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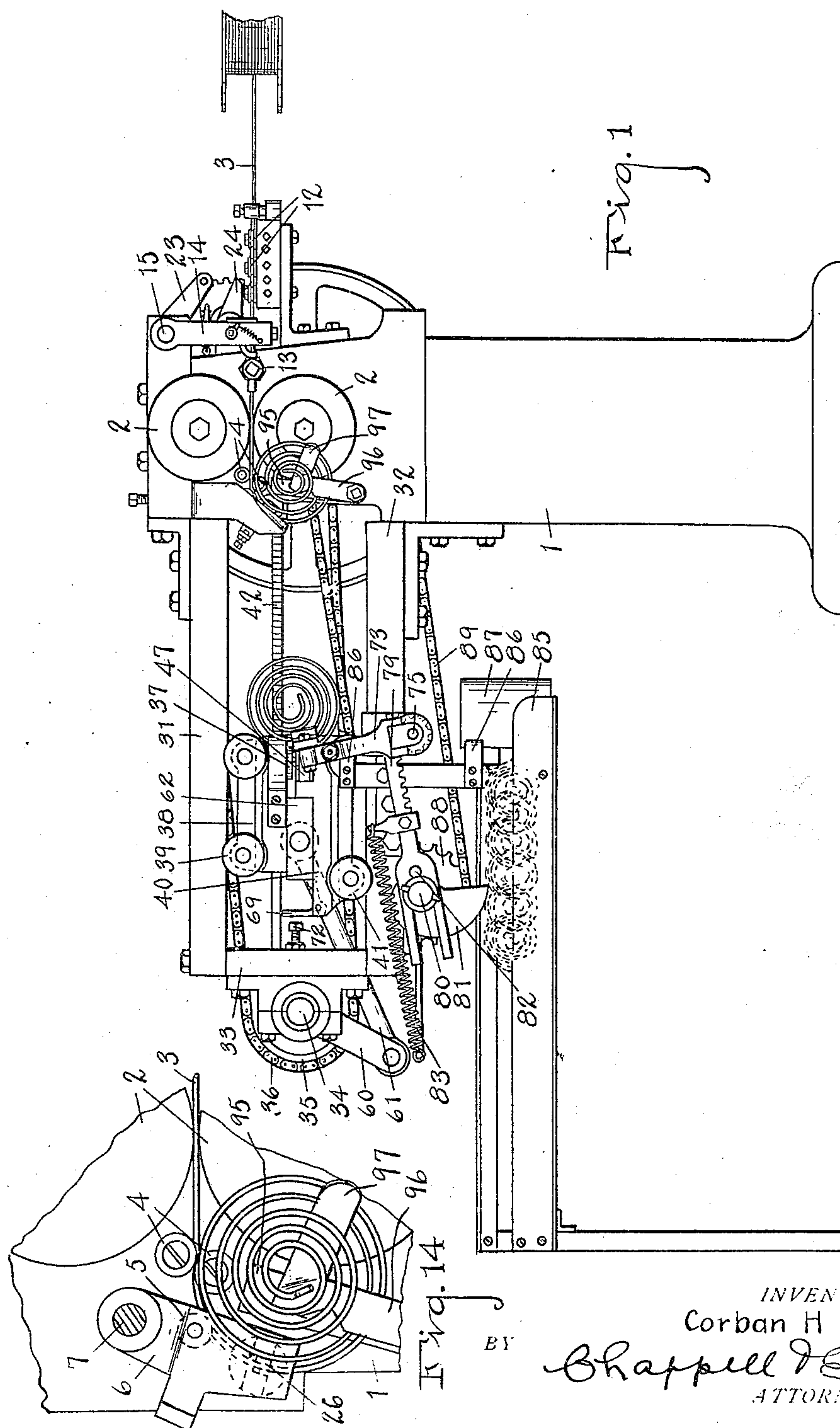
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C. H. ZILER

WIRE SPRING MAKING MACHINE

Filed Feb. 5, 1927

5 Sheets-Sheet 1



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WIRE SPRING MAKING MACHINE

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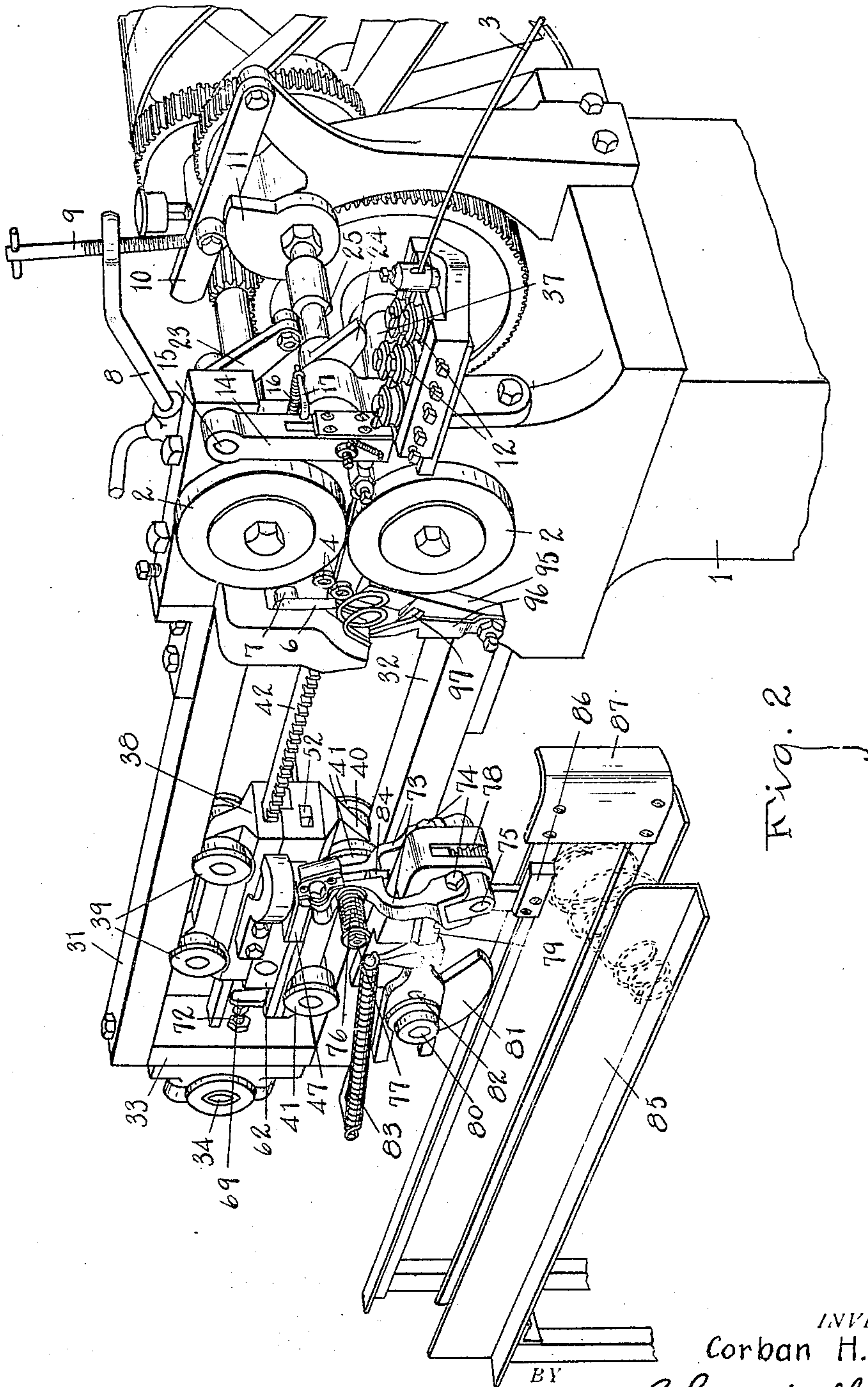


