No. 631,901. Patented Aug. 29, 1899.

W. McCLAVE.

FURNACE.

(Application filed Dec. 24, 1898.)

(No Model.) 6 Sheets—Sheet 1.

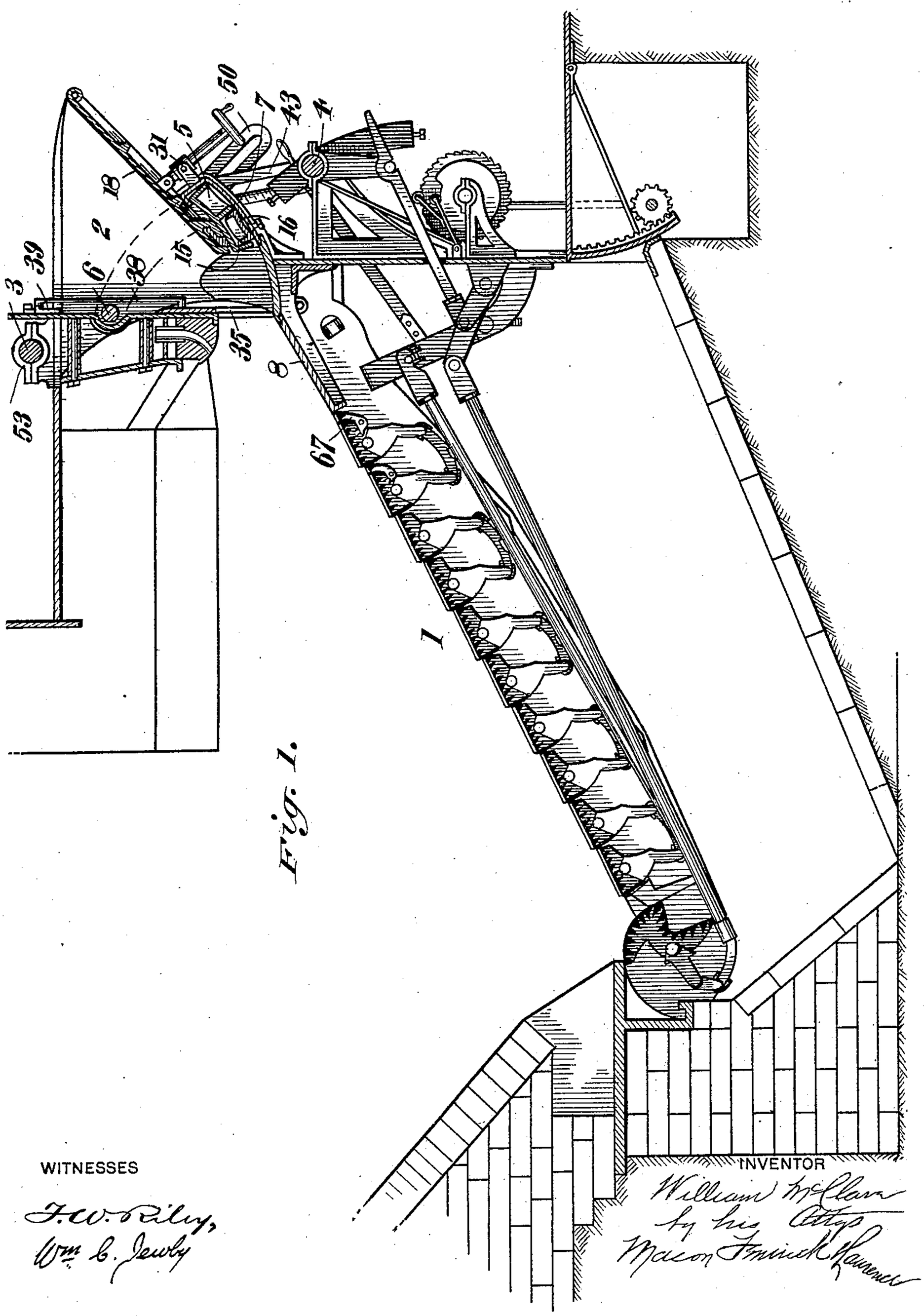

Fig. 1.

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(No Model.) 6 Sheets—Sheet 2.

