

No. 627,870.

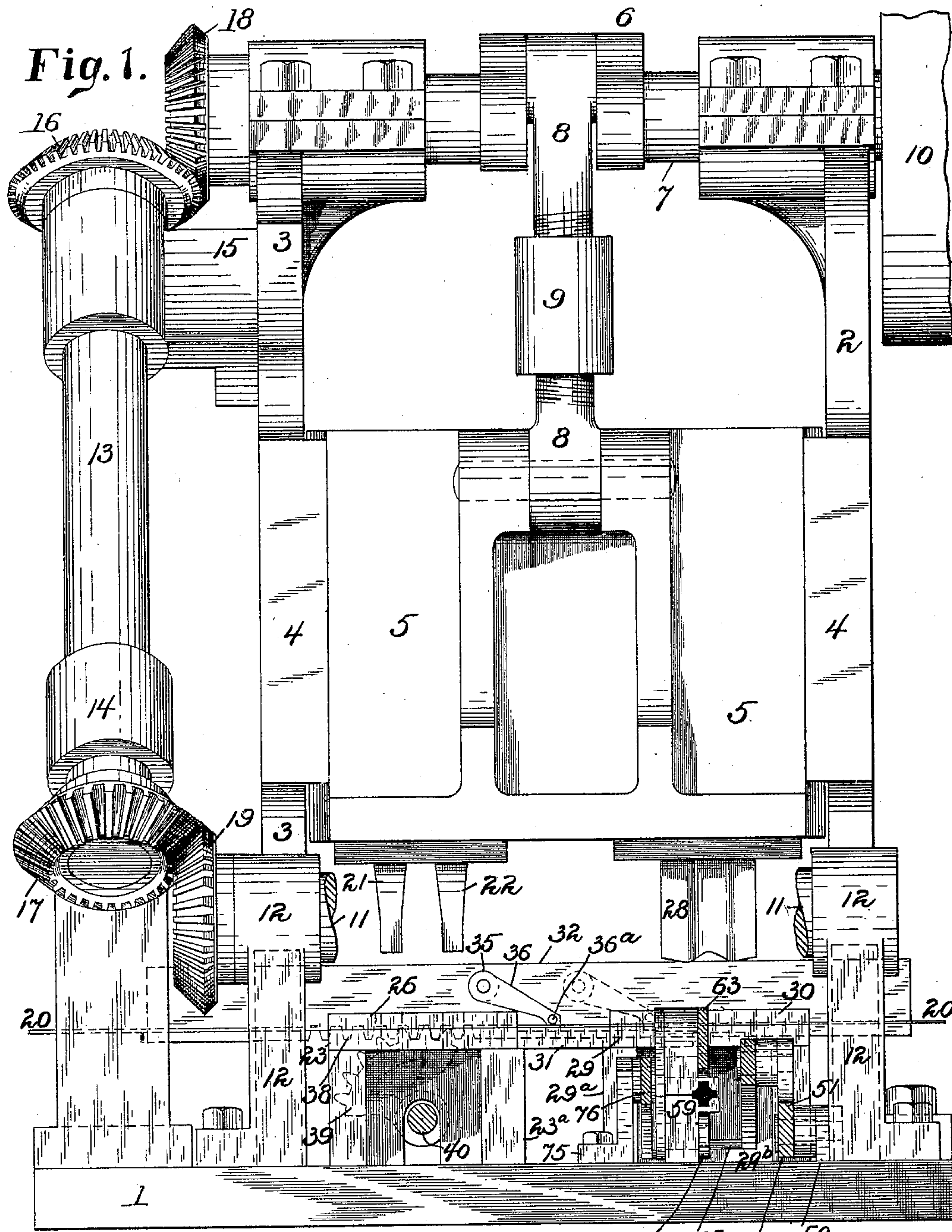
Patented June 27, 1899.

H. B. MORRIS.  
MACHINE FOR MAKING CHAINS.

(Application filed Jan. 20, 1899.)

(No Model.)

6 Sheets—Sheet 1.



WITNESSES:

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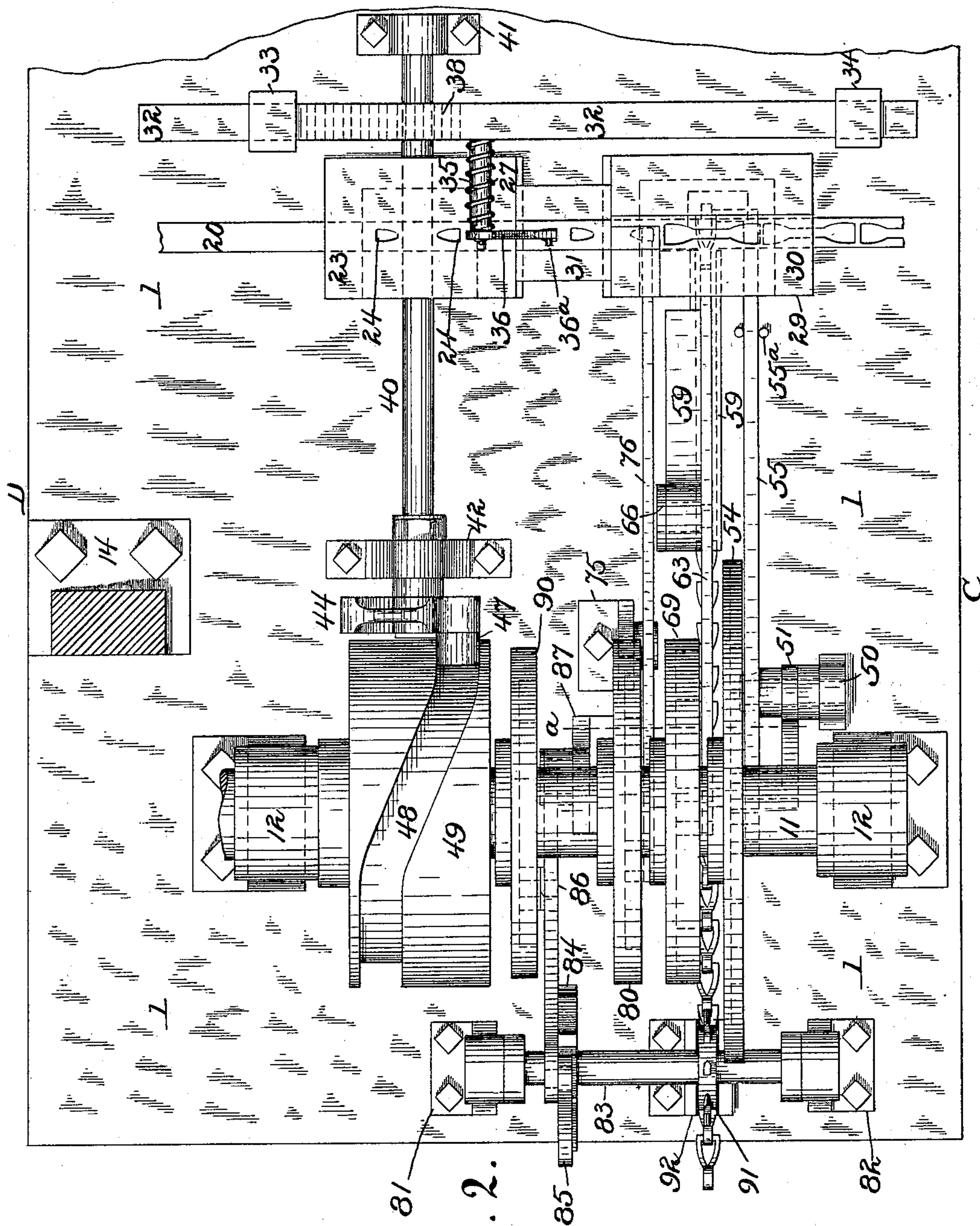


Fig. 2.

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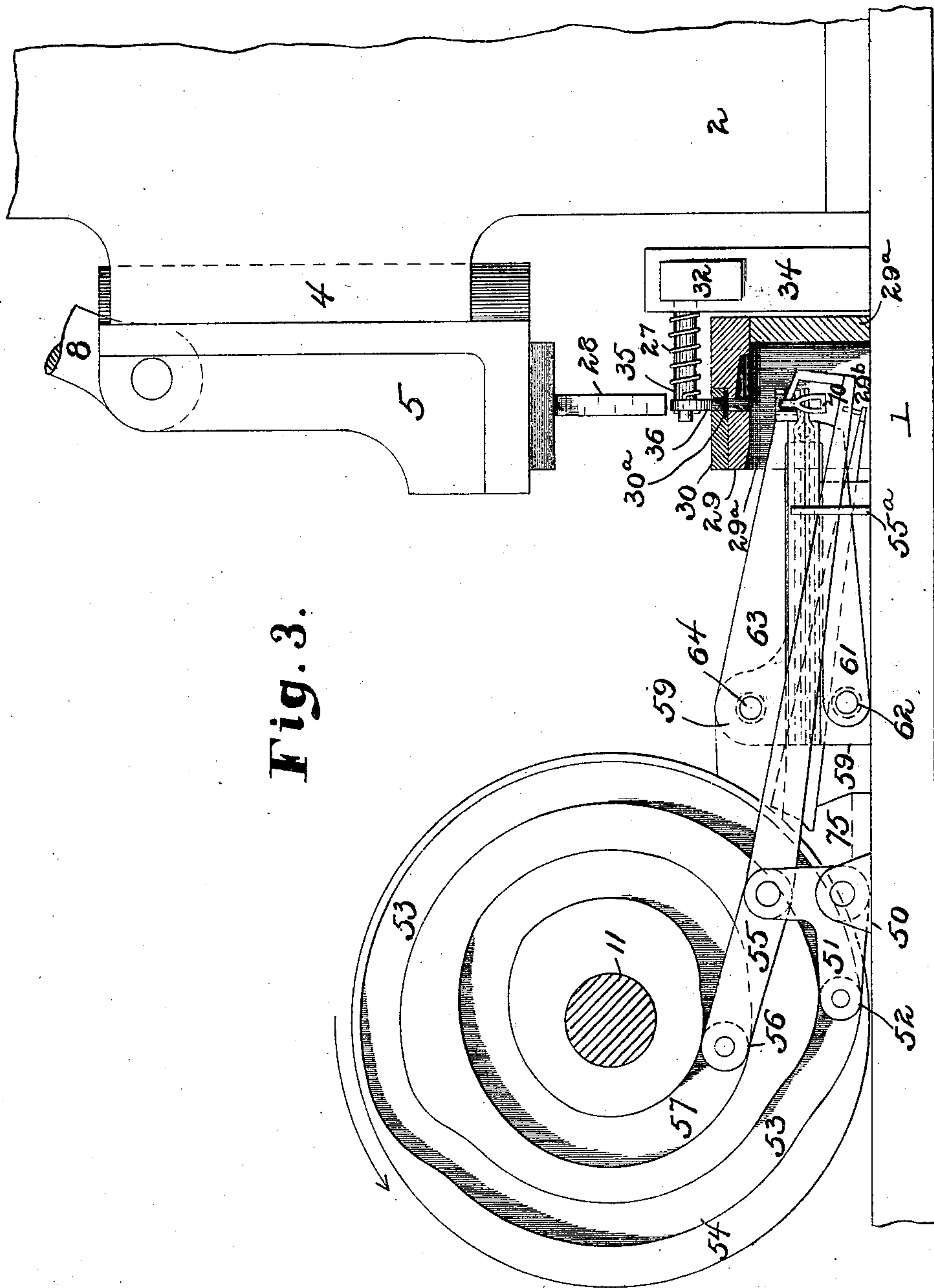
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Fig. 3.



