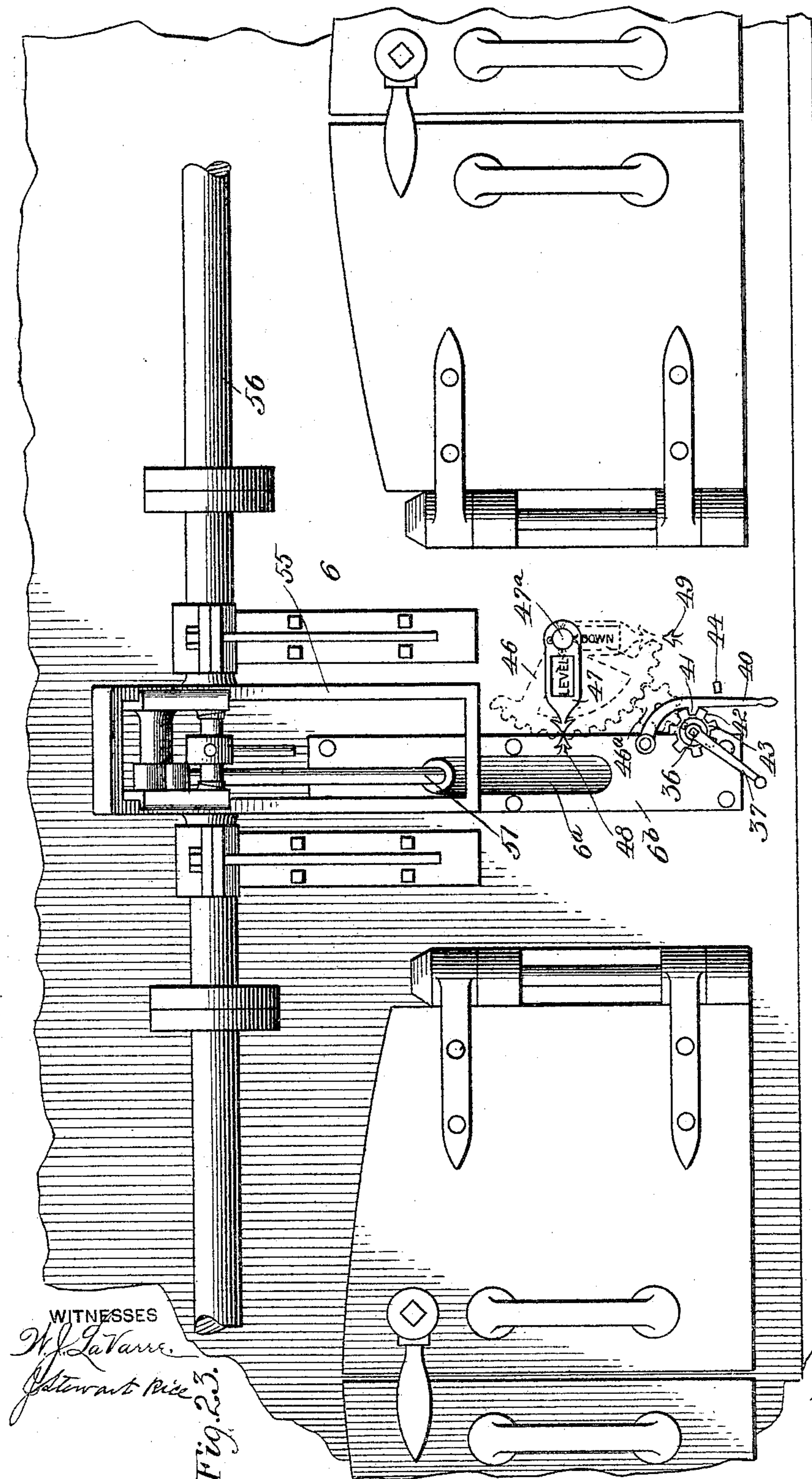
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W. McCLAVE.
FURNACE.

(Application filed July 2, 1898.)

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11 Sheets—Sheet 11.



WITNESSES

W. J. LaVarre.
Postmaster Price

INVENTOR

William McKim
by his Attys
Mason & Hamrick

UNITED STATES PATENT OFFICE.

WILLIAM MCCLAVE, OF SCRANTON, PENNSYLVANIA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 622,517, dated April 4, 1899.

Application filed July 2, 1898. Serial No. 685,069. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MCCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in furnaces, and more particularly to that class of furnaces which employ inclined rocking grates for feeding fuel downwardly and which are employed in connection with a mechanical stoker.

My invention is not only well adapted for use upon any furnace using rocking bars for producing a feed movement, but is also particularly well adapted for use upon a grate having rocking bars adapted to be thrown back to cut out the clinkers and ashes, as well as feed the fuel downwardly, as described and shown in my application for a patent filed on May 10, 1898, Serial No. 680,272.