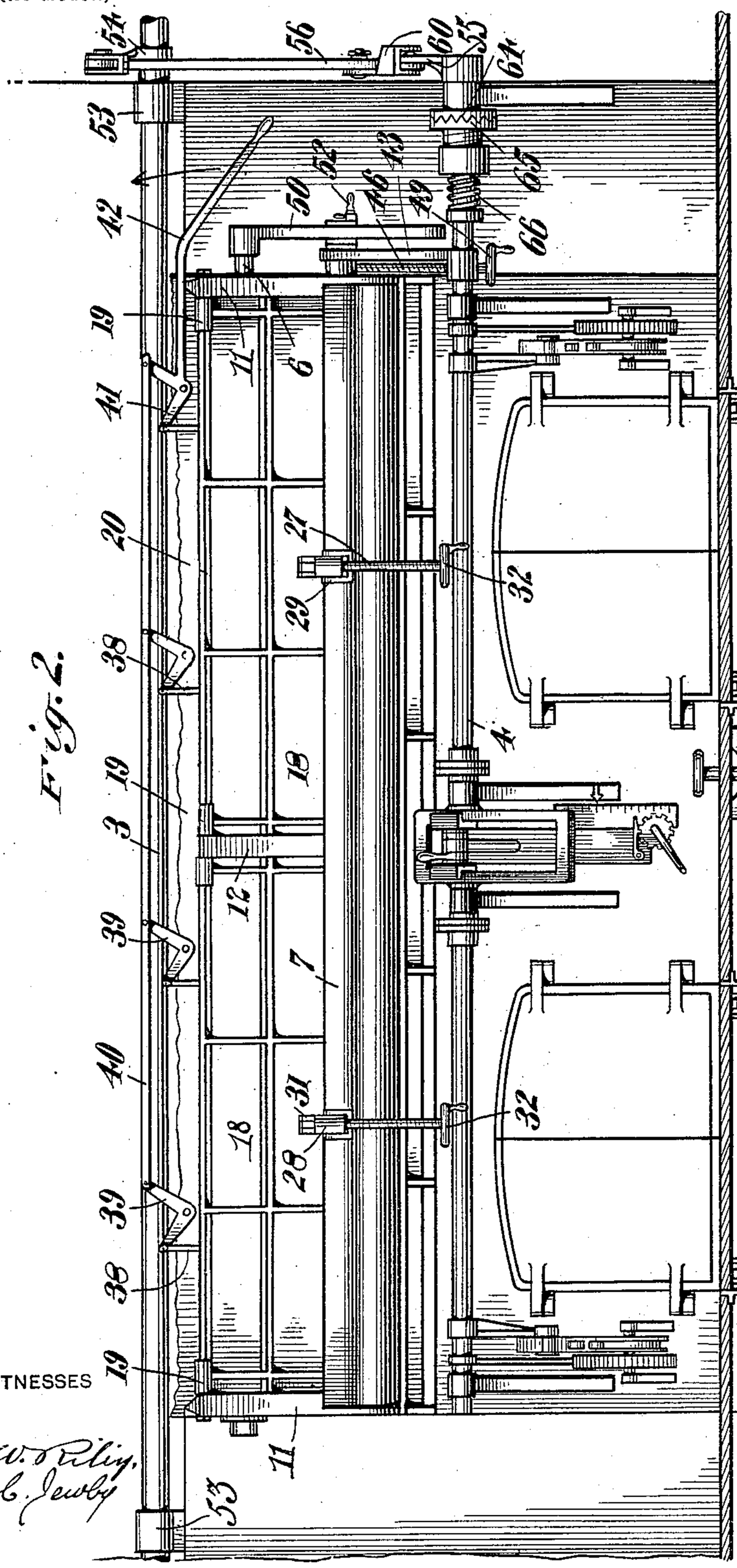

Fig. 2.

Fig. 15.

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(No Model.) 6 Sheets—Sheet 3.

Fig. 3.

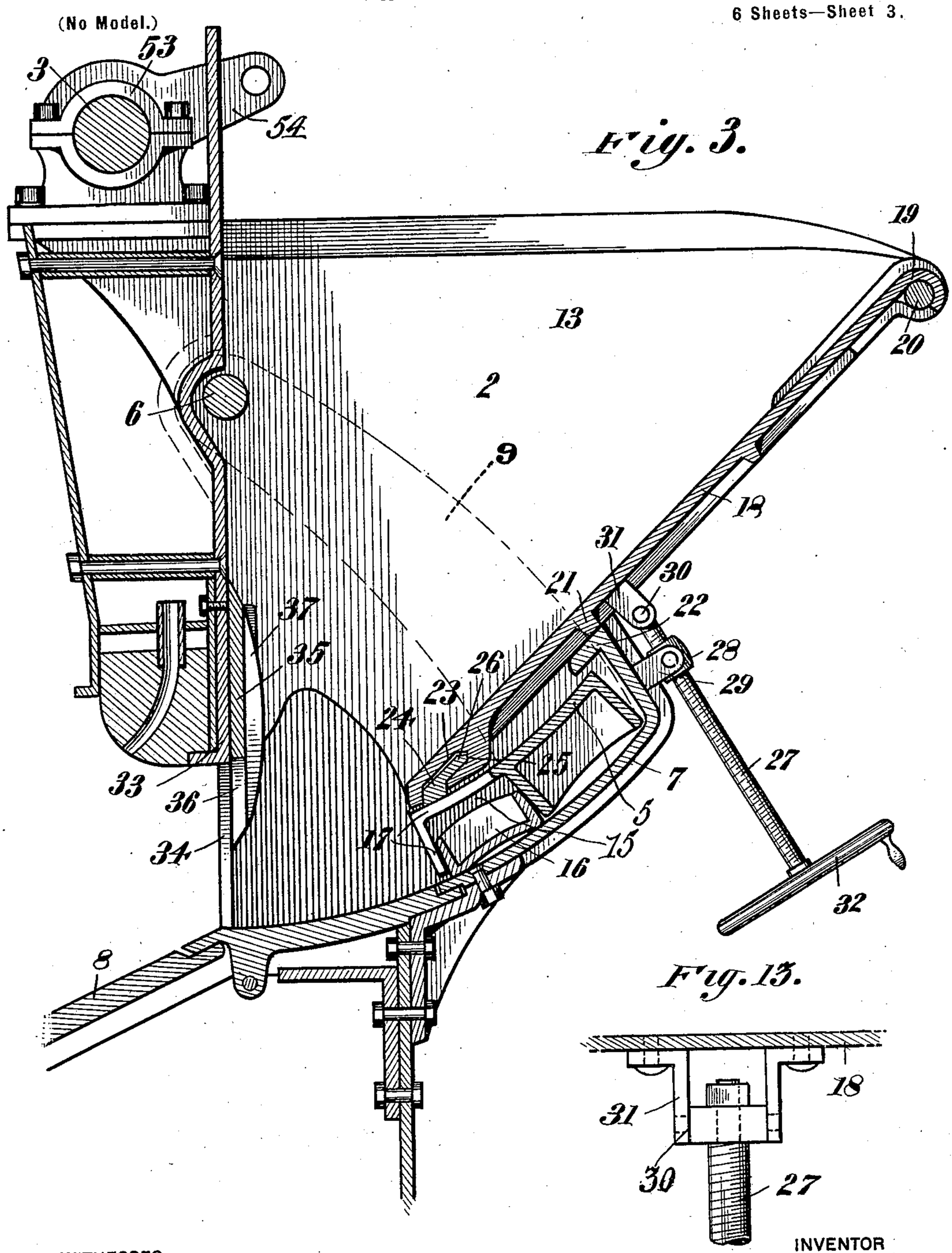

Fig. 13.

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(No Model.) 6 Sheets—Sheet 4.

Fig. 4.