Fig. 2

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5 Sheets-Sheet 3

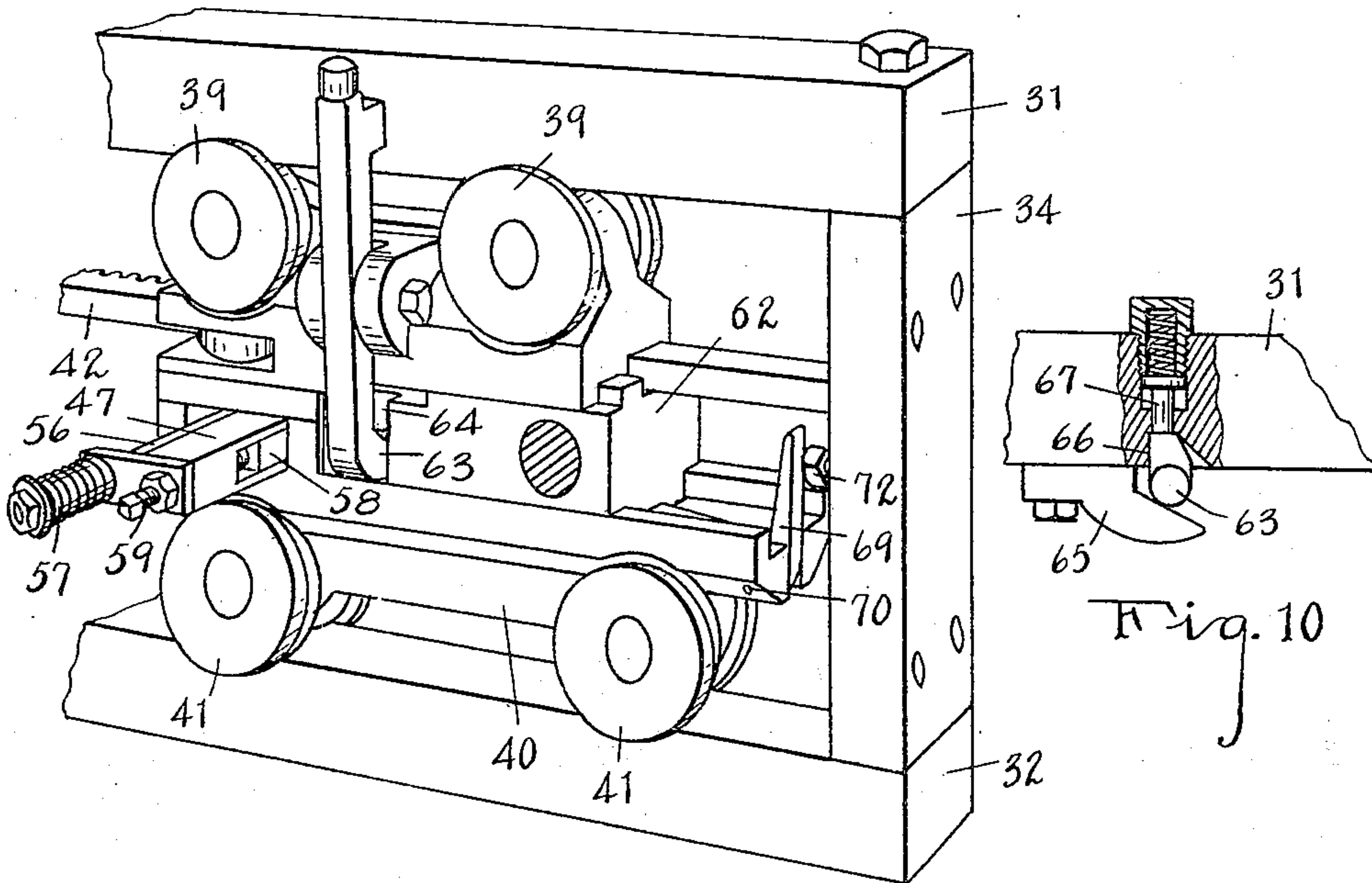


Fig. 3

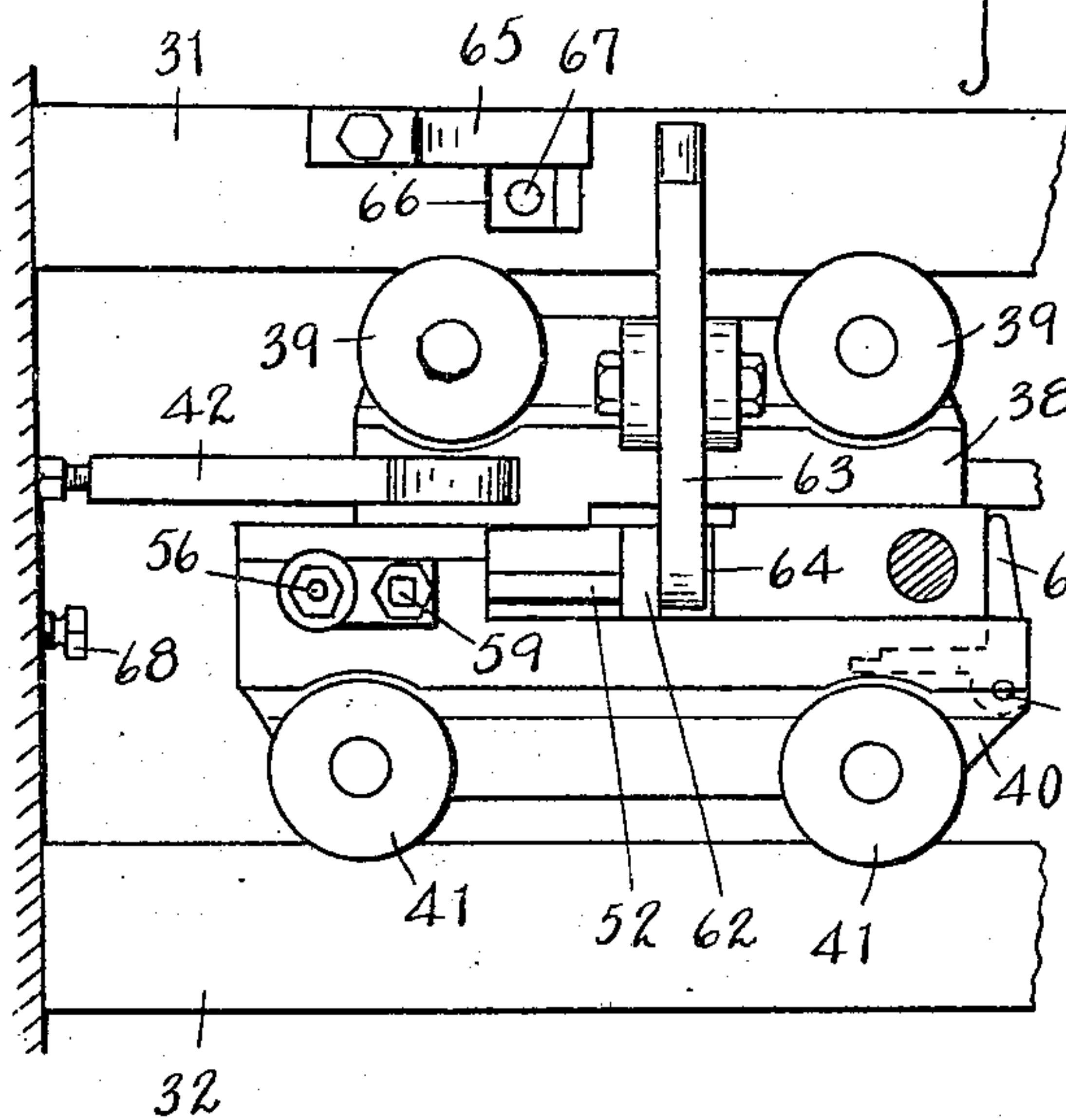


Fig. 4

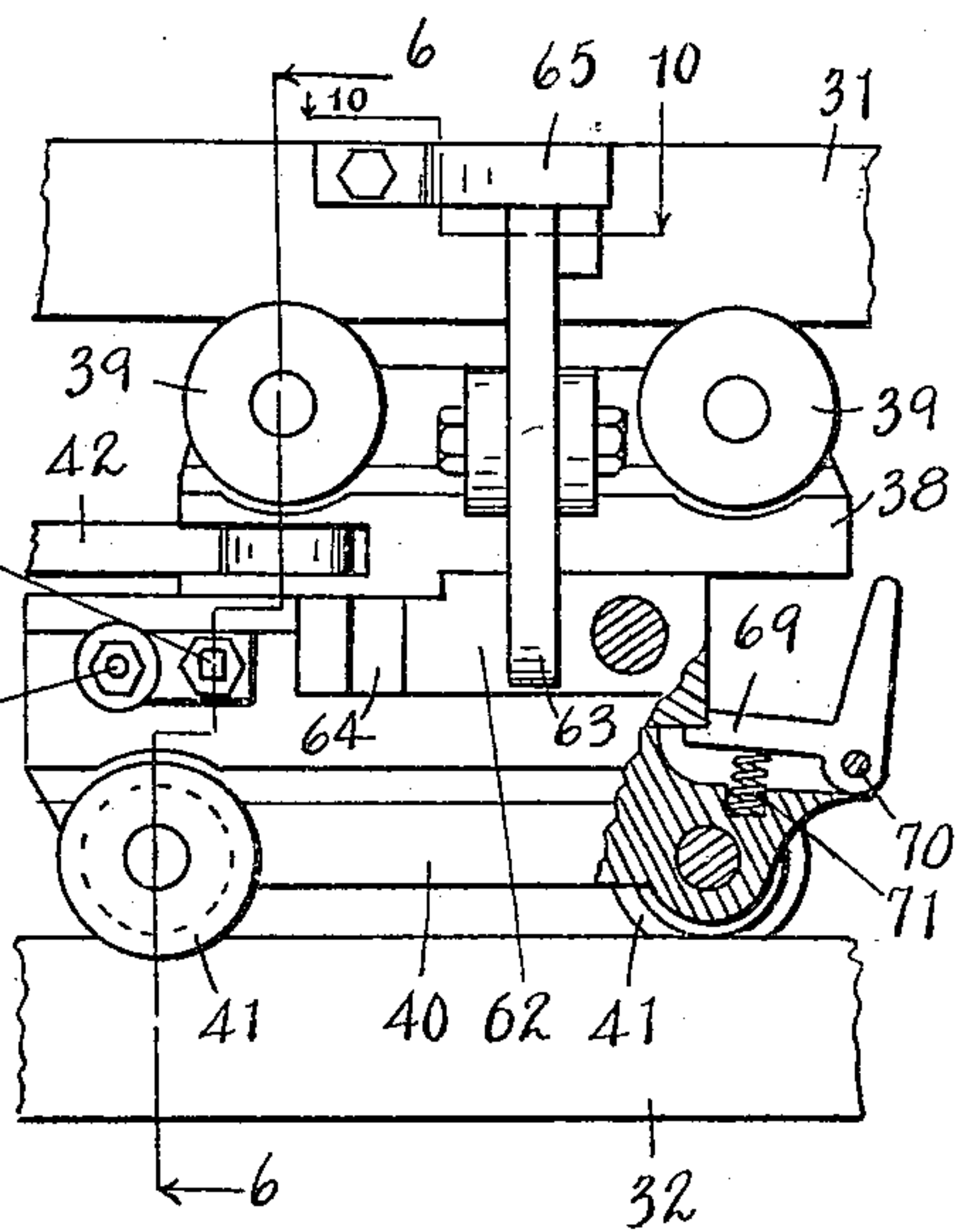


Fig. 5

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WIRE SPRING MAKING MACHINE

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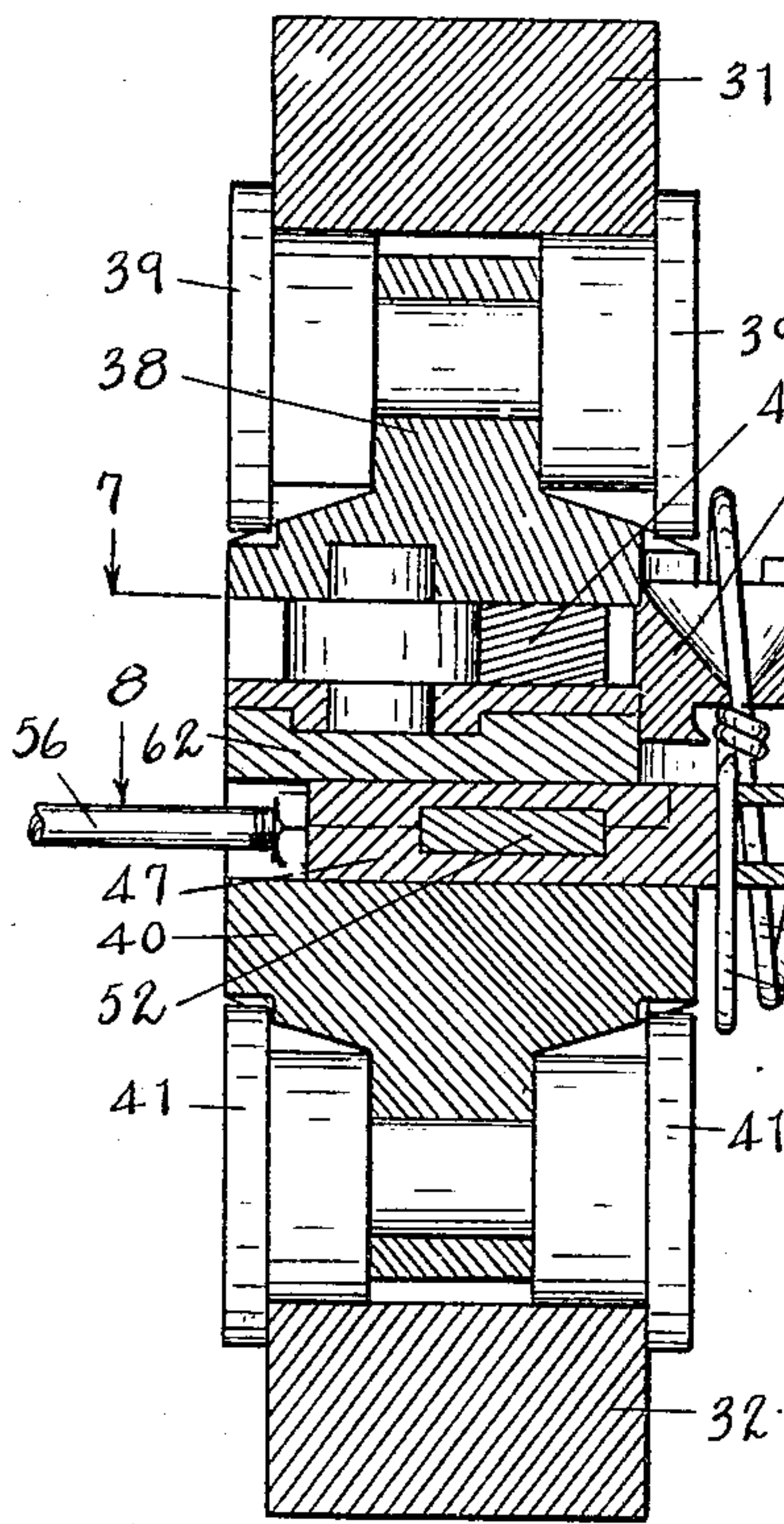


