F. L. O. WADSWORTH.

RATCHET AND PAWL ACTUATING MECHANISM.

APPLICATION FILED JAN. 6, 1909.

925,855.

Patented June 22, 1909.

3 SHEETS—SHEET 1.

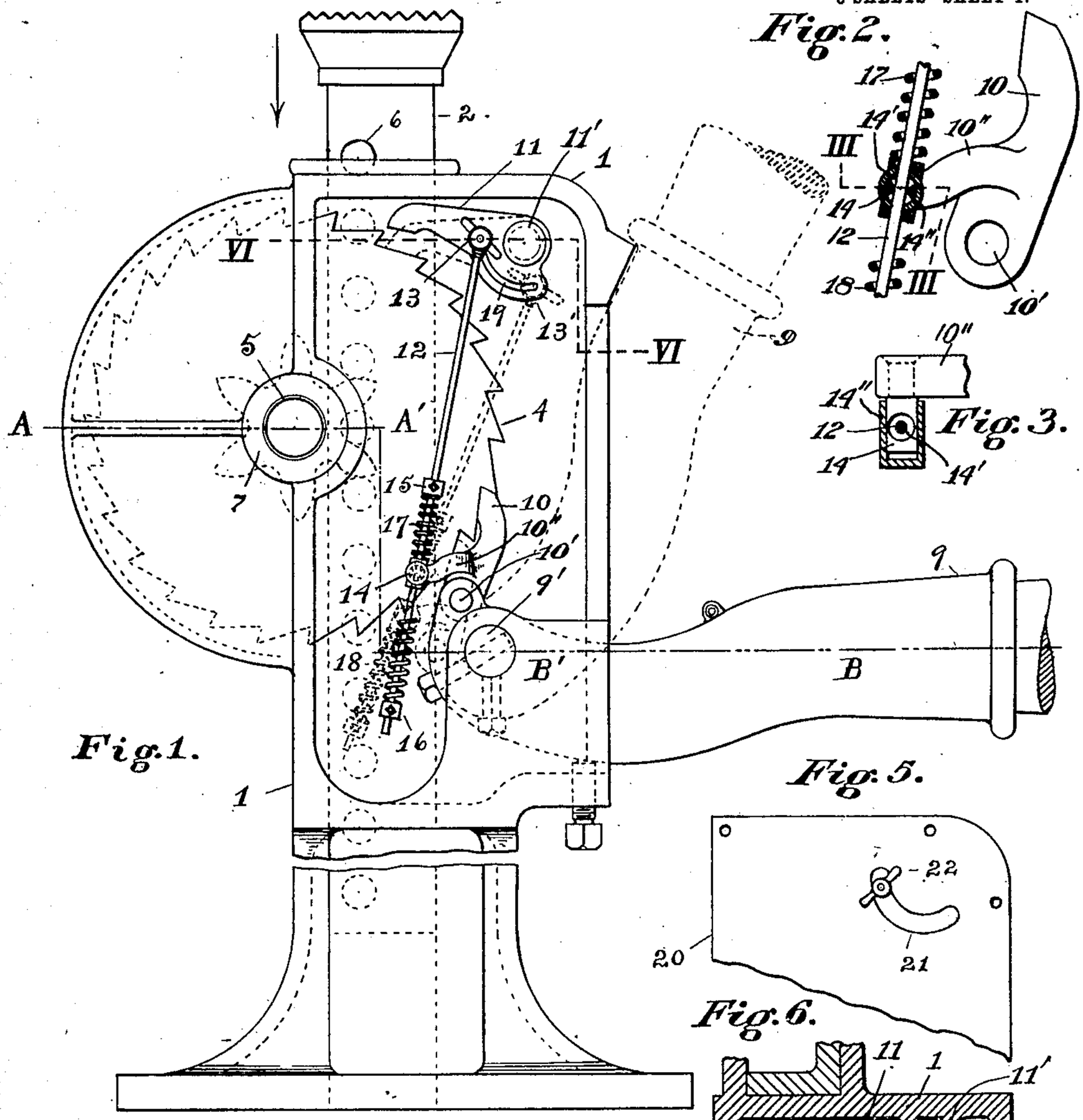


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 5.