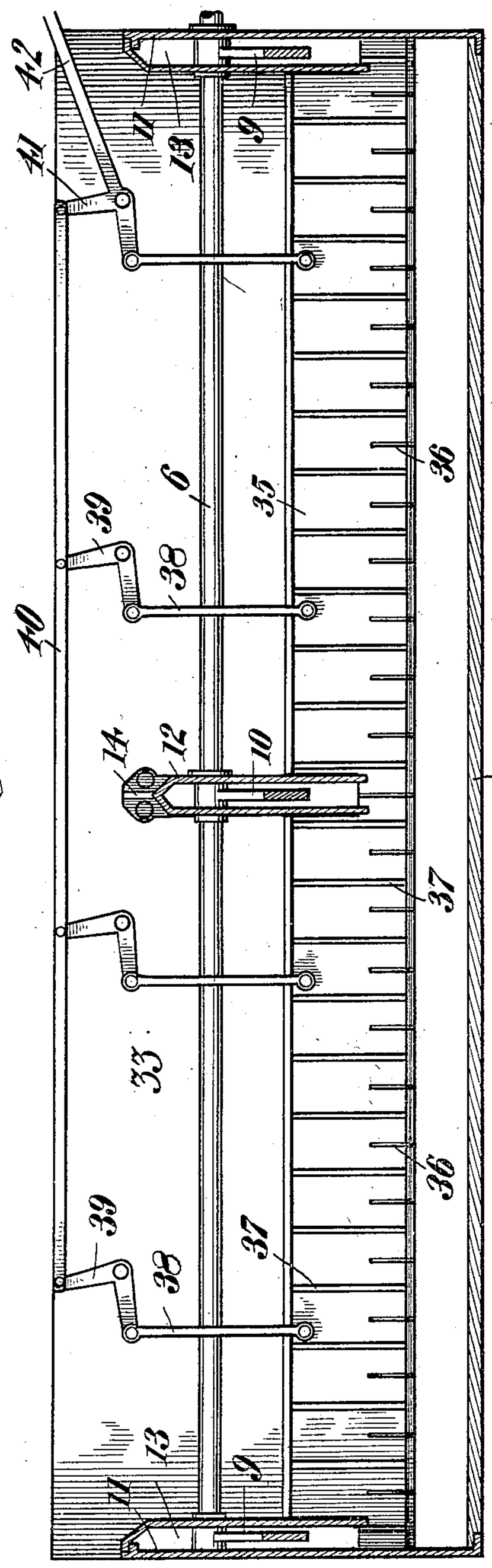
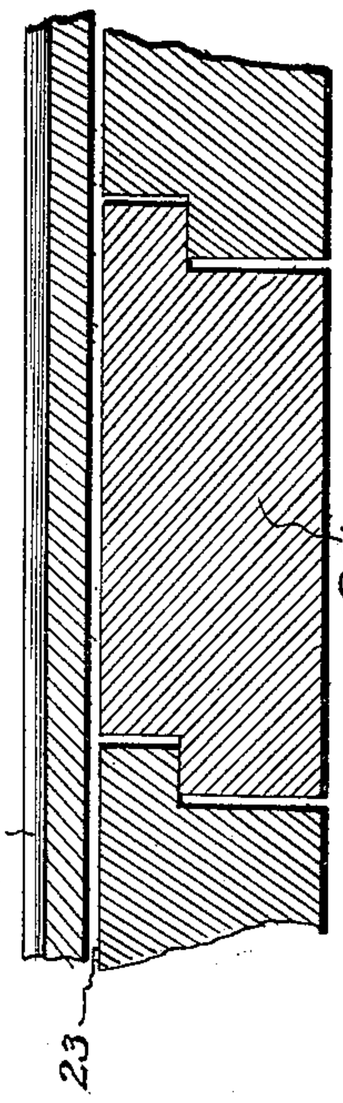


Fig. 14.



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No. 631,901. Patented Aug. 29, 1899.

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(No Model.) 6 Sheets—Sheet 5.

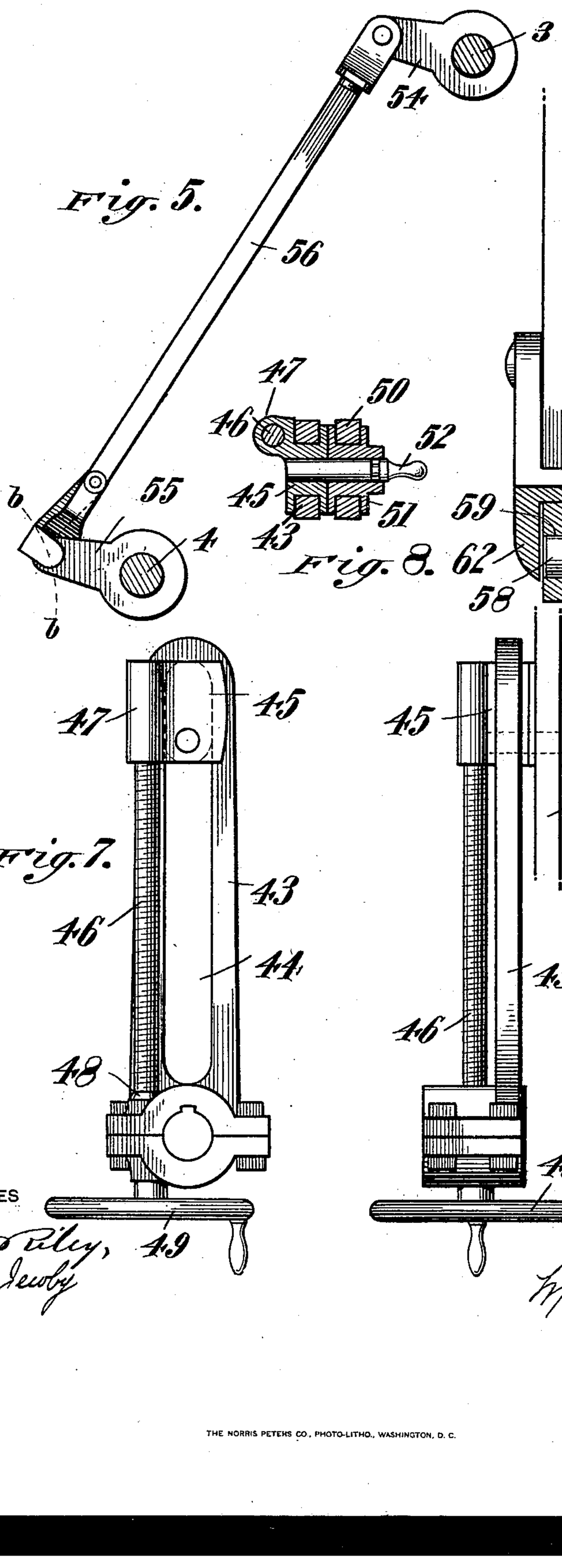

Fig. 5.