It consists in providing an inclined grate having rocking grate-bars with adjustable means for rocking the same, whereby some of the bars may be rocked more than others for causing a more rapid feed of the fuel upon one part of the grate than upon another.

It also consists in providing an inclined grate having rocking bars with adjustable means for rocking the same, said means comprising a rocking frame and movable journal-blocks carried by the said frame, said journal-blocks being connected with the grate-bars, and means for adjusting the journal-blocks to regulate the throw of the grate-bars with respect to each other.

It also consists in providing an inclined grate having rocking grate-bars with means for rocking the said bars and means connected with the said rocking means whereby the throw of the grate-bars may be adjusted from the outside of the furnace and while the same is in use.

It further consists in providing a furnace with an inclined grate having rocking grate-bars with means for rocking the said bars, comprising an oscillating frame, movable journal-blocks mounted upon the said frame,

means connecting said journal-blocks, and means for raising and lowering the same, the construction being such that all the grate-bars may be adjusted at a single movement, so as to grade the movement of the bars with respect to each other to produce either a normal feed throughout or a greater feed upon one portion than upon another.

It also consists in certain other novel constructions, combinations, and arrangements of parts, as will be hereinafter more fully described and claimed.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section through a portion of a furnace provided with a grate constructed in accordance with my invention. Fig. 2 represents a similar view, but showing the grate-bars as rocked forward when feeding the fuel. Fig. 3 is a similar view to Figs. 1 and 2, but showing the grate-bars rocked to the rear for cutting out clinkers and ashes. Fig. 4 represents a front elevation of the rocking frame employed in actuating the rocking grate-bars. Fig. 5 represents an end elevation of the same. Fig. 6 is a similar view to Fig. 4, but showing the movable journal-blocks arranged so as to rock the grate-bars with a uniform movement. Fig. 7 represents a detail transverse sectional view through the rocking frame, illustrating the curvature of the bars which carry the movable journal-blocks. Fig. 8 represents a vertical transverse section through the central portion of the rocking frame. Fig. 9 represents a horizontal sectional view upon the line *a b* of Fig. 4. Fig. 10 represents a detail side elevation of one of the movable journal-blocks. Fig. 11 represents a detail horizontal cross-section through the same. Fig. 12 represents a detail sectional view through a portion of the front of the furnace, showing the means for operating the mechanism carried by the rocking frame from the outside of the furnace. Fig. 13 represents a front elevation of the said operating means and showing an indicator working in conjunction therewith. Fig. 14 represents a front elevation of a rocking frame, showing the manner of forming the same when more of the grate-bars are operated singly. Fig. 15 represents a detail longitudinal section through the grate, showing the manner of connecting

such a frame with the separate bars of the grate. Fig. 16 represents a detail view showing a modified form of rocking frame in which the movable journal-blocks are capable of being moved above the line of uniform movement as well as below. Fig. 17 represents another form of rocking frame, the same being adapted to operate a single grate-section instead of two sections, as heretofore illustrated. Fig. 18 represents a detail view of a connecting-bar, showing the manner of attaching the same to the rocking frame and to the grate-bars. Fig. 19 represents a modification of the same. Fig. 20 represents a detail view showing the manner of connecting the rods to the rocking grate-bars when the said rods are round. Fig. 21 represents a similar view showing the manner of connecting the said rods when they are rectangular in shape. Fig. 22 represents a detail perspective view showing the manner of connecting the rod which operates the oscillating frame to the said frame; and Fig. 23 represents a view of a portion of the front of a furnace, showing the indicating mechanism upon the front of the same.

In using inclined grates in furnaces in connection with stokers to assist in the feed of the fuel I find that it is advisable to employ a means for regulating the throw of the grate-bars so that their movements may be graded from top to bottom with respect to each other. In feeding fuel down an inclined grate the fuel moves more easily when it first reaches the grate because it is comparatively unburned and loose; but as it proceeds down the grate-surface it becomes more compactly held together and filled with clinkers until at the lower end, especially with some fuels, it is likely to form cakes or slabs of clinkers. For this reason it is far better to have the grate so constructed that the movement of the feeding-bars can be made greater at the lower end of the grate than at the top. The intermediate portions of the grate-surface should also be constructed so as to give the grate-bars a gradually-increasing movement from the top to the bottom to correspond more nearly with the clinker forming or caking tendency of the fire. A grate of this kind should be formed also, to produce the best result; so that it can be caused to operate uniformly throughout when first starting a fire or when the feed has been stopped and it is desired to get new fuel down to the lower portion of the grate again. I have constructed my improved grate with a view to accomplish all these ends, and in addition have so constructed the same that it may be easily operated from the outside of the front of the furnace. Thus the grate can be adjusted while the furnace is in use and at any time so as to grade the movement of the grate-bars to a greater or less extent, as it may be found desirable. The grate-bars are also constructed and connected up so that they can be rocked backwardly to cut out clinkers

and ashes from the under portion of the fuel when it is found necessary to more thoroughly break up the clinker. This action may also be graded so as to produce a greater cut-out movement at the bottom than at the top.

