

No. 614,692.

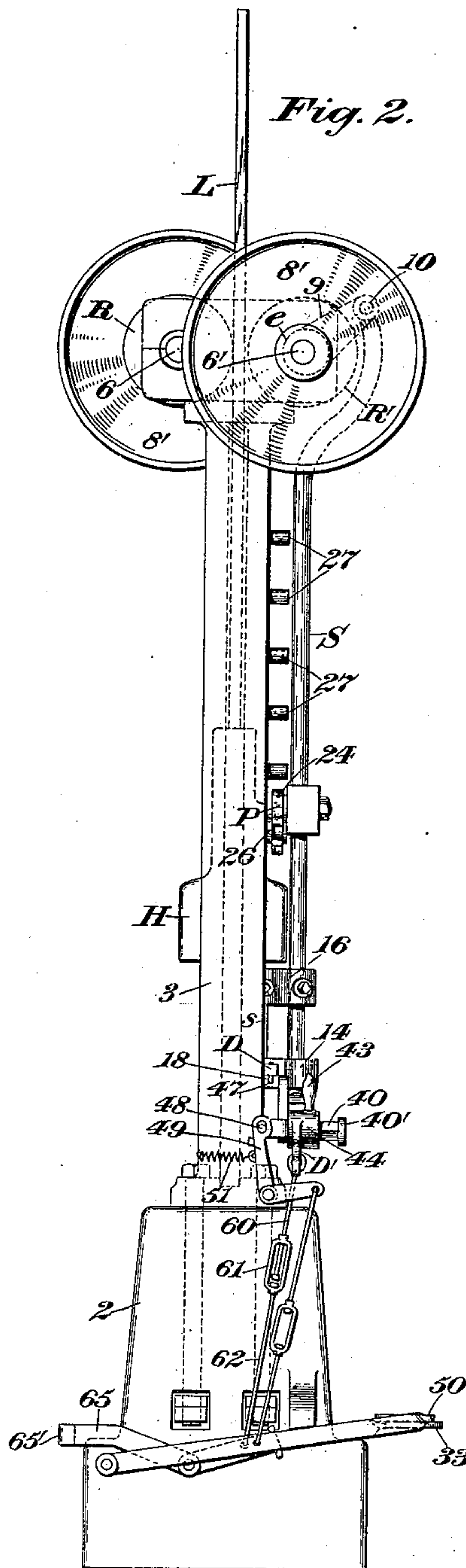
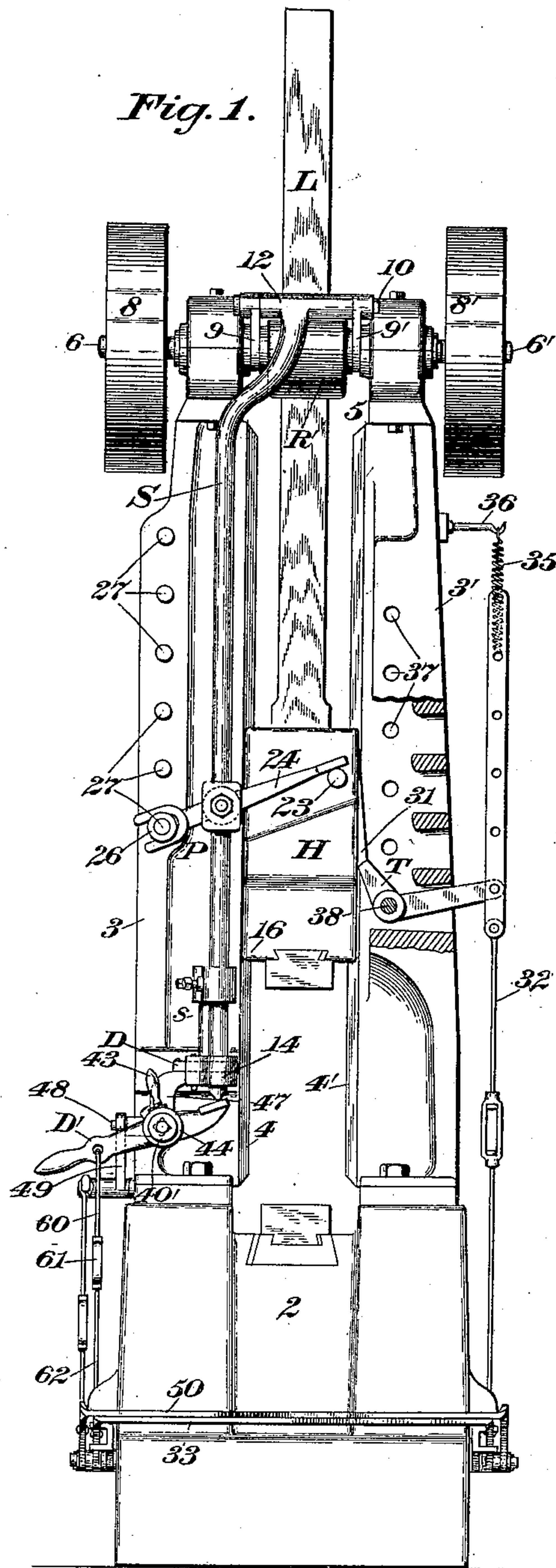
Patented Nov. 22, 1898.

F. C. BILLINGS.  
DROP HAMMER.

(Application filed Feb. 25, 1898.)

(No Model.)

3 Sheets—Sheet 1.



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DROP HAMMER.

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3 Sheets—Sheet 2.

Fig. 8.

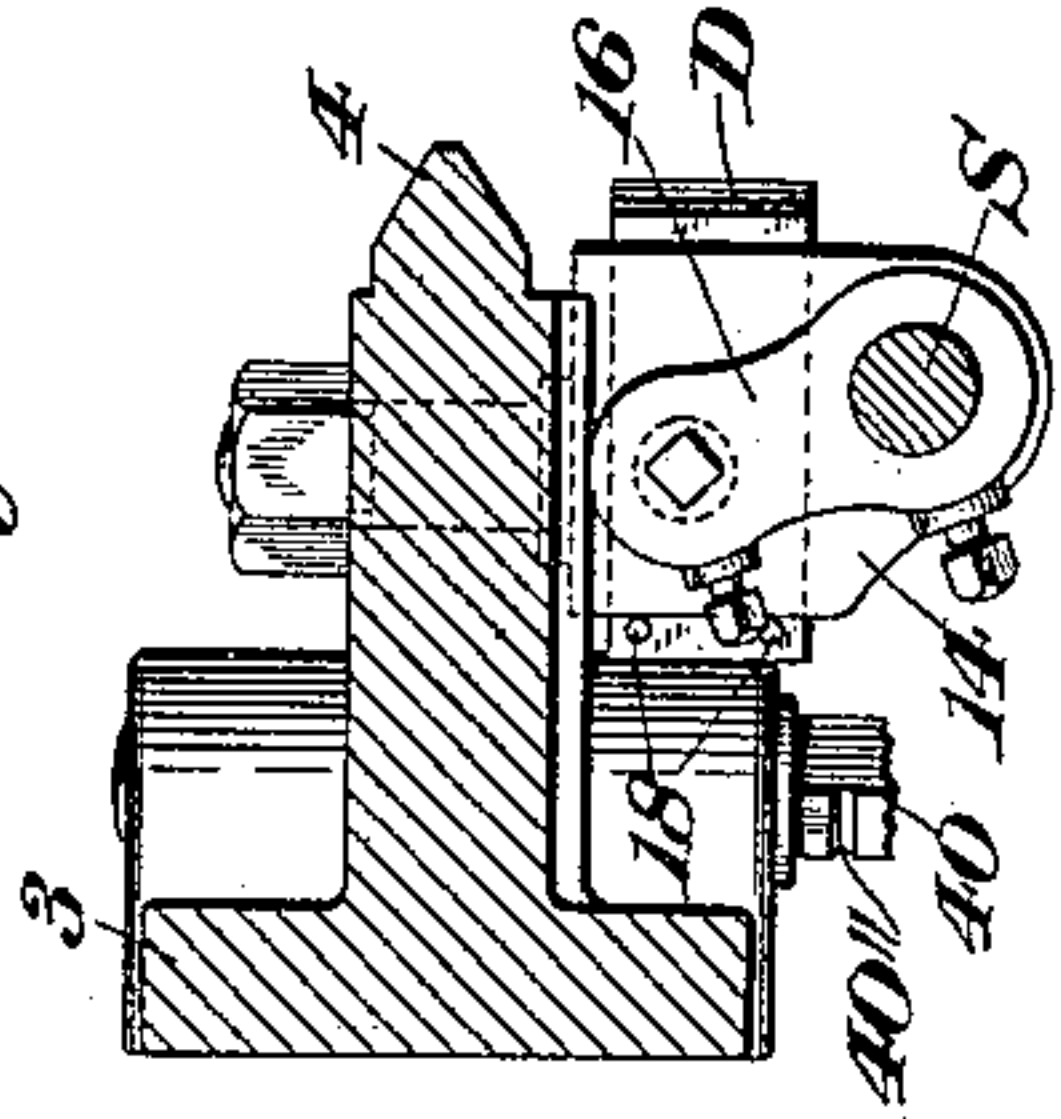


Fig. 7.

