

No. 713,969.

Patented Nov. 18, 1902.

P. L. CROWE.

TRAVELING GRATE FOR FURNACES.

(Application filed July 8, 1901.)

(No Model.)

4 Sheets—Sheet 1.

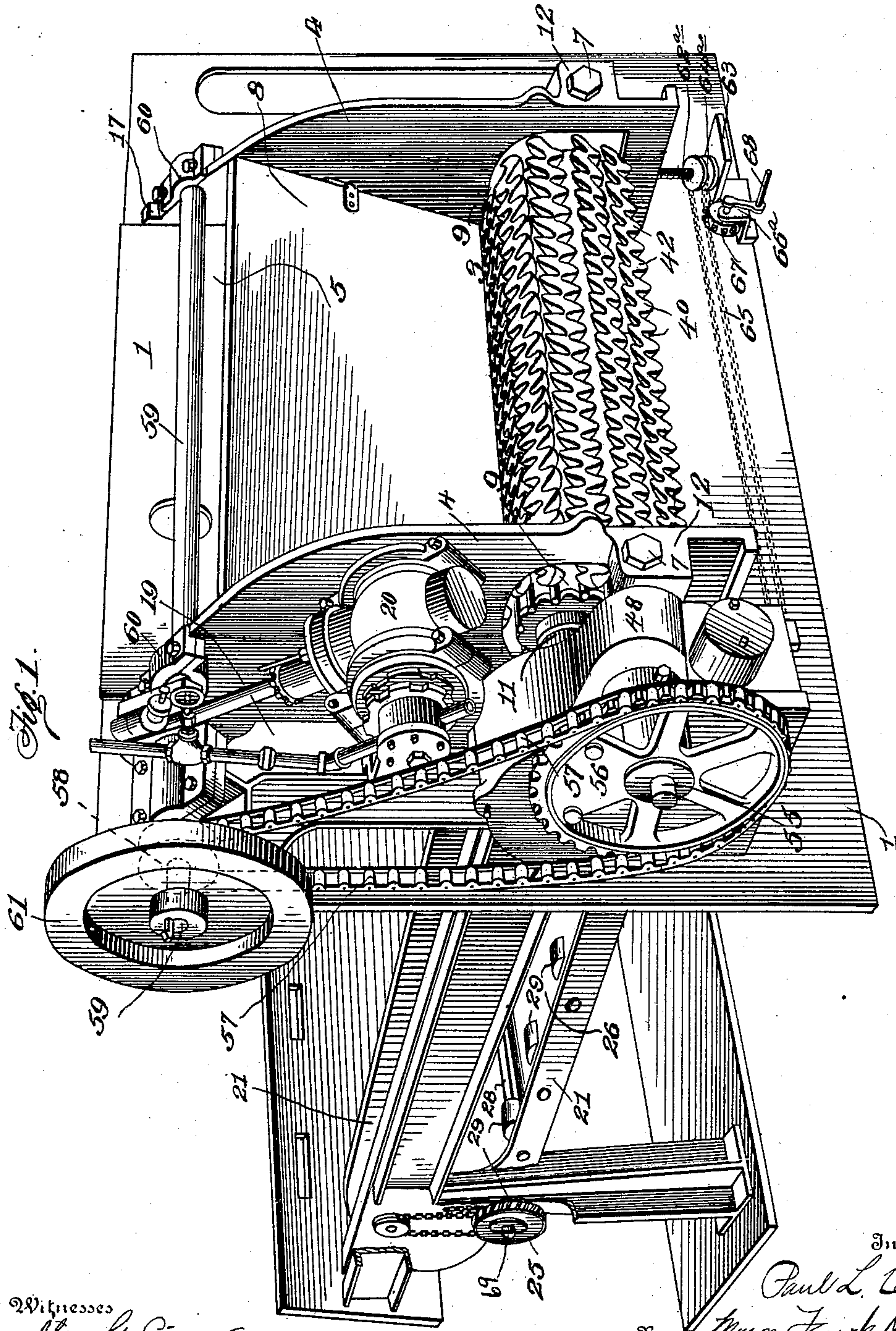


Fig. 1.

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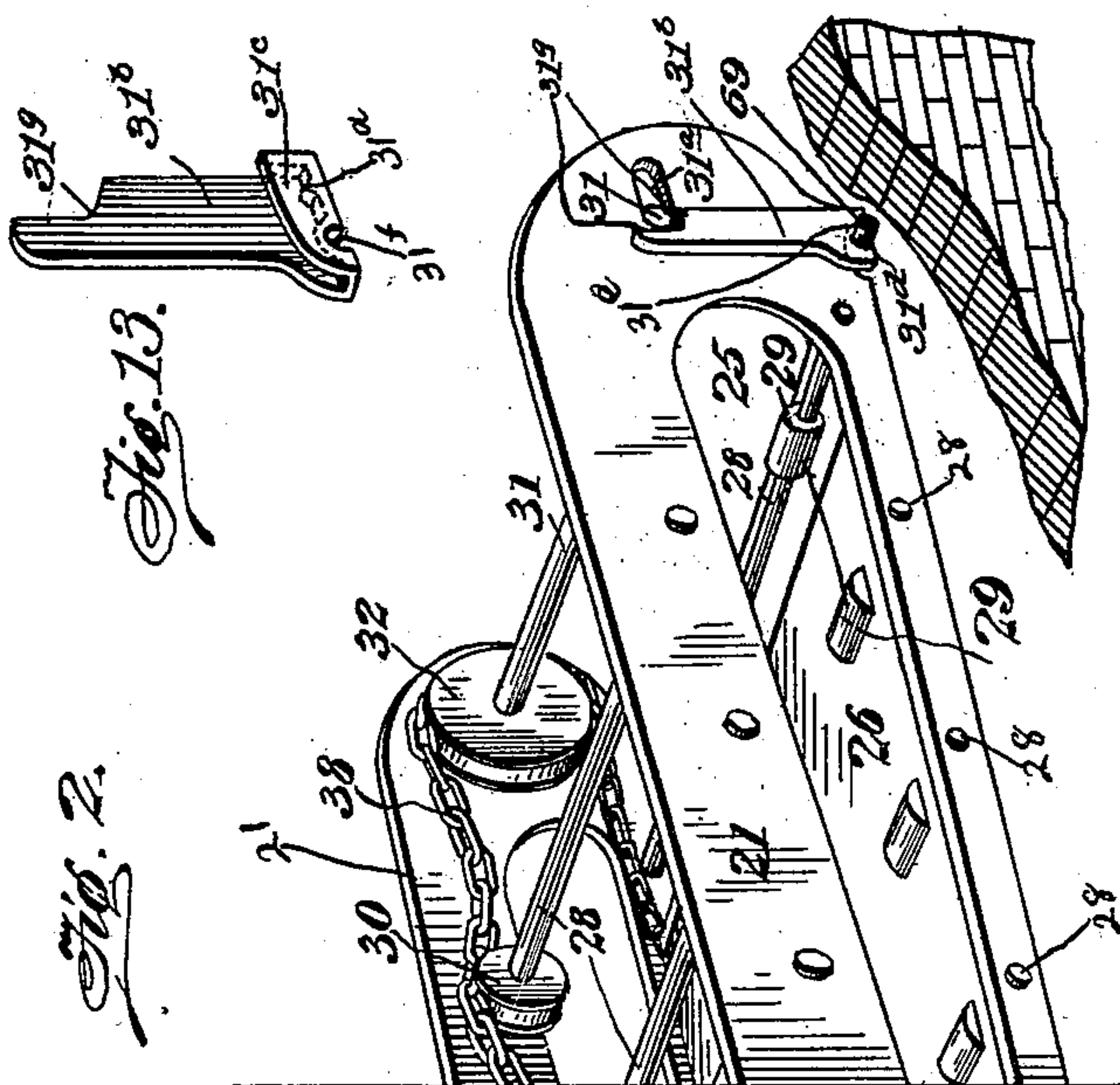


Fig. 11.