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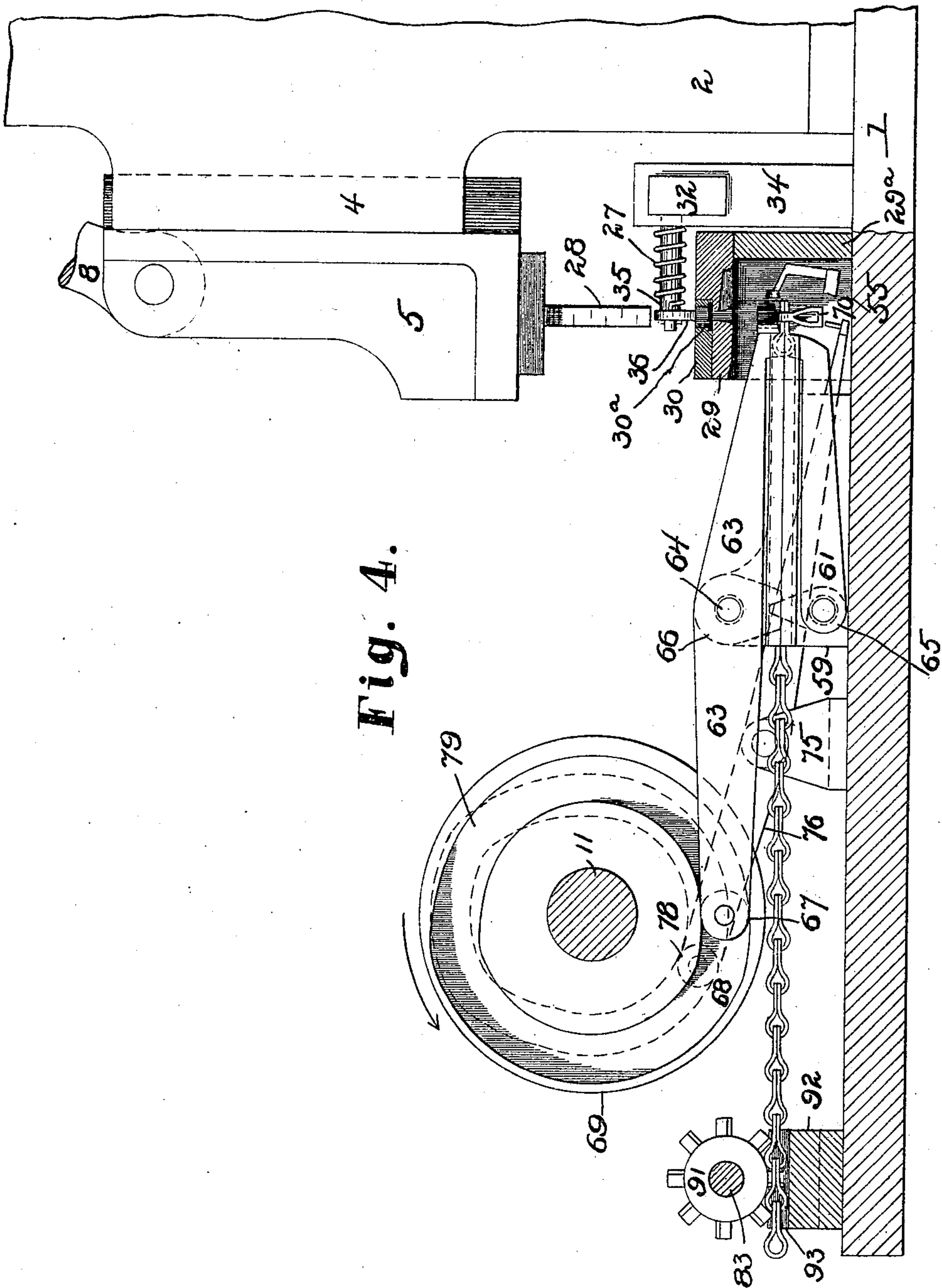
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(No Model.)

6 Sheets—Sheet 4.

Fig. 4.



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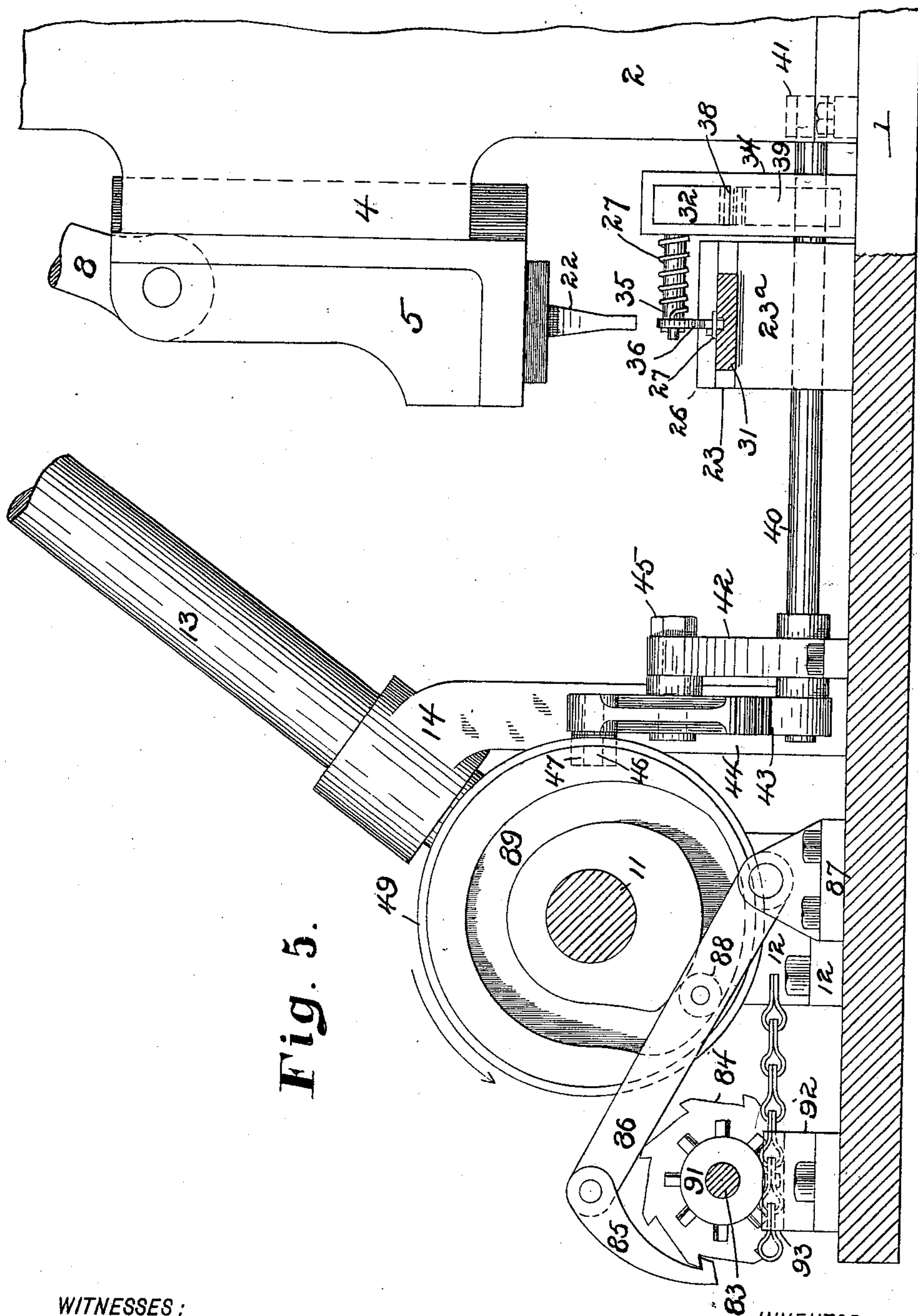


Fig. 5.