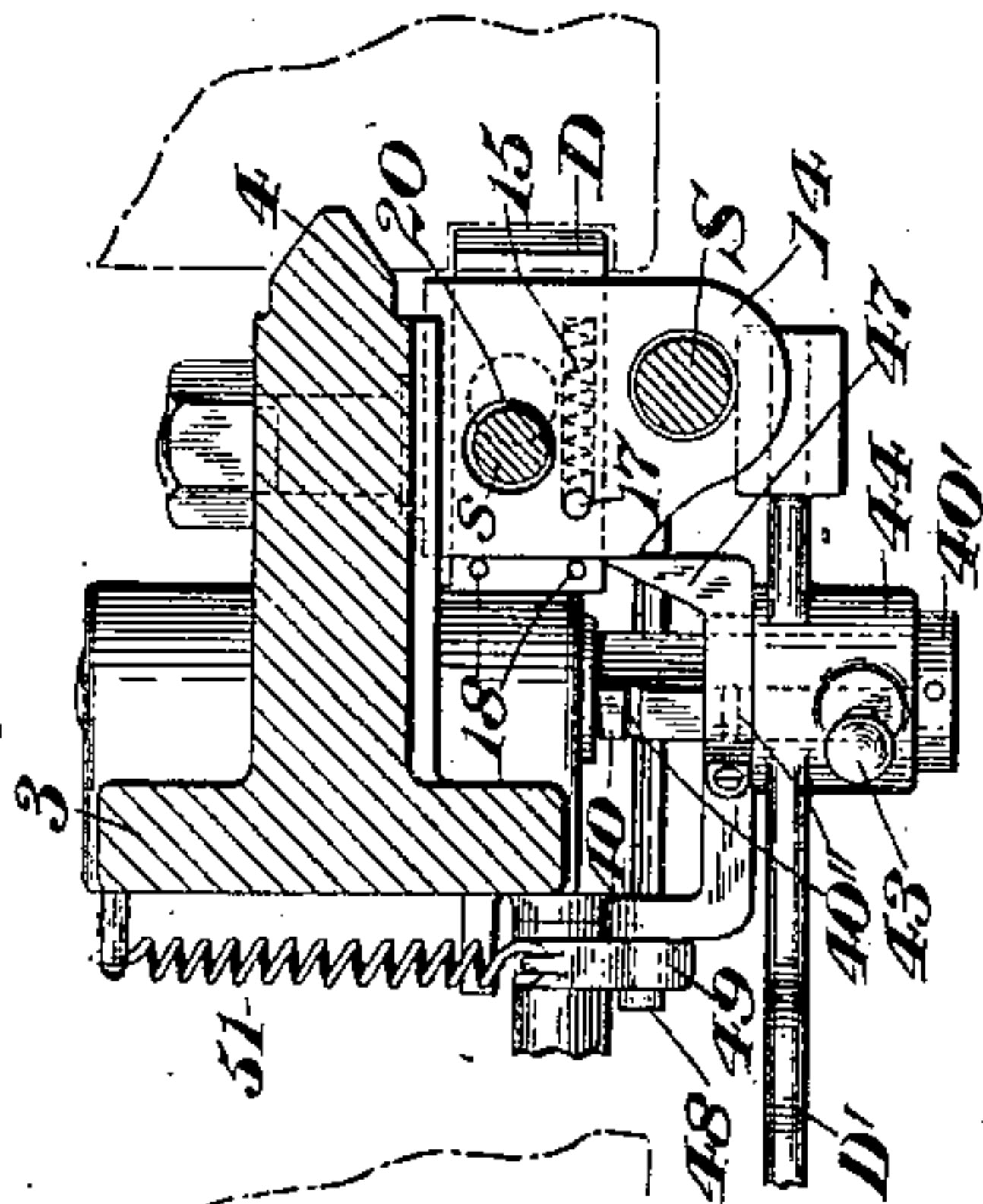


Fig. 6.

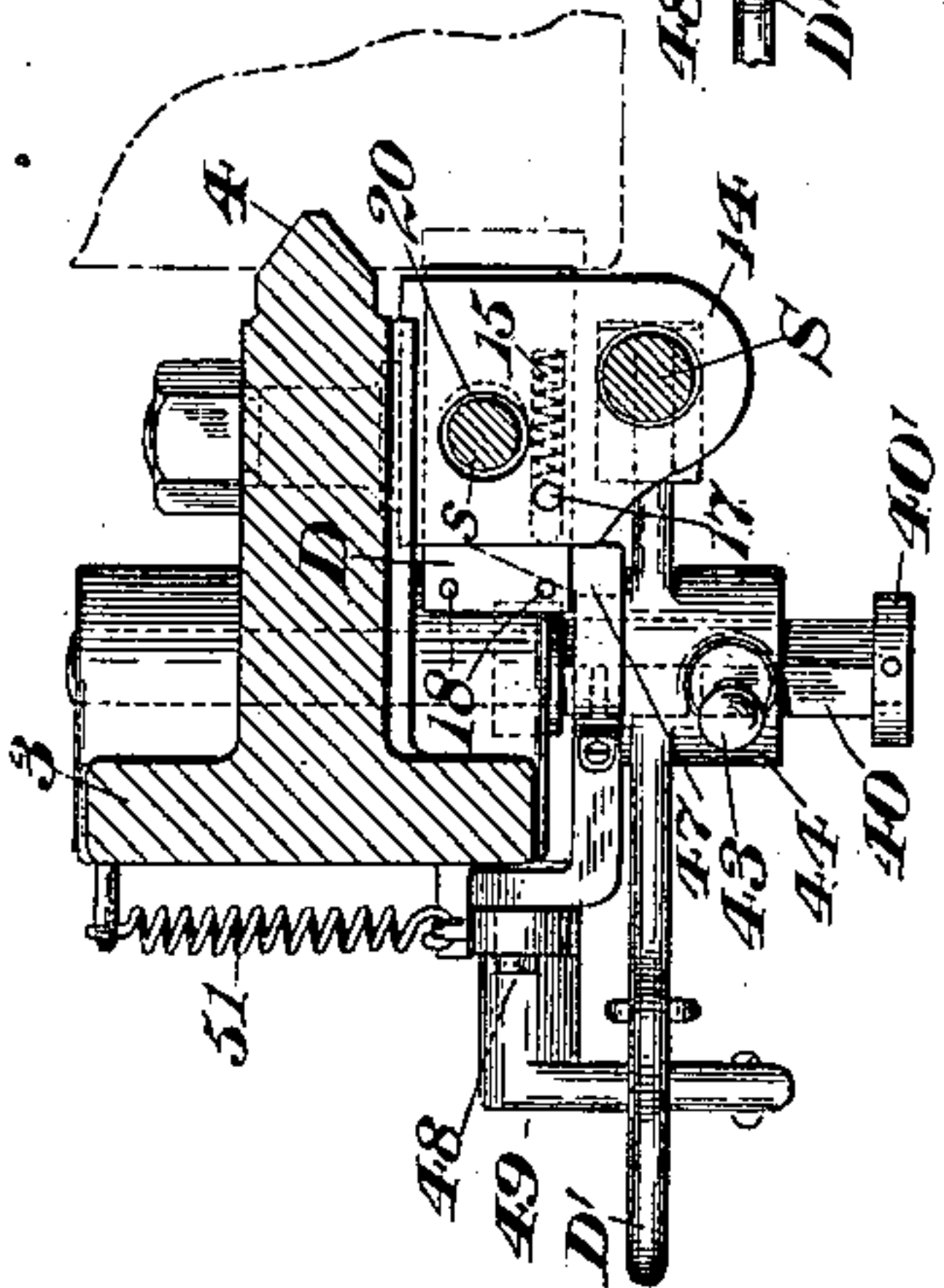


Fig. 16.

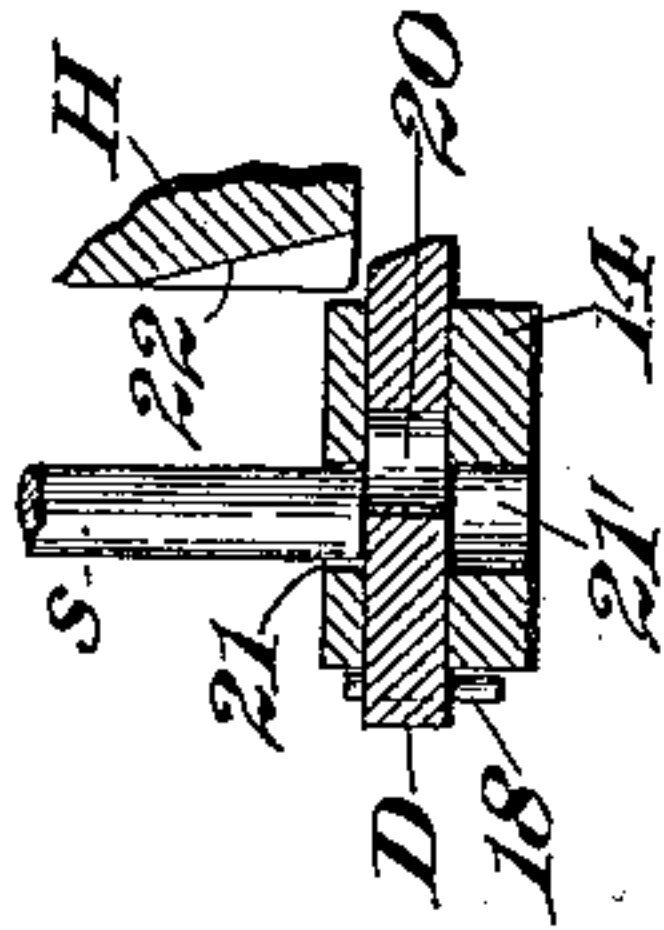


Fig. 17.