1 in the drawings represents a grate; 2, carrier-bars forming a part of the same; 3, rocking grate-bars, and 4 a rocking or oscillating frame for actuating the said bars.

While my improved means for rocking the grate-bars may be applied to furnaces employing a single section or row of grate-bars, yet I prefer to use the same with a grate-surface composed of two sections or rows. Of course it will be apparent that the parts may be so arranged as to operate a greater number of sections, if desired. The carrier-bars 2 of the grate 1 are mounted, as illustrated in Figs. 1, 2, and 3 of the drawings, in the furnace upon an incline, the lower end of the said carrier-bars resting upon the bridge-wall, as at 5, and the upper end engaging supports formed upon the front 6 of the furnace. The rocking grate-bars 3 are journaled at their ends in the carrier-bars 2, the said journals being at a suitable point with respect to the fire-bearing surface of the bar to permit of the same being rocked to give the desired feed. The grate-bars 3 are provided with actuating-journals, as at 7, which are adapted to be engaged by any suitable means for rocking the grate-bars. In order to produce a graded movement in the bars from one end to the other, it is necessary to rock one or more of the said bars separately from the others. While each of the bars may be connected separately and operated independently of each other, yet for ordinary purposes I find that it is desirable to connect the lower bars by twos, while a greater number of the top bars may well be joined for producing the desired result. As shown in Figs. 1, 2, and 3 of the drawings, the lower bars 3 are joined by means of short connecting-bars, as 8, while a longer connecting-bar 9 joins the four upper grate-bars. These connecting-bars 8 and 9 may be pivotally secured to the journals 7 in any desired manner. The connecting-bars 8 and 9 are pivotally secured to the operating-rods, as 10, said rods extending toward the front of the furnace and engaging the rocking or oscillating frame 4. The rods 10 are pivotally connected to the bars 8 and 9, so that they will allow for the movement of the grate-bars.

In order to produce a graded movement in the rocking of the grate-bars, it is necessary to connect each set of bars in such a manner that the throw of some of the bars will be more than that of the others. For this purpose I employ the rocking frame 4, which is pivoted upon brackets, as 11, secured to the inner face of the furnace-front 6. As seen in the drawings, the frame 4 is provided with journals, as 12, which engage suitable bearings in the brackets 11, whereby it is pivotally supported in place. A greater part of

the frame 4 extends upwardly from the journals 12. The frame 4 has been illustrated in the drawings, except in Fig. 17, as adapted to rock the grate-bars of two sections of a furnace-grate, the two sides or wings of the said frame being constructed alike. The frame 4 comprises approximately triangular portions, as 13 13, connected at their inner ends to each other by means of cross-bars, as 14 14. Each of the wings 13 of the frame 4 is provided with vertically - arranged guide - bars, as 15 15, which are adapted to support and guide movable journal-blocks, as 16. The operating-rods 10 are connected with the movable journal-blocks 16, and because of the comparative movement of the parts the guide-bars 15 are slightly curved, the concaved side being toward the grate. This permits of the adjustment of the movable journal-blocks 16 upon the said guides 15 without any binding action between the parts and without changing the throw of the rods in their adjusted positions. The inner movable bearing 16 is connected with the upper four grate-bars, and therefore, the connecting-rod 10 being shorter than the other connecting-rods, the inner guide is constructed with a greater curve than the outer ones to correspond with the lesser radius of the arc described. The curvature of the guides 15 will only be very slight, and while it is much better to make them curved, yet the grate can be operated if the said guides were made straight, so that I contemplate using them in this way if it is found desirable, all of which is within the scope of the present invention. I prefer to have the lower bar of each grate-section so connected with the rocking frame 4 that it will always have the normal throw communicated by the said frame, and for this purpose the bar 10, which connects the same with the frame, is journaled directly to the outside of the said frame, as seen at 17, a movable journal-block not being used at this point. In order to move the journal-blocks 16 uniformly with relation to each other and at a corresponding decreasing or diminishing ratio, I mount a pivoted bar, as 18, upon a journal on each of the wings 13 of the frame 4, each of said bars 18 extending toward the central portion of the frame and being connected by means of links 20 with each of the movable journal-blocks 16. The links 20 are provided with eyes in their upper ends which engage journals, as 21, formed upon the outer faces of the movable journal-blocks 16. The lower ends of the said links 20 are preferably provided with journal-studs, as 22, which engage corresponding apertures formed in the links 18. It will be apparent that when one of the said journal-blocks 16 is moved upon its guide 15 the other journal-blocks 16 will be correspondingly moved upon their guides. The length of the links 20 and the pivotal points of the bars 18 are so arranged that when the inner journal-blocks 16 are moved to a point upon a level with the journals 17 all of