Fig. 6.

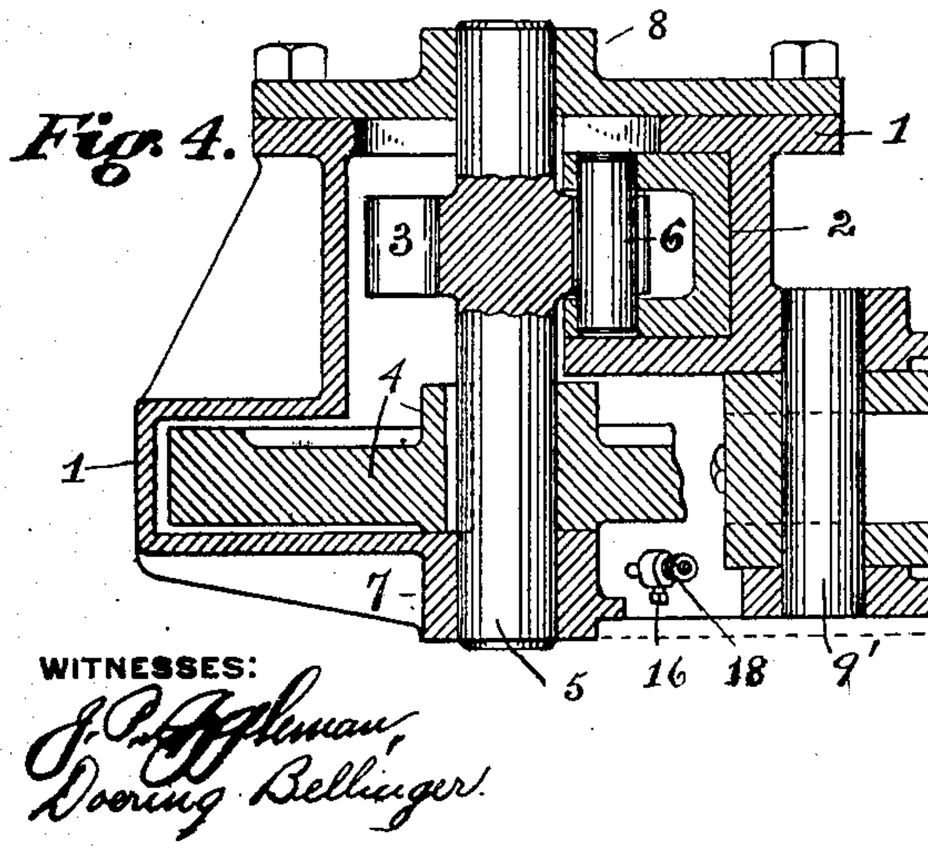
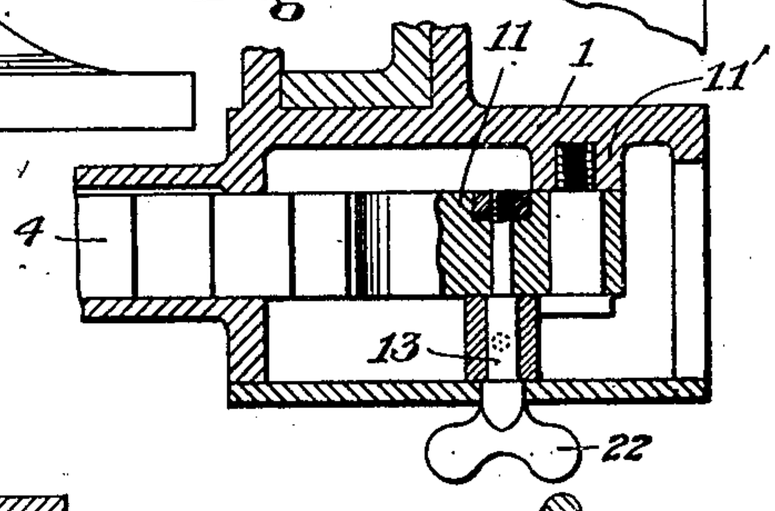


Fig. 4.