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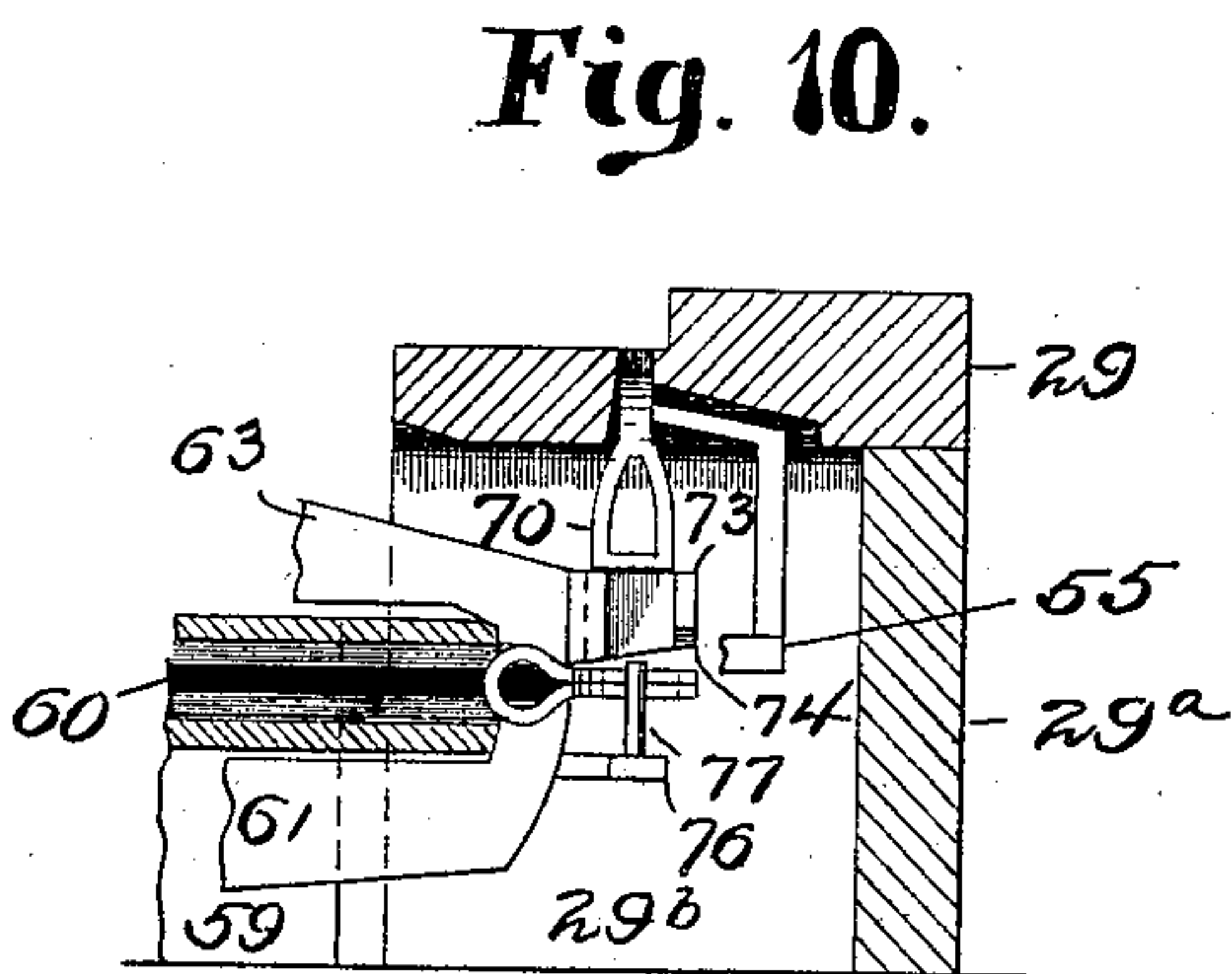
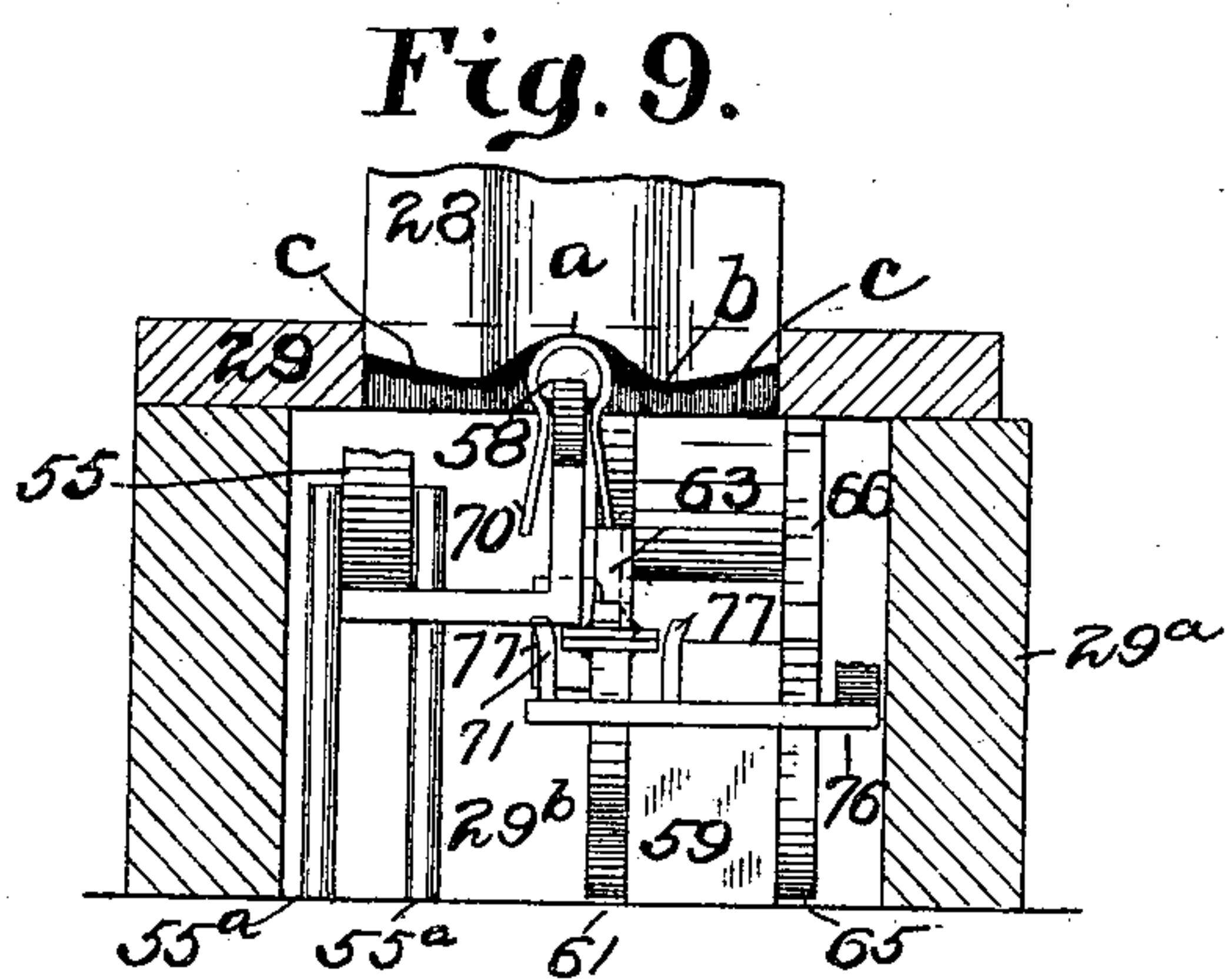
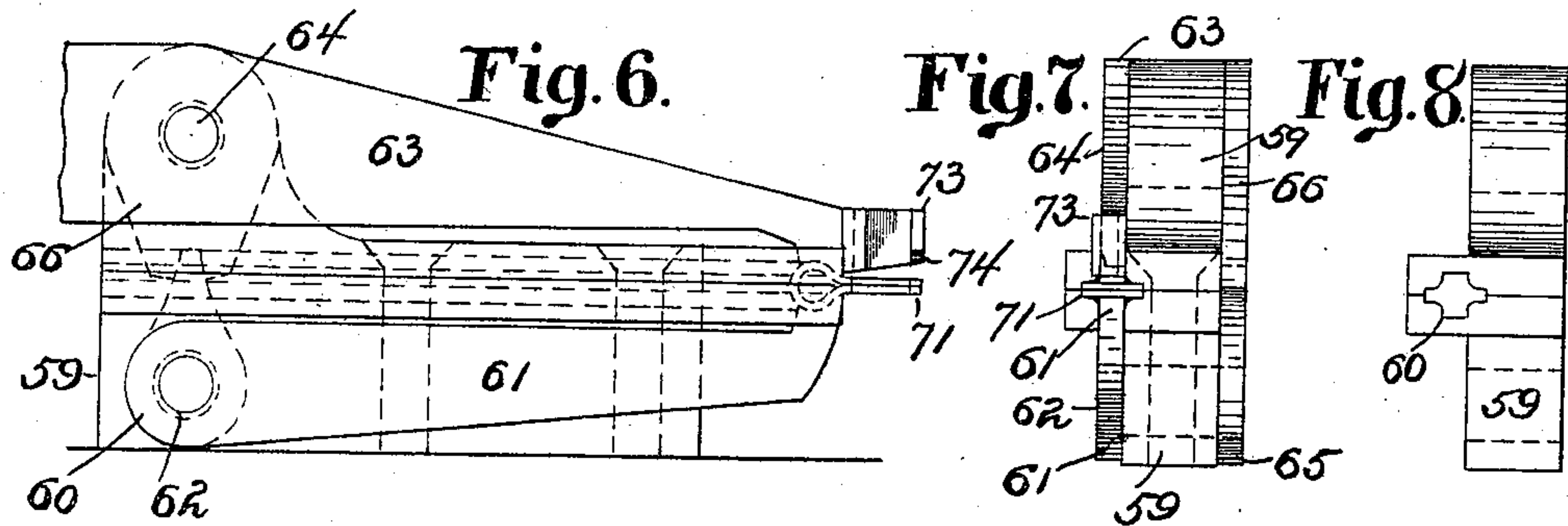


Fig. 11.