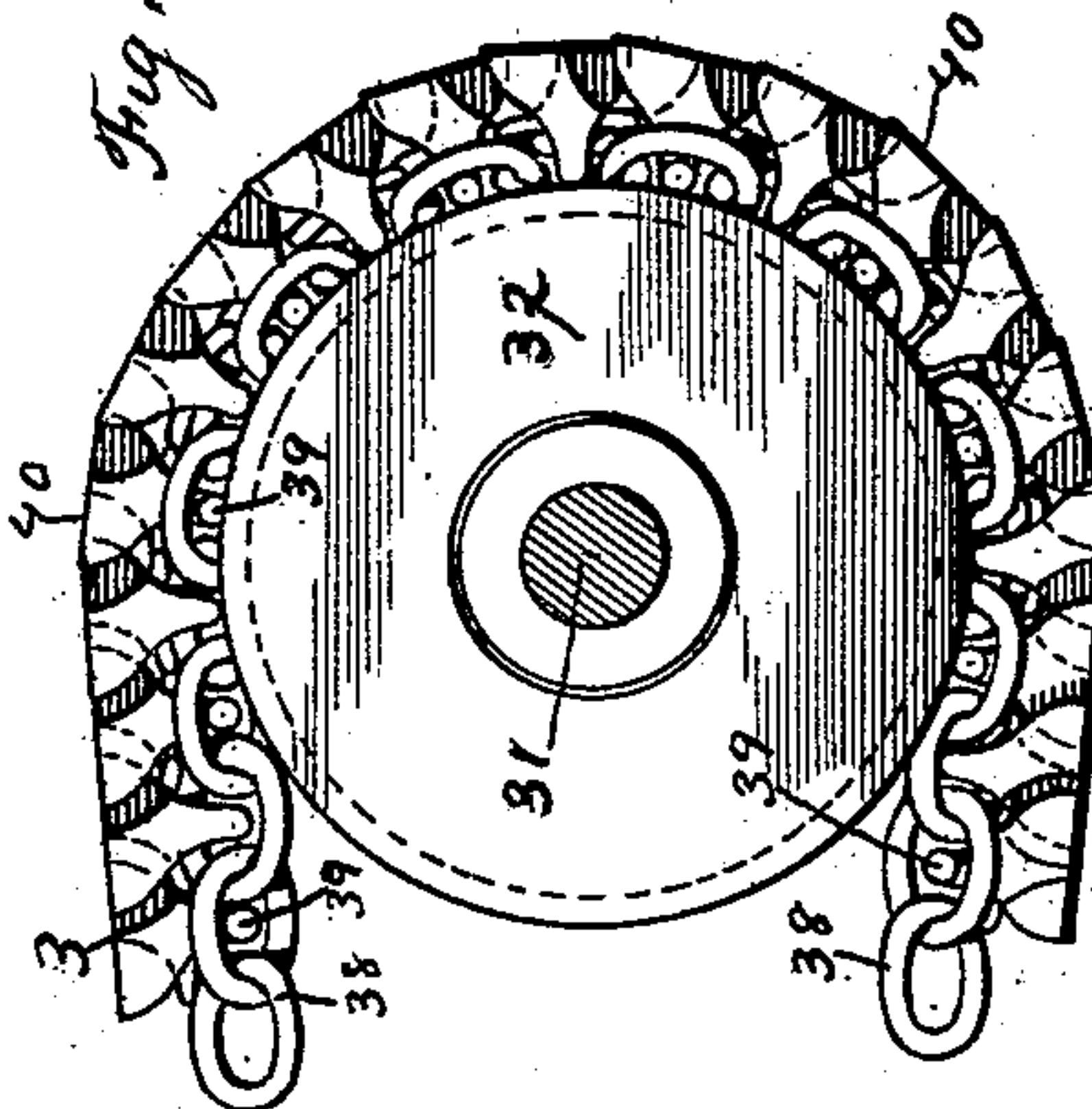


Fig. 2.

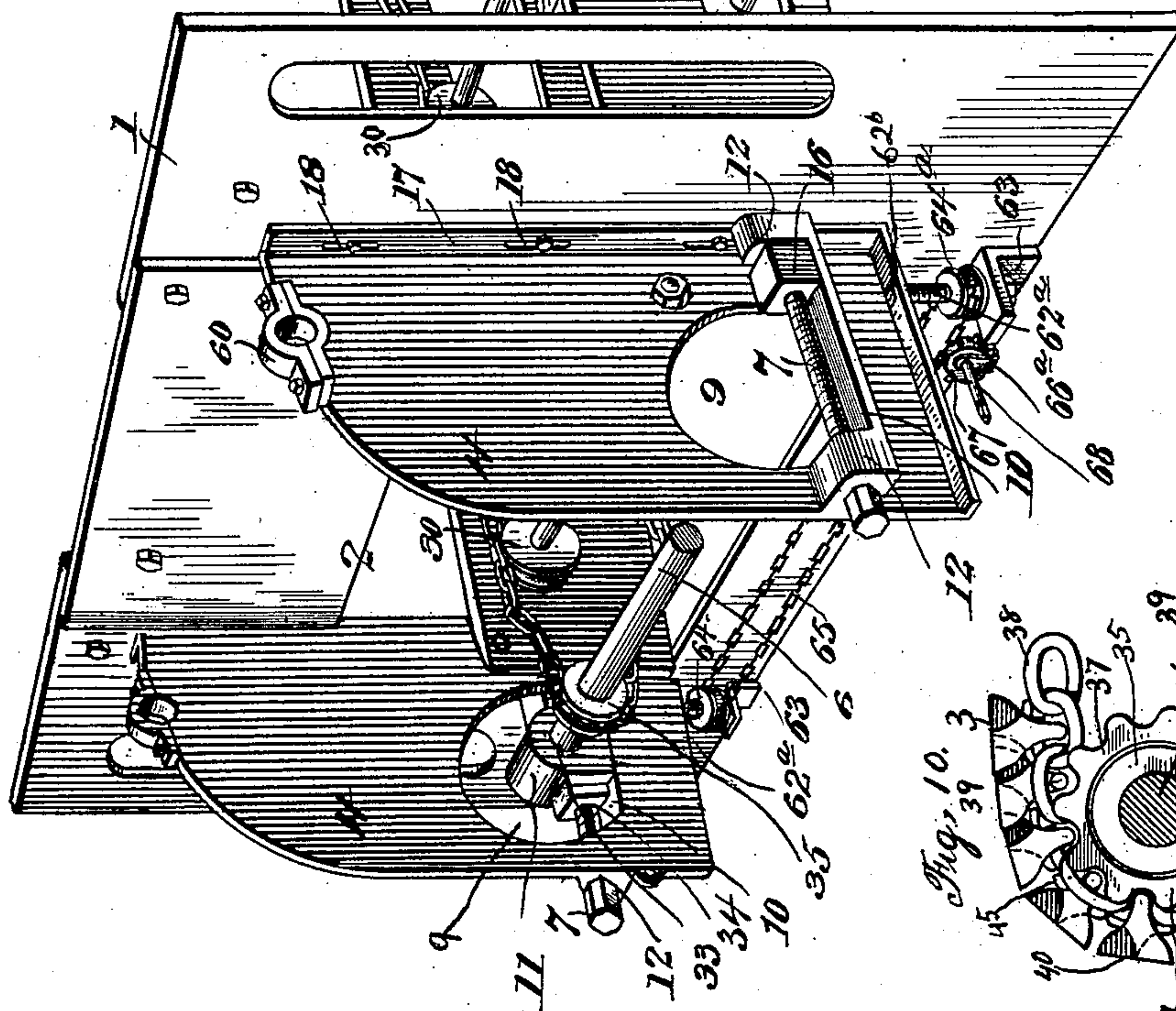
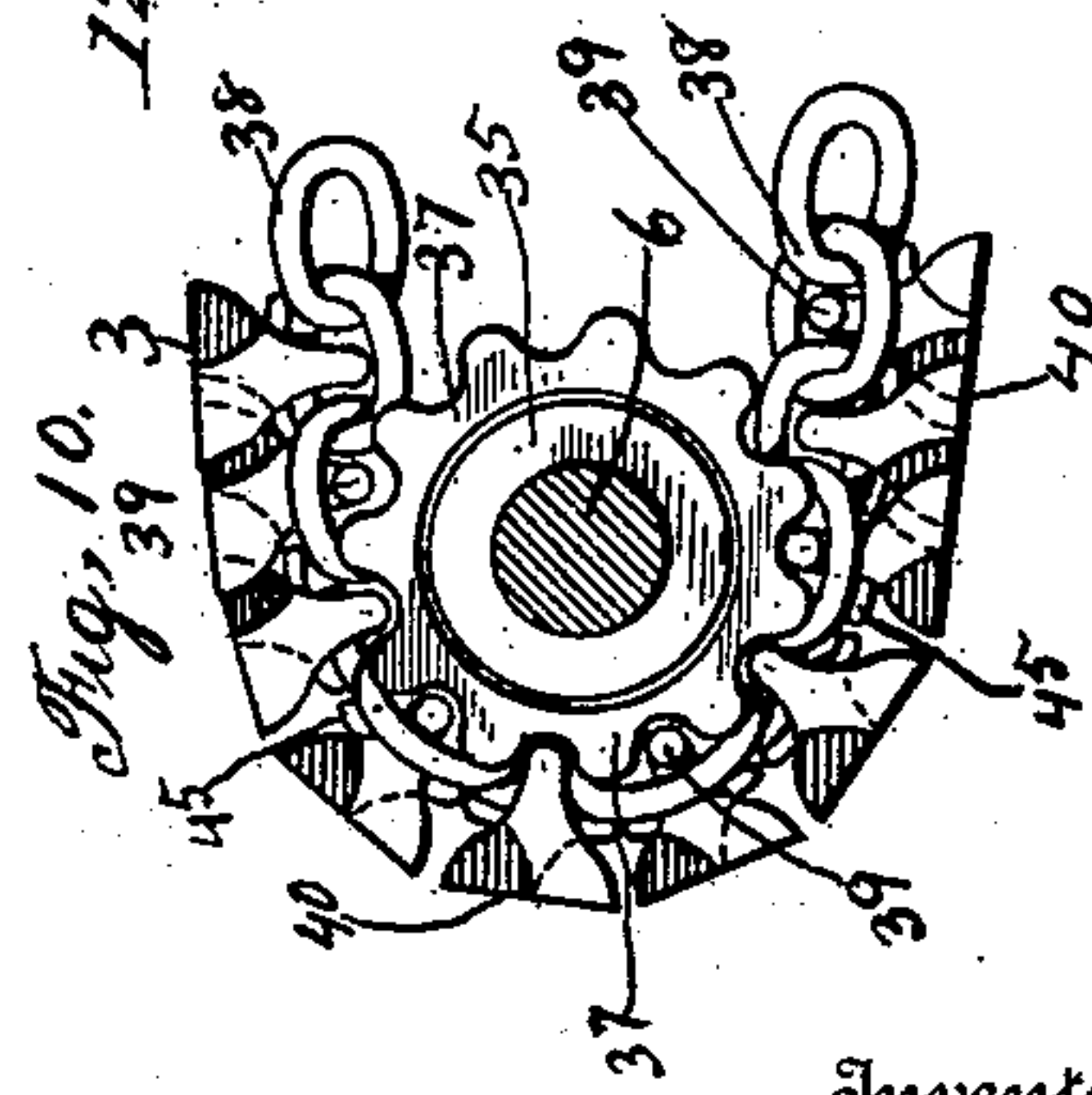