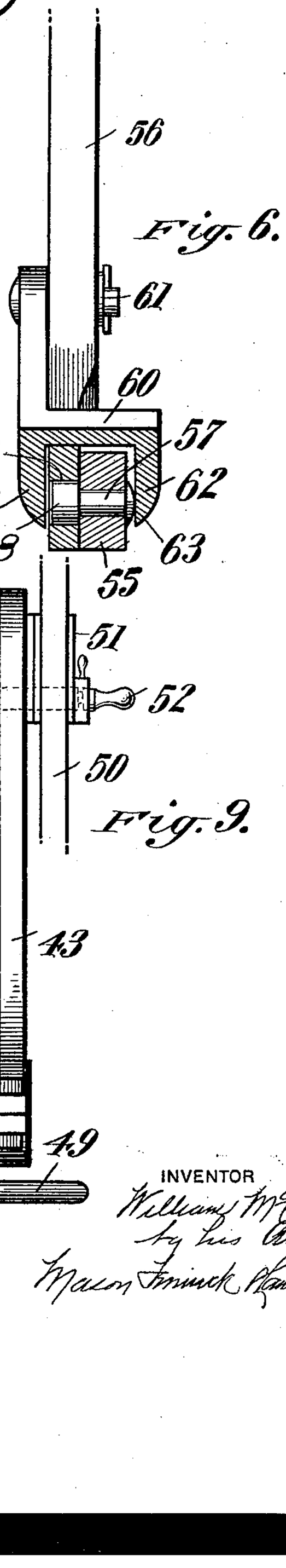

Fig. 6.

Fig. 8.

Fig. 7.

Fig. 9.

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Fig. 10.

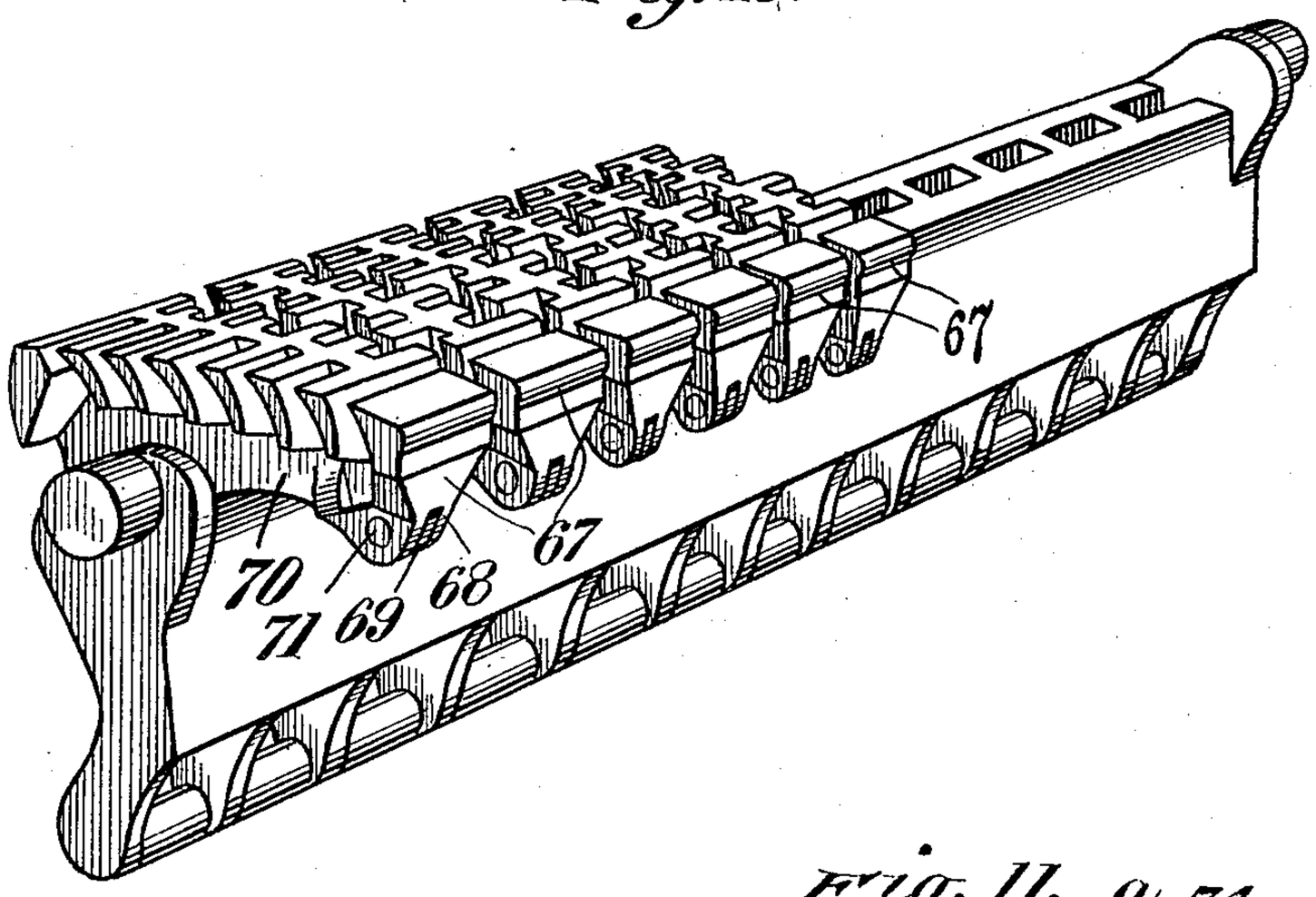


Fig. 11.