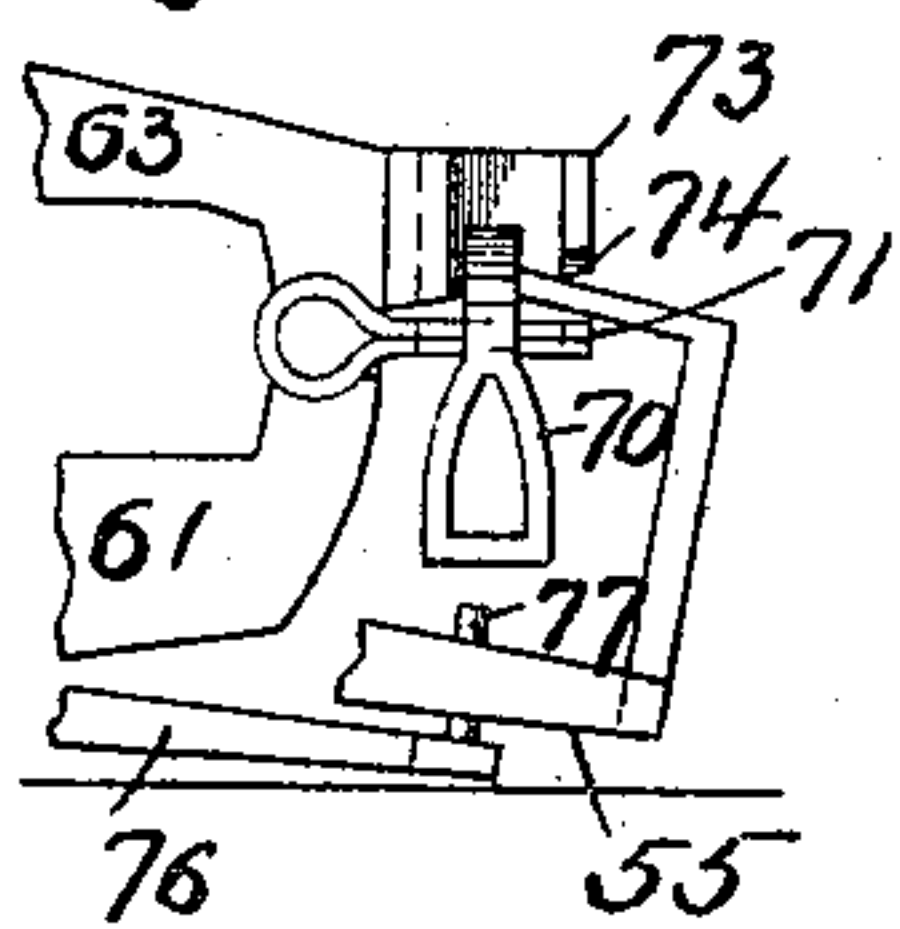


Fig. 12.

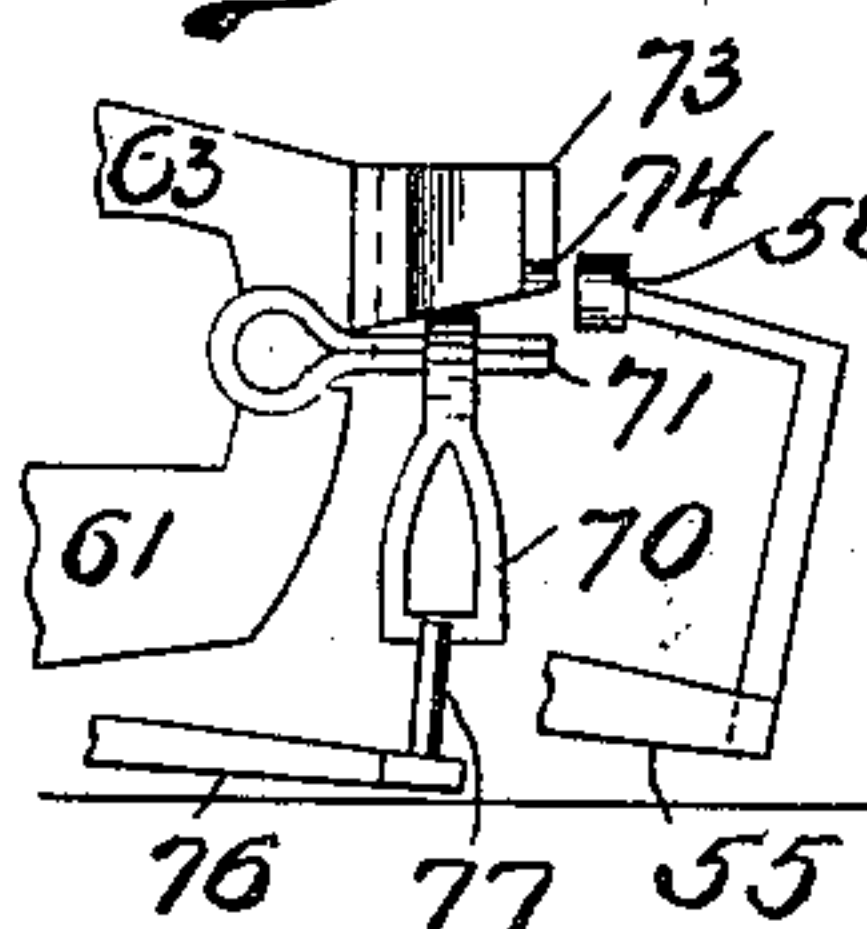


Fig. 13.

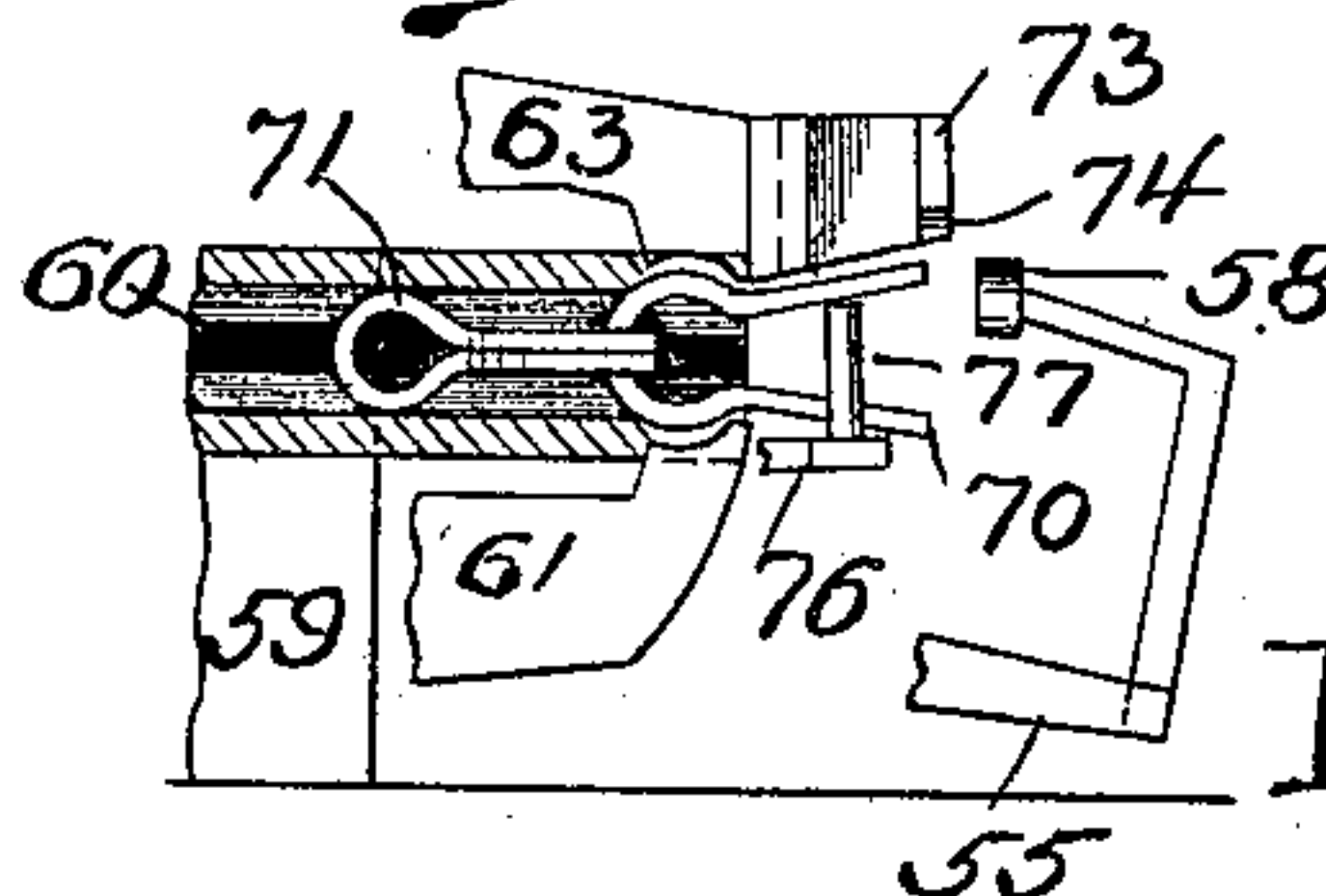


Fig. 14.