Fig. 10.



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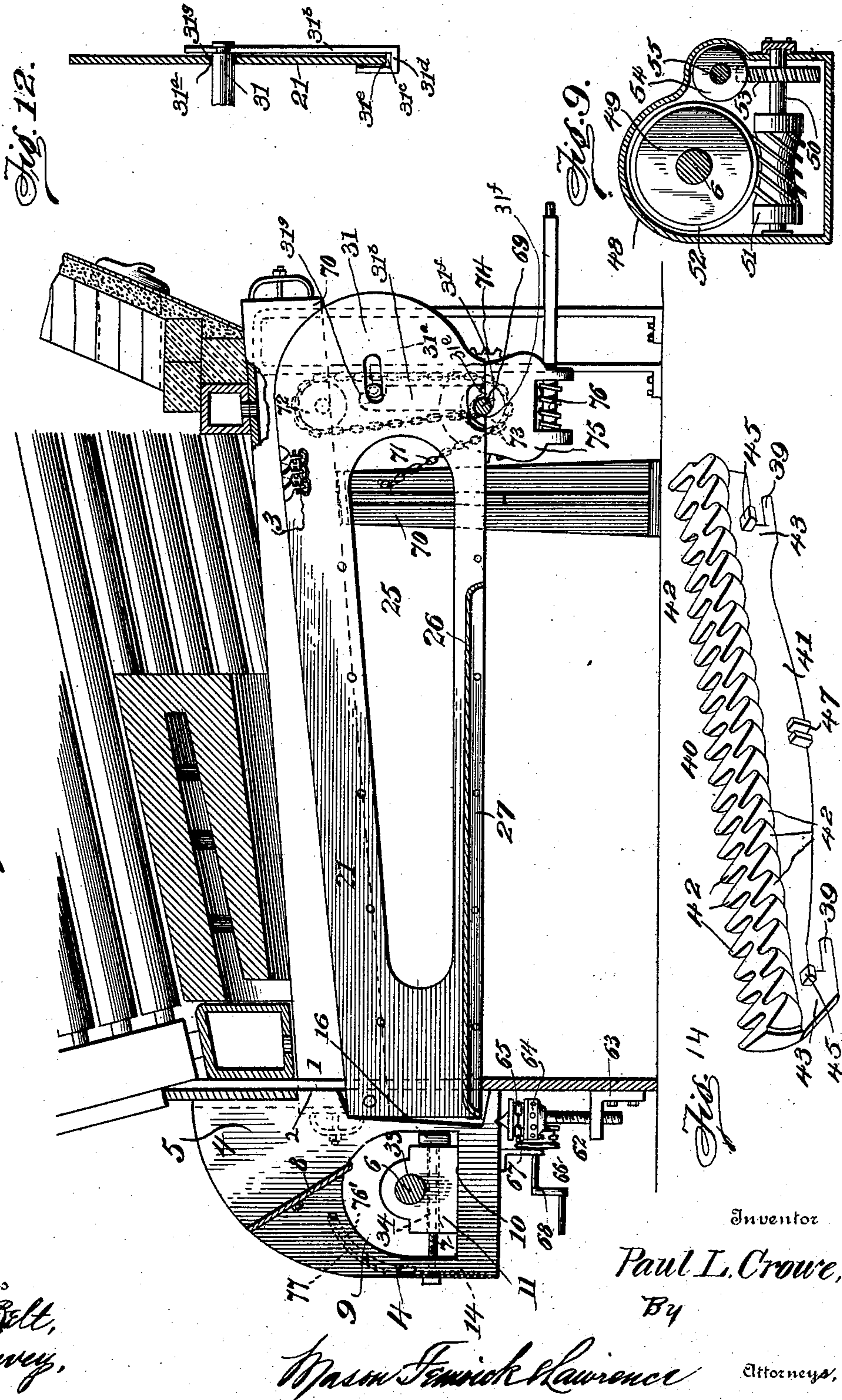
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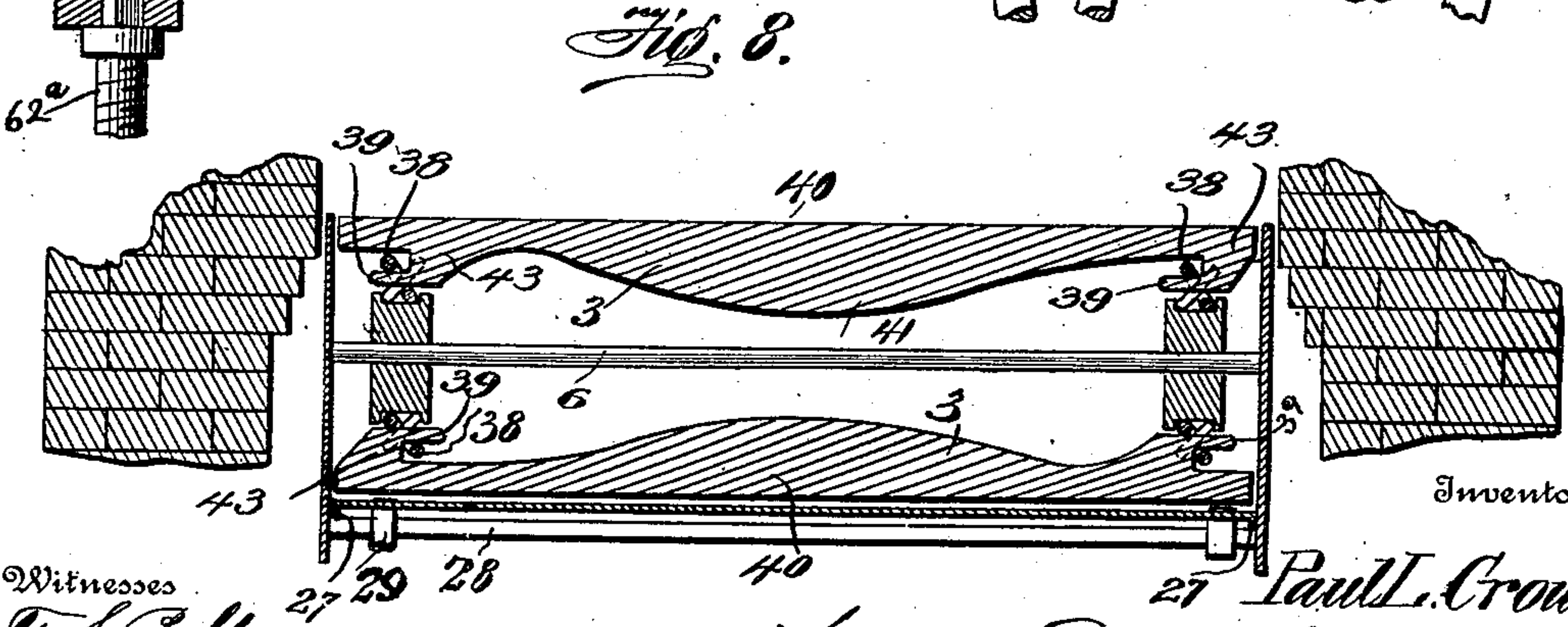
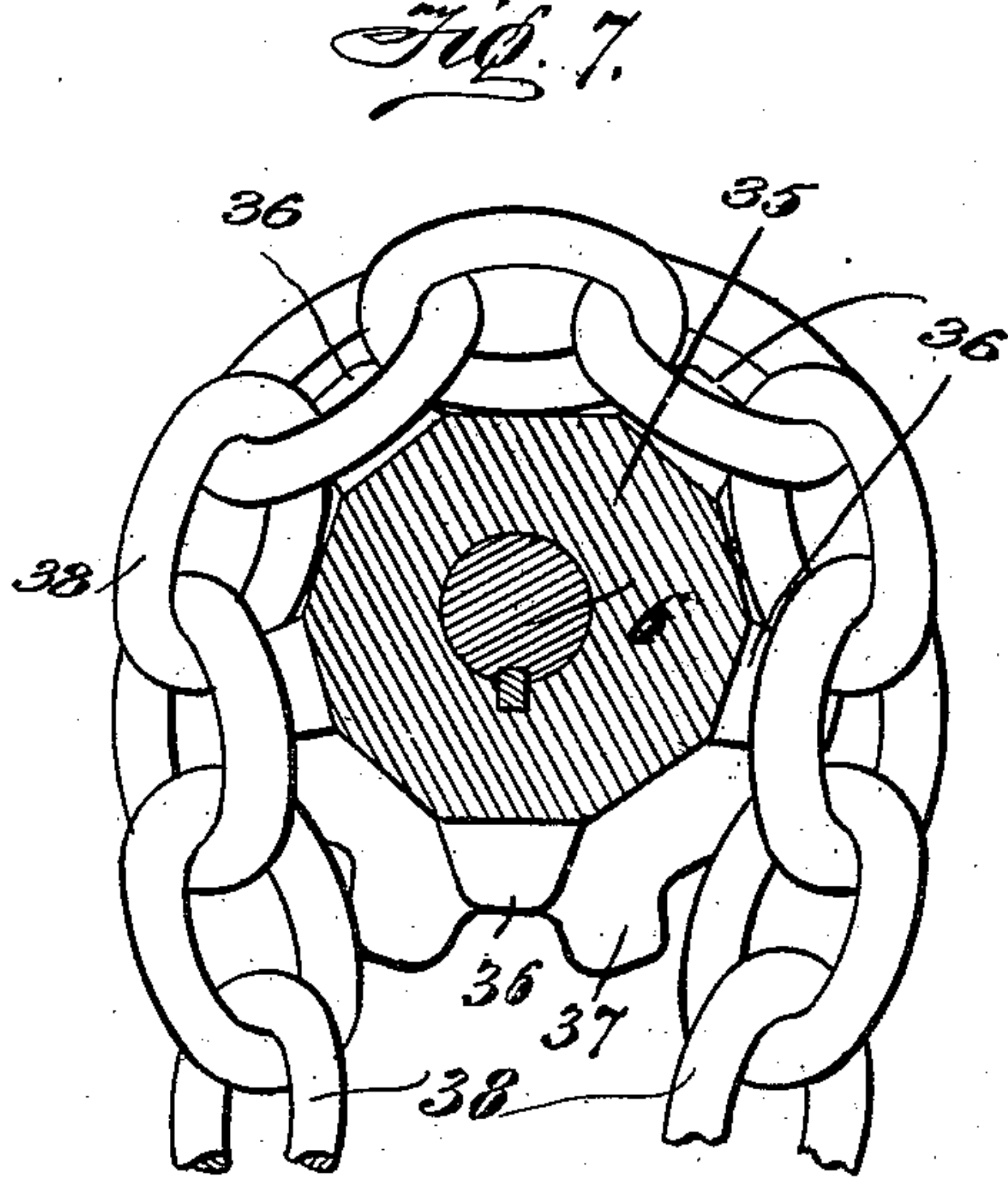