the journal-blocks 16 will be upon the same line, as clearly illustrated in Fig. 6 of the drawings. When the journal-blocks are in this position, they will all be at an equal distance from the axial point of the frame 4, and consequently will all have the same throw when the said frame is rocked upon its journals. It will thus transpire that all of the grate-bars having the same actuating movement will be rocked uniformly throughout the length of the grate. When it is desired to rock the upper portion of the grate-surface less than the lower portion, the links 18 are lowered, when the movement of the grate-bars will be graded from top to bottom to the extent that may be desired. The movable journal-blocks 16 are each preferably formed of a hollow body portion, as 23, which may be put in position upon the guide 15 when the block 24 is inserted between the sides of the said body portion and secured in place by means of screw-bolts, as clearly seen in Figs. 9, 10, and 11 of the drawings. This holds the said journal-blocks movably upon the said guides. The journals proper are formed, as at 25, upon the opposite sides of the said hollow body portion 23 of each of said journal-blocks 16. The journals 21, as heretofore described, are located upon one face of the said body portion. Cotter-pins may be employed to hold the links 20 upon the journals 21 and the studs 22 in the apertures of the links 18. The journals 25 are preferably two in number upon each movable journal-block, the connecting-rods 10 being preferably bifurcated to engage the same, as will be hereinafter more fully described. The inner movable journal-blocks 16, however, are each constructed with a single journal, as 26, upon one side of its frame in order not to interfere with means for raising and lowering the said movable journal-blocks, which will now be described.

The inner portions of the wings 13 13 are provided with vertical slots, as at 27, which are adapted to accommodate and guide vertically-moving racks, as 28. These racks are formed with elongated slots or recesses at their upper ends, as at 29, which engage similar journals, as 30, formed upon the sides of the inner movable journal-blocks 16. The journals 30 are preferably provided with antifric-tion-rings, as 31, to produce less friction in the frame 4. The racks 28 mesh with or engage gear wheels or pinions, as 32 33. The pinions 32 33 are mounted upon studs secured to a cross-bar 34, forming a part of the frame 4. The pinion 33 meshes with an actuating-pin-ion 35, which is secured upon the inner end of an actuating-shaft, as 36, extending through the front 6 of the furnace. By turning the shaft 36 the pinion 35 will be caused to communicate movement to the pinions 32 33, whereby the racks 28 will be moved up and down in the slots 27, and thus adjust the positions of the movable journal-blocks 16 in the frame 4. As the frame 4 has a rocking movement upon its journals 12 and as the pinion

35 is mounted upon the stationary shaft, the pinion 33 has a rocking movement with respect to the said pinion 35. Because of this movement I find it desirable to construct the pinions 35 and 33 with teeth having their edges curved, as clearly shown in Fig. 12 of the drawings. By this construction a proper shape will be given to the teeth so that the pinion 33 may rock with respect to the pinion 35 without binding or friction. In order that this may be so, I find that it is necessary to mount the said pinions so that their coinciding pitch-lines will be upon a line drawn through the axis of oscillation of the frame 4. By arranging the pinions in this manner the least movement between the same can be secured.

In order to operate the shaft 36 from the outside of the furnace, its outer end extends through the front 6 and is squared or otherwise adapted to receive an operating crank or handle, as 37, the inner end of the said shaft being supported inside the furnace-front by means of a suitable bracket, as 38. The crank or operating-handle is preferably removable from the shaft and is only placed thereon when it is desired to operate the mechanism for changing the position of the movable journal-blocks. As seen in Fig. 23, the shaft 36 projects through the furnace-front just to one side of the slide 6^a, which closes the slot through which the operating-rod 51 for rocking the frame 4 passes. The slide 6^a is constructed as described and shown in my previous application above referred to, but instead of being arranged upon the central line of the furnace is preferably moved a little to one side to accommodate the shaft 36. As seen in Figs. 12 and 23, the shaft may pass through the guide-casing 6^b of the slide in order to gain a still broader bearing in the front. In order to lock the shaft 36 against movement after it has been adjusted, I arrange a latch-lever, as 40, upon the front of the furnace, preferably pivoting it to the guide-casing 6^b, as seen in Fig. 23, the said latch or lever being provided with a projection or lug, as 41, which is adapted to engage corresponding recesses 42, formed upon a wheel, as 43, also rigidly secured to the shaft 36, just inside of the crank or handle 37. When it is desired to move the shaft 36, the latch-lever 40 may be thrown to one side and held out of engagement temporarily by means of a lug, as 44, mounted upon the front of the furnace. The crank or handle 37 may be then turned to produce the proper adjustment of the movable journals, when the latch-lever can be disengaged from the lug 44 and brought into engagement with the recesses 42 to lock the parts in their adjusted position. Inasmuch as all of the mechanism except the portion for operating the same by hand is inside the furnace, it is desirable to have a suitable indicator to show the party operating the grate the exact position to which the movable journal-blocks have been adjusted. To