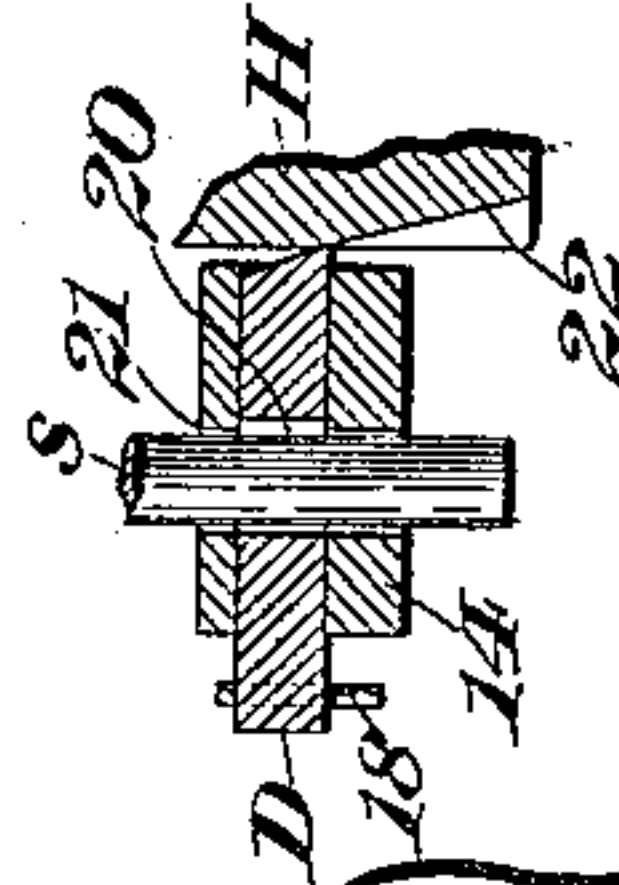


Fig. 5.

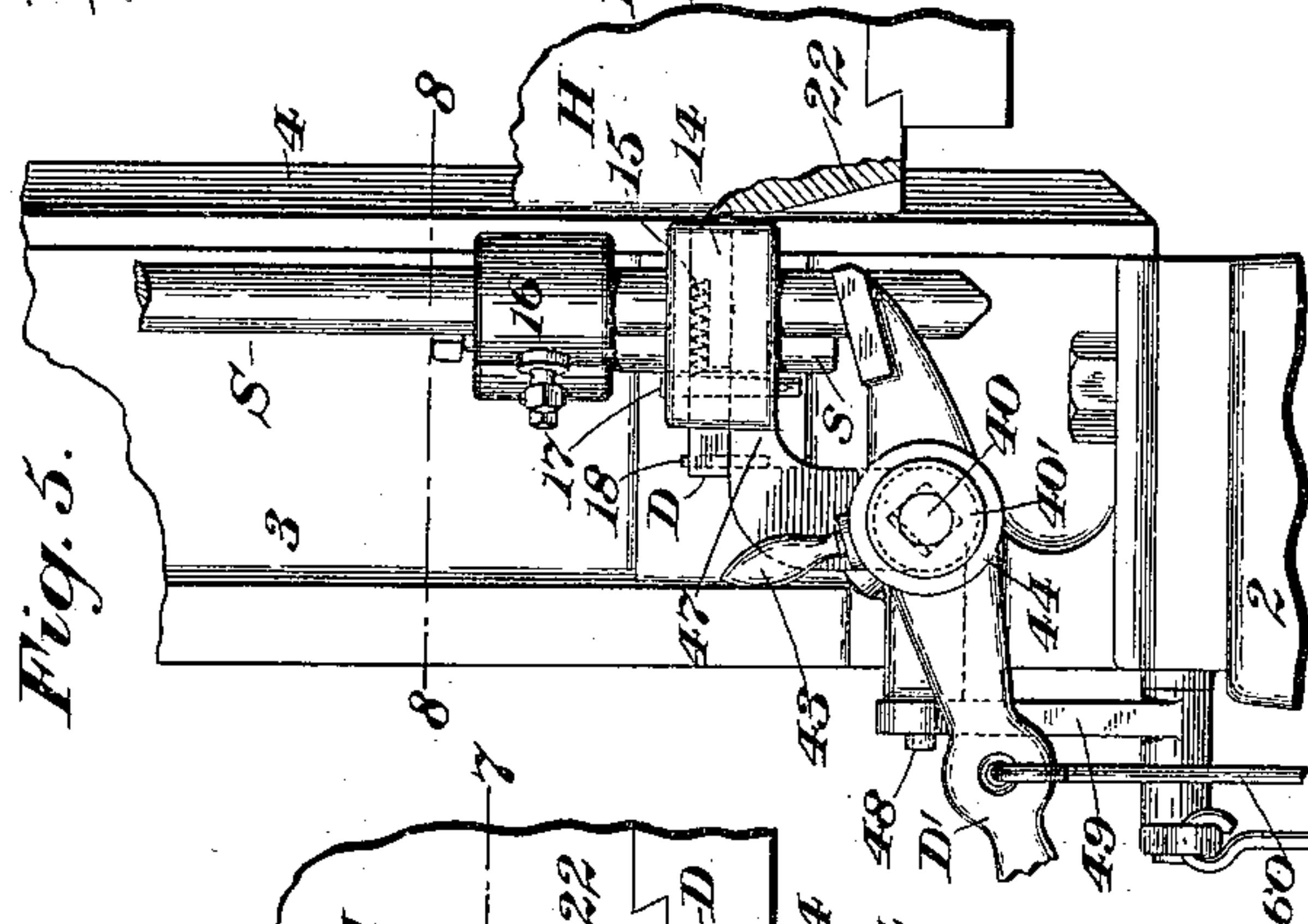


Fig. 4.

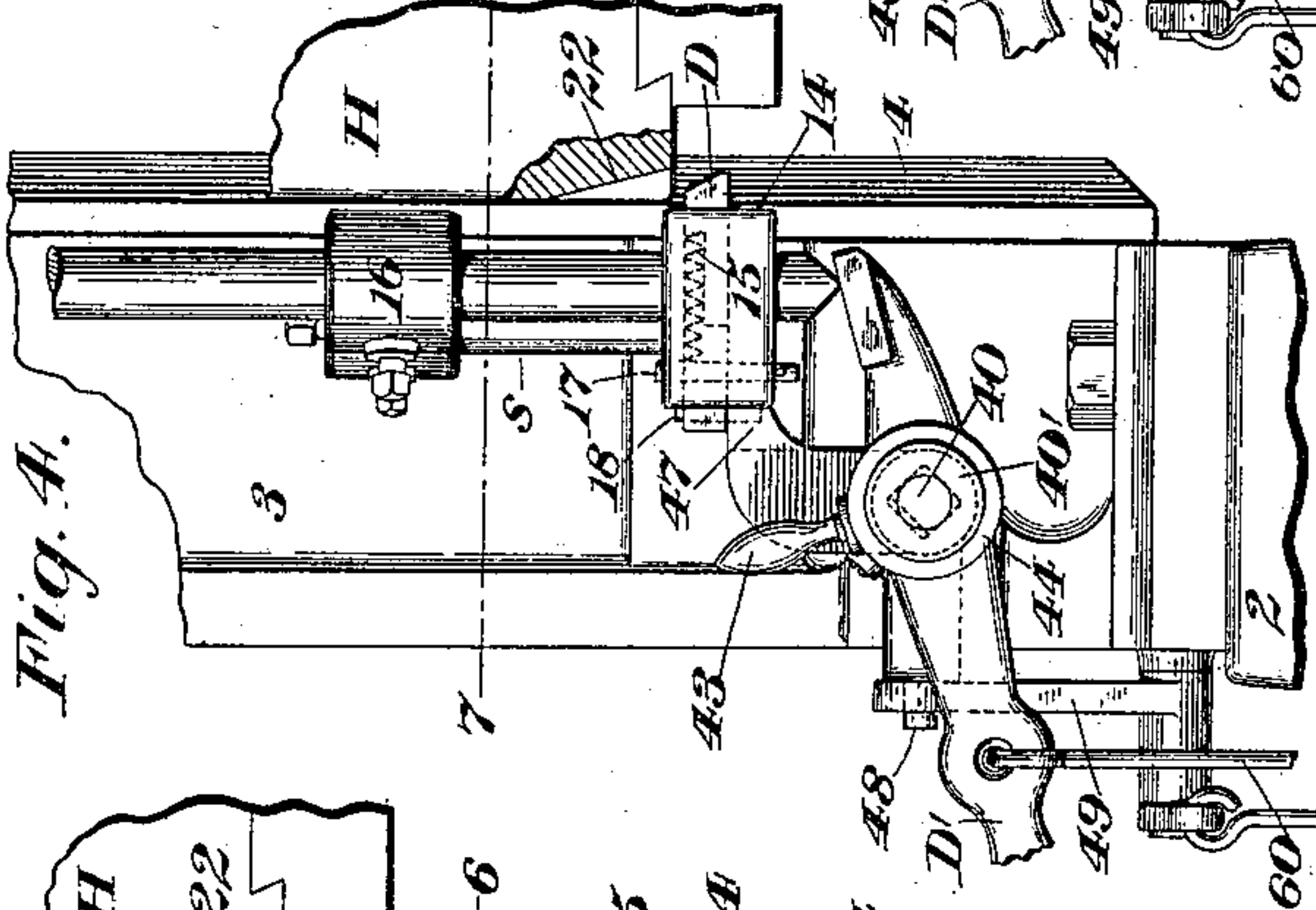


Fig. 3.