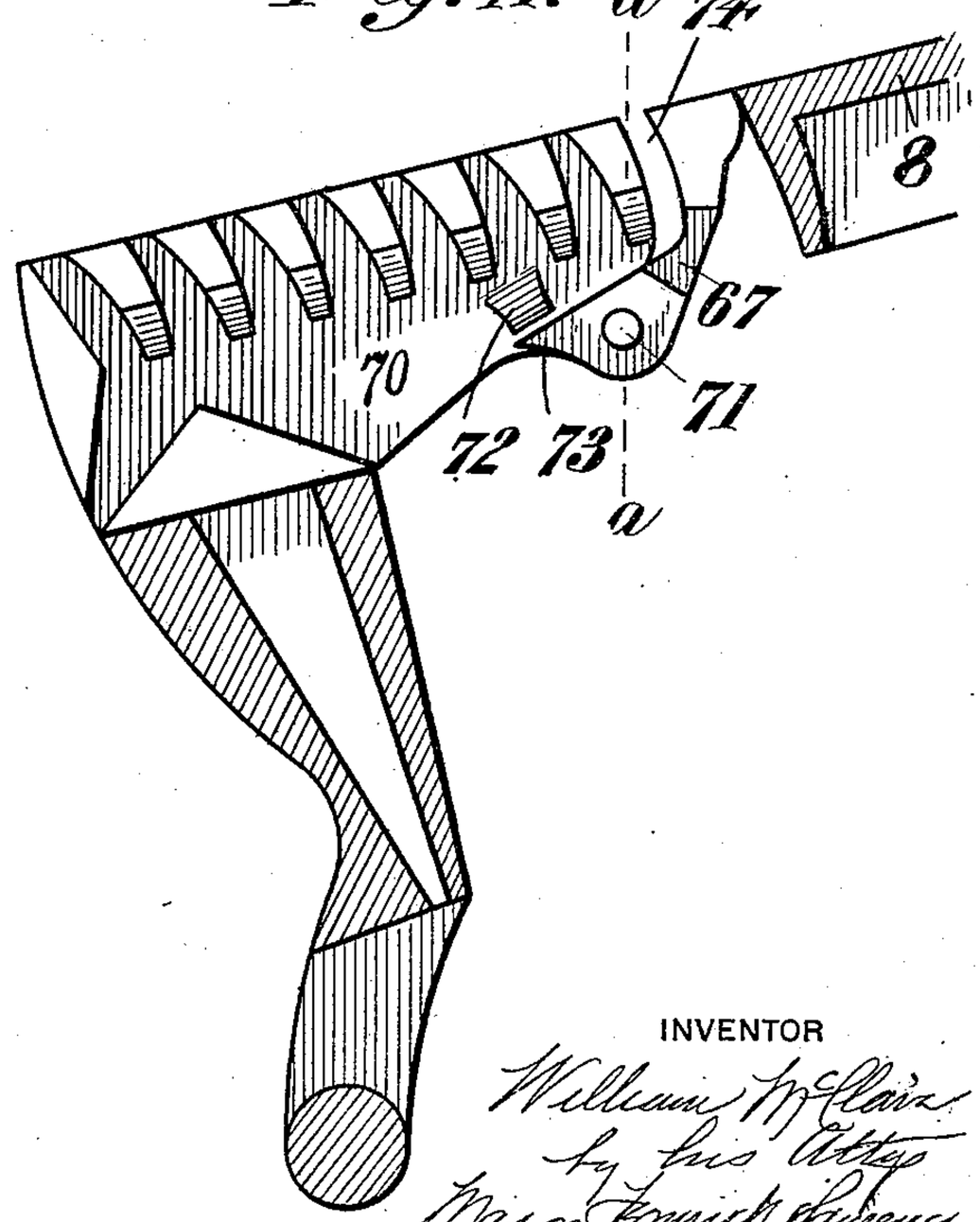
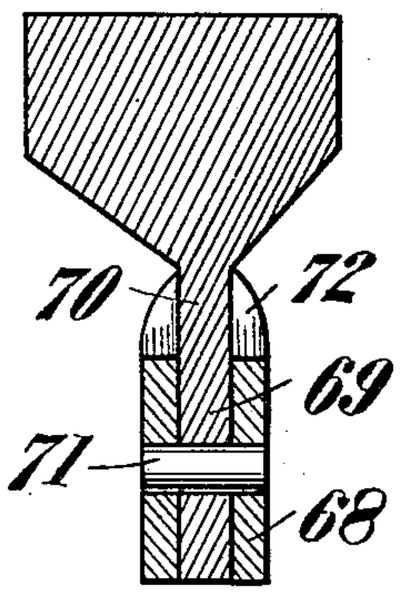


Fig. 12.



WITNESSES

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UNITED STATES PATENT OFFICE.

WILLIAM McCLAVE, OF SCRANTON, PENNSYLVANIA.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 631,901, dated August 29, 1899.

Application filed December 24, 1898. Serial No. 700,217. (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 particularly to the feeding of fuel to and upon the grates of furnaces and is especially well adapted to furnaces having inclined grates.

The objects of my invention are to provide an improved hopper or magazine and also to so construct the upper portion of the grate that fuel may be fed thereto from the hopper over the dead-plate and passed from said dead-plate onto the grate-bars without liability of the unconsumed fuel sifting down into the ash-pit between the dead-plate and the upper row of grate-bars or between several rows of grate-bars at the upper end of the grate for some distance down the incline.

My invention consists in providing a furnace having an inclined grate with a hopper for feeding fuel thereto, the said hopper having a pivoted front and a curved lower portion, means for raising or lowering the pivoted front for permitting access to the interior of the furnace on a line with the top surface of the grate for introducing fuel, and a pusher mounted in the lower portion of the hopper for forcing the fuel out upon the grate.

My invention also consists in a furnace having an inclined grate and a feed-hopper for supplying fuel to the upper end of the grate, the upper grate-bars of the grate having hinged points or noses for closing the space between them and the dead-plate and between one or more rows of grate-bars to assist in feeding the fuel farther down the grate without permitting the same to drop into the ash-pit in an unburned condition.

It further consists in a furnace having an inclined grate and a hopper for feeding fuel thereto, the said hopper having a hinged front for permitting access to the top of the grate and sliding gates adapted to regulate the size of the discharge-opening of the hopper and means for raising or lowering the same.

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

In the accompanying drawings, Figure 1 represents a vertical longitudinal section through a portion of a furnace constructed in accordance with my invention. Fig. 2 represents a front elevation of the same, parts being broken away. Fig. 3 represents an enlarged detail sectional view through the hopper. Fig. 4 represents a longitudinal vertical section through the feed-hopper and showing the gates for adjusting the discharge-opening. Fig. 5 is a detail view showing the means for connecting the power-shaft of the furnace with the main power-shaft. Fig. 6 is an enlarged detail showing the means for connecting and disconnecting the two shafts. Fig. 7 represents a side elevation of the actuating-arm for moving the pusher in the hopper. Fig. 8 is a detail sectional view through the slides in the pusher-operating arms. Fig. 9 is a front elevation of a portion of the said arm. Fig. 10 is a perspective view of one of the grate-bars, part of the teeth or leaves thereof being removed. Fig. 11 represents an enlarged detail sectional view through the upper grate-bar and the lower end of the dead-plate. Fig. 12 is a detail sectional view on the line *a a* of Fig. 11. Fig. 13 is a detail view of the upper end of the screw for adjusting the hopper-front. Fig. 14 is an oblique sectional view through the lower end of the pivoted front plate in the hopper, showing the construction of the followers carried thereby. Fig. 15 is a detail perspective view of the follower-plates employed in the hopper-pusher, showing the rabbeted construction.

1 in the drawings represents an inclined grate mounted in a furnace of suitable construction. 2 is a hopper, 3 a main power-shaft, and 4 a furnace power-shaft.