accomplish this result, I secure a pinion, as 45, to the shaft 36, just inside the front 6, and pivot the pinion 46^a by a tap-bolt so as to mesh with the said pinion 45, the said pinion 46^a meshing with the teeth of a segment or quadrant 46. The shaft 47^a, upon which the segment 46 is mounted, extends through the front 6 and carries a pointer or indicator 47. This pointer is preferably provided with a slot, through which indications or words on the furnace-front may be seen. The number of teeth in the segment 46 may be so regulated with respect to the teeth of the pinion 45 that the position of the grates can be told at an instant by glancing at the said pointer 47. The position of the movable journal-blocks may be indicated by arrows, as at 48 and 49, and by the words "Level" and "Down." When the pointer 47 is brought opposite the arrow 48, the word "Level" will appear through the pointer 47 and the movable journal-blocks 16 will all be level and the grate will have a uniform movement throughout. When the indicator 47 is brought opposite the arrow 49, the word "Down" will appear through the slot in the pointer and the movable journal-blocks will be at their lowest positions and the grate-bars will have a graded action from top to bottom. Of course the parts may be locked at any intermediate point for grading the movement of the grate-bars more or less, as may be desired. It will be apparent, of course, that the pointer 47 may travel over a graduated scale upon the front 6 to communicate more accurately the position of the parts and to determine the intermediate points more perfectly.

In order to rock the frame 4 upon its pivotal point, a journal is formed, as at 50, upon the cross-bar of the frame 4. The said journal is adapted to be engaged by the inner end of an actuating-rod, as 51. This bar is preferably provided with a flattened end portion, as seen at 52 in Fig. 22, to the opposite sides of which may be clamped flat angular pieces, as 53, having journal-bearings, as 54, formed therein. The said journal-bearings after being placed over the ends of the journal 50 may be clamped in place upon the flattened portion 52 of the rod 51 by means of suitable bolts. The rod 51 extends through the front of the furnace and is secured to an actuating member 55 of a grate-rocking mechanism mounted on the front of the furnace, said member 55 being secured to the power-shaft 56. The member 55 and its connection with the operating-rod 51 are constructed precisely in the manner in which I show and describe the same in another application, filed by me on May 10, 1898, Serial No. 680,272, heretofore referred to. As this mechanism forms no part of the present invention and is claimed in my former application, it will not be necessary to further describe the same at this point. Of course it will be noted that the means for rocking the frame 4 can be

regulated to move the said frame to a greater or less extent both to give a greater feed or to throw the grate-bars back for cutting out the clinkers and ashes, as clearly seen in the said previous application.

While any suitable means may be employed for securing the connecting-rods to the grate-bars and to the rocking frame, yet I prefer to construct these rods as illustrated in Fig. 18.

In this construction the rod is preferably made round and is provided with an eye, as 63, which is adapted to engage a stud 64, secured upon the connecting-bars 8 and 9. A cotter-pin may be employed to hold the eye upon the said stud. The other end of the rod 10 is preferably screw-threaded and engages a correspondingly-screw-threaded recess formed in the end of a hooked engaging piece 65. The said engaging piece 65 is preferably formed with bifurcated hooked end portions, as 66, which are adapted to engage the journals 25 upon each side of the casings 23. Sometimes it is preferable to make the connecting-rods of flat or rectangular metal, in which case the socket formed in the hooked engaging portion 65 is preferably made rectangular to receive the same, and a pin, as 67, may be passed through the socket and the end of the rod to hold the same in place, as seen in Fig.

19. The bifurcated hooked end portions 66 are preferably held in place upon the journals by means of pins or bolts, as 68. (Seen in Fig. 18.) In order to cause all the rods 10 to move almost in the same plane, the studs 64 upon the connecting-bars 8 and 9 are preferably dropped lower and lower toward the top of the grate. Thus, as seen in Figs. 1, 2, and 3, the stud 64 upon the lowest bar 8 is near its upper edge, while the stud on the one next in front of it is dropped to the central portion thereof, and the two above this are dropped still lower. This produces a more uniform movement in the connecting-rods 10. In order to accommodate the inner movable journal-blocks to the connection of the same with the actuating-racks, each movable journal-block to which the rod is connected is formed with its journal-stud upon one side only, said stud being made longer than the studs upon the other journal-blocks. In this instance the connecting-rod instead of having a bifurcated end portion is bent or offset, so as to pass to one side of the movable journal-block, and carries a single engaging hook for engaging the journal. A cotter-pin may be used to hold the said hook in place upon the said journal.

As previously intimated, the grate-bars may be each connected separately with the operating rocking frame. As illustrated in Figs. 14 and 15 of the drawings, the rocking frame 57 may be so constructed as to accommodate a greater number of movable journal-blocks, as 58. For this purpose a corresponding number of guide-bars 59 are added to the frame 57, and the journal-blocks are all connected to the links 60 by means of the links 61.

Racks 62 are also employed and operated in the same manner to raise and lower the movable journal-blocks 58, as heretofore described with respect to the racks 28.