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3 SHEETS—SHEET 2.

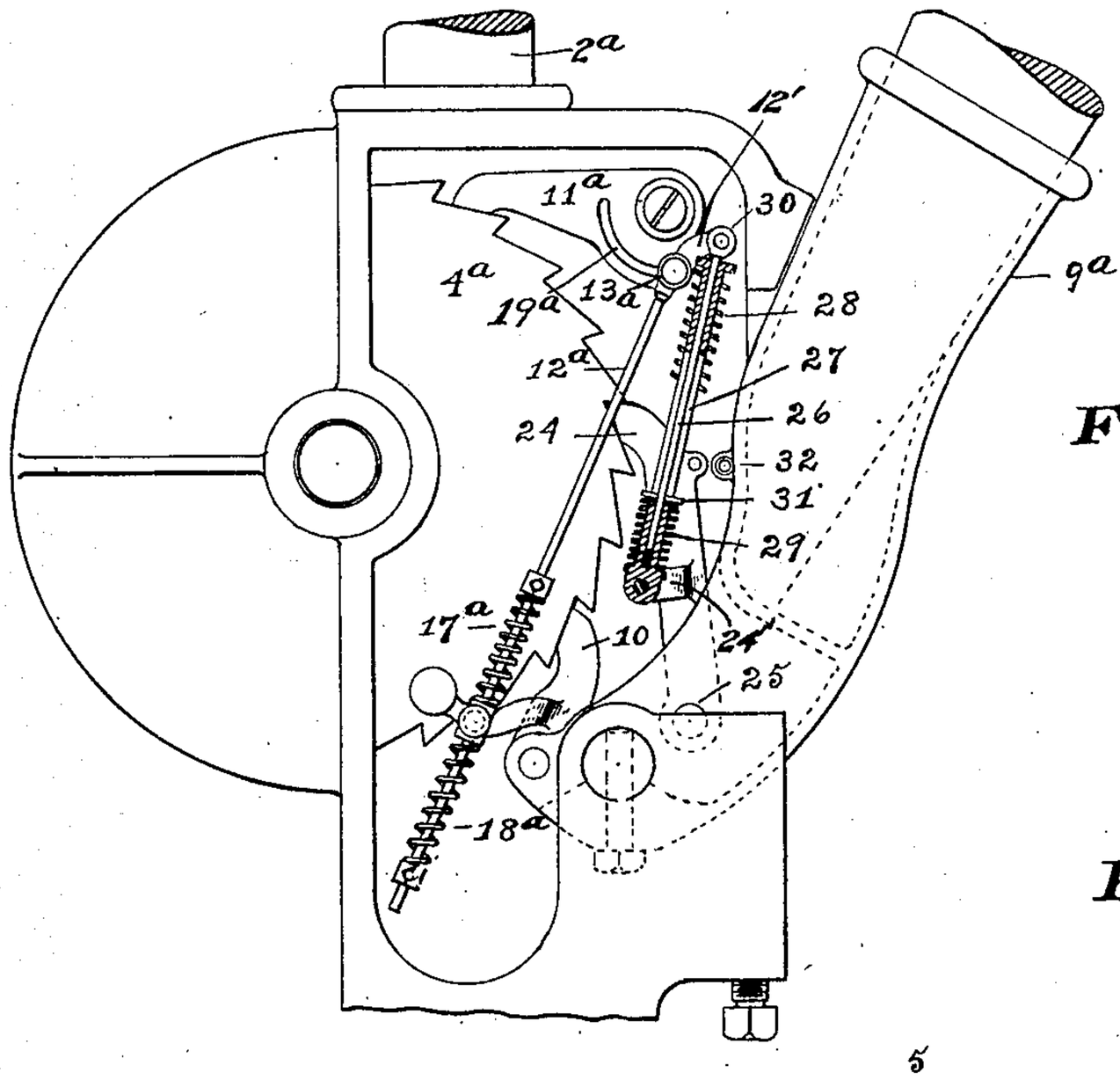

Fig. 7.