In a furnace constructed in accordance with my invention in which an inclined grate, as 1, is employed the fuel is fed to the same from the top of the grate by means of a hopper, as 2, in which I preferably use a pusher, as 5, which oscillates upon a shaft, as 6, to

which it is pivotally secured. The lower portion of the hopper 2 is preferably formed with a curved bottom, as 7, the said curved bottom extending to the top of the dead-plate 8 at its lower end and at its upper end to a point about half-way up the front of the hopper. The pusher 5 comprises a main body portion which is supported at its ends by arms, as 9 9, upon the shaft 6, and at its center by an arm, as 10, also secured to the shaft 6. The shaft 6 finds suitable bearings in the end walls 11 11 of the hopper and in a central housing, as 12. The end walls of the hopper, as illustrated in Fig. 4, are each provided with an inner lining, as 13, which forms an inclosing space in which the arms 9 may swing and prevents the fuel from obstructing the movements of the said arms. The upper edges of the linings 13 are inclined, so as to direct any fuel that might strike the same into the hopper. The central housing 12, inclosing the arm 10 of the pusher, is hollow, as seen in Fig. 4, and protects the same arm 10 from the fuel. The housing 12 is provided along its upper edge with a dividing ridge portion, as 14, which will part the fuel and throw the same into the hopper upon either side of the housing. The body portion of the pusher 5 is preferably constructed with a curved upper surface and downwardly-extending rib portions forming recesses upon its under side. The lower recess, as 15, of the said pusher is provided with a series of followers, as 16, which are loosely inserted therein and rest upon the lower curved plate of the hopper, so that in the movement of the said pusher all fuel upon the curved bottom of the hopper will be scraped or pushed from the same in front of the said pusher and cannot get to the rear of the pusher to clog its movement. The followers 16 are preferably formed in sections placed end to end in the recesses 15, extending from one end of the pusher to the other, thus forming broken lines of metal at this point. The adjacent edges of the said followers are preferably rabbeted so as to lap over one another and thereby close the spaces between them. The pushing edge of the pusher is also provided with cuts or slits, as at 17, forming broken lines of metal upon that edge of the pusher. This construction permits of the proper expansion and contraction of the metal without causing the parts to bind in their movement. As the pusher moves away from the grate, the fuel falls in front of it, and when the pusher travels downwardly it forces the fuel in front of it onto the dead-plate and the upper end of the grate. In using a feed-hopper of this kind I find that it is often desirable to gain direct access to the top of the grate from the outside of the furnace, especially when it is desired to insert wood or other materials for starting up a fire upon the grate. In order to provide for easily accomplishing such an operation I preferably form the upper portion of the hopper-front of pivoted plates, as 18. While one plate 18 might be formed to extend from end to end of the hopper, yet, as seen in Fig. 2 of the drawings, I preferably form two plates 18, each one extending half the length of the hopper. It will be apparent, of course, that I might use three or more plates for making up the front of the hopper, if desired, without departing from the spirit of my invention. Each plate 18 is preferably formed with hinges or bearings, as 19, at their upper edge which engage a rod or shaft, as 20, from which the said plates are suspended. The plates are preferably pivoted upon each side of the central housing 12 and the end walls 11 of the hopper, so as to be capable of swinging between the said housing and end walls. Each of the plates 18 may be constructed of comparatively light metal, but are preferably strengthened by means of strengthening-webs, as seen in the drawings. One of the longitudinally-arranged strengthening-webs, as 21, is so located as to meet the inturned edge 22 of the curved bottom of the hopper, thus forming a snug joint at this point when the plate is down. The lower end of each plate 18 extends preferably to a point approximately flush with the pushing edge of the pusher 5 when the said pusher is in its highest position, as seen in Fig. 3 of the drawings, the said plate thus permitting the pusher to recede below its lower end in order to permit the fuel to fall in front of it.

It is desirable to prevent any fuel getting in between the lower portion of the plates 18 and the upper surface of the pusher, and for this purpose I form a suitable recess, as 23, in the under side of the lower edge of each plate 18 and mount in the said recess a series of followers, as 24, placed end to end and preferably rabbeted into each other, so as to extend from one end of each plate to the other. These followers when the plate 18 is in its lower position rest directly upon the upper curved surface of the pusher and scrape all fuel which might rest thereon off of the top of the said pusher. Sufficient space is provided in the recess 23 to allow the followers 24 a slight movement up and down there, and thus provide for any contraction or expansion of the metal under the influence of heat. The recess 23 is extended to one side of its lower opening, as at 25, so that the followers, which are formed with a projection 26 fitting therein, will be prevented from falling out of the said recess when the plate 18 is lifted. Because of this construction it is necessary to insert the followers in the recesses 23 from the end of the plate, which can be easily done before the plate is put into position. By this construction it is not necessary for the lower edges of the plates 18 to come in contact with the pusher and increase the friction at that point, for the followers being much lighter than the plates are the only weights engaging the top of the pusher, and they are sufficient to seal the joints between the said plates

and pusher. So also because of the followers 16 the pusher may be constructed so as not to engage the lower curved surface of the hopper, thus reducing friction at this point.

In order to raise the front plates 18 upon their pivotal points, I provide each with a lifting-screw, as 27, which engages a pivoted sleeve, as 28, internally screw-threaded and mounted upon suitable projections, as 29, upon the hopper-front. The upper end of each screw 27 is pivotally connected by a swivel-joint at 30 with standard projections 31, formed upon the front of each plate 18. An operating-wheel, as 32, is preferably secured to the lower end of each screw, whereby it may be rotated. By rotating the screw 27 each plate 18 can be quickly raised to the desired height for forming the necessary opening between it and the curved bottom of the hopper to permit of sufficient access to the top of the grate. It will be observed that the opening formed by raising the front plates thus will permit access to the grate upon a plane in line with the top surface of the grate and wood or other fuel can be inserted and pushed to any point thereon without difficulty.