Where the connecting-rods, as 69, are connected directly to the grate-bars, as seen in Fig. 15, the manner of connecting the same to the connecting-bars is preferably a little different to that previously described in connection with the connecting-bars 10. As seen in Figs. 15, 20, and 21, the connecting means preferably consists of a yoke, as 70, passed over the journal on the lower edge of the grate-bar and receives a spacing-block upon the other side of the said journal for completely inclosing the same. The rod 69 passes through the yoke or clip 70 and the block 71 and is secured therein by means of wedges or pins 72 72, which are driven into suitable openings formed in the rods 69. Where the rods are round, as shown in Fig. 20, the pins are preferably inserted on a vertical line; but where the rod is flat, as seen at 73 in Fig. 21, the wedges, as 74, are inserted horizontally. By this construction it will be seen that the connection with the bars can reach up to the journal, so as not to interfere with the rocking movement of the said grate-bars. It will be noted also by reference to Fig. 15 that the clips 70 may be lengthened as they approach the upper end of the grate to drop the lower ends of the rods 69 to a suitable level with respect to the rocking frame. While I show the upper four grate-bars connected by means of a single connecting-bar, yet it will be apparent that each of the upper grate-bars could be connected separately in the same manner as the lower ones by leaving a wider dead-plate to permit the rocking frame to be moved farther away from the grate-bars without departing from the spirit of my invention. I find, however, in practice that it is just as well to connect the upper three or four bars together, as shown in the drawings.

As seen in Fig. 17 of the drawings, the rocking frame may be adapted to move only the grate-bars of a single grate-section. In this instance the frame 75 may be constructed with only one wing portion for carrying the movable journal-blocks 76. The frame 75 is pivoted in the same manner, as heretofore described, upon the journal-blocks 77 and carries the movable journals upon vertical guides 78. A rack 79 is employed to move the parts; but only one pinion, as 80, is needed, and as only one set of grate-bars are being operated the pinion 80 of course would receive its movement from the pinion 81 in the same manner as heretofore described with respect to the pinion 35. When the frame is constructed in this manner, one of the journals 77 is preferably braced with respect to the rest of the frame by means of a diagonal brace-rod, as 82. In using a rocking grate of this character there may be times when it is desirable for a short period to communicate an increasing rocking movement to the upper bars of the

grate in addition to the adjustment heretofore described. This may occur, for instance, when the fires have been banked—that is, when the feed to the grate has been stopped and the grate has been allowed to feed the fuel on the same, so as to permit air to pass above it at the upper end of the grate, and the feeding of the grate is then stopped, and in starting up the fire again it is desirable to get a sufficient quantity of fresh fuel upon the upper portion of the grate to fill up the gap formed in banking. In order to enable the movement of the grate to be so graded that the upper bars will move faster than the lower ones, I contemplate constructing the rocking frame as shown in Fig. 16 of the drawings, in which wing portions 83 are extended to a greater height near their inner ends than heretofore described and shown. This permits of the guides 84 being made longer and enables me to raise the movable journal-blocks 85 to a higher point than was necessary for the movement heretofore described. Racks, as 86, should be made a little longer to permit of this extended movement, and the slots or recesses in the same, which engage the inner movable journal-blocks 85, are made a little longer to permit of a greater range of movement between the said inner journal-blocks and the said racks. The other parts of the frame are constructed and arranged, preferably, in the same manner as heretofore shown and described, and the racks receive their movement from the pinions and the outside operating mechanism in precisely the same way. As seen in Fig. 16, when the parts are actuated so as to raise the movable journal-blocks 85 they can be carried to graduated points above the level of the point of uniform feed. The inner journal-blocks 85, being connected to the upper bars of the furnace, will of course receive a greater throw than the lower bars, which are connected to the fixed bearings in the frame 83. Of course it will be apparent that these bearings can be moved to the lower part of the frame in the same manner as heretofore described and shown for producing the desired uniform or graded movement of the rocking grate-bars.

A suitable rocking cut-out bar, as 87, is located at the lower end of the grate to bridge and control the space between the lower end of the grate-bars and the bridge-wall of the furnace. This rocking cut-out is preferably constructed in the same manner as the cut-out shown in my previous application above referred to. I do not claim its construction and operation in the present application, and it therefore needs no further description here.

It will be very evident from the above description that I am enabled by my invention to produce an inclined grate for feeding fuel which is of novel construction and possesses great utility and adaptability for the purpose of feeding fuel. It will be noted that its parts are very simple and yet strong, and that by

its construction the grate may be adjusted for a uniform feed or for a graduated feed at any time while there is a fire in the furnace, and that all the parts can be adjusted to a nicety for producing any amount of rock or graduation that may be desired for properly feeding the fuel to suit the exact circumstances and condition of the fire. My improved construction is also very superior in that it by means of the indicator upon the outside of the furnace-front enables the operator to determine the position in which the grate-bars are placed and to readjust them to suit the condition of the fire.