Fig. 6

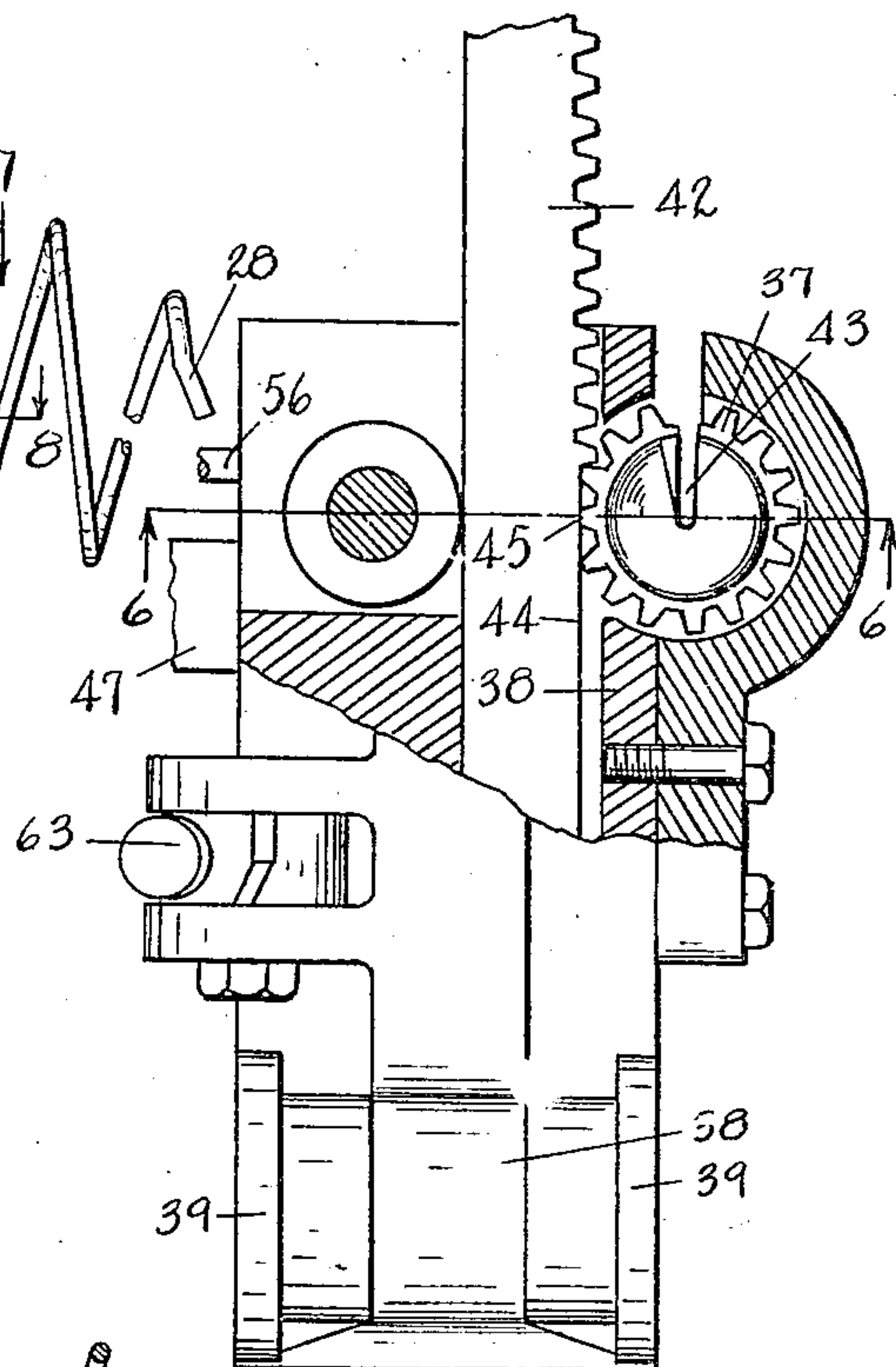


Fig. 7

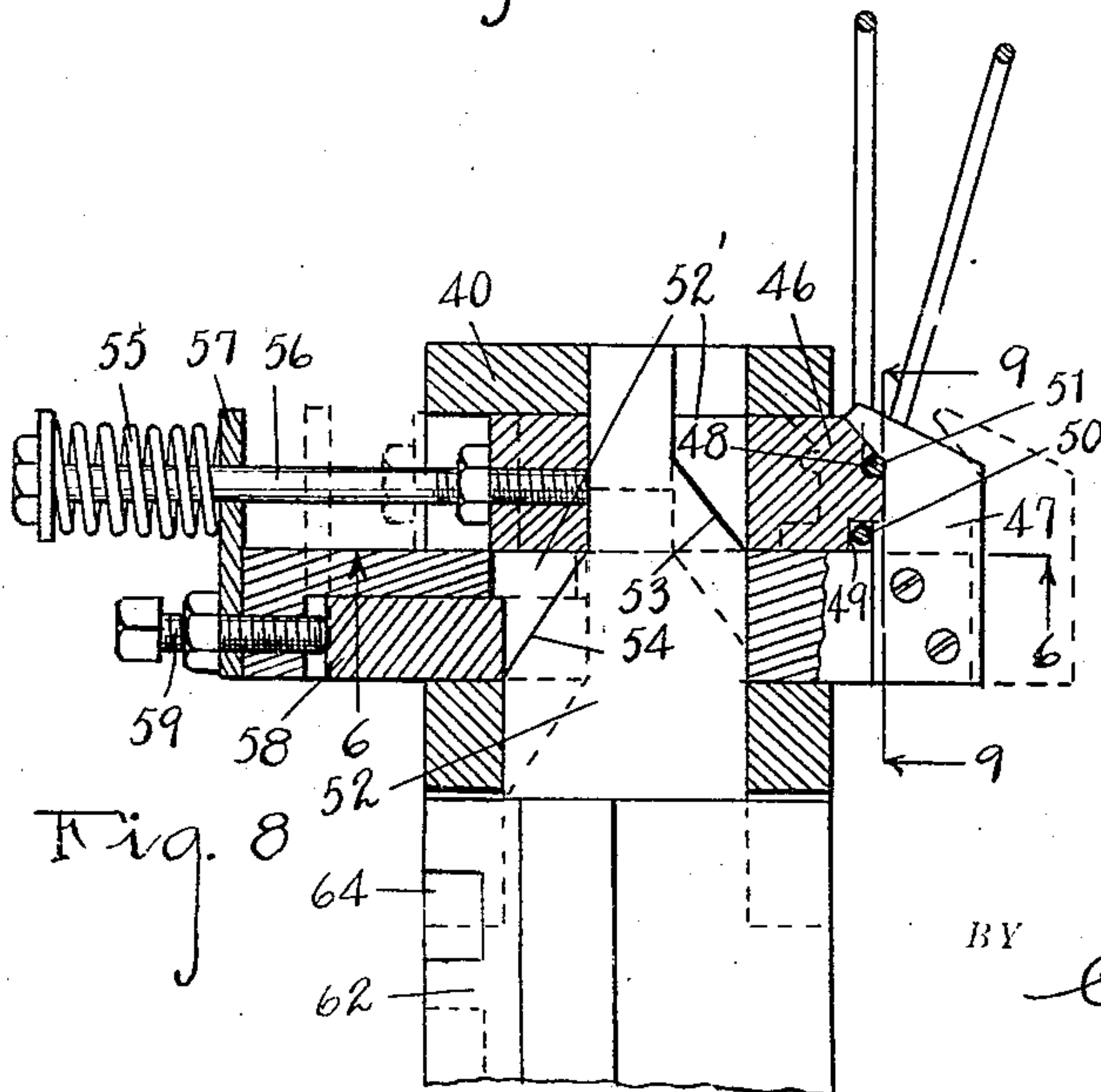


Fig. 8

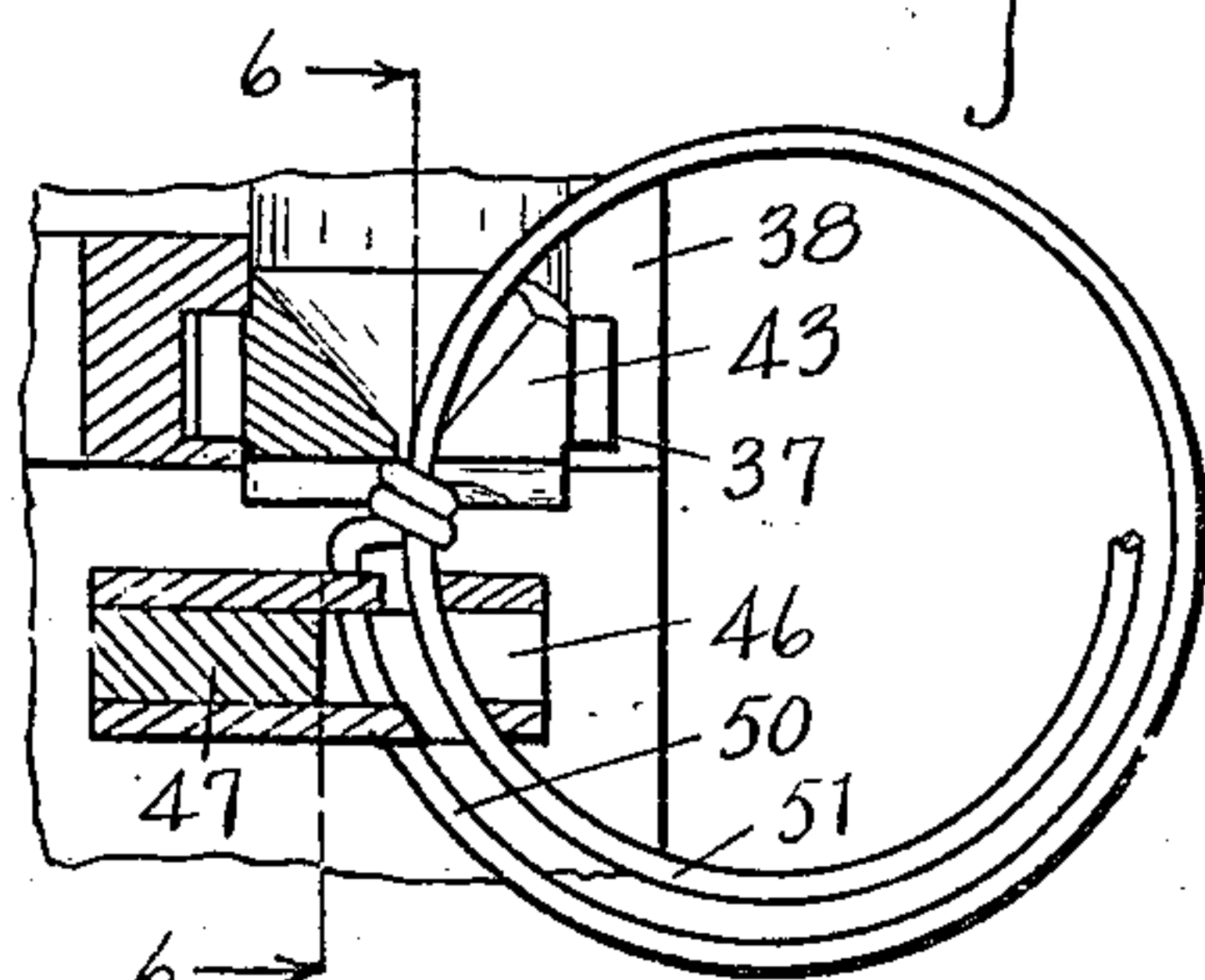


Fig. 9

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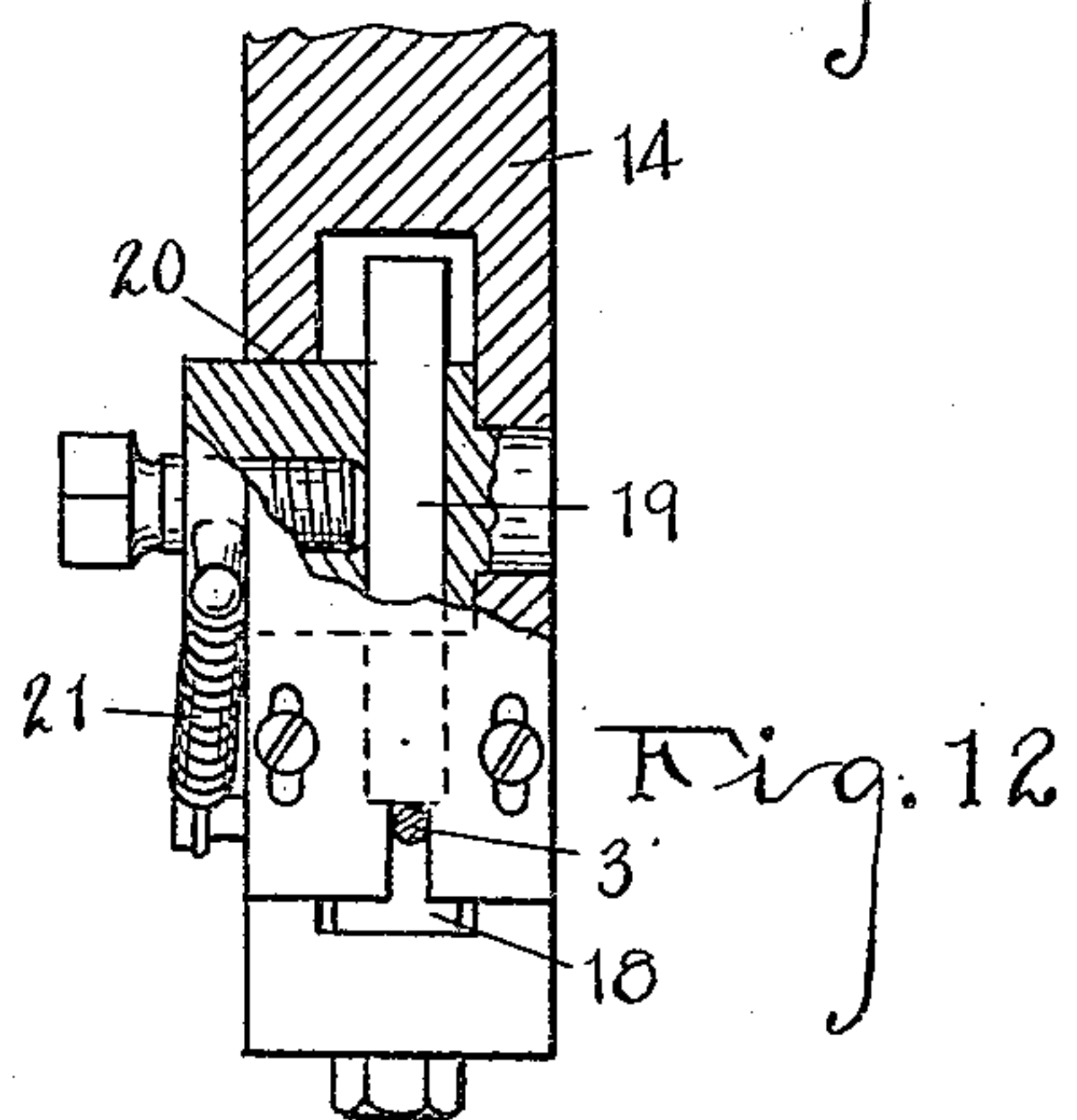
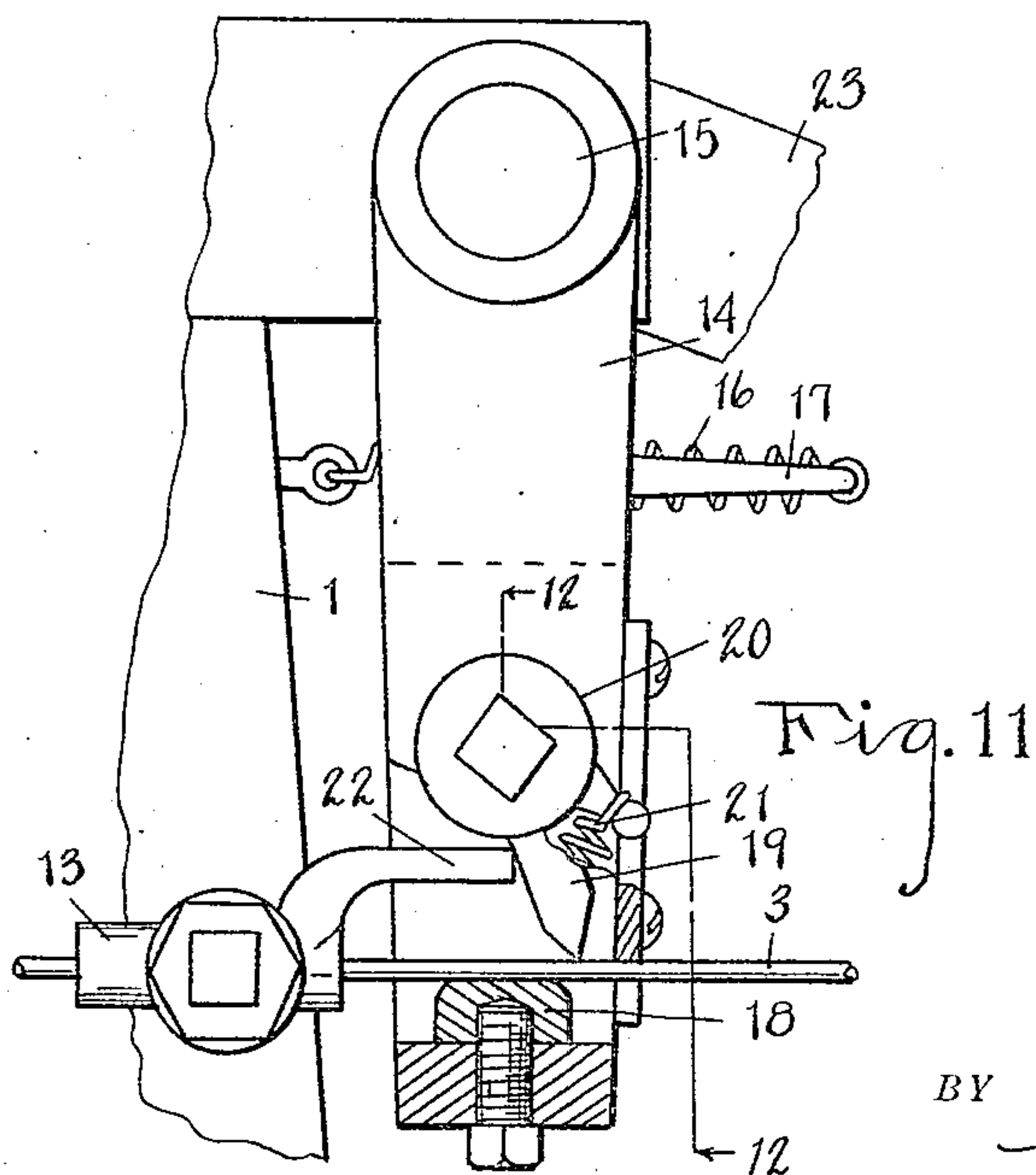