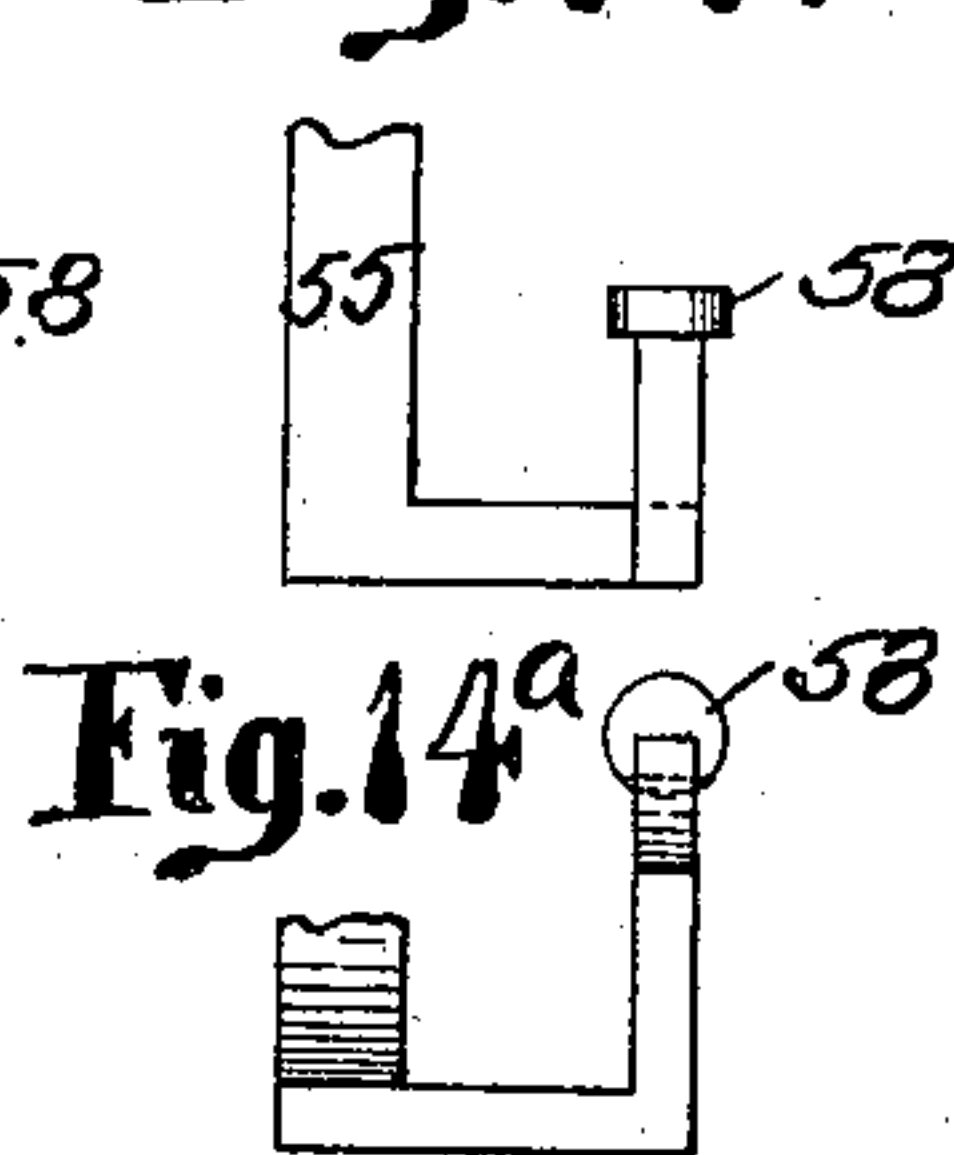


Fig. 15.

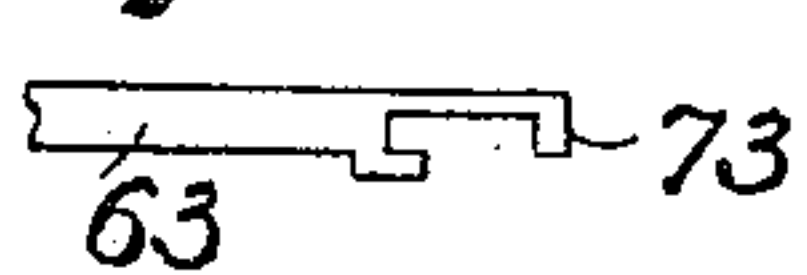


Fig. 16.

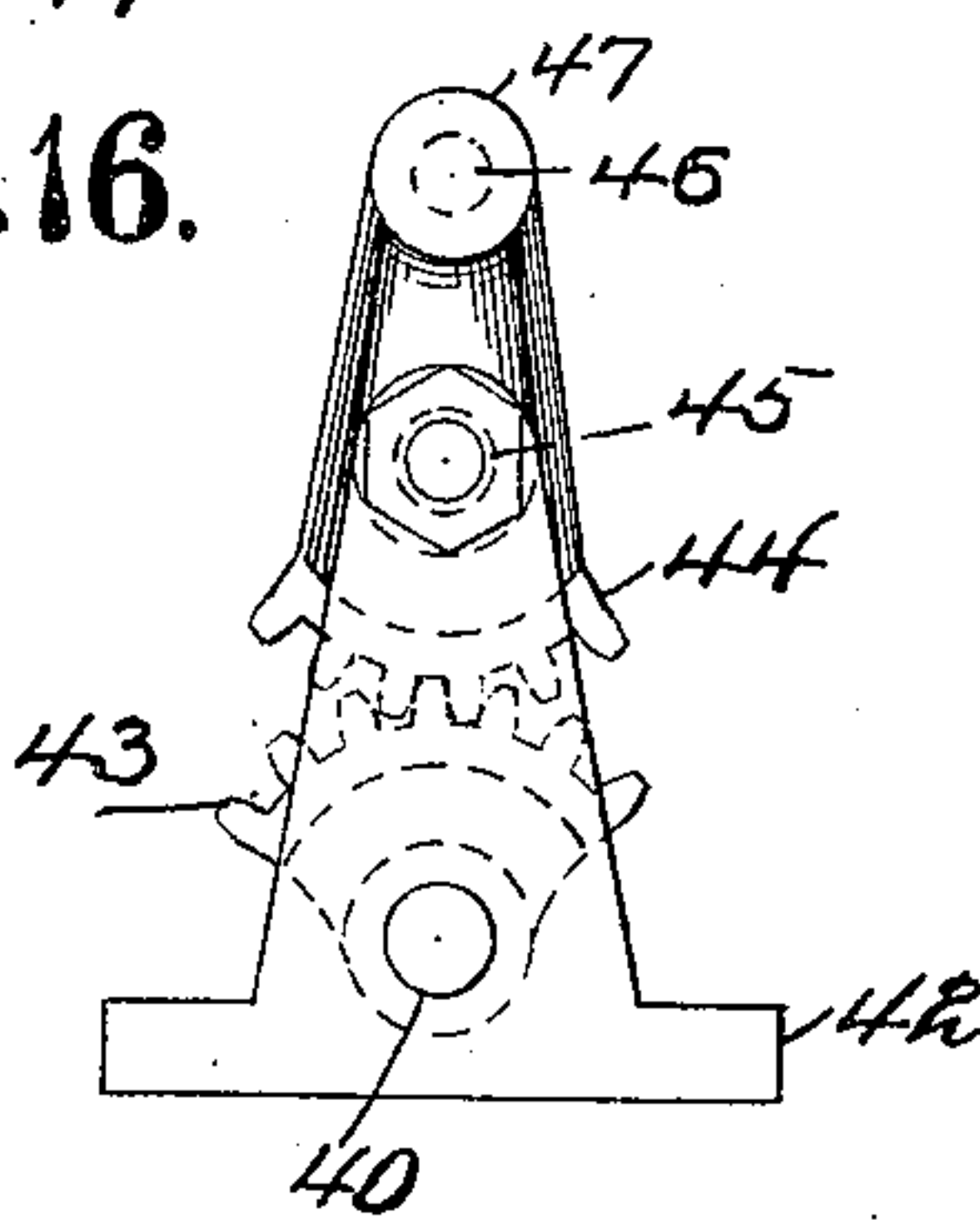
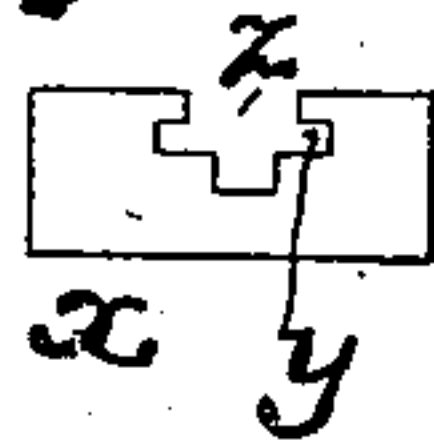


Fig. 17.



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# UNITED STATES PATENT OFFICE.

HENRY B. MORRIS, OF MICHIGAN CITY, INDIANA.

## MACHINE FOR MAKING CHAINS.

SPECIFICATION forming part of Letters Patent No. 627,870, dated June 27, 1899.

Application filed January 20, 1899. Serial No. 702,768. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY B. MORRIS, a citizen of the United States, residing at Michigan City, in the county of La Porte and State of Indiana, have invented certain new and useful Improvements in Machines for Making Chains, of which the following is a specification.

My invention relates to the manufacture of sheet-metal chains of the kind in which the links are each composed of a short length of sheet metal bent centrally to form a loop and having two eyes on its ends which register with each other and through which extends the loop portion of another link in the chain. In the manufacture of this class of chains it has been customary heretofore to first punch out from a strip or ribbon of sheet-metal link-blanks, which are usually assembled in a well, from which they are delivered one at a time to bending mechanism. In some cases, however, the link-blanks are fed directly to the bending mechanism and are joined to the previously-formed portion of the chain and then bent into final form.

The object of my invention is to manufacture chains of this character by improved mechanism which is rapid and certain in its operation and produces an article free from flaws. My invention comprehends improvements in the mechanism for feeding the stock, the mechanism for punching the eyes and for punching the link-blanks from the stock, and also in the mechanism for joining links as they are formed to previously-made chain, and in mechanism for giving final form to the links.