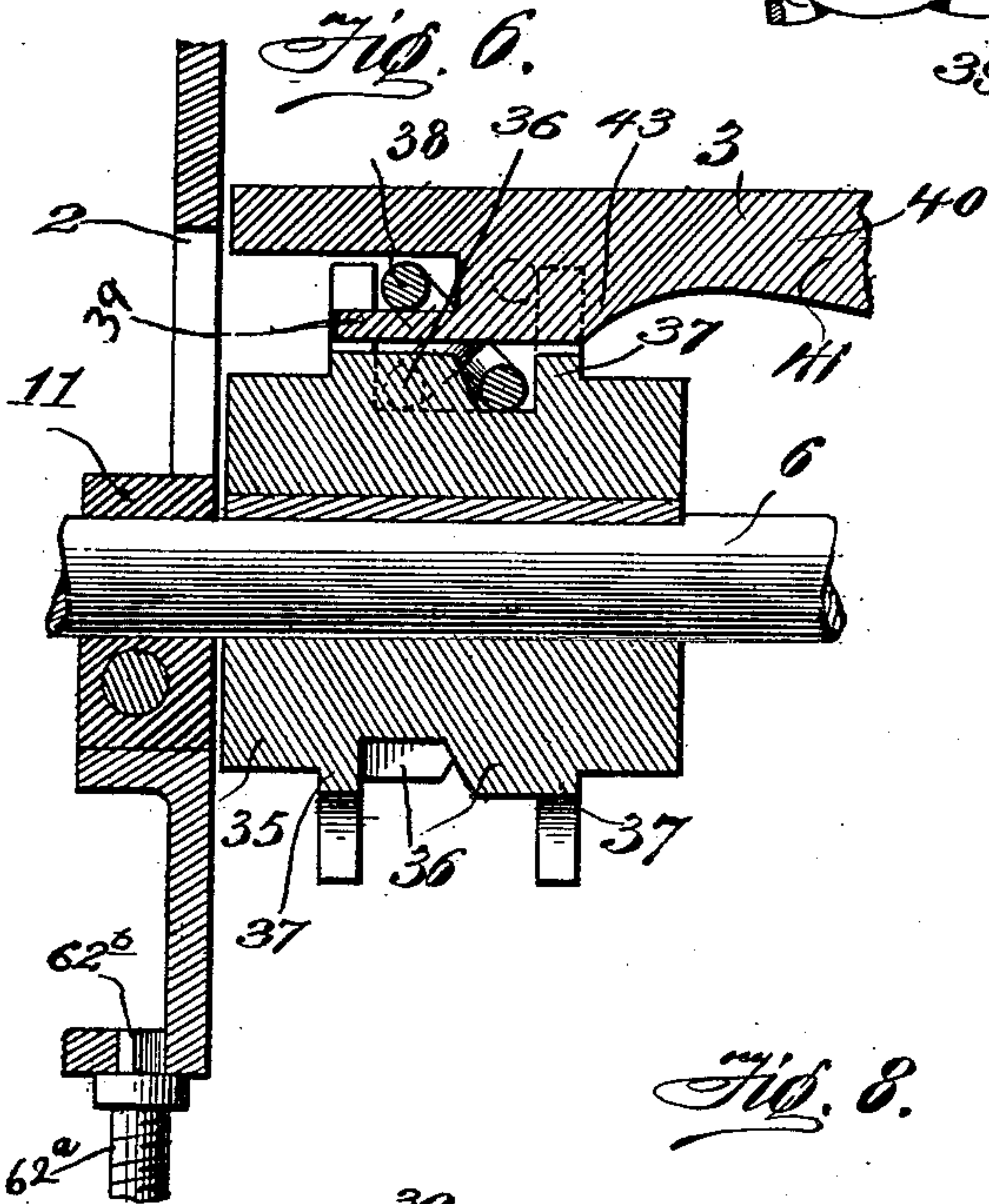
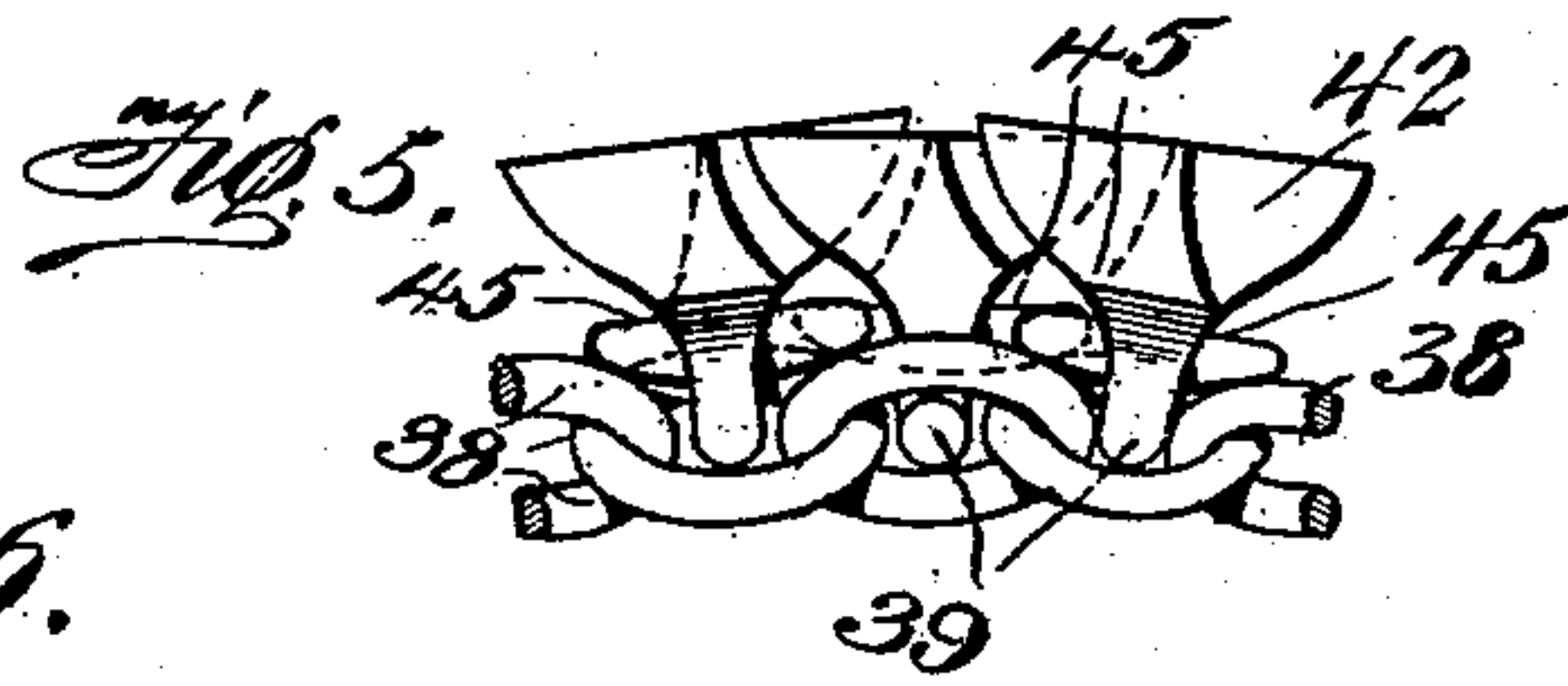
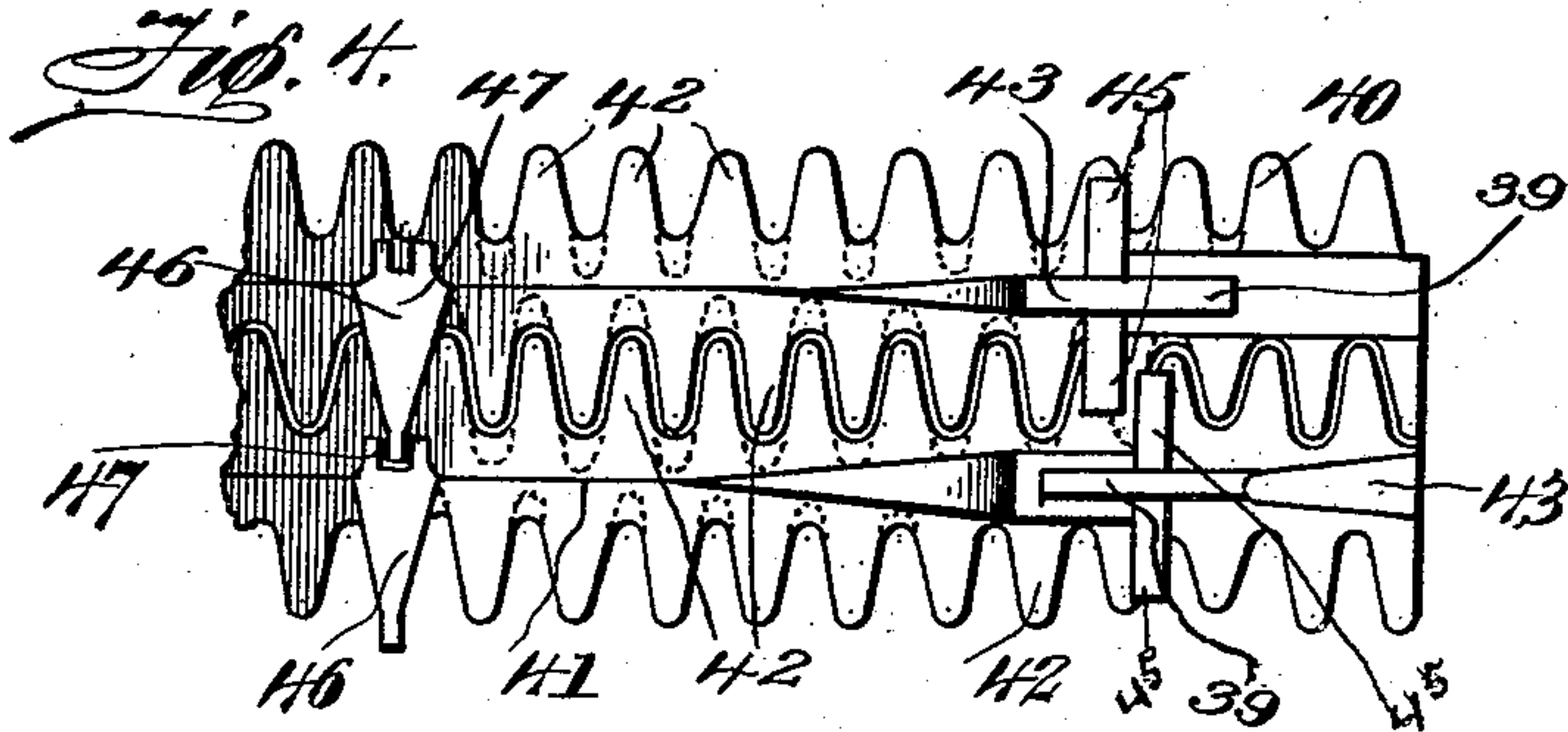
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UNITED STATES PATENT OFFICE.