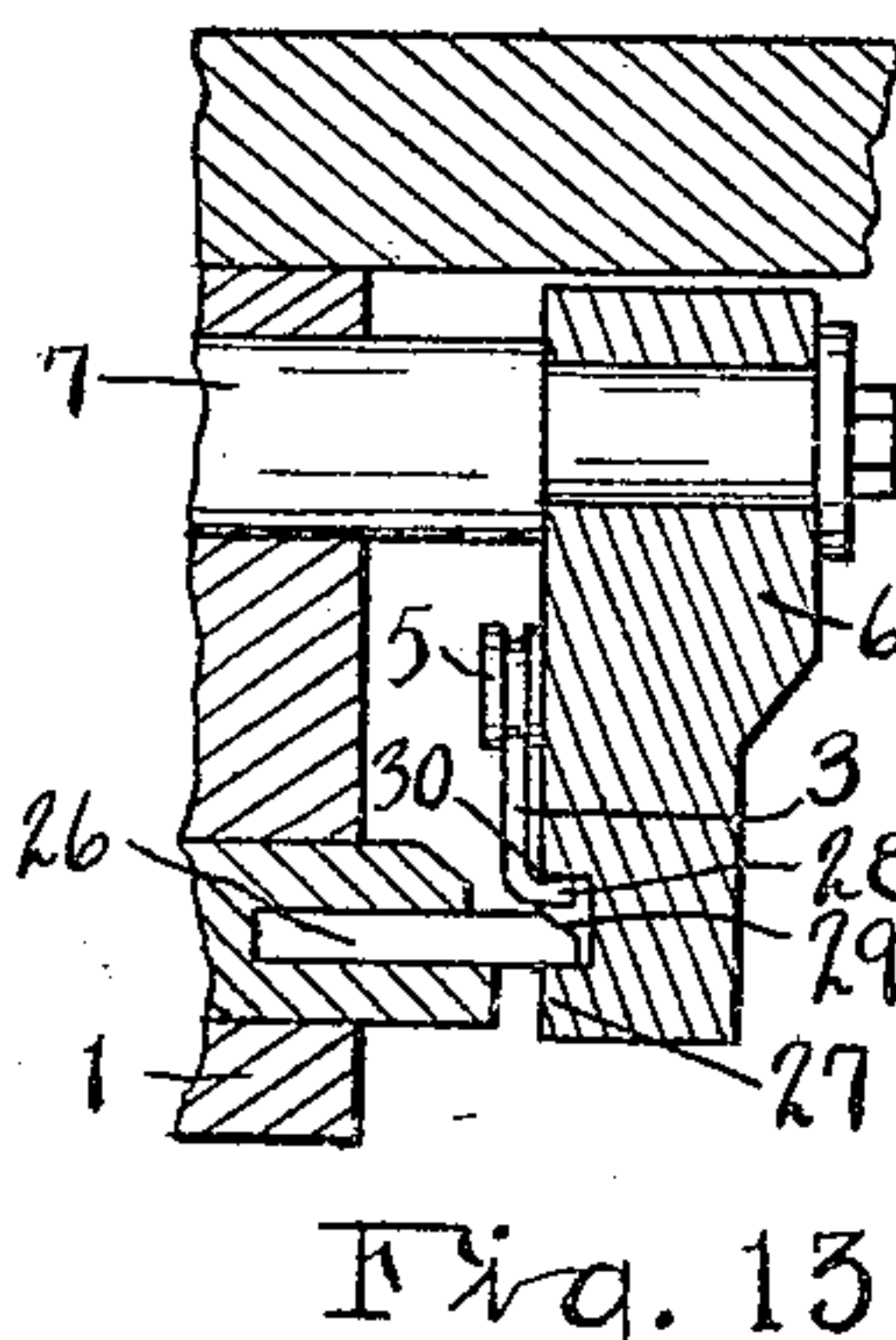
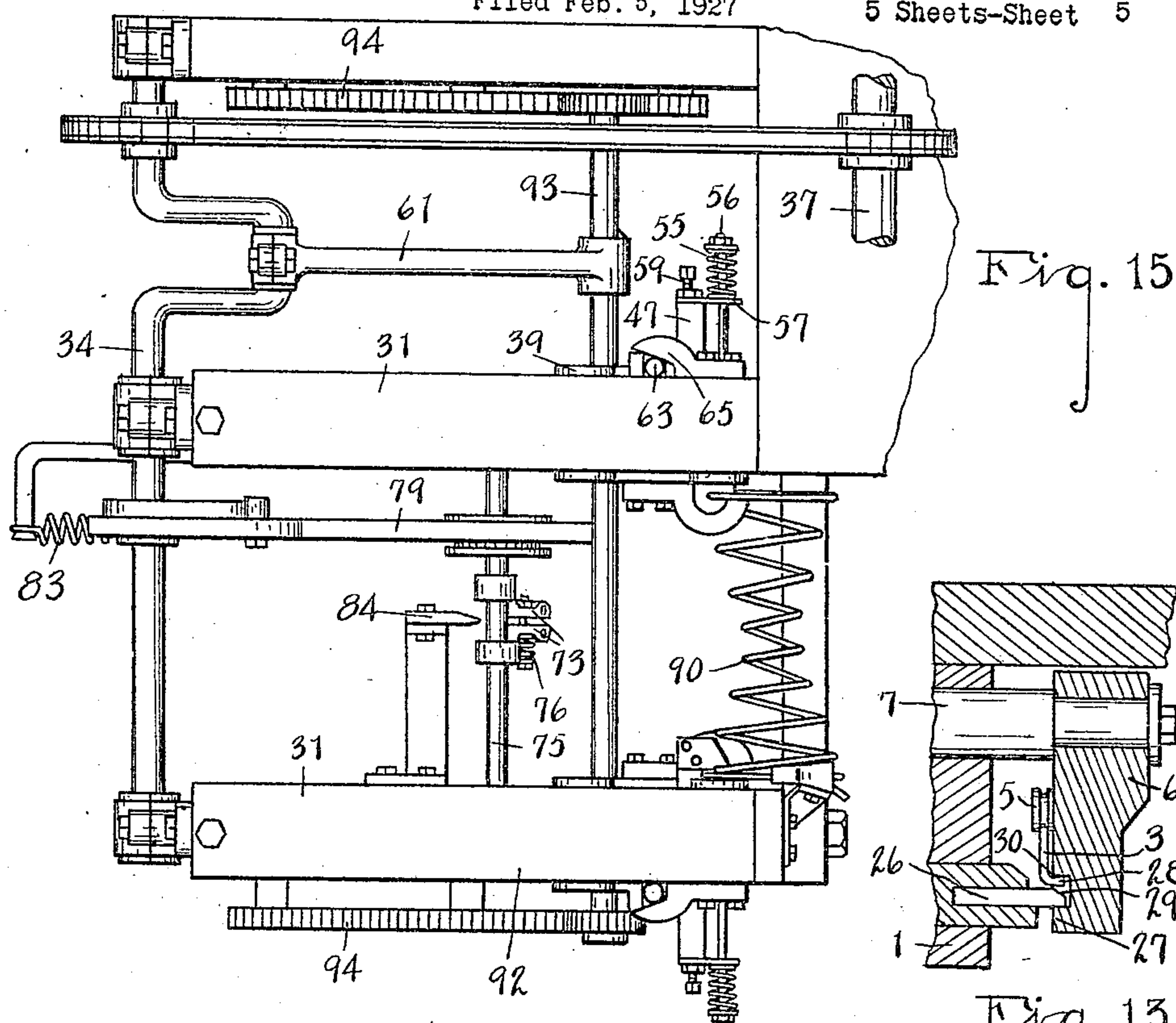
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WIRE SPRING MAKING MACHINE

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5 Sheets-Sheet 5



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# UNITED STATES PATENT OFFICE.

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## WIRE-SPRING-MAKING MACHINE.

Application filed February 5, 1927. Serial No. 166,153.

The main objects of this invention are:

First, to provide an improved spring making machine in which the springs are automatically formed and knotted which is of large capacity.