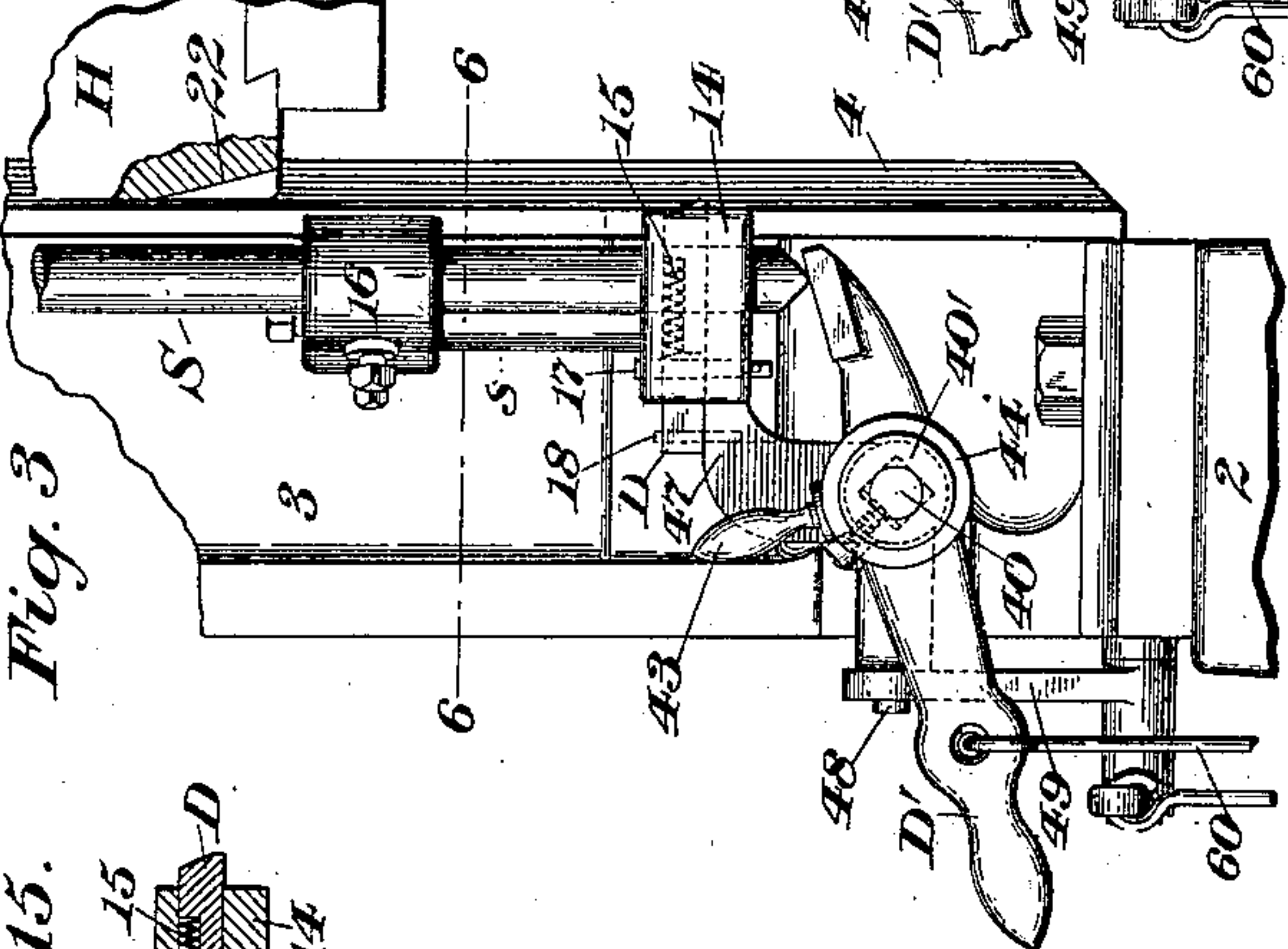
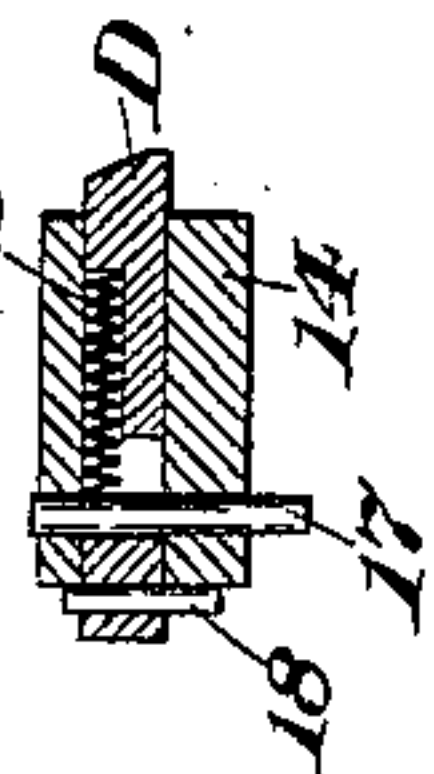


Fig. 15.



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3 Sheets—Sheet 3.

Fig. 11.

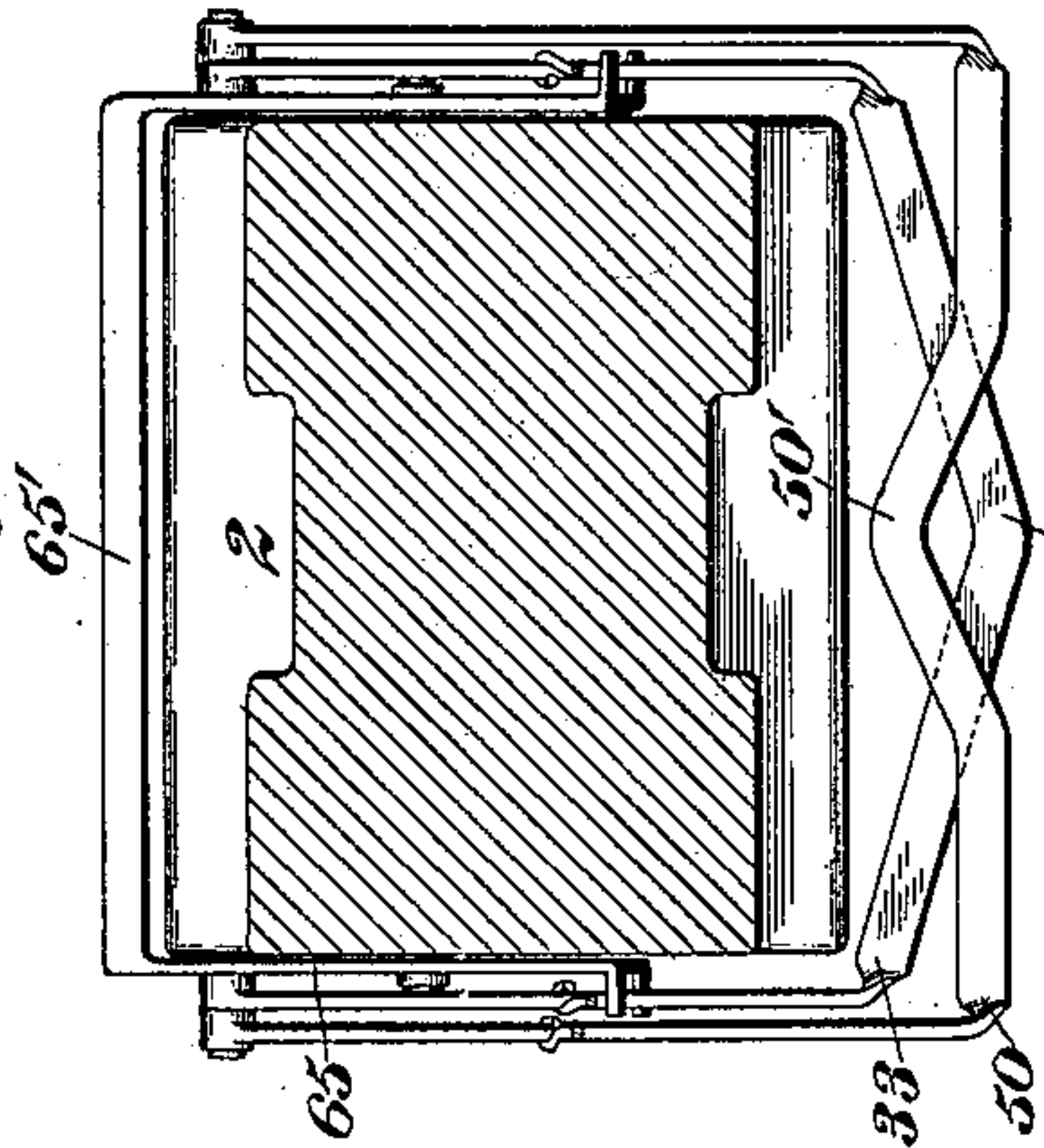


Fig. 12.