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TRAVELING GRATE FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 713,969, dated November 18, 1902.

Application filed July 8, 1901. Serial No. 67,476. (No model.)

To all whom it may concern:

Be it known that I, PAUL L. CROWE, a citizen of the United States, residing at New York, in the borough of Manhattan, county and State of New York, have invented certain new and useful Improvements in Traveling Grates for 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 traveling grates for furnaces, and has for its object the assembling of the members and parts exclusive of the side and rear walls and casings and of the boiler in such a manner as to produce an effective, convenient, and durable machine.

The invention consists in a furnace mechanism comprising a front wall plate or plates having an aperture for the accommodation of the grate and for the introduction of fuel, side plates or hopper-sides secured thereto, a grate-frame, and rollers or pulleys mounted in said frame, a chain grate traveling over the same, a power-shaft mounted outside the front plate and engaging the chain of the grate, means for rotating the said power-shaft for communicating motion to the traveling grate, and means for raising or lowering one or both ends of the grate for regulating its position with respect to the bridge-wall or boiler of the furnace and for regulating the amount of fuel fed to the grate.

It also consists in certain other novel constructions, combinations, and arrangements of parts, as will be hereinafter more fully described, illustrated in the accompanying drawings, and pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a perspective view of a grate mechanism as applied to furnaces in accordance with the present invention. Fig. 2 represents a perspective view of a portion of the same mechanism looking at the same from the other side of the furnace, parts being left out to better reveal the construction of the framing. Fig. 3 represents a vertical longitudinal section through such a furnace. Fig. 4 is a detail inverted plan view of a portion of the traveling grate, showing the relation of the

grate-bars to each other. Fig. 5 is an end elevation of a portion of the traveling grate, showing some of the bars and a portion of the chain carrying the same. Fig. 6 is an enlarged detail sectional view through the actuating wheel-chain for driving the traveling grate. Fig. 7 is a detail sectional view through the said sprocket-wheel, showing the chain engaging the teeth thereof. Fig. 8 is a transverse section through the grate-frame, showing the grate-bars in position. Fig. 9 is a detail sectional view through one of the adjustable journal-boxes and showing the speed-reducing gearing mounted therein. Fig. 10 is a detail vertical section through one of the sprocket-wheels, showing the grate-bars and chain in position on the same. Fig. 11 is a detail vertical section through the rear guiding-wheels of the chain grate, showing the grate-bars and chain in position thereon. Fig. 12 is a sectional view of one side of the grate-frame, showing the supporting tension-plate in engagement therewith. Fig. 13 is a detail perspective view of the said supporting tension-plate. Fig. 14 is an enlarged perspective view of one of the grate-bars.