Second, to provide an improved spring making machine in which the springs are automatically formed, knotted and nested.

Third to provide an improved spring coiling and knotting machine which is very simple and economical in structure and at the same time of large capacity and durable in use.

Objects pertaining to details and economies of my invention will definitely appear from the detailed description to follow. The invention is clearly defined and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawing forming a part of this application, in which:

Fig. 1 is a side elevation of a spring making machine embodying the features of my invention.

Fig. 2 is a fragmentary front perspective view.

Fig. 3 is a detail rear perspective view showing details of parts of the knotter mechanism.

Fig. 4 is a fragmentary rear elevation of the knotter mechanism in another position from that shown in Fig. 3.

Fig. 5 is a fragmentary elevation of the parts shown in Figs. 3 and 4 in still another position.

Fig. 6 is an enlarged detail section on a line corresponding to line 6—6 of Figs. 7, 8 and 9 showing further details of the knotter mechanism.

Fig. 7 is a detail view partially in section on a line corresponding to line 7—7 of Fig. 6.

Fig. 8 is a sectional view on a line corresponding to line 8—8 of Fig. 6 showing details of the knotter clamp mechanism.

Fig. 9 is a detail section on a line corresponding to line 9—9 of Fig. 8 showing further details of the knotter clamp mechanism.

Fig. 10 is a detail view partially in section on line 10—10 of Fig. 5.

Fig. 11 is a fragmentary view showing details of the wire feed.

Fig. 12 is a fragmentary view partially in section on a line corresponding to line 12—12 of Fig. 11.

Fig. 13 is a detail section showing details of the cutter and end former.

Fig. 14 is a fragmentary view showing details of the spring forming mechanism.

Fig. 15 is a fragmentary plan view of a modified embodiment of my invention which is adapted for the forming of double helically coiled springs and knotting both ends thereof.

Referring to the drawing, 1 represents the main pedestal of the machine supporting the main feed rollers 2 by means of which the wire 3 is fed through the guide rolls 4 against the coiler member 5 which in the embodiment illustrated is a roll.

This coiler roll is movably supported by a swinging arm 6 mounted on the rockshaft 7. This rockshaft is controlled so that the coiler roll is swung to properly shape the spring. The rockshaft is provided with an arm 8 carrying an adjustable tappet 9 resting on the lever 10 controlled by the cam 11. These features are of well-known construction and are not illustrated or described with further detail herein.

In order to properly present the wire I provide a series of straightening rolls 12 which also form no part of this invention.

In order that the end of the stock may be properly presented to the forming roll for each successive spring, I provide a means for retracting the wire slightly after the formed spring is severed from the stock. This I illustrate in Figs. 11 and 12 and comprises a clutch carrying arm 14 mounted on the rockshaft 15 and held yieldingly in its initial or forward position by means of the coiled spring 16 connected to the bracket 17 and to the frame of the machine.

This arm 14 carries a fixed clutch jaw 18 and a pivoted clutch jaw 19 disposed in an opposed relation to the jaw 18, the jaw 19 being pivoted at 20 and urged toward gripping position by means of the coiled spring 21. When the clutch arm 14 is swung to the forward position as shown in Fig. 11 the pivoted jaw 19 engages with the fixed stop 22, thereby releasing the jaw 19. As soon, however, as the arm 14 swings rearwardly the spring 21 causes the jaw 19 to engage the wire 3, thereby drawing the wire rearwardly through the feed rolls.

The rockshaft 15 is provided with an arm 23 coacting with a cam 24 on the shaft 25 which also carries the cam 11 so that the



movement of these parts is properly synchronized.

The formed spring is severed by means of the cutter 26 coacting with the shear bar 27. The action of this cutter is properly timed so that the spring is severed as the spring is completely formed and before the retracting means is actuated.

In the embodiment of my invention illustrated in Figs. 1 to 14, the structure is adapted for the forming of single helically coiled springs, one end only of the spring being knotted and the small end of the spring being slightly offset at 28 to facilitate attachment to the support. This I form at the time the springs are cut off, the cutter being provided with a former 29 coacting with the former 30 on the arm 6. This avoids a second operation in forming the ends of the springs for mounting on the support such as a wire base or the like. The pitch block 95 is disposed in operative relation to the forming roll. To "set" the springs as they are formed I provide an arm 96 having a finger 97 projecting therefrom, the spring coils being forced against this arm after leaving the pitch block and being compressed to give them the desired "set."

My improved knotter mechanism is arranged to engage the springs prior to the severing of the formed spring so that the coils are held in proper relation during the knotting and so that it is not necessary to provide a separate supporting or transfer means for the spring. The knotter mechanism is supported on a pair of horizontally disposed ways 31, 32 connected at their outer ends by a spacing block 33, the ways being mounted at their inner ends on the main frame of the machine. On the spacing member 33 I mount a shaft 34 which is driven by a sprocket wheel 35 and a sprocket chain 36 from the main driving shaft 37. The connections for the sprocket to this shaft 37 are not detailed. The object, it will be understood, is to drive the shaft 34 in synchronism with the spring forming and cut-off mechanism.

The knotter gear 37, which is of well-known design, is rotatively mounted in a coiler member 38. This coiler member has rollers 39 engaging the top way 31 and is slidably supported on the carriage 40, that is, it is mounted thereon for limited sliding movement. The carriage 40 is in turn provided with rollers 41 traveling on the bottom way 32.

The knotter member 38 has a longitudinal opening therethrough to receive the rack 42, this rack coacting with the coiler gear so that as the coiler member is reciprocated the gear is rotated to insure the proper positioning of the coiler, permitting the spring to be withdrawn therefrom and also permitting the proper presentation of its slot 43 to re-

ceive the coils. The rack 42 has a portion 44 without teeth and with which the teeth of the coiler gear slidably engage as shown in Fig. 7, one tooth 45 of the coiler gear being cut off or shortened as shown in Fig. 7 so that the coiler gear is positively held in the position illustrated while the gear is in sliding engagement with this position of the rack.

On the carriage I mount a pair of coacting spring gripping jaws 46 and 47, the jaw 46 having a pair of coil rests 48 and 49 adapted to engage the end coil 50 of the spring adjacent the end thereof and also the adjacent coil 51 of the spring. The jaw 47 is adapted to clamp the coils in these seats as shown in Fig. 8. The jaws are preferably formed of spaced engaging members to better adapt them to grip the curved springs.

These jaws are slidably mounted in the carriage 40 for relative movement so that they are opened and closed, the jaws being controlled by the cam 52, see Figs. 6 and 8. The cam is slidable through openings in the jaws. The cam faces 53 and 54 coact on the jaws 46 and 47, respectively. These cam faces are disposed in an opposed relation so that when the cam is actuated the jaws are closed and when retracted the jaws are opened by the coiled spring 55 which is mounted on the bolt 56 projecting from the jaw 46 through an arm 57 on the jaw 47, the spring thus acting to separate or open the jaws.

To facilitate adjustment in taking up wear I provide a hardened block 58 coacting with the cam 52, this block being adjustable by means of the set screw 59. It will be observed that the jaws are positioned below the knotter gear and so that the work is carried into the knotter gear and properly supported during the knotting operation.

On the forward stroke of the carriage the open jaws receive the spring, the jaws being closed at the end of the forward stroke of the carriage. The carriage is reciprocated from the shaft 34 which is provided with a crank arm 60 connected by the pitman 61 to the cam member 62 which is mounted between the carriage and the coiler member for limited sliding movement relative thereto. This cam member is, during a portion of the stroke, locked to the coiler block by means of the dog 63 which is pivoted on the coiler block to engage the notch-like keeper 64 in the cam member. The dog comes in contact with a cam 65 disengaging the coiler member from the cam member. This dog also serves as a positive stop for the coiler member, the upper way being provided with a recess stop shoulder 66, see Fig. 10, below the cam and into which the dog is forced by the cam.

To insure the releasing of the dog on the return stroke I provide a spring pressed plunger 67 with which the dog engages the



spring being put under stress with the parts in position shown in Fig. 10 so that on the return stroke the spring acts to assist in disengaging the dog. This dog is disengaged just prior to the carriage reaching the limit of its forward stroke so that continued movement after disengagement of the coiler member closes the jaws upon the spring.

This forward movement also brings the carriage 40 into contact with a stop 68 so that the cam member is moved forwardly relative thereto, permitting the cam locking dog 69, which is pivoted at 70 on the carriage and urged to engaging position by the coiled spring 71, to lock the cam member in jaw locking position. The jaw member is thus locked to the carriage so that these parts travel together until the jaw member is released at the rear end of the stroke.

The initial movement of the return stroke carries the spring into the knotted gear and brings the dog 63 into engagement with the keeper 64 so that the parts all move rearwardly together. In this rearward movement, the knotter gear traveling on the rack is rotated and the knot formed.

As the parts near the rear end of the stroke the cam locking dog 69 is brought into engagement with the trip 72 thereby releasing the cam and opening the jaws. The knotter gear is at this point positioned by the means described so that it is possible to disengage the spring therefrom.

In the embodiment illustrated I provide a nesting means adapted to remove the springs from the knotting means and nest them together. This mechanism comprises a pair of coacting shifter jaws 73 which are pivotally mounted at 74 on the rockshaft 75. These jaws are held yieldingly together by the coiled spring 76 mounted on the bolt 77 carried by the inner jaw and disposed through the outer jaw. The rockshaft is provided with a pinion 78 driven from a rack 79. The rear end of this rack is supported on the shaft 80 of the cam 81, the cam coacting with the pin 82 on the rack.

A spring 83 acts to return the rack to its retracted position, the cam advancing the rack to actuate the spring clamping jaws. The jaws are opened when in receiving position by engagement with the cam 84 which opens the jaws in position to receive the knotted spring, as it is carried rearwardly. The forward movement of the jaws, carrying them from the cam, allows them to close on the formed spring under the action of the spring 76 so that the spring is carried downwardly to the position shown by dotted lines in Fig. 2 into the nesting rack or holder 85. The jaws in this position engage the jaw opening cam 86 so that the jaws are opened and the spring deposited.