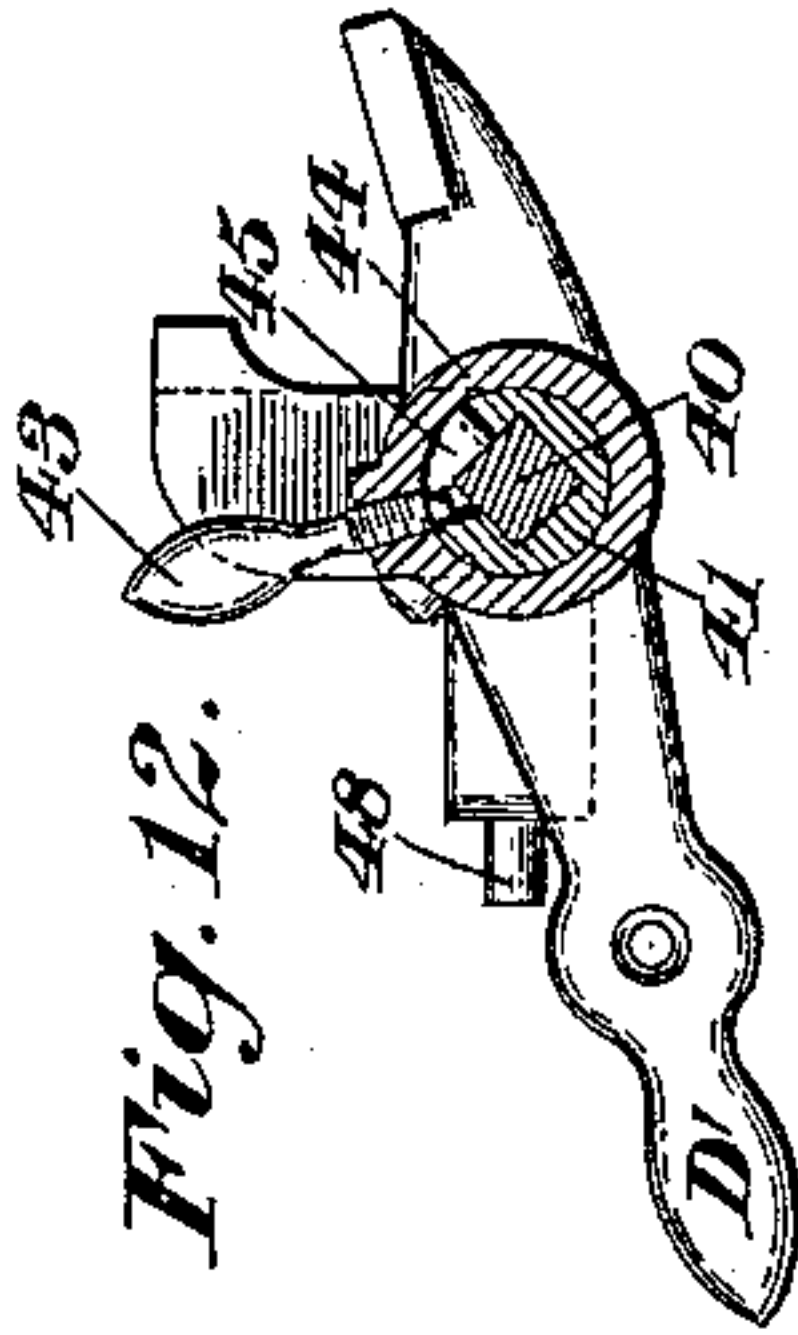


Fig. 14

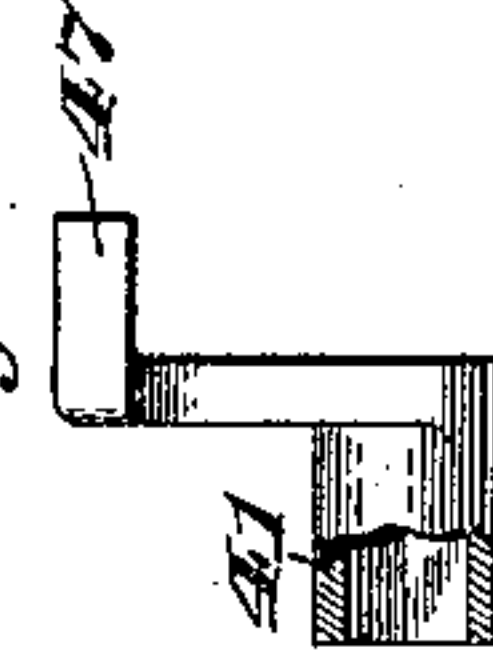


Fig. 13.

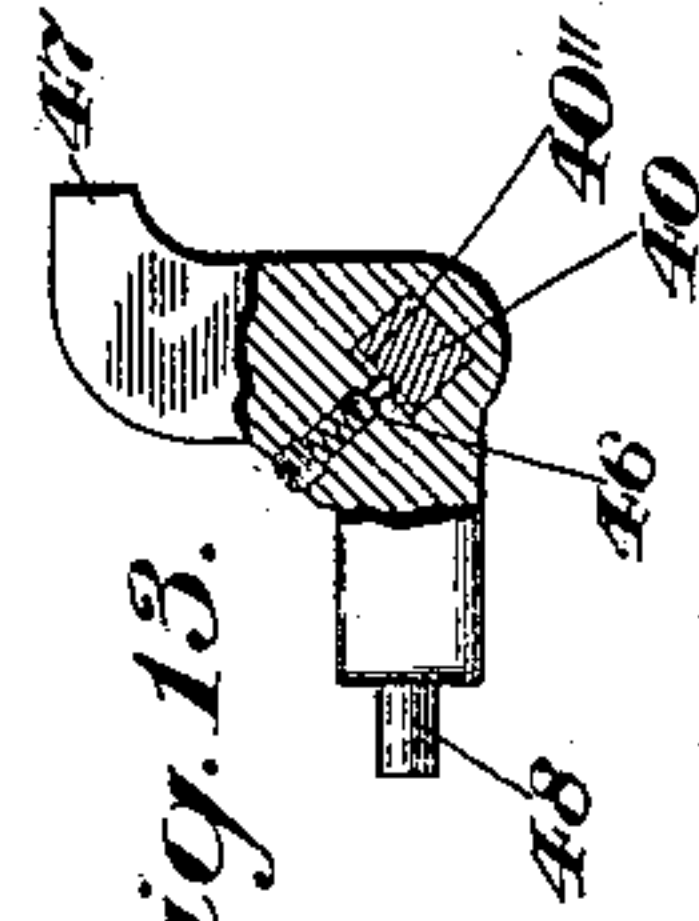


Fig. 10.