My invention embodies a metallic front wall or facing 1, adapted to be secured to or to support an interior front wall of brick or other suitable material and to be secured to side walls of any suitable description. The said front is provided with a large central opening to form a fuel-port 2 or to permit the passage of the front end of a traveling grate 3. It is also provided with forwardly-extending housings 4 4, arranged at right angles to the said front plate 1 and adapted to form the side plates of a fuel-hopper 5 and to support the bearings of the grate-operating sprocket-shaft 6, as well as to form bearings for tension-screws 7 7 and to form a support for an adjustable interior fuel-hopper plate 8. It may also form, if desired, the support for the pivoted front end of the traveling grate 3. The housings 4 4 are provided with apertures 9 9 for the passage of a shaft and with oppositely-extending shelves 10 10, forming bearings upon which the journal-boxes 11 11 of the sprocket-shaft 6 are movably mounted. These apertures also make it possible to move the grate-bars of the grate

endwise at this point for removing them or inserting them. Each of the housings 4 4 is further provided with apertured lugs 12 12, the apertures of which are parallel with said bearings 10 and are adapted to receive a tension-screw 7, which passes through the front lug 12, and thence through a smooth aperture 14 in the said journal-box 11, and thence through a threaded nut 16, and into a recess in the rear lug 12. The screw may pass through an aperture in the lug 12, if desired, letting the head of bolt against the said front facing of housing. The tension-screw 7 is threaded, so that it is adapted to engage the threaded nut 16. The construction is such that upon turning the said screw it draws forward the nut upon the slides, thereby operating to push the said journal-box before it, which advances the shaft 6, which supports the grate-chains and grate. Thus the slack of the grate and its chains is taken up. When the screw is reversed, the nut 16 is pushed back along the slide, and the weight of the grate draws back the shaft and journal-box. The chains of the grate are thus slackened. This arrangement is an important feature of my invention, the head of the screw-bolt being easily and conveniently accessible from the front of the furnace to adjust the grate at any time.

Each of the housing-plates 4 4 is provided with an outward laterally-extending flange 17, by which it may be rigidly bolted to the furnace-front 1, or, if desired, slots, as 18 18, may be formed in the said flange 17, so that the housings may be bolted to the furnace-front in such a manner as to permit of vertical adjustable movement of the housings carrying the forward end of the grate and the propelling and other mechanism. A lateral arm or bracket 19 preferably extends from one of the said housings to carry a driving-engine 20, hereinafter described. The bearings for supporting the said engine, however, may be bolted direct to the fixed furnace-front in case said housings are not made vertically adjustable; but the engine-bearings are bolted to said housings whenever said housings are vertically adjustable. In the rear of the said front wall or facing and projecting forward beyond it I set up the grate 3, consisting of a grate-frame 21, formed by side plates pivoted near their front upper corners to the housings 4 4. Said side plates are preferably provided with enlarged central apertures 25 to permit the passage of air from the side and is also provided with a shoe-plate 26, extending from one side plate to the other near the lower edges thereof and from a point near the forward ends of the said side plates to a point near the rear ends thereof. The shoe-plate 26 preferably rests upon continuous angle-iron brackets or shelves 27 27, attached to the inner face of said side plates and extending a suitable distance from the front toward the rear—say about two-thirds or three-fourths the length of the side plates. The grate-

frame 21 is provided with lateral shafts 28 28 at intervals, extending from one side plate to the other on two different planes. The first plane is beneath the shoe-plate 26, in which plane the shafts carry flat pedlar-wheels 29 29, arranged near each end, respectively, of each lateral shaft 28. The peripheries of said wheels project slightly above the shoe-plate 26, through which apertures are formed to accommodate the same. The shoe-plate is used to retain the unburned fuel and separate it from the refuse, so that the grates as they return to the front deposit this unburned fuel at the front of the furnace, so that it may be used again, said wheels supporting the chains of the grate. The second plane is slightly below the upper edge of the said side plates, in which plane the shafts 28 carry flanged pedlar-wheels 30 30. The grate-frame is further provided with a shaft 31, extending from one side plate to the other near the rear ends thereof and arranged slightly above the central plane of the frame and carrying flanged guide-wheels 32 32. The shaft 31 preferably engages at its ends elongated slots 31^a in each side of the grate-frame, which permit of the said shaft being moved forwardly and rearwardly in the grate-frame. The rear end of the grate-frame rests upon tension-plates 31^b 31^b, which are provided with hooked projections 31^c at their lower ends for receiving the edges of the grate-frame side plates. The hooked portion carries a knife-edge, as 31^d, which engages a correspondingly-shaped notch 31^e, formed in the under edges of the said side plates. Each of the plates 31^b is provided with a forwardly-extending bearing, as at 31^f, at its lower end, while its upper end is formed with a vertical bearing-surface 31^g, adapted to engage and rest against the shaft 31 of the grate. The bearings 31^f of the said tension-plates engage and rest upon the supporting-shaft 69 at the rear end of the grate. It will be seen that by the use of these tension-plates 31^b the shaft 31 will be normally forced rearward in the slots 31^a by the weight of the grate-frame resting upon the knife-edges 31^d, and the tension of the grate-chains will be automatically maintained.

In case the grate-chains become excessively stretched beyond the extent allowed by the elongated slots in the grate-frame the tension of the grate will be regulated by tension-screws 7 7, as will be hereinafter described. The chains of the traveling grate in feeding fuel to the furnace pass inwardly from the front over the flanged pedlar-wheels 29, making a complete circuit through the grate-frame. Upon the lateral shelves 10 10 of the said housings I set the journal-boxes 11 11, provided with transverse upper apertures or bearings 33 33 for the reception of the grate sprocket-shaft 6 and also provided with lower longitudinal apertures 34 34 for the passage of the stretching or tension screws 7 7, which are adapted to take up the slack of the chain grate. The sprocket-shaft 6 is journaled in

the said boxes, so as to be parallel with the front of the furnace, and carries near each end a keyed sprocket-wheel 35, flanged and provided with peripheral lugs 36 36 between the flanges 37. The lugs or teeth 36 extend from the flange on one side of a sprocket-wheel 35 to a plane slightly beyond the center of the said wheel and are approximately pyramidal on three of their sides. 10 The flange forms the fourth side, their tops being flat and flush with the upper edge of the side flange. The lugs or teeth 36 extend alternately from the opposite flanges of the walls, a tooth or lug upon one side being arranged opposite the space between adjacent teeth upon the other side of the wheel. At 15 each side of said grate-frame over the upper and lower pedlar-wheels 30 and 29, respectively, above the shoe-plate 26, and around the sprocket-wheels 35 and the rear guide-wheels 32 I stretch endless chains 38, of the common cable pattern, and between said chains and removably secured thereto by the insertion of attaching-fingers 39 in the links 25 of the chain I assemble the grate, the grate-bars 40 composing the grate-surface. Each of the grate-bars 40 preferably consists of a body portion having a strengthening-web 41 beneath it. Laterally-extending teeth 42, arranged at the upper edge of the body portion, 30 form a fire-bearing surface, said teeth being rounded upon their under edges and curving back from their upper corners to said body portion. The depressions between the said teeth 42 extend at their tops to the center longitudinal line of said bar and become gradually more shallow below the top in approximately opposite contour to said teeth. A depending projection 43 near each end of said 40 bar terminates, respectively, in a longitudinal projecting finger 39, forming a chain-engaging hook near each end of the same. A lateral lug 45 is formed upon each side of said bar, at each end thereof, and at the base of said downwardly-projecting hook portion. 45 The grate-bar is provided with a lateral finger 46 upon one side of the body portion or web and preferably at the vertical center thereof and has a bifurcated lug 47 upon the said body portion or web on the opposite side 50 of said web to said central finger, the horizontal mid-section of said central finger and the bifurcated lug being on the horizontal mid-sectional plane of the horizontal portion of said chain-engaging hooks 39. One or 55 more of the lateral teeth near the hook projections 39 are preferably shorter than the other teeth on the said bar, and one or more of the depressions adjoining said short teeth are correspondingly shallower than the other depressions between the other teeth of said bar. The bars 40 are made in rights and 60 lefts—that is to say, the chain-engaging hooks are both directed to the right on alternate bars and to the left on other alternate bars, and the teeth of one bar are adapted to mesh with the teeth of the adjoining bar

throughout the grate. The central finger 46 upon one side of the web of a bar is adapted to mesh with the bifurcated lug 47 upon the web 70 of the adjoining bar throughout the grate.