The nesting rack is provided with a curved guide plate 87 at its forward end, the spring

being carried across this plate to be engaged by the side members of the rack at the rear of the plate. The end coil of the spring engaging the rear edge of this plate prevents the spring being retracted with the return movement of the nesting jaws. As successive springs are carried into the nesting rack several springs are pushed along therein as indicated in Fig. 1.

The cam shaft 80 is driven from a sprocket 88 and a sprocket chain 89; the driving connection for this sprocket chain 89 to the driving shaft 37 not being illustrated.

In the modification shown in Fig. 15 I show my improvements adapted for knotting both ends of a double helically coiled spring shown at 90. The mechanisms, so far as the knotting is concerned, are duplicates of the knotting mechanism described. The relation of the parts for the outer knotter designated generally by the numeral 92 is reversed, that is, changed side for side.

In this embodiment the pitman 61 is connected by the elongated wrist pin 93 to both knotter mechanisms. Equalizing racks 94 are provided to insure simultaneous movement of the two parts and relieve the parts of strain.

Structures embodying my improvements are of very large capacity and are relatively simple and durable in structure. I have not attempted to illustrate or describe various embodiments or adaptations which I contemplate, as I believe this disclosure will enable those skilled in the art to embody or adapt my improvements as may be desired.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a wire spring making machine, the combination of a coiling means, means for feeding wire to said coiling means, means for severing formed springs from the stock, spaced top and bottom ways, a carriage traveling on the bottom way and provided with a pair of spring clamping jaws, a knotter member coacting with the top way, said knotter member and carriage being slidably associated for relative movement, a knotter gear rotatably mounted on said knotter member, a fixed rack with which said knotter member is slidably associated coacting with said knotter gear, said rack having an untoothed portion at its rear end, said knotter gear having a flattened portion coacting with said untoothed portion of said rack whereby the knotter gear is held against rotation, a jaw closing cam member slidably disposed between said carriage and knotter member for limited movement relative to both, said cam member having driving engagement with said carriage, springs acting to open said jaws, a dog pivoted on said knotter member for locking it to said cam member, said dog being disposed to slidably



engage the upper way whereby it is held in engagement with said cam member, said way having a recess in the side thereof permitting the disengagement of said dog, a tripping cam for said dog disposed opposite said recess in said way, actuating means connected to said cam member whereby it is actuated to close the jaws after the knotter member and the carriage have reached the limit of their forward stroke, a dog on said carriage for locking said cam member to said carriage in its jaw actuating position, and means for releasing said dog on said carriage as the knotter member nears the end of its stroke whereby the knotted spring is removed from the knotter gear and the jaws are opened.

2. In a wire spring making machine, the combination of a coiling means, means for feeding wire to said coiling means, means for severing formed springs from the stock, spaced top and bottom ways, a carriage traveling on the bottom way and provided with a pair of spring clamping jaws, a knotter member coacting with the top way, said knotter member and carriage being slidably associated for relative movement, a knotter gear rotatably mounted on said knotter member, a fixed rack with which said knotter member is slidably associated coacting with said knotter gear, a jaw closing cam member slidably disposed between said carriage and knotter member for limited movement relative to both, said cam member having driving engagement with said carriage, springs acting to open said jaws, a dog pivoted on said knotter member for locking it to said cam member, said dog being disposed to slidably engage the upper way whereby it is held in engagement with said cam member, said way having a recess in the side thereof permitting the disengagement of said dog, a tripping cam for said dog disposed opposite said recess in said way, actuating means connected to said cam member whereby it is actuated to close the jaws after the knotter member and the carriage have reached the limit of their forward stroke, a dog on said carriage for locking said cam member to said carriage in its jaw actuating position, and means for releasing said dog on said carriage as the knotter member nears the end of its stroke whereby the knotted spring is removed from the knotter gear and the jaws are opened.

3. In a wire spring making machine, the combination of a coiling means, means for feeding wire to said coiling means, means for severing formed springs from the stock, spaced top and bottom ways, a carriage traveling on the bottom way and provided with a pair of spring clamping jaws, a knotter member coacting with the top way, said knotter member and carriage being slidably associated for relative movement, a knotter

gear rotatably mounted on said knotter member, a fixed rack with which said knotter member is slidably associated coacting with said knotter gear, said rack having an untoothed portion at its rear end, said knotter gear having a flattened portion coacting with said untoothed portion of said rack whereby the knotter gear is held against rotation, a jaw closing cam member slidably disposed between said carriage and knotter member for limited movement relative to both, said cam member having driving engagement with said carriage, springs acting to open said jaws, a dog pivoted on said knotter member for locking it to said cam member, a tripping cam for said dog, actuating means connected to said cam member whereby it is actuated to close the jaws after the knotter member and the carriage have reached the limit of their forward stroke, a dog on said carriage for locking said cam member to said carriage in its jaw actuating position, and means for releasing said dog on said carriage as the knotter member nears the end of its stroke.

4. In a wire spring making machine, the combination of a coiling means, means for feeding wire to said coiling means, means for severing formed springs from the stock, spaced top and bottom ways, a carriage traveling on the bottom way and provided with a pair of spring clamping jaws, a knotter member coacting with the top way, said knotter member and carriage being slidably associated for relative movement, a knotter gear rotatably mounted on said knotter member, a fixed rack with which said knotter member is slidably associated coacting with said knotter gear, a jaw closing cam member slidably disposed between said carriage and knotter member for limited movement relative to both, said cam member having driving engagement with said carriage, springs acting to open said jaws, a dog pivoted on said knotter member for locking it to said cam member, a tripping cam for said dog, actuating means connected to said cam member whereby it is actuated to close the jaws after the knotter member and the carriage have reached the limit of their forward stroke, a dog on said carriage for locking said cam member to said carriage in its jaw actuating position, and means for releasing said dog on said carriage as the knotter member nears the end of its stroke.

5. In a wire spring making machine, the combination of a coiling means, a reciprocating carriage provided with spring clamping jaws, a reciprocating knotter member associated with said carriage for limited relative movement, a knotter gear rotatably mounted on said knotter member, a fixed rack coacting with said knotter gear, said rack having an untoothed portion at its rear end, said knotter gear having a flattened



portion coacting with said untoothed portion of said rack whereby the knotter gear is held against rotation, a jaw actuating member operatively associated with said carriage and knotter member for limited movement relative to both and having driving engagement with said carriage, a dog for locking said jaw actuating member to said knotter member, a tripping cam for said dog, actuating means connected to said jaw actuating member whereby it is actuated to close the jaws after the knotter member and the carriage have reached the limit of their forward stroke, a dog for locking said jaw actuating member to said carriage, and means for releasing said carriage dog, for the purpose specified.

6. In a wire spring making machine, the combination of a coiling means, a reciprocating carriage provided with spring clamping jaws, a reciprocating knotter member associated with said carriage for limited relative movement, a knotter gear rotatably mounted on said knotter member, a fixed rack coacting with said knotter gear, a jaw actuating member operatively associated with said carriage and knotter member for limited movement relative to both and having driving engagement with said carriage, a dog for locking said jaw actuating member to said knotter member, a tripping cam for said dog, actuating means connected to said jaw actuating member whereby it is actuated to close the jaws after the knotter member and the carriage have reached the limit of their forward stroke, a dog for locking said jaw actuating member to said carriage, and means for releasing said carriage dog, for the purpose specified.

7. In a wire spring making machine, the combination of a coiling means, a reciprocating carriage provided with spring clamping jaws, a reciprocating knotter associated with said carriage for limited relative movement, a jaw actuating member operatively associated with said carriage and knotter for limited movement relative to both and having driving engagement with said carriage, a dog for locking said jaw actuating member to said knotter, a tripping cam for said dog, a dog for locking said jaw actuating member to said carriage, means for releasing said carriage dog at the end of the return stroke of the carriage, and actuating means connected to said jaw actuating member.

8. In a wire spring making machine, the combination of coiling means, means for feeding wire to said coiling means, means for severing the formed springs from the stock, a reciprocating knotter, a reciprocating transfer member operatively associated with said knotter for limited independent reciprocating movement, means for actuating said transfer member whereby it is actuated to engage the formed spring prior to the severing of the same from the stock and delivering the same into operative relation to the knotter, means for actuating the knotter to form the knot during the return movement of the knotter, means for limiting the movement of said jaws relative to the knotter on the return stroke thereof so that the knotted spring is released from the knotter, and a second transfer member receiving the knotted spring from said knotter transfer member.

9. In a wire spring making machine, the combination of a coiling means, means for feeding wire to said coiling means, means for severing the formed springs from the stock, a reciprocating knotter, a reciprocating transfer member operatively associated with said knotter for limited independent reciprocating movement, means for actuating said transfer member whereby it is actuated to engage the formed spring prior to the severing of the same from the stock and delivering the same into operative relation to the knotter, and means for actuating the knotter to form the knot during the return movement of the knotter.

10. In a wire spring making machine, the combination of coiling means, a reciprocating knotter, a reciprocating transfer member operatively associated with said knotter for limited independent reciprocating movement, means for actuating said transfer member whereby it is actuated to deliver the same into operative relation to the knotter, means for actuating the knotter to form the knot during the return movement of the knotter, means for limiting the movement of said jaws relative to the knotter on the return stroke thereof so that the knotted spring is released from the knotter, and a second transfer member receiving the knotted spring from said knotter transfer member.

11. In a wire spring making machine, the combination of coiling means, a reciprocating knotter, a reciprocating transfer member operatively associated with said knotter for limited independent reciprocating movement, means for actuating said transfer member whereby it is actuated to deliver the same into operative relation to the knotter, means for actuating the knotter to form the knot during the return movement of the knotter, and means for limiting the movement of said jaws relative to the knotter on the return stroke thereof so that the knotted spring is released from the knotter.

12. In a wire spring making machine, the combination of coiling means, a reciprocating knotter, a reciprocating transfer member operatively associated with said knotter for limited independent reciprocating movement, means for actuating said transfer member whereby it is actuated to deliver the same into operative relation to the knotter, means for actuating the knotter to form the knot during the return movement of the knotter, and means for limiting the movement of said jaws relative to the knotter on the return stroke thereof so that the knotted spring is released from the knotter.