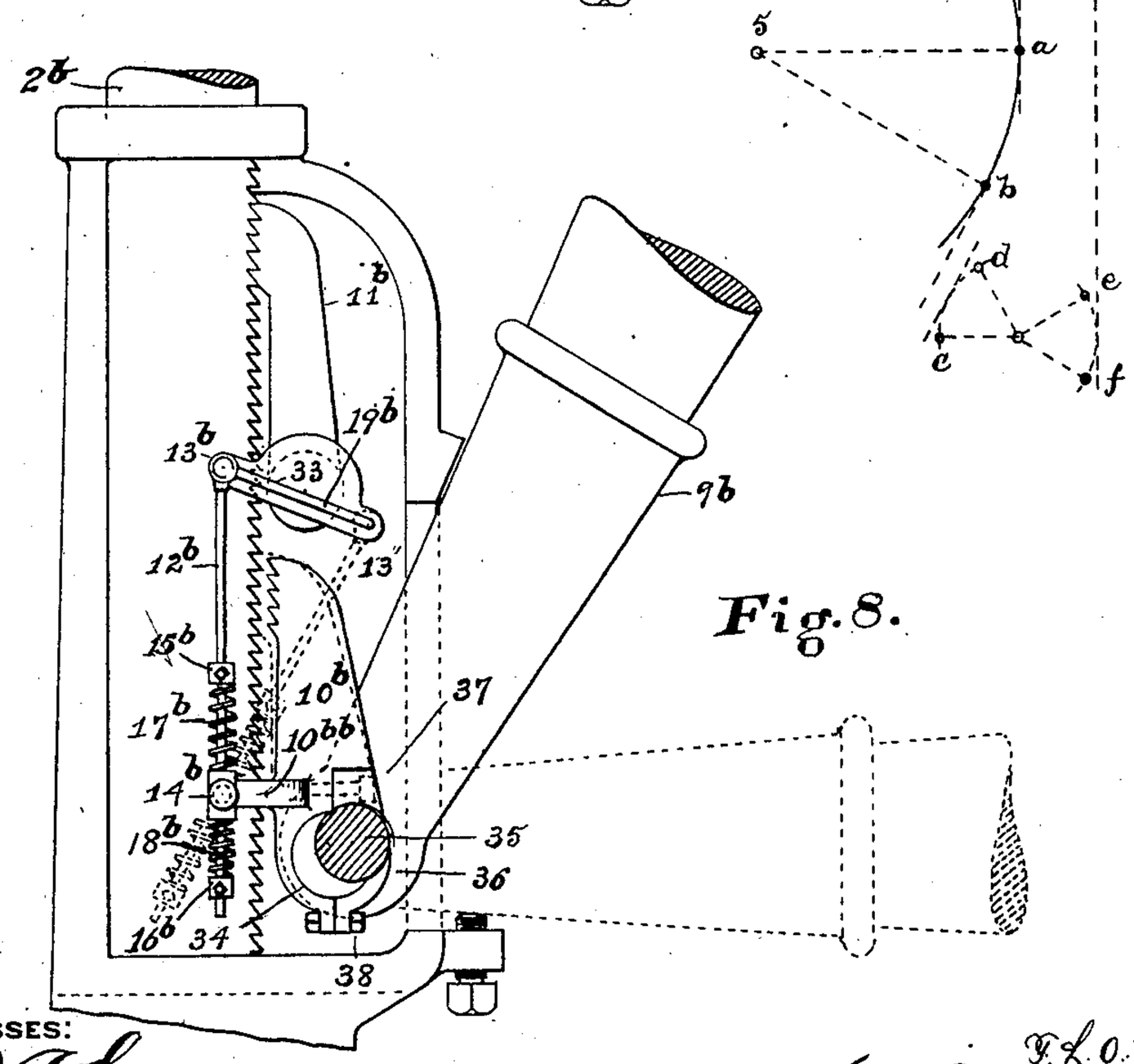

Fig. 8.