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

1. In a furnace, the combination with a grate made up principally of rocking grate-bars, of means for rocking the said grate-bars, means for adjusting the said rocking means, whereby the grate-bars may be given a uniform movement throughout or may have a graduated movement from one end to the other.

2. In a furnace, the combination with an inclined grate having rocking grate-bars, of a rocking frame for actuating the same, adjustable means connecting said frame with the said bars, the construction being such that the frame will be adapted to rock the said bars uniformly or with a graduated movement with respect to each other, substantially as described.

3. In a furnace, the combination with an inclined grate having rocking grate-bars, of a rocking frame adapted to actuate the same, rods connecting the said frame with the bars and means for adjustably connecting said rods to the said frame, the construction being such that upon rocking the frame a graduated or uniform movement will be given to the different portions of the said grate, substantially as described.

4. In a furnace, the combination with an inclined grate having rocking grate-bars, of a rocking frame adapted to actuate the same, the said frame carrying movable journals, means for adjusting the movable journals, rods connecting the journals with portions of the grate, and means for rocking the frame, the construction being such that the movable journals may communicate a uniform or graduated movement to the grate-bars according to their position in the frame, substantially as described.

5. In a furnace, the combination with an inclined grate having rocking grate-bars, of a frame pivotally mounted in the furnace, said frame having guide-bars, movable journal-blocks adapted to move upon the said guide-bars, means for adjusting said blocks, connecting-rods interposed between said movable journal-blocks and the grate-bars, and means for rocking the frame whereby the rocking bars may be rocked simultaneously to a uniform extent or have a graduated mo-

tion with respect to each other, substantially as described.

6. In a furnace, the combination with an inclined grate having rocking grate-bars, of a rocking frame having guide-bars formed therein, movable journals mounted upon the guide-bars, means for connecting the movable journals to a single member or arm, and means for operating the said arm or member, whereby the position of the movable journals may be regulated with respect to each other, the construction being such that the different portions of the grate-bars will be adapted to move uniformly or with a graduated action, substantially as described.

7. In a furnace, the combination with an inclined grate having rocking grate-bars, of means for rocking the said bars comprising a rocking frame pivotally mounted in the furnace, movable journal-blocks mounted in the said frame, means for connecting the journal-blocks, and means for operating the said journals, and connecting means, whereby all the journal-blocks will be moved to regulate the throw of the grate-bars, substantially as described.

8. In a furnace, the combination with an inclined grate having rocking grate-bars, of means for rocking the same comprising a rocking frame, movable journals mounted therein, a rack for raising or lowering the said journals, a pinion for engaging the said rack, and means for operating the said pinion whereby the journals are adjusted to impart different movements to the grate-bars, substantially as described.

9. In a furnace, the combination with an inclined grate having rocking grate-bars, of a frame for operating the same, said frame having supporting-journals, guides formed in the said frame, movable journal-blocks moving upon the said guides, a pivoted arm mounted upon the said frame, links connecting said arms with the said journal-blocks, and means for raising and lowering said links and journal-blocks whereby each one has a graduated movement relative to the other, and means for connecting said movable journal-blocks with different grate-bars, the construction being such that the grate-bars will be moved according to the position of the said movable journals, substantially as described.

10. In a furnace, the combination with an inclined grate and rocking grate-bars, of a pivoted frame for moving the same, movable journals mounted in the said frame, racks for raising or lowering the said journals, pinions engaging the said racks, an actuating-pinion for operating the said pinions, a shaft for rotating the said actuating-pinion, said shaft being adapted to extend through the front of the furnace, and operating means secured to the outer ends of the said shaft, the construction being such that the movable journals may be adjusted in the frame from the outside of the furnace to regulate the throw of the grate-bars, substantially as described.

11. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for actuating the same, movable journals mounted in the said frame, racks connected with said journals, a shaft having an actuating-pinion adapted to engage said racks to raise or lower the said movable journals, said shaft extending through the front of the furnace, hand-operated means secured to the outer end of the shaft, and means for rocking the hand operating mechanism to its different adjusted positions, substantially as described.

12. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for operating the same, means for connecting the grate-bars with the said frame, a shaft for adjusting the said connections to impart different movements to the parts of the grates, operating means upon the outer end of the said shaft, and an indicator mounted on the front of the furnace and actuated by the operating means, whereby the position of the grate-bars may be determined and adjusted without inspecting the interior of the furnace, substantially as described.

13. In a furnace, the combination with an inclined grate and rocking grate-bars, of a frame for actuating the same, guides formed in the said frames, movable journal-blocks mounted on the said guides, each of said journal-blocks comprising a hollow casing adapted to inclose the said guides, and journal-studs mounted thereon, means for connecting said journal-studs with the rocking grate-bars, and means for adjusting said journal-blocks, substantially as described.

14. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for operating the same, movable journal-blocks mounted in the said frame and connected with the said grate-bars, said journal-blocks comprising hollow casings adapted to receive guides formed in the frame, studs formed upon the faces of the said bearings and means for connecting all the studs with a pivoted arm, the construction being such that when one casing is moved all the other casings will be moved relatively, substantially as described.

15. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for actuating the same, movable journals mounted in the said frame connected with said grate-bars, racks connected with the said journals, pinions for operating the said racks, and a stationary pinion adapted to actuate the said pinions on the rocking frame, said stationary pinion and the one with which it meshes being provided with teeth having curved edges, whereby the frame may rock with respect to the actuating-pinion without throwing the parts out of engagement, substantially as described.

16. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for actuating the same, rods

connecting said frame with separate grate-bars, movable journals mounted upon the said frame, means for adjusting said journals, said rods being provided with engaging end portions having bifurcated hooks for engaging the movable journals and means for connecting the other ends of the said rods to the grate-bars, substantially as described.

17. In an inclined feeding-grate, the combination with rocking grate-bars, of a rocking frame pivotally mounted with respect to the said grate, movable journals mounted in said frame, means for connecting said journals with single bars, and means for adjusting the journals so as to give the bars a uniform or graduated movement, substantially as described.

18. In an inclined feeding-grate for furnaces, the combination with rocking grate-bars, of means for rocking the same comprising a frame adapted to impart a graduated or uniform feed to the said bars, rods connecting said bars with the said frame, yokes or clips adapted to engage journals upon the said bars and having openings to receive the ends of the operating-rods, and spacing-blocks interposed between the ends of the said clips and wedges for holding the connecting-rods in the said clips and spacing-blocks, substantially as described.

19. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame cooperating with the same, movable journals mounted in the said frame and connected with separate grate-bars, racks connected with said movable journals adapted to raise or lower the same, said racks being guided in slots in the said rocking frame, the upper end of the said rack being provided with an elongated slot adapted to receive a journal formed upon one of the movable journals, and pinions for actuating the said racks, the construction being such that the racks may adjust themselves with relation to the said journals, substantially as described.

20. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame connected therewith for operating the same, curved guides mounted in the said frame, movable journal-blocks mounted upon the said guides, and means for raising or lowering the said movable journal-blocks for regulating the throw of the grate-bars, substantially as described.

21. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame connected with different grate-bars for imparting the same or different movements to the same, means for rocking the said frame, said means comprising a rod having a bifurcated inner end, said rod passing through the front of the furnace, a journal upon the frame for engaging the said rod, and means outside the furnace for reciprocating the said actuating-rod, substantially as described.

22. In a furnace, the combination with an inclined grate, and rocking grate-bars, of a

rocking frame for actuating the same, movable journals mounted in the said frame, means for bringing the said journals upon the same line to impart a uniform movement to the grate-bars, and means for lowering the said journals to graduate the movement of the said grate-bars more or less with respect to each other, substantially as described.

23. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for actuating the same, movable journals mounted in the said frame, means for moving the said journals upon a level and above and below the same, the construction being such that when the journals are brought upon a level they will communicate a uniform movement to the said grate-bars and when they are moved above and below the level, they will impart a graduated feed to the grate, substantially as described.

24. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for actuating the same, movable journals mounted in the said frame and connected with the grate-bars, means extending outside the furnace for adjusting the movable journals in the frame, and an indicating means also arranged outside the furnace, whereby the position of the journals on the said frame can be determined from the exterior of the furnace, substantially as described.

25. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for actuating the same, movable journals mounted in the said frame, pinions for raising or lowering the said journals, and an actuating-pinion engaging one of said pinions for moving it, the said pinion which engages the said actuating-pinion having teeth with curved edges to permit of the rocking of the frame without interfering with the engagement of the said pinions with the actuating-pinion, substantially as described.

26. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for actuating the same, movable journals mounted in the said frame, means for moving the said journals, the construction being such that when the journals are brought upon a level, they will communicate a uniform movement to the said grate-bars, when they are moved below the level they will impart a graduated feed to the said bars with the maximum movement at the bottom, and when they are moved above the level, they will impart a graduated feed to the said bars with the maximum movement at the top, substantially as described.

27. In a furnace, the combination with an inclined grate, principally made up of rocking grate-bars, of means for rocking the said grate-bars for producing a feeding movement and a cut-out movement, means for adjusting the said rocking means, whereby the grate-bars may be given a uniform movement throughout or may have a graduated action,

and means connecting the said rocking means with an actuating-shaft outside the front of the furnace, substantially as described.

28. In a furnace, the combination with an inclined grate and rocking grate-bars, of a rocking frame for operating the same, means connecting the said bars and frame, a shaft for adjusting the said connections to impart the same or different movements to the parts of the grates, an indicator mounted on the

front of the furnace, and gearing connecting said indicator with said shaft whereby it is adapted to indicate the position of the parts inside the furnace, substantially as described.

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

WILLIAM MCCLAVE.

Witnesses:

E. T. FENWICK,

LUTHER L. APPLE.