13. In a wire spring making machine, the combination of coiling means, a reciprocating knotter, a reciprocating transfer member operatively associated with said knotter for limited independent reciprocating movement, means for actuating said transfer member whereby it is actuated to deliver the same into operative relation to the knotter, means for actuating the knotter to form the knot during the return movement of the knotter, and means for limiting the movement of said jaws relative to the knotter on the return stroke thereof so that the knotted spring is released from the knotter.



the same into operative relation to the knotter, means for actuating the knotter to form the knot during the return movement of the knotter, and a second transfer member receiving the knotted spring from said knotter transfer member.

13. In a wire spring making machine, the combination of coiling means, a reciprocating knotter, a reciprocating transfer member operatively associated with said knotter for limited independent reciprocating movement, means for actuating said transfer member whereby it is actuated to deliver the same into operative relation to the knotter, and means for actuating the knotter to form the knot during the return movement of the knotter.

14. In a wire spring making machine, the combination with spring coiling means, of a knotting means comprising a reciprocating knotter member carrying a knotter gear, a rack coacting with said gear as the knotter member is reciprocated, said rack having an untoothed portion at its rear end coacting with said gear to hold it against rotation, jaws mounted to reciprocate with said knotter member and having a limited movement independent thereof whereby the jaws may be advanced to grip the formed spring and operatively associate the spring with the knotter gear while the knotter member is at the forward end of its stroke, and means for releasing said jaws after the knot has been formed in the spring.

15. In a wire spring making machine, the combination with spring coiling means, of a knotting means comprising a reciprocating knotter member carrying a knotter gear, a rack coacting with said gear as the knotter member is reciprocated, jaws mounted to reciprocate with said knotter member and having a limited movement independent thereof whereby the jaws may be advanced to grip the formed spring and operatively associate the spring with the knotter gear while the knotter member is at the forward end of its stroke, and means for releasing said jaws after the knot has been formed in the spring.

16. In a wire spring making machine, the combination with spring coiling means, of a reciprocating knotter, jaws mounted to reciprocate with said knotter member but having a limited movement independently thereof whereby the jaws may be advanced to grip the formed spring and operatively associate the spring with the knotter gear while the knotter member is at the forward end of its stroke, and means for releasing said jaws after the knot has been formed in the spring.

17. The combination with a coiler mechanism, of means for severing the formed spring from the stock, a reciprocating knotter, means for actuating said knotter dur-

ing the reciprocating movement thereof, means for transferring the spring from the coiler to the knotter comprising jaws adapted to grip the formed spring prior to its being severed from the stock and to support the same in coacting relation to the knotter, and means for opening said jaws at the end of the return stroke of said knotter.

18. The combination with a coiler mechanism, of a reciprocating knotter, means for actuating said knotter during the reciprocating movement thereof, means for transferring the spring from the coiler to the knotter comprising jaws adapted to grip the formed spring and to support the same in coacting relation to the knotter, and means for opening said jaws at the end of the return stroke of said knotter.

19. The combination with a coiler mechanism, of a reciprocating knotter, means for actuating said knotter during the reciprocating movement thereof, and means for transferring the spring from the coiler to the knotter.

20. In a wire spring making machine the combination of a spring forming means, a knotter comprising a rotating knotter member, a reciprocating support therefor, means for rotating said member during such reciprocating movement, and means for transferring the spring from the coiler into operative relation to said rotating knotting member.

21. In a wire spring making machine, a coiler, a reciprocating knotter, and means for engaging the bottom and an adjacent coil of the spring while in the coiler and prior to its being severed from the stock and for positioning the spring in operative relation to said knotting means.

22. In a wire spring making machine, a coiler, a reciprocating knotter, and means for engaging the spring and for positioning the same in operative relation to said knotting means.

23. In a wire spring making machine, a coiler, a reciprocating knotter, means for reciprocating the knotter to and from the coiler to receive the springs, and means for actuating the coiler to knot the spring during the reciprocating movement of the knotter.

24. In a wire spring making machine, a coiler, reciprocating knotting means, and means for transferring a spring from said coiler to said knotting means and supporting the spring in operative relation to said knotting means during the reciprocation thereof.

25. The combination with a coiler, a knotter mounted for reciprocating movement operatively associated with said coiler to receive the springs therefrom, said knotter being actuated during its reciprocating movement to form the knot.

26. The combination with a coiler, a mov-



ably mounted knotter operatively associated with said coiler to receive the springs therefrom, and means for actuating said knotter to knot the spring while the knotter is in motion.

27. The combination with a coiler, of a movably mounted knotter operatively associated with said coiler and provided with means whereby the knot is formed during the movement of the knotter.

28. The combination with a coiler mechanism, of a reciprocating knotter, means for transferring the spring from the coiler to the knotter, means for releasing the spring at the end of the return stroke of the knotter, a nester comprising a nesting rack, a rockshaft provided with a pinion, a pair of opposed jaws pivotally mounted on said rockshaft to swing into said rack, a spring for urging said jaws yieldingly together, said jaws being positioned so that the knotted spring is carried between them at the end of the work stroke of the knotter, means for opening said jaws when in receiving and in delivery position, a rack coacting with said pinion, and means for reciprocating said rack timed with the movement of said knotter.

29. The combination with a coiler, of a reciprocating knotter operatively associated therewith and provided with means for forming the knot during the retracting movement of the knotter, a nester comprising a nesting rack provided with an outwardly curved guide plate at its front end, a rockshaft provided with a pinion, a pair of opposed forwardly diverging jaws pivotally mounted on said rockshaft, a spring for urging said jaws yieldingly together, said jaws being positioned so that the knotted spring is carried between them at the end of the work stroke of the knotter, cams positioned to open said jaws when they are in receiving and in delivery position, a rack coacting with said pinion, and means for reciprocating said rack timed with the movement of said knotter.

30. The combination with a coiler, of a reciprocating knotter operatively associated therewith and provided with means for forming the knot during the retracting movement of the knotter, a nester comprising a nesting rack, a rockshaft, a pair of opposed forwardly diverging jaws pivotally mounted on said rockshaft, a spring for urging said jaws yieldingly together, said jaws being positioned so that the knotted spring is carried between them at the end of the work stroke of the knotter, cams positioned to open said jaws when they are in receiving and in delivery position, and means for actuating said rockshaft timed with the movement of said knotter.

31. The combination with a coiler, of a movable knotter operatively associated with

said coiler, a nester comprising a nesting rack, a rockshaft, a pair of opposed forwardly diverging jaws pivotally mounted on said rockshaft, a spring for urging said jaws yieldingly together, said jaws being positioned so that the knotted spring is delivered between them by said knotter, cams positioned to open said jaws when they are in receiving and in delivery position, and means for actuating said rock shaft timed with the knotter.

32. The combination with a coiler, of a movably mounted knotter operatively associated with said coiler and provided with means whereby the knot is formed during the movement of the knotter, a nester comprising a nesting rack, spring engaging jaws oscillatingly mounted to swing into said rack, and means for opening said jaws when in receiving and discharging position.

33. The combination with a coiling means, a reciprocating knotter operatively associated with said coiler to receive the springs therefrom and acting to knot the springs on the reciprocation of the knotter, a nesting means comprising a transfer member to which the knotted springs are delivered by said knotter, a nesting rack to which said springs are delivered by said transfer member, and synchronized operating means for said coiler, knotter and transfer member.

34. The combination with a coiler, a knotter mounted for reciprocating movement operatively associated with said coiler to receive the springs therefrom, said knotter being actuated during its reciprocating movement to form the knot, and a transfer member to which the knotted spring is delivered by said knotter, said coiler, knotter and transfer member being provided with synchronized driving means whereby their actuation is timed.

35. The combination with a coiler, a movably mounted knotter operatively associated with said coiler to receive the springs therefrom, means for actuating said knotter to knot the spring while the knotter is in motion, and a transfer member to which the knotted spring is delivered by said knotter.

36. In a spring forming machine, the combination with feed rollers, a coiling member against which the wire is fed by said rollers, means for severing the formed springs comprising a reciprocating cutter, a shear block, coacting forming members on said shear block and cutter for conforming the end of the stock as said cutter is actuated, means for retracting the stock after the formed spring has been severed comprising a pivoted arm provided with a relatively fixed clutch jaw over which the stock passes to said feed rollers, a coacting spring pressed pivoted jaw carried by said arm, means for oscillating said arm timed with



said cutter, and a tappet adapted to disengage the pivoted clutch jaw when said clutch arm is in its normal position.

37. In a spring forming machine, the combination with feed rollers, a coiling member against which the wire is fed by said rollers, means for severing the formed springs comprising a reciprocating cutter, a shear block, coacting forming members on said shear block and cutter for conforming the end of the stock as said cutter is actuated, and means for retracting the stock after the formed spring has been severed.

38. In a spring forming machine, the combination with wire feed means, a coiling member against which the wire is fed, means for retracting the stock after the formed spring has been severed comprising a pivoted arm provided with a relatively fixed clutch jaw over which the stock passes to said feed rollers, a coacting spring pressed pivoted jaw carried by said arm, means for oscillating said arm timed with the severing means, and a tappet adapted to disengage the pivoted clutch jaw when said clutch arm is in its normal position.

39. In a spring forming machine, the combination with wire feed means, a coiling member against which the wire is fed, and means for retracting the stock after the formed spring has been severed.

40. The combination in a spring forming means comprising a wire feed means, a forming member, and a pitch member, of an arm disposed in spaced opposed relation to said pitch member and against which the coils of the springs are successively thrust as they are formed whereby the coils are partially compressed, said arm being provided with a coil engaging finger.

41. The combination in a spring forming means comprising a wire feed means, a forming member, and a pitch member, of an arm disposed in spaced relation to said pitch member and with which the coils of the springs successively engage at points substantially removed from the pitch member as they are formed whereby the coils are partially compressed.

42. The combination with a coiled spring forming means of an arm-like member operatively associated with said spring forming means so that the coils of the springs are successively forced against the member the point of engagement of the springs with said member being substantially removed from the coil forming means so that the coils may be placed under compression by said member.

In witness whereof I have hereunto set my hand.

CORBAN H. ZILER.