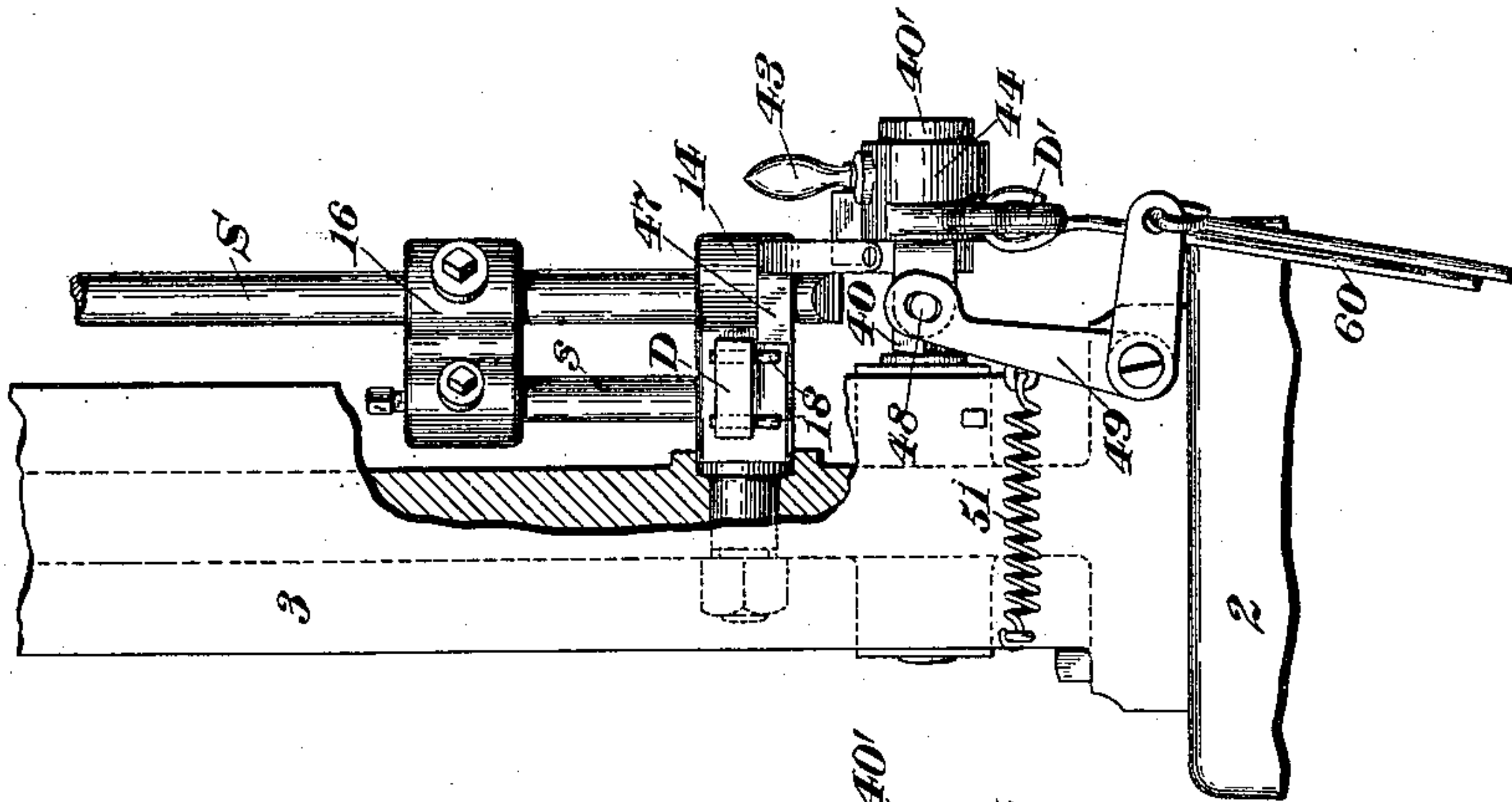
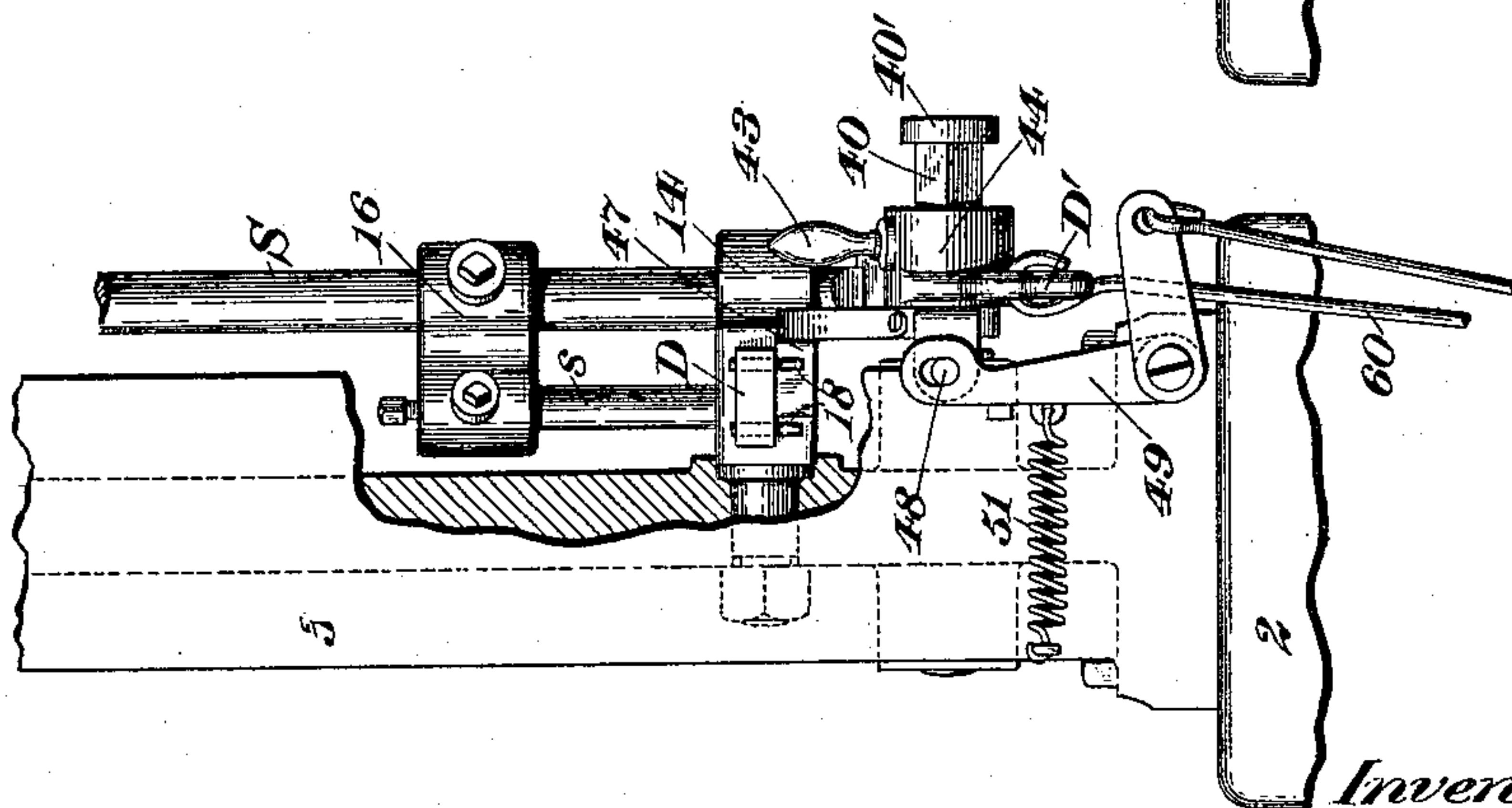


Fig. 9.



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# UNITED STATES PATENT OFFICE.

FREDERIC C. BILLINGS, OF HARTFORD, CONNECTICUT.

## DROP-HAMMER.

SPECIFICATION forming part of Letters Patent No. 614,692, dated November 22, 1898.

Application filed February 25, 1898. Serial No. 671,659. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERIC C. BILLINGS, a citizen of the United States, residing in Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Drop-Hammers, of which the following is a specification.

This invention relates to drop-hammers; and it has for its main object the provision of improved devices for controlling the movements of the usual shifting-rod or actuator by means of which the operation of the hammer-lifting rolls is governed. In connection with this actuator or roll-shifting rod a stop is usually employed for engaging the actuator at a predetermined point in its descent and holding it until it is desired to permit the actuator to descend to the limit of its stroke to start the rolls in their hammer-lifting movement, this stop being released automatically by the descent of the hammer, and it has also been the custom to employ in connection with such rod or actuator a releasing device or lever, operative by hand or by treadle, for limiting in a similar manner the extreme descent of such rod when it is desired to operate the hammer intermittently, such releasing device serving also when shifted to release the rod and permit the lifting mechanism to operate upon the hammer-lifting means.

One of the main objects of this invention is the provision of releasing and stop devices coöperative in such a manner that the movements of the stop are controlled by the shifting of a hand-operated or treadle-operated releasing device from its operative to its inoperative position, and vice versa. Hence both the automatically-operative releasing device carried by the hammer or governed thereby and the other releasing devices will coact with such stop, and therefore with each other, to control the operation of the hammer to actuate the latter continuously or intermittently, as may be desired.

Other features of this invention relating to the construction of the stop, the releasing devices, and the treadle mechanism will be described more fully hereinafter.

In the drawings accompanying and forming part of this specification, Figure 1 is a front elevation, with parts broken away, of a drop-hammer constructed in accordance with my present improvements. Fig. 2 is a side eleva-

tion of the same, looking from the left in Fig. 1. Figs. 3, 4, and 5 are enlarged detail front elevations illustrating different positions of the stop, the hand-operated releasing device, and coacting parts. Figs. 6, 7, and 8 are enlarged horizontal sections of the parts shown in Figs. 3, 4, and 5, the sections being taken in lines 6-6, 7-7, and 8-8, respectively. Figs. 9 and 10 are enlarged detail end elevations, with parts broken away, showing the releasing and stop devices in the positions illustrated in Figs. 3 and 4, respectively. Fig. 11 is a horizontal section of the base of the machine, illustrating the treadle mechanism. Fig. 12 is a sectional detail of the releasing-lever and the stud by which it is carried. Figs. 13 and 14 are details of portions of the releasing device. Fig. 15 is a vertical section of the stop-slide for the actuator and the guide for said slide. Figs. 16 and 17 are vertical sections of said slide and guide in positions corresponding to those shown in Figs. 4 and 5, respectively.

Similar characters designate like parts in all the figures of the drawings.

The framework of my improved drop-hammer may be of any suitable construction for carrying the operative parts, and in the form thereof herein shown embodies the usual base portion 2, a pair of uprights or side frames 3 and 3', separately bolted to the base, at opposite sides thereof, and having guides, such as 4 and 4', for the hammer, and a top frame or head 5, secured to the upper ends of the uprights or side frames 3 and 3', this head being of any construction suitable for carrying the hammer-lifting rolls and coöperative parts.

In the present case two hammer-lifting rolls are carried by the head 5 and are designated in a general way by R and R', the latter being shiftable toward and from the other in the usual manner for engaging the lifting-board or other member by which the hammer is raised.

The roll R is secured to a shaft, such as 6, journaled in the head 5, while the movable roll R' may be fixed to a shaft 6', carried at its opposite ends in a divided or two-part eccentric, this eccentric being indicated in a general way by e and being also journaled in bearings in the head 5.