The lower portion of the rear wall 33 of the hopper is cut away at its lower end to form a suitable opening, as 34, through which the pusher may discharge the fuel upon the dead-plate. In order that this opening may be sufficiently large to permit easy access to the top of the dead-plate, the said opening is formed larger than I desire to have it when the pusher is automatically feeding the fuel upon the grate. In order, therefore, to restrict this opening to the desired size when in ordinary use, I mount sliding gates, as 35, upon the outer face of the hopper-wall 33. These gates, as illustrated in Fig. 4 of the drawings, may consist of plates having their lower edges provided with slots, as 36, forming thus broken lines of metal to the action of heat. These plates 35 are preferably strengthened by a series of webs, as 37, and the said plates are also formed with beveled upper and lower edges, so as to easily force their way through the fuel. The plates 35 are preferably two in number, each filling a space between the central housing 12 and the ends of the hoppers 11, the ends of the said plates being cut away to some extend to allow for the said housing and end walls. In order to raise the plates properly and easily, they are connected by means of links 38 with a series of bell-crank levers 39, which are pivoted to the wall 33 of the hopper. A connecting-bar, as 40, is attached to the upper arms of each of the bell-crank levers 39, so that they all move simultaneously and equal distances. One of the bell-crank levers, as 41, is provided with an operating arm or lever, as 42, which extends beyond the end of the hopper 2 and within easy reach of the furnace attendant. The plates 35 normally occupy their lower position, as seen in Fig. 3 of the drawings, but when it is desired to insert material beneath the raised plates 18 directly to the grate it is only necessary to take hold of the lever 42 and pull it downwardly in order to raise the plates 35 and thus completely open the hopper-outlet 34. This, it will be seen, is a quickly-operated and effective means for accomplishing this purpose. It will be noted that when the plates 35 are in their lower position the orifice left between them and the top of the dead-plate is just sufficient for the pusher to pass under it, the said pusher when in its lower position being preferably carried a little beyond the lower edge of the said plates.

The furnace-shaft 4, which is supported in suitable bearings upon the furnace-front, communicates power to the pusher in the hopper by means of an arm, as 43, which is keyed to the said shaft 4 preferably a little to one side of one end of the hopper. This arm 43 is provided with a slot, as 44, in which a slide, as 45, is adapted to move. The slide 45 may be moved in said slot by means of a screw, as 46, engaging a screw-threaded sleeve portion, as 47, formed upon the said slide 45. The said screw 46 passes through a bearing, as 48, formed upon the lower end of the arm 44, the said screw being provided at its lower end with a hand operating-wheel, as 49, by which it may be rotated. The shaft 6, to which the pusher 5 is secured, extends outside the hopper and carries an arm, as 50, which is also slotted and provided with a slide, as 51, which may move in said slot. The slide 51 may be secured to the slide 45 by means of a pivot-pin, as 52, which engages suitable bearings formed in each of the said slides and holds them in pivotal relation with each other. The pivot-pin 52 thus pivotally connects the arms 43 with the arm 50, so that any movement of the arm 43 is communicated to the arm 50, and by communicating a rocking movement to the shaft 4 an oscillating movement may be imparted to the pusher 5 in the hopper. The throw, and consequently the extent of movement, of the said pusher may be regulated by the position of the slides in the slotted arms 43 and 50, and the position of these slides can be changed at will, so as to effect the desired feed, by means of the adjusting-screw 46.

While the shaft 4 might be connected directly with any suitable source of power, yet I prefer to connect it with a main power-shaft, as 3, which may extend along the fronts of a series or battery of furnaces and be connected up with any or all of the said furnaces, as may be desired. The main power-shaft 3 is preferably to the rear of the hopper in suitable bearings, as 53, and extended to any suitable point to receive power from any source. In order to connect the shaft 4 with the shaft 3, an arm, as 54, is rigidly secured to the said shaft 3, and a similar arm, as 55, is secured to the shaft 4. A connecting-link, as 56, joins the two arms 54 and 55, being

preferably pivotally connected to each. In order that the said shafts 3 and 4 may be quickly connected or disconnected, the lower end of the link 56 is preferably provided with means which can be easily brought into engagement with the arm 55 and disconnected therefrom. As seen in Fig. 6 of the drawings, the arm 55 carries a stud, as 57, the projecting portion 58 of said stud being adapted to engage a circular opening or bearing, as 59, formed in the lower end of the link 56. This link can be easily sprung to one side, so as to engage the projection 58 or to be removed therefrom, as may be desired. In order to hold the parts in their joined position, a pivoted clamp, as 60, is secured to the link 56, as at 61, the said clamp being provided with downwardly-extending jaws, as 62 62, which are adapted to embrace the connected ends of the arm 55 and link 56. In order to prevent any friction between the said clamp 60 and the arm 55, it is preferably prevented from touching the said arm by forming the stud 57 with a rounded head, as 63, which holds the said clamp away from the arm 55. It will be readily seen that when it is wished to disconnect the shaft 4 from the shaft 3 it will only be necessary to throw the clamp 60 upwardly upon its pivotal point, when the link 56 may be sprung to one side and disengaged from the stud 57. The two shafts may be connected again as easily by reversing this operation. This construction would necessitate the rocking of the shaft 3 in order to impart the desired movement to the shaft 4. If, however, it is desired to rotate the shaft 3, it will be apparent that the upper end of the connecting-link 56 could be secured to the shaft 3 by means of an eccentric or a crank in order to impart the desired rocking movement to the shaft 4.

The power-shaft 4 in addition to operating the hopper-pusher for feeding the fuel is also connected with the rocking grate-bars through mechanism which has been heretofore described and claimed in applications previously filed by me, and in rocking a furnace of this kind it sometimes occurs that the parts of the device become clogged or caught in some way, so that unless there is an allowance made for such a contingency harm may be done to the mechanism. In order to render this impossible, I form upon the shaft a clutch device which is of such a character that under extreme pressure or clogging of the grates or hopper mechanism the shaft will be able to stand still until it is fixed. One portion of the pressure mechanism, as 64, is secured to the portion of the shaft carrying the arm 55. The other member of the clutch, as 65, is splined upon the remaining portion of the shaft 4 and is held into engagement with the portion 64 by means of a spring-tension spring, as 66. The teeth of the clutch are made so that the shaft will move as one under ordinary circumstances, and the tension of the spring is such that it requires such a clogging of the grate and hopper mechanism as to almost break the same before it will slip. It is so made, however, that the clutch members will slip by one another rather than permit of a braking strain being applied and at the same time will make so much noise as to attract the attendant's attention to the matter and will continue to make such a noise until the trouble is rectified or until the link 56 is thrown out of engagement.