I have embodied all of my present improvements in a power-driven machine which is entirely automatic, a metal ribbon or strip of indefinite length being automatically fed to the punchers which form the links and the links as fast as formed being automatically joined to the previously-formed chain; but I do not wish to limit my invention to a power-driven machine or one which is automatic, as some of the operations may be performed by hand or some of the mechanism may be hand-operated, and some parts of the mechanism may be used independently of the others. I have endeavored to point out the novel fea-

tures of my invention in the claims at the end of this specification.

Instead of feeding the stock by means of feed-rolls, which have heretofore commonly been employed, I employ a feed-pawl the end of which extends through one of the eyes cut in the stock and when moved forward gives a proper definite movement to the stock. Thus there is no danger of the feed mechanism slipping or failing for any cause to feed the stock to the proper extent at each operation, it obviously being very important that the stock should be fed to the same extent in each operation in order that the eyes of the link-blank may exactly register when the blank is bent.

Heretofore the link-blanks have been cut or punched from the stock before they are bent, and separate mechanism has been employed to bend the links. By my improvements I simultaneously sever the link-blank from the stock and bend it into such form that it may conveniently be threaded into the last link of the previously-formed chain and may then be readily closed by a short movement of properly-constructed link-closing devices.

The link-closing devices which I employ are also of an improved construction, and these, with other parts of the invention, will be hereinafter fully described.

The accompanying drawings show my improvements embodied in an automatic machine organized to operate in the best way now known to me. Such parts of the mechanism as are not necessary to a full understanding of the invention are omitted, and these may be of any common or ordinary construction.

Figure 1 is a general front elevation of the machine, the cam-shaft and chain-feeding devices being omitted in order that the other parts of the mechanism may be more clearly seen, the mechanism for holding the completed chain, the finger-lever, the adjusting mechanism, and the link-closing mechanism being shown in section. Fig. 2 is a general plan view on about the same scale as Fig. 1, the housing, the sliding head or punch-gate, and the intermediate shaft being removed in order to better exhibit the remaining parts of



the machine. Fig. 3 is a right-hand side elevation designed to illustrate particularly the finger and the means for operating it. Fig. 4 is a right-hand side elevation designed to illustrate particularly the mechanism for joining a new link to the previously-formed chain, the mechanism for closing the link, the devices for adjusting the new link previous to being closed, and the mechanism for feeding the chain. Fig. 5 is a right-hand side elevation illustrating particularly the mechanism for feeding the stock and the mechanism for feeding the completed chain. Fig. 6 is a detail view, on an enlarged scale, of the holder for the completed chain and the mechanism for closing the links. Fig. 7 is a rear elevation of the same. Fig. 8 is a rear elevation of the holder with the link-closing mechanism removed. Fig. 9 is an enlarged detail view, partly in section, showing particularly the blanking punch and die, the finger, and the link-adjusting devices. Fig. 10 is a view similar to Fig. 9, but taken at right angles to that of Fig. 9. Fig. 11 is a detail view showing particularly how a new partially-closed link is joined to the last link of the previously-formed chain. Fig. 12 is a similar view showing the same parts, the finger, which is also a transferring device, being withdrawn from the newly-formed partially-bent link. Fig. 13 is a detail view showing how the newly-formed partially-bent link is drawn against the mouth of the holder and how the compressing-levers operate to close the new link. This figure also shows how the adjusting devices operate to adjust the position of the link before it is closed. Fig. 14 is an enlarged detail view, in front elevation, of the finger. Fig. 14<sup>a</sup> is a plan view of the same. Fig. 15 is an enlarged detail plan view of one end of the upper link-closing lever. Fig. 16 is a rear elevation of part of the mechanism for operating the feed-pawl. Fig. 17 is an enlarged side elevation of a modified form of supporting-bridge for feeding the stock.

The working parts of the machine are shown as mounted upon a flat horizontal bed-plate 1. From the rear portion of the bed-plate rise two housings 2 and 3, which are provided with parallel vertical guides 4, between which slides a head or gate 5. This gate is operated from a shaft 7 by means of a crank 6 thereon and a connecting-rod 8, which is preferably made in two parts oppositely screw-threaded and joined by a sleeve-nut 9. The crank-shaft 7 is journaled in bearings on top of the housings 2 3 and is driven by a pulley 10 or in any other suitable way. A horizontal shaft 11 is mounted above the forward portion of the bed-plate in suitable bearings in standards 12, rising from the bed-plate. Motion is imparted to this shaft from the crank-shaft 7 through the medium of an intermediate shaft 13, which is situated at the left side of the machine and is so inclined as to extend upward and backward from the left-hand end of the shaft 11 to the left-hand end of the shaft 7. The shaft

13 is journaled near its lower end in a standard 14, rising from the bed-plate, and near its upper end in a bracket 15, rigidly attached to the left-hand housing 3. Upon the ends of the shaft 13 two miter-gears 16 and 17 are mounted, said gears being arranged to engage two similar miter-gears 18 19, secured, respectively, upon the left-hand ends of the shafts 7 and 11. The construction and arrangement of these parts are such that the shaft 11 is revolved synchronously with the crank-shaft or driving-shaft 7, so that the cams hereinafter described, which are carried on the shaft 11, perform one complete revolution at each revolution of the driving-shaft 7, and consequently at each full stroke of the sliding head or punch-gate 5.

A strip or ribbon of metal 20, from which the link-blanks are cut, is fed transversely across the machine from left to right by mechanism soon to be described. The link-blanks are punched out longitudinally in a single row from the strip, which is preferably a little wider than the links to be formed. Secured to the lower end of the sliding head or gate 5, near its left-hand side, are two punches 21 22. These project vertically downward and are adapted to form the two eyes 24 in the link-blank. They are arranged to reciprocate over a die 23, mounted below them on the bed-plate. A stripper 26 of ordinary construction is rigidly attached to the upper side of the die 23 for disengaging the metal strip 20 from the punches when they ascend, and a recess 27 in the stripper serves as a guide to insure the passage of the strip across the die in a correct line. A punch 28, which for convenience will be called the "blanking-punch," is secured to the lower end of the sliding head 5, near the right-hand side thereof. This punch is fitted to a die 29, mounted below it on the bed-plate. The blanking-punch and its die are of the form of a chain-link and are arranged to punch out the links from the metal strip 20. A stripper 30, similar to the stripper 26, is employed for disengaging the ribbon 20 from the punch when it ascends. The two dies 23 and 29 are disposed in a straight line and at such a distance apart that a length of the strip 20 a little greater than that of two links is at all times interposed between them, the purpose being to insure the formation of perfect links. The upper surfaces of the dies 23 and 29 are preferably on the same plane with each other, and they are connected together by a horizontal piece of metal 31, which I call a "bridge" and whose upper surface is level with the dies. The die 23 is supported upon a block 23<sup>a</sup>, the middle forward portion of which is recessed or hollowed out to permit the pieces of metal punched out of the strip 20 to fall freely. The die 29 is supported upon a block 29<sup>a</sup>. It is also provided with a large recess 29<sup>b</sup> to make room for the chain-assembling mechanism hereinafter to be described.

Before proceeding with the description of the operation of the dies I will first describe



the construction and operation of the feeding mechanism.

At the rear side of the dies 23 29 is arranged a horizontal bar 32, which I call the "feed-bar." This bar is supported in two bearings 33 34, mounted on the bed-plate. Preferably the feed-bar is rectangular in cross-section to prevent it from rolling, and it is so mounted that it may be slid horizontally in its bearings to and fro. A feed-pawl 36 is pivoted on a stud 35, projecting forwardly from the feed-bar at a point between the punches 22 and 28. The free end of the pawl extends downwardly and to the right, the arrangement being such that the pawl is directly over the middle of the strip 20, and its free end is formed to enter and engage one of the eyes 24 which have been punched in the strip. The end of the pawl is prevented from descending too low by a forwardly-projecting pin 36<sup>a</sup>, secured to the pawl near its free end. This pin not only limits the descent of the pawl, but also prevents the strip 20 from rising and so becoming disengaged from the pawl. A spring 27, wound upon the stud 35, engages the pawl and impels it downward upon the strip 20. Preferably the free end of the pawl extends for a short distance below the strip 20, entering a groove in the upper surface of the bridge 31. The main or blanking die 29 is also for the same purpose correspondingly grooved for a short distance to permit the pawl to travel a short distance over its left-hand end. It will thus be seen that the feed-pawl is arranged between the punching and the blanking dies and that the metal strip is fed forward by a positive and secure engagement of the pawl with the strip.

The feed-bar is actuated by the following mechanism: On the lower side of the feed-bar, near its middle portion, is formed a rack 38, which engages a curved rack or segment 39, secured to a horizontal shaft 40, which is journaled in bearings 41 42, mounted on the bed-plate. The shaft 40 is disposed at right angles to the feed-bar and extends forward from the rack 39 through an opening in the die-block 23<sup>a</sup>. A pinion 43 is secured on the forward end of the shaft 40 and engages a curved rack or segment 44, centrally pivoted on a stud 45, mounted in the forward bearing 42 vertically over the shaft 40. The upper portion of the circular rack 44 is provided with a forwardly-projecting stud 46, which carries a friction-roller 47, engaging a cam-groove 48, formed in the surface of a revolving cam 49, which I call the "feed-cam," and which is rigidly secured to the cam-shaft 11. At each revolution of the machine and at proper times the circular rack 44 is oscillated to and fro and an oscillating movement is imparted to the shaft 40 and circular rack 39, thereby reciprocating the feed-bar. The motion thus given to the feed-bar is such that at each operation the strip 20 is fed forward, so that a

pair of the previously-punched eyes 24 are in proper position under the blanking-punch with reference to the new link to be formed.