Fig. 9.

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3 SHEETS—SHEET 3.

Fig. 10.

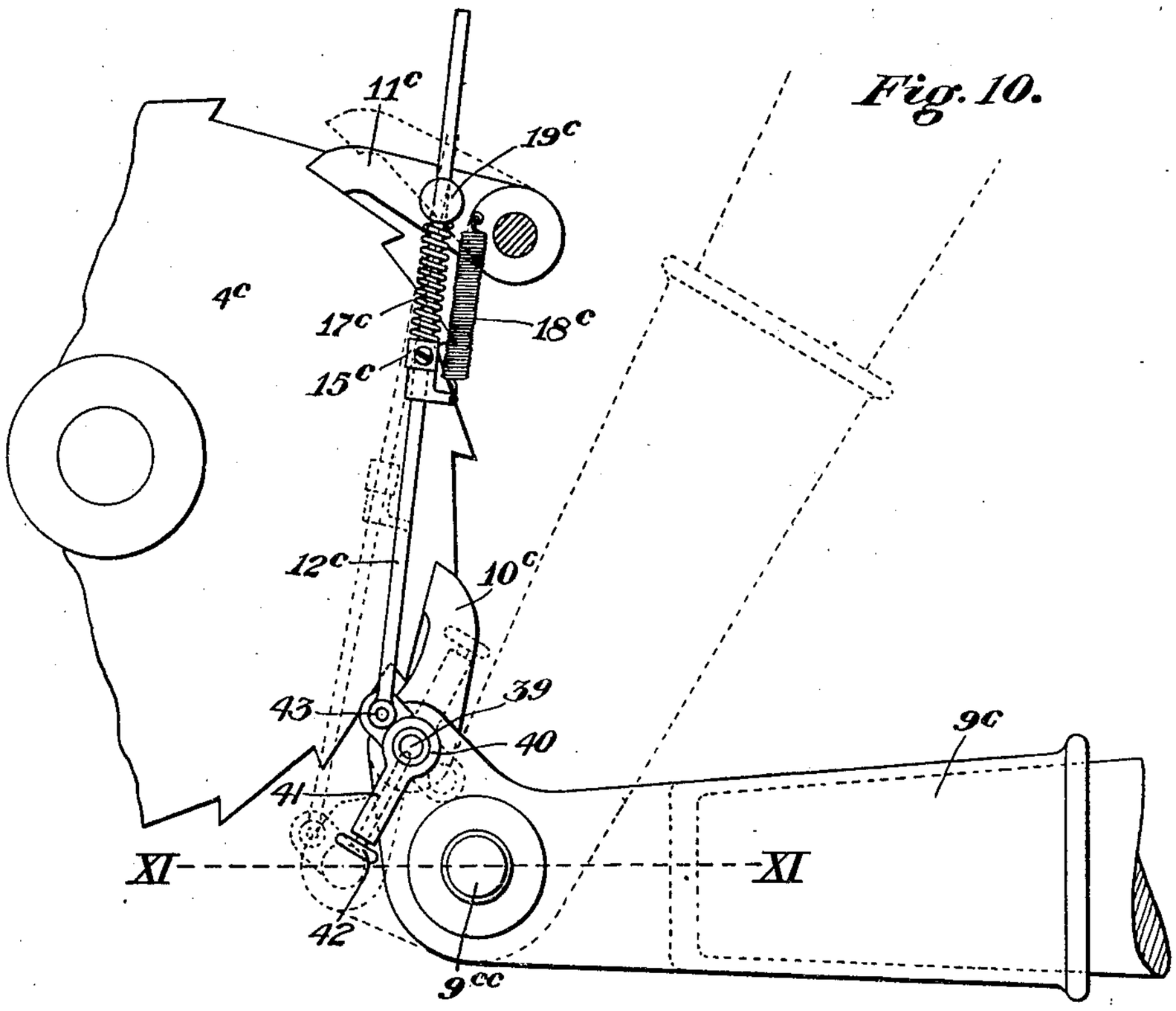


Fig. 11.