In feeding fuels to the furnace, especially fine fuels or fuels in which coarse and fine are mixed together, it is desirable to provide some means whereby the fine portion of fuel will not sift through the upper edge of the grate but help to feed it on down the grate-surface. For this purpose I preferably construct the fingers of the upper grate-bars with pivoted end portions or noses, as 67. As seen in Fig. 10, these pivoted ends 67 are provided with bifurcated lower ends, as at 68, which surround a downwardly-projecting portion 69 of the web 70 of each finger. A pivot-pin is passed through these parts, as at 71, to thoroughly hold the said ends or noses in place. Side limiting-lugs, as 72, are formed upon the webs of each finger, preferably upon each side thereof, and engage the projecting end portions 73 of the pivoted noses. A grate-bar constructed in this manner and located next to the dead-plate 8, as shown in my drawings, will when rocked move up and down with respect to the said dead-plate, so that the pivoted ends or noses just touch and scrape the inner curved surfaces of the said dead-plate, as clearly seen in Fig. 11 of the drawings. By this construction I am enabled to close the space between the finger ends of the grate-bar and the dead-plate, so that fine fuel cannot sift through the same. If the grate-bars are not thus constructed, a space would have to be left between the said bars and the dead-plate in order to allow for the expansion of the metal under the influence of the heat, and it would be impossible to move the grate-bars in connection with the dead-plate if the tips or ends of the fingers were made solid with the body portion of the finger. By my improved construction, however, the space can be completely closed and sufficient space for the expansion of the metal can be left between the pivoted finger and the remaining portion of the finger, as at 74. The fuel is more apt to fall between two moving parts than between the interstices of an integral part or parts that move together. Hence by closing the space between the stationary dead-plate and the moving gate-bar the fuel is practically prevented from running through at this point. It may be found necessary also to construct the second grate-bars in the same manner as the first, as the fuel does not begin to be thoroughly ignited and caked together until it gets part way down the grate. Of course after the fuel has become more or less burnt it cakes more and it is not usually neces-

sary to employ such a construction near the lower part of the grate. As shown in the drawings, I preferably apply it to the two upper grate-bars, but may use it upon only one or all, if I desire, without departing from the spirit of my invention.

It will be seen that all the parts which have now been described contribute toward the introducing and feeding of fuel in an effective manner upon an inclined grate and the preventing of the liability of fine fuel to run through the grate before it has become ignited and more or less caked.

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 an inclined grate, of a hopper for feeding fuel thereto, the front of the hopper being formed with a stationary curved lower portion, a plate or plates forming the upper portion pivoted at the top thereof, means for changing the angle of said plate or plates, with respect to the pivoted end or ends of the same, and an oscillating pusher which works within the stationary curved lower portion of the hopper, whereby easy access to the grate may be obtained by forming an opening between the pivoted plate or plates and the oscillating pusher, substantially as described.

2. In a furnace, the combination with a suitable grate, of a hopper for feeding fuel thereto, the hopper being formed with a stationary curved lower portion, a pivoted plate forming the upper front wall of the hopper and pivoted to the top thereof for permitting access to the grate for introducing kindling from the stationary curved portion, means for raising and lowering said pivoted front and supporting the same in various adjusted positions and an oscillating pusher operating beneath the said pivoted plate and within the said stationary curved portion, substantially as described.

3. In a furnace, the combination with a grate, of a hopper for feeding fuel thereto, the said hopper having a curved bottom, an oscillating pusher mounted in the said hopper, means for closing the joint between the pusher and the curved bottom of the hopper, a pivoted plate forming the front of the hopper, the lower end of the said plate when in its lower position engaging the oscillating pusher, and means for oscillating the said pusher whereby fuel may be forced upon the grate, substantially as described.

4. In a furnace, the combination with a grate, of a hopper, for feeding fuel thereto, the said hopper having end walls and a central partition or housing, the said end walls and the partition being hollow and adapted to inclose the supporting-arms of a pusher, an oscillating pusher secured to the said arms, and means for oscillating the said pusher for forcing the fuel out of the hopper, substantially as described.

5. In a furnace, the combination with a grate, of a hopper for feeding fuel thereto, the said hopper having a curved pusher mounted in said hopper and pivotally supported so as to move along the surface of the curved bottom, a pivoted front mounted in the hopper extending down into close proximity to the said pusher, followers mounted in the said recesses in the lower end of the said plate and engaging the upper surfaces of the pusher for keeping the fuel from getting between the said pusher and plate, and followers mounted in the pusher for preventing the fuel from getting beneath it, substantially as described.

6. In a furnace, the combination with a grate, of a hopper, for feeding fuel thereto, a swinging pusher mounted in the said hopper, means for operating the said pusher comprising a power-shaft mounted outside the furnace-front, an arm secured to the said shaft, an arm secured to the shaft of the pusher, slides moving in both of these arms, and means for pivotally connecting them, a screw mounted upon one of said arms and engaging one of the slides, and means secured to the said screw for rotating it whereby the slides will be adjusted to regulate the feed of the pusher, substantially as described.

7. In a furnace, the combination with a hopper, of a pusher mounted therein, means for oscillating the said pusher comprising a rock-shaft mounted outside the furnace-front, a slotted arm secured thereto, a slotted arm secured to the pusher, slides mounted in each of the said slotted arms and a pivot-pin for connecting them, a screw mounted upon the power-shaft arm and engaging a sleeve upon one of the slides, and a hand operating-wheel secured to the said screw whereby the slides may be adjusted in the slots to vary the swing of the pusher, substantially as described.

8. In a furnace, the combination with a rocking grate and a hopper, of a rocking shaft for operating the same, a main power-shaft mounted above the hopper, an arm secured to the rock-shaft, a link detachably secured to the said arm, a spring-pressed clutch mounted upon the rock-shaft, the construction being such that if the grate or hopper mechanism become clogged the clutch will permit the rock-shaft to stop and at the same time make sufficient noise to attract attention, substantially as described.

9. In a furnace, the combination with an inclined grate having rocking grate-bars and a hopper for feeding fuel to the said grate, of means for passing the fuel thus fed down the surface of the grate without permitting it to run through, comprising grate-bars having pivoted tips or noses, the said noses occupying the space between the upper grate bar or bars and the dead-plate or between the grate-bars, substantially as described.

10. In a furnace, the combination with an inclined grate having rocking grate-bars, and a hopper for feeding fuel to the said grate, of means for passing the fuel thus fed, down the surface of the grate without permitting

it to run through, comprising grate-bars having pivoted tips or noses, the said noses occupying the space between the upper grate bar or bars and the dead-plate or between the grate-bars, said pivoted noses having bifurcated lower portions pivoted to the webs of the fingers, and lugs upon the said fingers for limiting the movement of the pivoted ends, a sufficient space being left between the pivoted ends and the body portion of the fingers to permit of the expansion of the fingers, substantially as described.

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

WILLIAM McCLAVE.

Witnesses:

JOHN L. FLETCHER,

EDW. H. JONES.