As before described, the strip 20 in passing from the die 23 to the die 29 moves through a bridge 31. The construction of the bridge shown as embodied in the machine is regarded as the best form to use; but when very thin metal is employed for the manufacture of the chain I preferably cover the bridge with a cap-piece recessed upon its lower side for the strip and grooved through its top for the passage of the pawl 36. By this arrangement the edges of the strip 20 are guided and held down, so that the strip is prevented from being bent. This form of bridge is fully shown in detail in Fig. 17, the bridge-block *x* being recessed at *y* for the metal strip and grooved at *z* for the passage of the feed-pawl.

The lower end of the main or blanking punch 28 is of a peculiar formation. It has a centrally-concaved recess *a*, occupying about one-third the area of the end of the punch and joining at *b* outwardly and upwardly projecting surfaces *c*. The highest part of the curve is in the middle of the punch, and the lowest portions thereof are at points within the opposite sides of the punch, the formation corresponding in general outline to the parts of the finished link where the curve of its loop begins. The object and effect of this formation of the punch is that in its descent the two flat portions of the link containing the eyes are first punched out from the strip 20, and by the progressive descent of the punch the middle portion of the link is afterward punched out, being at the same time curved into a loop in consequence of the concaved curved shape of the middle part of the punch. The punch 28 is of such form, however, as not to bend the ends of the link close together, as they are in the finished chain, but to leave them so far apart that one of them may be easily passed through the eyes of a finished link. A link in this condition, which I call "half-bent," may readily be fully closed into its finished form by a compressing force subsequently applied to the bent or loop portion thereof.

Owing to the great difference which exists between different metals and even between different parts of the same metal strip as to temper, hardness, pliability, and elasticity it would be practically impossible for the punch, as above described, to produce unaided half-bent links of a uniform shape. For instance, a link cut from a hard non-elastic piece of metal would not ordinarily be closed so far as one cut from a softer and more pliable piece, and if the punch were formed to properly shape the hard links then the softer ones would be closed too far, so that they could not be joined to the last link of the finished chain. Uniformity in this particular is secured by means of a device which I call a "finger," but which also serves to receive the link from the punch



and to carry it or transfer it into engagement with the chain already made.

While the use of a finger is not absolutely necessary in the manufacture of chains where-  
 5 in a punch and die like that just described are employed, yet to obtain the best results and to insure uniformity such a finger is a highly-important factor, and I therefore always preferably employ it.

10 The finger 58 is constructed and operated as follows: Upon the bed-plate, at a short distance in front of the main die 29, is a stand-  
 15 ard 50, to the upper portion of which is centrally pivoted a right-angled bell-crank lever 51, one arm of which extends upward, while the other arm extends forward. A friction-  
 20 roller 52 on the forward arm of the lever engages a cam-groove 53, formed in the side of a revolving cam-wheel 54, secured on the cam-  
 25 shaft 11. To the end of the upright arm of the bell-crank lever is pivoted a lever 55, which I call the "finger-lever." The pivot is located at a point a short distance forward  
 30 of the middle of said lever, and the lever is normally in nearly a horizontal position, its forward end being a little higher than its rear  
 35 end. A friction-roller 56, pivoted upon the forward end of the finger-lever, engages a cam-groove 57, formed in the side of the cam-  
 40 wheel 54. The rear end of the finger-lever extends under the main die 29, entering the large recess 29<sup>b</sup> in the die-block 29<sup>a</sup> near its  
 45 right-hand end and reaching to a point to the rear of the link-aperture in said die. From this point the lever is bent at a right angle  
 50 horizontally to the left to a point corresponding with the middle of the die. Thence said lever is bent upward in a substantially vertical  
 55 direction and then forward and slightly upward to a point corresponding with the middle of the die, where it terminates in the  
 60 finger proper, 58, which is in form substantially cylindrical and rises above the adjoining portion of the finger-lever. It corresponds  
 65 in shape with the inside of the loop portion of a half-bent link and is of such thickness that it may enter the narrow middle portion  
 of the die and may be elevated so that its upper surface is substantially level with the  
 upper surface of said die. In order to allow the upper portion of the finger-lever to rise  
 to the required height, the lower side of the die 29 is recessed at that part adjoining the  
 finger-lever, and the rear side of the die-plate is thickened upon its upper surface, as shown  
 in Fig. 10, to reinforce it, as it might otherwise be weakened by the recessing of its un-  
 der side. When the finger is elevated to its highest position, it is then substantially in  
 contact with the lower side of the metal strip 20, which rests upon the die 29, and each link  
 as it is punched out is caused by the bending action of the punch 28 to be wrapped over  
 the finger, so that the middle or looped portion of the link embraces the finger tightly.  
 The finger thereby serves to receive the half-bent link from the punch, and, as will be

presently explained, the finger also operates to bring said partially-formed link into en-  
 70 gagement with the chain already formed.

The construction and arrangement of the parts for operating the finger are such that the finger may by the action of the finger-le-  
 75 ver 55 and cam-groove 57 be elevated and depressed. It may also by the action of the bell-  
 crank lever 51 and cam-groove 53 be moved forward and backward independently of its  
 rising-and-falling motion.

That portion of the chain which has already been formed and assembled is held in a holder  
 80 consisting of a hollow block 59, erected upon the bed-plate in front of the die 29 and extending partly beneath it. A horizontally-  
 disposed recess or tube 60, formed in the holder, extends from front to rear thereof,  
 85 and its bore corresponds in form with the chain-links which are to pass through it. The form of the bore is illustrated in end ele-  
 90 vation in Fig. 8, and it is such that it fits the wide flat eye portions of the link, so that its  
 eyes shall be in position one over the other and its grooves at its top and bottom substan-  
 95 tially fit the loop portions of the links.

The tube 60 is preferably formed by making the hollow block 59 in two parts and form-  
 100 ing one half of the tube or bore in the upper part and the other half in the lower part.

A horizontal lever 61, which I call the "lower compressing-lever," is journaled in the for-  
 105 ward portion of the hollow block 59, being fixed upon a short shaft 62, which extends horizontally through a corresponding recess  
 in the block 59. The lower compressing-lever extends to the rear of the block 59, its rear  
 110 end being bent upward and forward to fit the lower side of the loop portion of a finished  
 chain-link. Above the chain-tube 60 is a lever 63, called the "upper compressing-lever." It is journaled in the hollow block 59, being  
 115 mounted upon a short shaft 64, situated vertically above and disposed parallel to the shaft 62. The lever 63 extends from the hol-  
 low block to the rear, whence it is bent downward at a point vertically over the correspond-  
 120 ing portion of the lower compressing-lever 61, said bent portion being conformed to the shape  
 of the loop of a finished link. The holder-block 59 is recessed away at the extreme rear  
 end to allow the rear ends of the compressing-levers to close. The jaws or rear ends of the  
 125 compressing-levers are of a thickness corresponding substantially with the width of the  
 loop portion of a link.

To the left-hand ends of the shafts 62 and 64 are rigidly attached two gears 65 66, which  
 130 engage one another, as shown in Fig. 6, in such manner that the compressing-levers are  
 caused to move in opposite directions when they are operated.

The upper lever 63 is extended for a short  
 135 distance forward of the holder-block in a horizontal direction, its forward end being pro-  
 vided with a friction-roll 67, which engages a cam-groove 68, formed in the side of the



cam 69, mounted upon the cam-shaft 11. By the operation of this cam-groove the upper compressing-lever is at proper times oscillated vertically and the lower lever, through the medium of the gears 65 66 just described, is oscillated in the opposite direction for opening and closing the compression-jaws.

The chain already formed is contained in the chain-tube 60, its last link projecting to the rear beyond the compressing-jaws, which latter are normally closed upon the loop portion thereof. By this arrangement the eyes of said link project to the rearward of the compression-jaws, and the disposition of the parts is such that said eyes are directly under the left-hand free end of the half-bent link, which is held upon the finger 58, formerly described. The finger being depressed in a vertical line, the left-hand free end of the half-bent link 70 is caused to pass through the eyes of the link 71, held between the compressing-jaws, which I also call "holder-jaws," inasmuch as they perform the important function of holding the last link of the chain in proper position to receive the new link. The finger 58 descends until its lower side is nearly in contact with the link 71, as shown in Fig. 11, which suffices to engage the half-bent link 70 therewith.

In order to prevent any displacement of the link 70 in its descent, a guide 73 is attached to the rear end of the upper lever 63. Said guide consists of a vertical groove formed in the lever, which extends upward so far that the link 70 when its descent begins immediately enters said groove. The upper surface of the guide 73 is normally at such a height that the link 70 enters it as soon as it begins to descend; but the guide is not high enough to be touched by the left-hand end of the link while said link is being punched out and bent. The forward side of the groove is formed to overlap one edge of the link 70, thereby holding it in engagement with the guide during its descent. The rear side of the groove does not overlap the link, as one overlapping surface is sufficient. The lower edge of the guide 73 is slightly beveled, as shown in Fig. 11, the rear portion being higher than the forward portion. The guide 73 is preferably beveled a little to facilitate the entrance of the half-bent link. After the finger by its descent has introduced the half-bent link 70 into the link 71 it is moved horizontally to the rear, thereby drawing itself out of engagement with the loop of link 70, as illustrated in Fig. 12, and in order to facilitate this operation the finger 58 may be tapered very slightly.

The rear side of the guide 73 is recessed away at its lower portion 74 to permit the withdrawal of the finger; but said recess is not large enough to allow the loop of the link 70 to retreat with the finger, and therefore the guide serves as a stripper to assist in freeing the half-bent link from the finger. In order to facilitate the entrance of the loop portion of the half-bent link into the chain-

tube, the latter is slightly enlarged or chamfered at its rear end. After the finger has retreated the holder-jaws are, by the action of the cam-groove 68, opened, and the chain is drawn forward a distance of one link by means which will presently be described. This results in bringing the link 70, which hung loosely from the link 71 after the retreat of the finger, into the position lately occupied by the link 71, as shown in Fig. 13. The loop of the half-bent link is, however, larger in diameter than the loop of a finished link, and said half-bent link is thus prevented from being drawn too far forward, as the chain-tube 60 is of sufficient size only from top to bottom to permit the passage of a finished link.