The relative sizes of the front driving sprocket-wheels 35 to the chain grate and of the rear guide-wheels 32 to the said chain grate are important. The front sprocket-wheels 35 are made comparatively small in 75 diameter, so that when the chain grate passes around them at the front of the furnace the bars of the grate will be well separated. This brings about two important results, making 80 it possible for the grate to automatically eject all fuel and cinders which may have been collected in its interstices. It also makes it possible to easily remove any one of the grate-bars and insert a new one in the place 85 thereof. When a bar is to be removed, it is done while the bar is passing around the sprocket-wheels 35, for at this time its teeth are out of mesh with the teeth of the adjacent bars on each side. When the bars are in this 90 position, also, the centering fingers and lugs 46 and 47 can be easily separated, so that it is only necessary to move the bar longitudinally to disengage its hooks 39 from the links of the grate-chains. The openings 9 in the 95 front housings permit of this endwise movement of the grate-bars at this point. A new bar can be as easily inserted in the place thus vacated by the old one. This removal and replacement of the bar can, in fact, take place 100 while the grate is in operation, its movement not being interfered with in the least. The rear guiding-wheels 32 of the grate instead of being made small, like the front sprocket-wheels, so as to spread the grate-bars, are 105 made quite large, so that the bars of the grate as they pass about the said guide-wheels will not be appreciably opened or separated and will not permit the falling of clinkers or products of combustion between the interstices of 110 the grate-bars. To the exterior side face of one of the sprocket-shaft journal-boxes 11 11 is fixed or formed integrally therewith or, if desired, attached thereto a gear-box 48, containing gears and pinions or a worm and gear 115 or gears meshing with a gear keyed to the said sprocket-shaft 6, the said gearing acting as an intermediate speed-reducing driving-gear between the said shaft and the engine and may be of any desired and suitable construction. 120 The said gear-box and the gears contained therein and the shaft 6 are movable with the said journal-box 11 and with the housings 4, supporting the same, when the said housings are adjustably bolted to the front wall of the 125 furnace. While the gear may be of any desired construction, I prefer to form the same so as to comprise a counter-shaft 50 at right angles to the chain sprocket-shaft 6 and an integral or keyed worm 51, secured thereto, which en- 130 gages a cog-wheel or worm-gear 49 on said chain sprocket-shaft 6. The said counter-shaft 50 also carries a cogged collar or gear 53 near its forward end, which meshes with

a worm 54, carried by a third shaft 55, which is arranged at right angles to the said counter-shaft 50. One end of the third shaft 55 projects through said journal-box 11 and carries a keyed sprocket or other wheel 56, which engages a sprocket-chain or other belt 57. This sprocket-chain passes around a sprocket-wheel 58 on the driving-shaft 59 of the actuating-engine 20. The gear-box above described may be provided with suitable oil-cups or preferably with an integral underlying reservoir of oil, in which the peripheries of the worms and gears on the said counter-shaft 50 dip, or a tightly-closed box may be used which is kept full of oil.

In order to actuate the mechanism above described, I mount upon the furnace-front 1 or preferably upon a laterally-extending arm 19, secured to one of the housings 4, so as to admit of the vertical adjustment of said housings, an oscillating driving-engine 20, of suitable construction and adapted to operate a crank driving-shaft 59, extending partly or wholly across the face of said furnace and journaled in bearings 60, formed upon and affixed to the tops of the housings 4. The crank-shaft 59 carries near its outer end the sprocket or other belt wheel 58, which is connected with the sprocket-wheel 56 by the sprocket-chain or belt 57. The said crank-shaft also carries at one of its ends a suitable balance-wheel, as 61. Pipes, preferably having a flexible connection, are used to connect the driving-engine 20 with any suitable source of power-supply. I also employ suitable means for adjusting the grate and its frame to different heights in the furnace. For raising and lowering the forward end of the grate I preferably arrange beneath the housings 4 4 lifting-screws 62 62. The said screws 62 extend through guiding and supporting brackets 63, secured to the wall of the furnace. Upon said screws are arranged wheels or pulleys 64. The outer peripheries of the said wheels 64 are preferably provided with teeth or projections adapted to engage the links of a sprocket or cable chain 65. The chain 65 connects the pulleys or wheels 64 of the screws under each of the housings 4, so that by turning one of the said wheels or pulleys both will be actuated and the screws will be raised or lowered simultaneously upon each side of the furnace. In order to actuate the chain 65, I have formed holes in the wheels, which may be engaged by a bar or pin to turn the said wheel, as clearly illustrated beneath the rear end of the grate-frame in Fig. 3.

As shown in Fig. 2 in the drawings, the lifting-screws for the housings may be provided with squared heads 62^b, fitting in correspondingly squared apertures formed in the bottom of the housings, whereby the screws will be prevented from turning. With this structure the screws are permitted to pass loosely through apertures in the brackets 63, and instead of being provided with fixed wheels or pulleys, as shown, the screws are engaged by

threaded gears or wheels, as 64, which rest upon the said bracket 63, supporting the screws thereon. I also arrange a bracket 66 on one of the housings 4 or elsewhere, upon which is mounted an actuating sprocket-wheel 67. The bracket and sprocket-wheel are so arranged that the teeth of the sprocket-wheel will engage links of the chain 65. The shaft 68, carrying the actuating sprocket-wheel 67, finds bearings on the under edge of the housing or in the bracket and one end of said shaft projects forwardly and is preferably squared, so that it may be engaged by a handle or crank for turning it. Thus the forward end of the grate may be readily or quickly raised or lowered to enlarge the fuel-entrance and without stopping or hindering in any way the operation of the grate, the feed of fuel being brought to any thickness on the grate.

As shown in Figs. 2 and 6 in the drawings, the lifting-screws for the hopper, as 62^a 62^a, may be provided with squared heads, as 62^b, fitting in correspondingly squared apertures formed in the bottom of the housings, whereby the screws will be prevented from turning. With this structure the screws are permitted to pass loosely through apertures in the brackets 63, and instead of being provided with fixed wheels or pulleys, as shown in Fig. 3, the screws are engaged by threaded nut gears or wheels, as 64^a, which rest upon the said brackets 63, supporting the screws thereon. These nut-pulleys 64^a will of course be engaged by the chains 65 in the same manner as the wheels or pulleys 64, as heretofore described. In using this construction the pulley 67 for actuating the chain 65 should be mounted upon a bracket, as 66^a, fastened to one of the brackets 63, since the said chain 65, when engaging the pulleys 64^a, will not be raised or lowered with respect to the said brackets 63. It will be apparent also that I might employ other minor changes in this respect without departing from the spirit of my invention.

Beneath the rear end of the grate-frame I also construct suitable lifting means. This may consist of lifting-screws similar to those described for the front end of the grate or other suitable lifting-screws. I preferably, however, construct the lifting means so as to comprise a straight horizontal shaft 69 underlying the grate-frame 3 and engaging notches cut in the lower edges of its side plates. The shaft 69 is swung from fixed supports 70 at each side of the grate-frame by means of chains 71, attached at one end of the said shaft, and carried thence upward and over pulleys 72, journaled in the support 70. The chains thence pass downwardly and under idler-pulleys 73, journaled upon the shaft 69, and thence upwardly, and finally are secured to a portion of the rigid support 70. The construction is such that when the shaft is revolved the chains 71 wind up upon it, and thus raise the shaft and the grate-frame rest-

ing upon it for the purpose of increasing or diminishing the aperture between the grate and the bridge-wall above it for the eduction of the refuse and preventing the admission of
 5 air above the grate. For revolving the shaft in such case there is keyed upon it near one end thereof a gear-wheel 74, and outward from said gear-wheel there is journaled a hanger 75 upon said shaft 69, in which hanger
 10 is journaled a worm 76 at right angles to the gear-wheel 74. The worm is so constructed as to engage said gear-wheel, and one end of the worm-shaft projects beyond the hanger and preferably pierces the rear wall of the fur-
 15 nace. The said shaft terminates in a squared end to engage a crank-handle, by operating which handle the shaft may be turned.

At the front end of the furnace and in connection with the housings 4 4 and the front
 20 wall 1 of the furnace and embodying the anterior plate 8, arranged between the said side plates or housings, I construct a fuel-hopper, in which said anterior plate 8 may be either fixed or adjustably attached to or supported
 25 by said side or housing plates 4 by any suitable or convenient means. If said plate is made adjustable it is capable of either a forward and rearward or vertical movement or all of them. The hopper is adapted to feed
 30 fuel downward upon the underlying projecting front end of said traveling grate and through the fuel-port in said front wall. The lower edge of plate 8 is preferably not fixed, but is allowed to drag on the grate,
 35 which aids in the distributing of the fuel fed upon the grate more evenly. I preferably attach to or form upon the opposing faces of said housings vertical curved ribs 76' to carry aprons 77, covering the front end of said
 40 grate.

In connection with the above-described parts of the furnace mechanism I construct outer rear and side walls, an overhanging or
 45 arch or arches. I also construct the boiler-settings of any suitable or desirable form, they being dependent largely upon the style of boiler to be used in connection with the said furnace or grate.

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

1. In a furnace, the combination of a front plate having an aperture for accommodating
 55 the end of the grate and for permitting the introduction of fuel, a grate-frame comprising side plates, forwardly-extending housings mounted on the front and pivotally supporting the grate-frame, means for adjusting the
 60 housings vertically with respect to the front plate, and means for raising and lowering the grate-frame, and a traveling grate carried by the said frame, substantially as described.

2. In a furnace, the combination of a front
 65 plate having an aperture to accommodate the end of a grate, upwardly-extending housings secured to the front plate, a grate-frame

mounted inside the furnace and extending through the opening in the front plate sufficiently far to engage the housings, means for
 70 movably connecting the grate-frame to the housings, cross-shafts mounted in the grate-frame having pulleys or pedlar-wheels, a traveling grate moving upon the said pedlar-wheels, and means mounted in the housings
 75 on the furnace-front for engaging the forward end of the traveling grate comprising an actuating-shaft, and means for adjusting the said shaft in the housings to regulate the tension of the traveling grate, substantially as
 80 described.