Each of the shafts 6 and 6' will usually have a suitable driving-pulley, such as 8 or 8', by



means of which pulleys the shafts and rolls may be rotated simultaneously in opposite directions from any suitable source of power. (Not shown.)

5 The two parts of the eccentric or eccentric-sleeve *e* in which the shaft 6' is turned have at their inner ends outwardly-projecting rocker-arms, such as 9 and 9', which arms may be connected by a tie rod or bolt 10, the  
10 inner ends of the two parts of the eccentric preferably abutting against opposite ends of the hub of the roll R'.

The hammer will be of the usual construction and may be of substantially the type  
15 shown at H, it being supported for vertical movement between the guides 4 and 4' of the side frames and having the usual lifting-board L, connected with the upper end thereof, which lifting-board extends between and is  
20 adapted to be engaged by the rolls R and R'.

For the purpose of actuating the eccentric *e*, in which the shaft of the roll R' is journaled, so as to shift the roll toward and from the roll R to engage and release the lifting-  
25 board, I make use of an eccentric actuator or rod, such as S, which rod constitutes a shifting device controlling the lifting mechanism and is pivotally connected at its upper end with the rock-arms 9 and 9', said rod  
30 having a T-head in the form of a bored sleeve 12, through which is passed the bolt 10, hereinbefore referred to, for connecting the two parts of the eccentric. This rod is located at one side of the path of movement of the  
35 hammer, and near its lower end may be passed through a guide-bracket, such as 14, removably secured to the side frame 3, as shown most clearly in Figs. 9 and 10. At some  
40 suitable point in its length, and preferably at its lower end, this actuator is intended to coact with a device or stop adapted for holding the rod normally in an elevated position, and thus preventing the lifting of  
45 the hammer. This holding device or stop is preferably in the form of a slide, such as shown herein at D, this stop-slide being reciprocatory under the lower end of the actuator and into and out of the path of movement of the latter. Normally a spring, such  
50 as 15, will press the slide D out into the path of the actuator, and when in this position said slide will prevent the descent of the latter to a point where it would become effective to cause the movable roll R' to engage the lifting-  
55 ing-board. In the preferred construction this reciprocatory stop or stop-slide is mounted in the bracket or guide 14 and is shiftable into and out of the path of movement of an auxiliary rod or member, such as *s*, carried  
60 for movement in unison with the main rod S, this short rod *s* being preferably clamped in a slidable bracket, such as 16, clamped to the main rod S. It should be understood, however, that the construction of these parts may  
65 be modified without departing from the spirit of the invention.

The stop-slide D may be limited in its movements in one direction by a stop-pin, such as 17, passed through the guide or bracket 14 and connected to the spring 15, and in the  
70 other direction by a pair of stop-pins, such as 18, passed through the stop-slide and adapted to be engaged by the edge of the bracket. At its inner end the stop-slide D preferably has a beveled face and projects into the path of  
75 movement of the hammer H, by which it is intended to be shifted automatically to permit the actuator to pass by the same and descend to the limit of its movement. Usually  
80 the slide D will have an opening therein, such as that shown at 20, through which some part of the actuator will pass—such, for example, as the auxiliary rod *s*. The opening 20 is intended to register at such times with one or  
85 more openings in the guide-bracket 14, and in this case the guide has two openings 21 and 21', with which the opening 20 in the slide is intended to register. When these openings  
90 do not register, of course the slide will act as a stop for preventing the descent of the actuator to its lowermost position; but when said slide is shifted outward, so that the openings register properly, the rod *s* will pass  
95 through the same and the actuator will descend to the limit of its movement and cause the roll R' to engage the lifting-board of the hammer. The shifting of the slide D to this  
100 position may be effected substantially in the usual manner by the hammer itself, this having thereon a cam-face, such as 22, which forces back the slide just before the hammer reaches its lowermost position.

It will be obvious that when the slide D is shifted in the manner just described and the actuator is permitted to descend the roll R'  
105 will grip the lifting-board L and the two rolls R and R' will lift the hammer with a relatively rapid movement. For the purpose of reducing this movement at a predetermined point in the ascent of the hammer I prefer to  
110 make use of a speed-reducing device substantially of the type shown in the patent granted myself and Frank Lombard August 27, 1895, No. 545,188. This speed-reducing device,  
115 which is designated in a general way by P, consists of a lever, such as 24, adjustably secured by any suitable clamping device to the rod S, at some point between the ends of the  
120 latter, this lever having its inner arm considerably longer than its outer arm and coacting at its inner end with a stop 23 on the hammer, by which stop the lever will be lifted at the proper time. At its outer end the short  
125 arm of the lever may be forked to straddle a sleeve or collar 26 on any one of a series of fulcrum-pins 27, spaced at regular intervals on the side frame 3. The position of the lever on the rod S and the engagement of the  
130 elongated arm of the lever with any one of the pins 27 will of course determine the point at which the inner end of lever 24 will be engaged by the stop-pin 23, and it will be obvi-



ous that the rod S will be lifted at a much slower rate than the extreme inner end of the lever 24.

For the purpose of automatically engaging and holding the hammer when desired when the same is at the end of its upward stroke I have provided a detent or trip lever, such as T, removably pivoted to the side frame 3', and the hammer may have a cam-faced stop, such as 31, cooperative with said detent and in position to be engaged by the latter at the proper point in the ascent of the hammer. This trip-lever may be connected by a rod, such as 32, to a treadle 33, pivoted to the base of the machine in a manner which will be hereinafter described, the upper end of said connecting-rod being connected to a spring 35, secured to an arm or hook, such as 36, projecting from the side frame 3. This side frame may have a series of equidistant pivot-holes 37, any one of which may receive the pin or pivot 38 of the trip-lever T to enable the latter to engage the hammer at different points in the upward stroke of said hammer. The connecting-rod 32 should also have a series of pivot-holes to receive a pin at the outer end of the trip-lever.

As before stated, one of the main objects of this invention is the employment of a holding device, which in this case is the stop-slide D, cooperative not only with the automatic releasing device carried by the hammer, but also with the manually or treadle operated releasing device near the base of the machine. This second releasing device will usually be in the form of a releasing-lever, such as that indicated herein by D', and said lever is supported substantially in the usual manner on some suitable part of the framework, such as a squared stud 40, projecting from the lower end of the side frame 3 and having a stop, such as 40', at its outer end. In this case, however, the releasing-lever D' is not supported directly on this stud, but on a sleeve carried by such stud and having a squared opening to prevent turning. This sleeve is indicated herein in detail in Fig. 14 and is designated by 41, it being adapted to slide longitudinally of the stud 40 and being attached in some suitable manner to the lever D', so as to carry the latter with it in its reciprocation.

In the construction shown the releasing-lever has a small handle 43, threaded into a boss on the sleeve 44 of the lever and projecting into a transverse slot 45 in the sleeve 41, so as to assure the movement of the sleeve 41 and the reversing-lever in unison longitudinally of the stud 40. It will be obvious, of course, that this construction permits the oscillation of the releasing-lever relatively to the sleeve 41 from its stop position to the releasing position, and vice versa.

For the purpose of locating the sleeve 41 and hence the releasing-lever in the proper positions longitudinally of the stud 40 the latter may have therein shallow grooves 40'',

with which may cooperate a spring-pressed detent, such as 46, carried by a member forming part of the sleeve 41. This member is in the form of a transverse plate carrying at one of its ends a member which cooperates with the slide D to shift the same into position to release the actuator and having at its other end a pin, such as 48, cooperative with an angle-lever 49, connected in the usual manner with a second treadle 50, located above the treadle 33, hereinbefore mentioned. By means of these connections and a spring 51 between the angle-lever 49 and the frame the parts will be maintained in the positions shown in Figs. 2 and 3.

The member which is carried by the sleeve 41 for operating the slide D may be a cam, such as that indicated by 47, and having a cam-face oblique to the axis of the stud 40. (See Figs. 6 and 7.) One face of the cam is parallel with the axis of said stud and lies against the outer wall of the guide-bracket 14, as shown clearly in these views. Hence the cam is in the form of a wedge, the oblique face of which coacts in this case with one of the two stop-pins 18, hereinbefore mentioned. It will be seen that when the two parts are in the positions shown in Fig. 6 the stop-slide is drawn back by the cam 47; but when the releasing-lever and its connected parts are shifted to the extreme outer end of the stud 40 the cam being withdrawn from the stop-pin 18 permits the spring 15 to shift the stop-slide into the path of the hammer and into position to prevent the descent of the actuator S.

The normal position of the releasing-lever D' is that shown in Figs. 1, 3, and 6, the weight of the handle serving to hold the inner end of the lever against the lower end of the actuating-rod S. When said rod descends, however, unless the lever is positively held the latter will be shifted by the rod, and hence the parts will operate automatically. This will be obvious by referring to the connections between the releasing-lever and the treadle 33, from which it will be seen that the rod 60, connected with the handle of the lever, passes through one end of a turnbuckle and has a slip-joint therewith, being free to slide therein, while the other end of the turnbuckle 61 is connected by a rod 62 in the usual manner to the treadle 33. By reason of these connections the releasing-lever may be oscillated and the hammer operated automatically, except when said releasing-lever is positively held in the position shown in Figs. 1 and 3, either by hand or by depressing the treadle 33.