In order to adjust the new link to proper position for being bent, I employ the following devices: A standard 75 is erected upon the bed-plate at a short distance forward of the holder-block 59. To the upper portion of such standard is pivoted a lever 76, which I call the "adjuster-lever." The pivot is located at a point a short distance forward of the middle of the lever. The lever 76 lies normally in a nearly horizontal position, its forward end being slightly higher than its rear end, and it extends from front to rear at the left-hand side of the holder-block 59, its rear end entering the recess 29<sup>b</sup> and being bent horizontally at right angles to the right. Two vertical pins 77 are fixed in the end of the bent portion of the lever and extend upward for a short distance, being about as far apart from one another as the width of the flat portion of a link. The upper ends of the pins 77 are preferably slightly bent outwardly away from each other, and they form a pair of guides for regulating the position of the link 70 in the holder-jaws. The forward end of the lever 76 is provided with a friction-roller 78, which engages with a cam-groove 79, formed in the side of a cam 80, mounted upon the shaft 11. The construction and arrangement of these parts are such that the lever 76 may by means of the cam-groove 79 be oscillated vertically. Said lever is normally so disposed that its rear end, with the pins 77, is depressed, being but a short distance above the bed-plate. When the half-bent link 70 has been drawn between the holder-jaws, as above described, then the rear end of the lever 76 is elevated, and the pins 77 are made to embrace the sides of the link and adjust it laterally, while the bent portion of the lever elevates the link to a proper height, the upper free end of the link being restrained from rising too high by the lower beveled edge of the guide 73, which is conformed to the position of the free end of the half-bent link, as shown in Fig. 13. The adjuster is maintained in its elevated position until the finger 58 is descending with a new half-bent link, when the adjuster-lever is depressed to its lowest position. The adjuster therefore constitutes a support to retain link 70 in its proper position until the new link is about



to engage it. When the link has thus been drawn forward and adjusted, the holder-jaws are by the action of the cam-groove 68 closed, thereby compressing the link held between  
 5 them to its finished form, when it is ready to receive another half-bent link from the finger 58. During the closing of the holder-jaws the adjuster-pins 77 serve as guides to prevent any lateral displacement of the ends of  
 10 the link, thereby insuring that the two eyes shall be made to coincide with each other. After having transferred the half-bent link to the last link of the previously-formed chain the finger 58 is elevated and maintains its  
 15 rearward position until it has risen to within a short distance of the die 29, when it is moved forward to engage the die, as before explained. As a result of this arrangement the finger during its ascent is prevented from  
 20 striking the link 71 and guide 73. The finger-lever 55 is prevented from being displaced laterally by two vertical parallel guide-pins 55<sup>a</sup>, erected on the bed-plate, one on either side of the lever, at a short distance in front  
 25 of the die 29.

The mechanism operates rapidly in the manner above described to form new links and join them to the previously-formed chain. The finished chain is fed or drawn from the  
 30 machine preferably by the mechanism now to be described.

Upon the bed-plate, at the forward portion thereof, are arranged two standards 81 82, and they support a horizontal shaft 83, which is  
 35 arranged parallel with the shaft 11. A ratchet-wheel 84 is secured to the shaft 83 and is partially revolved at proper times by means of a pawl 85, pivoted to the end of a lever 86, which extends rearwardly from the ratchet 84,  
 40 its rear end being pivoted upon a standard 87, erected upon the bed-plate. Near the central portion of the lever 86 is a friction-roller 88, which engages a cam-groove 89, formed in the side of a cam 90, mounted on the shaft  
 45 11. The lever 86 is oscillated vertically at proper times by the action of the cam-groove 89. Upon the shaft 83 is secured a toothed feed-wheel 91. The teeth of the wheel are formed to fit into and engage with the eyes  
 50 of the links composing the chain, and as the wheel is revolved it draws the chain forward step by step. The chain is supported and kept in engagement with the feed-wheel by means of a block 92, erected upon the bed-  
 55 plate below the feed-wheel. This block is provided on its upper side with a groove 93, formed with a central deep portion to permit the passage of the loops of the links and wider shallow portions at the sides to support  
 60 and guide the flat portions thereof.

I have illustrated and described the main punch 28 as having its lower end formed to produce a particular kind of link; but many varieties of sheet-metal chain of the general  
 65 construction above described are well known, and I wish it understood that I do not confine myself to the exact shape or form of the

punch shown in the drawings, the essential feature of my improved punch being a form which enables it to bend the link during the  
 70 act of punching it out into such shape that it may be joined readily to another link and may be closed into finished form by external pressure subsequently applied.

It will now be understood that my improved  
 75 machine is simple in its construction and mode of operation and is capable of running at a high speed without liability of accident or error and so that a perfect chain may be produced.  
 80

The operation of the mechanism has already been fully described. Briefly stated, the operation is as follows: The strip of metal from which the links are to be formed is first  
 85 placed between the punches 21 22 and the die 23 and the first set of eyes are punched from the strip. Then the feed-pawl 36 is made to engage one of the eyes. After that the machine may be run automatically. The strip  
 90 20 is fed forward step by step, the eyes being punched by the punches 21 22 and the link-blanks being punched out and partially bent by the punch 28. As each link is bent by the  
 95 punch 28 it is received by the finger 58 and afterward carried and threaded into the last link of the previously-formed chain, being guided and adjusted in the manner hereinbefore described. After being threaded the chain-feed mechanism operates to draw the  
 100 half-bent link into line with the remaining portion of the chain, as indicated in Fig. 13. Then the compressing-jaws operate to close the link, and while held by the compressing-jaws this link receives a new link, carried to  
 105 it by the finger.

I claim as my invention—

1. A machine for making sheet-metal chains, comprising suitable mechanism for feeding a strip of metal, suitable devices for  
 110 cutting eyes in the strip, and a punch for cutting a blank with a pair of eyes from the strip and simultaneously bending the blank.

2. A machine for making sheet-metal chains, comprising suitable mechanism for feeding a strip of metal, suitable devices for  
 115 cutting two eyes in the strip, a punch and die for cutting a blank with a pair of eyes from the strip and simultaneously bending the blank, and means for threading the link-blank thus formed into a link of the previously-  
 120 formed chain.

3. A machine for making sheet-metal chains, comprising suitable mechanism for feeding a strip of metal, suitable devices for  
 125 cutting two eyes in the strip, means for cutting a blank with a pair of eyes from the strip and simultaneously bending the blank, a holder for previously-formed chain, and means for transferring the newly-formed link to and  
 130 engaging it with a link of the previously-formed chain.

4. A machine for making sheet-metal chains, comprising suitable mechanism for feeding a strip of metal, suitable devices for



cutting two eyes in the strip, a punch and die for cutting a blank with a pair of eyes from the strip, and simultaneously bending the blank, and a finger about which the blank is bent by the punch.

5 In a machine for forming sheet-metal chains, the combination with a suitably-shaped die, of a punch formed on its lower end with a centrally-recessed portion, and with upwardly and outwardly extending end portions, substantially as described.

6. The combination of a die, a punch for cutting a link-blank and for simultaneously bending it, a holder for previously-formed chain, and means for uniting a newly-formed link with a link of the previously-formed chain.

7. In combination with the punch and die for cutting out and partially bending a link, a holder for previously-formed chain, a finger over which the link is wrapped, and means for moving the finger from the punch to the holder and to thread the new link in a link of the previously-formed chain.

8. The combination with the punches of a holder for the previously-formed chain, a device for transferring a newly-formed, partially-bent link to a link held by the holder, and an adjuster movable independently of the holder for adjusting the position of the partially-bent link joined to the chain held in the holder.

9. The combination of the punches, a holder for the chain, a device for transferring a partially-bent link from the punches to the chain, the adjusting-pins, and mechanism for moving the adjusting-pins at proper times to adjust the position of the partially-formed link after it is joined to the chain, and before it is completely closed or formed.

10. The combination of a holder-block, a chain-tube therein having side grooves to accommodate the flat wide portions of the links, and upper and lower grooves fitting the loop portions of the links, means for drawing the chain through the tube, the upper and lower compressing-levers, means for operating them and adjusting devices for adjusting the posi-

tion of the link prior to the operation of the compressing-levers.

11. The combination of means for holding or supporting the chain, means for drawing the chain forward, upper and lower levers provided with holding-jaws, a guide carried by the upper lever, punching devices for cutting out links, and devices for transferring partially-bent links from the punches through the guide of the upper holding-lever into engagement with a link of the chain.

12. In a machine for making sheet-metal chain, the combination of a punch for forming eyes in the stock, a punch for cutting the link-blanks from the stock, a feed-pawl interposed between the two punches and engaging the eyes formed by the eye-cutting punch, means for operating the punches, and means for operating the feed-pawl while the punches are elevated to feed the material toward the blank-cutting punch.

13. In a machine for making sheet-metal chain, the combination with punching devices, of a feed-pawl engaging the material from which the links are cut, a feed-bar to which it is pivoted, a toothed segment engaging a rack on the feed-bar, a shaft to which the segment is secured, a pinion on the opposite end of the shaft, a pivoted toothed segment engaging said pinion, and a cam for operating said segment.

14. In a machine for making sheet-metal chains, the combination with means for feeding the material from which the links are to be cut, means for punching and blanking the links, a finger over which the link-blank is bent by one of the punches, a lever to which the finger is secured, a bell-crank lever to which said first-mentioned lever is pivoted, a cam with which a roller on the bell-crank lever engages, and another cam in which a roller on the finger-carrying lever engages.

In testimony whereof I have hereunto subscribed my name.

HENRY B. MORRIS.

Witnesses:

FRED G. STASCHEN,  
I. I. SPIRO.