3. In a furnace, the combination of a front plate having an aperture to receive the front
 end of a grate, housings mounted on the front plate and projecting outwardly therefrom, a
 85 grate-frame carrying the grate and mounted in the furnace, said frame being connected with the housings, a traveling grate moving in said grate-frame, an actuating-shaft extending through apertures in the housing and
 90 engaging the traveling grate, movable journal-boxes mounted in the apertures of the housings, a supporting and driving shaft, and means for adjusting the journal-boxes away from or closer to the furnace-front in order
 95 to regulate the tension of the grate in said grate-frame, substantially as described.

4. In a furnace, the combination of a front plate having a central opening, a grate-frame
 mounted in the furnace and extending
 100 through said opening, housings upon the furnace-front supporting said grate-frame, a traveling grate carried by said grate-frame, a driving-shaft extending through apertures formed in the said housings and engaging the
 105 traveling grate forward of said frame, slide-bearings formed in the apertures of the housings, journal-boxes moving upon said slide-bearings, and tension-screws carried by the housings and engaging the journal-boxes,
 110 said tension-screws regulating the tension of the traveling grate in said grate-frame, substantially as described.

5. In a furnace, the combination with a front plate, of housings mounted thereon hav-
 115 ing attaching flanges for securing them to the furnace-front, the said flanges being provided with slots, bolts engaging said slots for adjustably securing the housings to the furnace-front, a grate-frame carrying a traveling
 120 grate mounted in the furnace and projecting through the opening in the front plate, means for pivotally connecting the grate-frame with the housings, raising and lowering means arranged beneath the housings and the rear end
 125 of the grate-frame, the structure being such that by operating the said means the position of the grate-frame with respect to the opening in the furnace-front and the boiler and bridge-wall of the furnace may be regulated,
 130 substantially as described.

6. In a furnace, the combination with a front plate of housings mounted thereon and forming between them a fuel-hopper, a front

plate secured between them for forming the front wall of said hopper, a grate-frame mounted in the furnace and projecting through an opening in the front plate, a traveling grate supported by said frame and the housings comprising continuous cable-chains, grate-bars secured thereto, pulleys or pedlar-wheels mounted upon shafts in the grate-frame for supporting the greater part of said traveling grate, and means mounted in the housing beneath the hopper for supporting the front portion of said grate and actuating the same, substantially as described.

7. In a furnace, the combination with a front plate, of vertically-adjustable housings secured thereto, a grate-frame mounted in the furnace comprising side plates hinged at their forward ends to the housings to permit of the adjustment of the housings and of the frame, a shoe-plate connecting the said side plates and adapted to collect unburned fuel from the grate-bar, a traveling grate mounted in the grate-frame, upper and lower pedlar-wheels mounted in the frame and adapted to support the greater part of a traveling grate above the shoe-plate, an actuating-shaft mounted in the housings supporting the remainder of the grate and engaging the same for moving it, the traveling grate traveling outwardly upon the lower pedlar-wheels and projecting just above the shoe-plate, so as to scrape unburned fuel therefrom to the furnace-front, substantially as described.

8. In a furnace, the combination with a front plate of adjustable housings forming a fuel-hopper mounted thereon, a grate-frame mounted in the furnace, a traveling grate carried thereby, means beyond the front of said frame and carried by the adjustable housings for actuating said grate, and a driving-engine secured upon the furnace-front and connected with the said grate-actuating means, substantially as described.

9. In a furnace, the combination with a front plate of housings projecting forwardly therefrom, a grate-frame mounted within the furnace and projecting outside the furnace-front, a traveling grate carried thereby, means for adjusting the housings and the grate-frame vertically, a bracket mounted upon one of the housings, and a driving-engine secured to the said bracket and connected with the traveling grate, the structure being such that the grate may be raised or lowered in the furnace without interfering with the operation of the engine and its connecting parts, substantially as described.

10. In a furnace, the combination with a front plate, of a grate-frame mounted in the furnace and projecting through the said front plate, a traveling grate carried by the said grate-frame, an actuating-shaft adjustable vertically and mounted outside the furnace-front and beyond the end of the grate-frame and engaging and supporting the traveling grate at that point, a driving-engine adjustably mounted on the furnace-front, a gear-box

mounted upon one end of the driving-shaft, and inclosing worm-gears, gear-wheels and a counter-shaft also mounted in said box and connected with the said gearing, and a third shaft connected with the counter-shaft, and means for connecting the engine with said third shaft, the whole mechanism accommodating itself to the position of the grate in the furnace, substantially as described.

11. In a furnace, the combination with a grate-frame carrying a traveling grate, the said grate-frame extending through the front wall of the furnace, of housings mounted on the furnace-front, means securing the grate-frame to the housings, means for lifting the housings comprising screws arranged beneath the same, brackets for supporting the screws, pulleys or wheels internally threaded and engaging the said screws, a chain connecting the pulleys or wheels of screws for moving them simultaneously, and a chain-engaging wheel mounted upon one of the said brackets or housings for driving the chain, and means under the rear end of the grate-frame for adjusting the same vertically, substantially as described.

12. In a furnace the combination with a grate-frame, of actuating sprocket-wheels located in the forward portion thereof, guiding-wheels at the rear of the frame, grate-chains passing over said sprocket and guiding wheels forming a grate-surface, the sprocket-wheels being comparatively small while the guiding-wheels at the other end of the grate are comparatively large the chain grate being opened considerably in passing around the sprocket-wheels for ejecting material that may have collected between the bars of the grate, the said structure facilitating the removal and replacement of any of the grate-bars and causing the grate-bars when passing around the large guiding-wheels to be held in comparatively close mesh for preventing fuel and clinkers from dropping between the bars of the grate, substantially as described.

13. In a furnace the combination with a grate-frame of a traveling grate mounted therein and projecting through the furnace-front, said grate comprising chains and intermeshing grate-bars engaging the same and capable of disengagement therefrom by longitudinal movement an actuating-shaft at the front end of the grate, sprocket-wheels of comparatively small diameter carried by said front shaft around the front of which the chain grate travels, and means for guiding the chain grate in the other portions of the grate-frame, the size of the said sprocket-wheels being such as to open or separate the bars of the chain grate so as to be out of mesh as they pass in front of the sprocket-wheels the said bars being thus capable of movement longitudinally for disengaging them from the grate-chains while the said bars are passing around the sprocket-wheels, substantially as described.

14. In a furnace the combination with a grate-frame of a traveling grate mounted therein, comprising grate-chains and grate-bars having intermeshing fingers and projections engaging said chains, said bars being capable of longitudinal movement, a longitudinal shaft at the front and one at the rear of said grate, sprocket-wheels on the front shaft for engaging and driving the grate-chains and guide-wheels on the shaft at the rear of the grate, the latter being of such size that the intermeshing fingers of the grate-bars will be only slightly separated or opened in passing around the said guide-wheels, so that large pieces of fuel and clinkers cannot enter the meshes of the grate, substantially as described.

15. In a furnace the combination with a grate-frame and a traveling chain grate mounted therein, of a front and rear shaft, sprocket-wheels and guiding-wheels carried by the said shafts, means tending continually to carry the rear shaft backward in the grate-frame under tension for maintaining the grate in a taut condition, and means for guiding the said shaft in its movement, substantially as described.

16. In a furnace the combination with a grate-frame of a traveling chain grate mounted therein, a front and rear shaft for supporting the grate at its ends, sprocket-wheels and guiding-wheels carried by the said shafts, the rear shaft engaging elongated slots in the grate-frame which direct and limit the movement of the said shaft, tension-plates finding bearings on the rear support of the grate-frame and carrying knife-edges for supporting the grate-frame side plates, the upper end of the said tension-plates engaging the rear shaft of the grate the weight of the grate-frame tending to force the said rear shaft rearwardly and maintain a proper tautness in the chain grate, substantially as described.

17. In a furnace the combination with a grate-frame of a shaft for adjustably supporting the rear end shaft, a traveling grate mounted in the grate-frame, front and rear shafts for supporting the grate in the said frame, sprocket-wheels and guiding-wheels carried by the said shafts, the rear shaft engaging elongated slots in the grate-frame, tension-plates formed with hooked lower ends for receiving the side plates of the grate-frame, knife-edges in the said hooked portions engaging corresponding notches formed in the side plates, forwardly-extending hooked portions formed on the said tension-plates adapted to engage and rest upon the supporting-shaft of the grate-frame, the upper ends of the said tension-plates having elongated bearing-surfaces adapted to engage the rear shaft of the traveling grate, the structure being such that the weight of the grate-frame will maintain a proper tautness in the chain grate, substantially as described.

18. In a furnace the combination with a grate-frame carrying a traveling grate of housings mounted on the furnace-front, means securing the grate-frame to the housings, means for lifting the housings and front end of the grate-frame to different heights, comprising screws having squared heads engaging correspondingly-shaped rests formed in the lower edges of said housings, internally-threaded pulleys or wheels engaging the said screws, and brackets for supporting the said wheels, the structure being such that when the wheels are turned the screws will be raised or lowered for correspondingly adjusting the housings, substantially as described.

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

PAUL L. CROWE.

Witnesses:

CASELL SEVERANCE,
JOHN L. FLETCHER.