The treadle mechanism which I have illustrated herein is of novel construction and embodies as its essential features two treadles, such as those indicated by 33 and 50. The former of these treadles is connected directly to the releasing trip-lever T and to the releasing-lever D' for oscillating the latter, while the treadle 50 is connected only to the angle-lever 49 of the releasing device D' for shifting the latter longitudinally of the stud 40.



The two treadles are supported for oscillation about a common axis or pivot and are superposed so that when the upper treadle 50 is depressed the lower one 33 will be carried  
 5 down with it, and, moreover, it is intended that when the lower treadle rises it shall carry the upper one with it. For this purpose a weighted frame, such as 65, is provided, having at its rear end the usual weighted cross-  
 10 bar 65' in advance of the pivot of the treadle-frames, the frame 65 having at its forward ends the usual forked arms engaging the sides of the treadle 33 and tending normally to raise the forward ends of both treadles.

15 In order that the two treadles may be operated either simultaneously or else the lower treadle operated independently of the upper one, the treadle-frames have at their forward sides the usual treadle-bars, so shaped as to  
 20 form two pedals, one of which, 50', is close to the base and will cause the depression of both treadles, while the other, 33', is somewhat farther from the base and may be operated independently of the upper one.

25 The operation of my improved machine is substantially similar to that of the machine shown and described in the prior patent to myself and Frank Lombard, to which I have hereinbefore referred.

30 When the parts are in their normal positions, (shown in Figs. 1, 2, 3, and 6,) the hammer may be operated automatically and continuously, the releasing-lever D' being carried down by the rod S at each descent of the lat-  
 35 ter and returning to the position shown in Fig. 3 by reason of its own weight, when the rod S rises again. Each descent of said actuating-rod causes the friction-rolls to grip the lifting-board and raise the hammer, and at a  
 40 predetermined point in the ascent of the latter the speed-reducing device P is shifted to cause the hammer to finish its ascent at a relatively slow rate of speed.

When the hammer rises to the limit of its  
 45 upward movement, the detent-pawl T comes into action to hold the hammer, and this trip-lever may be released by the depression of the treadle 33, which will hold the releasing-lever D' in its stop position and prevent lifting of  
 50 the hammer again after the descent thereof, this being the operation of the machine for obtaining separate single strokes of the hammer, while when both treadles are depressed by placing the foot upon the upper pedal 50' the machine will run continuously and auto-  
 55 matically.

When the releasing-lever D' is shifted to its inoperative position, (shown in Figs. 4 and 7), the hammer in its descent will shift the stop-  
 60 slide D into position to permit the actuator S to descend also and enable the parts to operate continuously in substantially the manner hereinbefore described.

Having described my invention, I claim—  
 65 1. In a drop-hammer, the combination, with a frame, of lifting mechanism; an actuator for shifting the lifting mechanism; a stop for

limiting the movement of said actuator; and a combined stop-releasing device and con-  
 70 troller for the actuator simultaneously shift-  
 able from an operative to an inoperative posi-  
 tion with respect to the stop and with relation to the actuator.

2. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which  
 75 is movable toward and from the other; a verti-  
 cally-movable actuator for said movable roll;  
 a stop for limiting the descent of said actua-  
 tor; a stop-releasing lever shiftable from an  
 80 operative to an inoperative position with re-  
 lation to said actuator; and stop-releasing  
 means simultaneously movable with said  
 lever.

3. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which  
 85 is movable toward and from the other; a verti-  
 cally-movable actuator for said movable roll;  
 a stop for limiting the descent of said actua-  
 tor; automatic means for releasing said stop;  
 and a combined stop-releasing device and  
 90 controller for the actuator operative inde-  
 pendently of said automatic means and simul-  
 taneously shiftable from an operative to an  
 inoperative position with respect to the stop  
 and with relation to said actuator. 95

4. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which  
 is movable toward and from the other; a verti-  
 cally-movable actuator for said movable roll;  
 a device shiftable from an operative to an in-  
 100 operative position beneath said actuator; a  
 slidable stop for limiting the descent of said  
 actuator; and releasing means actuated by  
 the shiftable device and coacting with the  
 stop to shift the same to an inoperative posi-  
 105 tion.

5. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which  
 is movable toward and from the other; a ver-  
 110 tically-movable actuator for the movable roll;  
 a device shiftable beneath said actuator; a  
 stop for limiting the descent of said actuator  
 and normally reactive into the path of the  
 latter; and a stop-releasing device movable  
 with said shiftable device and coacting with  
 115 the stop to shift the same to an inoperative  
 position.

6. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which  
 is movable toward and from the other; a ver-  
 120 tically-movable actuator for said movable  
 roll; an oscillatory and axially-movable de-  
 vice located beneath said actuator; a slidable  
 stop for limiting the descent of said actuator,  
 and normally spring-pressed into the path of  
 125 the latter; and stop-releasing means carried  
 by the oscillatory and axially-movable de-  
 vice.

7. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which  
 is movable toward and from the other; a ver-  
 130 tically-movable actuator for the movable roll;  
 a stop for limiting the descent of the actuator;  
 a manually-actuated stop-releasing device



and controller for the actuator; said releasing device consisting of a cam adapted to shift the stop out of its stop position, substantially as and for the purpose specified.

5 8. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which is movable toward and from the other; an actuator for said movable roll; a reciprocatory stop for limiting the descent of said actuator; 10 and a manually-actuated stop-releasing device shiftable transversely to the stop and having a cam-face coacting with said stop and adapted to shift the latter into an inoperative position.

15 9. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of which is shiftable toward and from the other; an actuator movable with reference to said shiftable roll; a guide on the frame; a stop-slide 20 reciprocatory in said guide and serving to limit the descent of said actuator; a device shiftable from an operative to an inoperative position with relation to said actuator; and releasing means operative by said shiftable 25 device and coacting with the stop-slide to move the latter out of its stop position.

10. In a drop-hammer, the combination, with a frame, of lifting mechanism; a hammer; a device for shifting said lifting mechanism; a stop; and an axially-movable oscillatory lever normally reactive to one end of the range of its axial movement and provided with means for releasing the stop.

11. In a drop-hammer, the combination, 35 with a frame, of hammer-lifting rolls one of which is movable toward and from the other; a vertically-movable actuator for said movable roll; a stop for limiting the descent of said actuator; and a movable releasing device 40 normally reactive to one end of each of its ranges of movement and coacting with the stop to shift the latter out of its stop position.

12. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of 45 which is movable toward and from the other; a vertically-movable actuator for said movable roll; a device shiftable back and forth beneath said actuator; a stop-slide movable into and out of the path of the actuator; a 50 vertically-movable hammer having an automatic releasing device coacting with the stop-slide; and means actuated by the shiftable device for releasing the stop.

13. In a drop-hammer, the combination, 55 with a frame, of hammer-lifting rolls one of which is movable toward and from the other; a vertically-movable actuator for said movable roll; a stud on the frame and disposed transversely to the actuator; an axially-movable oscillatory releasing device carried by 60 the stud and coacting with the actuator; and a spring-pressed detent between the releasing device and the stud, for holding said device in any determined axial position on the 65 stud.

14. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls one of

which is movable toward and from the other; a vertically-movable actuator for said movable roll; a stud on the frame and disposed 70 transversely to the actuator; an axially-movable oscillatory releasing device carried by the stud and coacting with the actuator and normally reactive to one end of its range of axial movement; and a spring-pressed de- 75 tent between the releasing device and the stud, for holding said device in any determined axial position on the stud.

15. In a drop-hammer, the combination, with a frame, of lifting mechanism; a ham- 80 mer; a shifting device for controlling said lifting mechanism; an axially-movable oscillatory releasing device for the shifting device; a holding device for the hammer; a re- 85 leasing device for said holding device; and a pair of treadles connected with both releasing devices and one operative for oscillating the first-mentioned releasing device and the other operative for shifting said releasing de- 90 vice axially and also for operating the other treadle.

16. In a drop-hammer, the combination, with lifting mechanism and a device for shifting the same, of an angular stud projecting from the frame; a sleeve carrying a releasing- 95 cam fitted on said stud for movement longitudinally thereof; a lever mounted for oscillation on said sleeve; and a stop for limiting the movement of the device for shifting the lifting mechanism and actuated by said sleeve 100 in its longitudinal movement.

17. In a drop-hammer, the combination, with lifting mechanism and a device for shifting the same, of an angular stud projecting from the frame; a stop; a sleeve carrying a 105 cam fitted on said stud for movement longitudinally thereof; a lever mounted for oscillation on said sleeve; and means for actuating said lever.

18. In a drop-hammer, the combination, 110 with lifting mechanism and a device for shifting the same, of an angular stud projecting from the frame; a stop; a sleeve carrying a cam fitted on said stud for movement longitudinally thereof; a lever mounted for oscil- 115 lation on said sleeve; a treadle; and means connecting the same with said lever.

19. In a drop-hammer, the combination, with a frame, of hammer-lifting rolls, one of 120 which is movable toward and from the other; a rod and means connected therewith for shifting the movable roll; a stop-slide movable in the frame and adapted to limit the descent of said rod; a stud projecting from the frame; a sleeve carrying a cam fitted for axial move- 125 ment on said stud; a lever journaled on said sleeve; an angle-lever connected with the sleeve and said lever; a treadle; and connections between said treadle and said angle-lever.

FREDERIC C. BILLINGS.

Witnesses:

CHARLES E. BILLINGS,  
HENRY BISSELL.