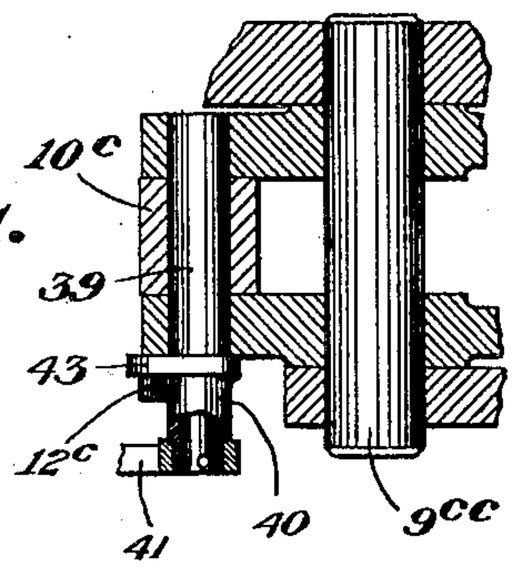
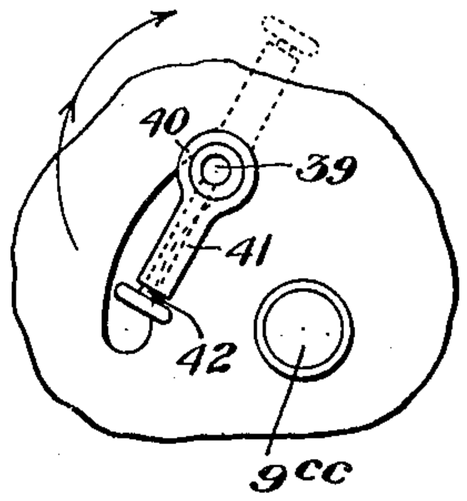


Fig. 12.



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by C. M. Clarke Atty.

UNITED STATES PATENT OFFICE.

FRANK L. O. WADSWORTH, OF SEWICKLEY, PENNSYLVANIA.

RATCHET-AND-PAWL-ACTUATING MECHANISM.

No. 925,855. Specification of Letters Patent. Patented June 22, 1909.

Application filed January 6, 1909. Serial No. 470,990.

To all whom it may concern:

Be it known that I, FRANK L. O. WADSWORTH, a citizen of the United States, residing at Sewickley, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Ratchet-and-Pawl-Actuating Mechanism, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention consists of an improvement in mechanism for actuating the ratchet and pawl mechanism of a lifting jack and similar mechanical constructions.

The object of the improvement is to provide simple, reliable and positively acting means for automatically controlling the engagement and disengagement of the pawls used in operating, controlling and holding the ratchet or ratchet wheel of a mechanical structure, as a jack of the type shown in the drawings, the invention being also applicable to the operation, control, and holding of ratchet bars, wheels, escapements, etc., of any similar apparatus wherein motion in either direction is desired, usually in opposition to or in the same direction with a continuously acting force. I accomplish this object by providing a yielding or elastic connection between a plurality of pawls acting respectively as the lifting pawl and retaining or holding pawl, such yielding connection being so constructed and combined with the other portions of the mechanism that it is alternately subject to a tensional and expansive action and a compressional and contractive action respectively whereby the proper relative movement of each pawl and of its attached parts is secured and controlled.

The invention also consists in certain novel combinations and arrangement of parts of ratchet and pawl mechanisms as shall be hereinafter more fully described.

In the drawings:—Figure 1 is a view in side elevation, partly broken away, of a lifting jack provided with one form of the invention, the front cover plate having been removed. Fig. 2 is a sectional detail view enlarged, of the lifting pawl and its spring bearing arm. Fig. 3 is a sectional view on the line III. III. of Fig. 2. Fig. 4 is a cross sectional view on the broken line A, A′, B of Fig. 1. Fig. 5 is a detail view of the upper portion of the case showing the adjusting mechanism for the locking pawl. Fig. 6 is a cross sectional detail view on the line VI. VI. of Fig. 1. Fig. 7 is a partial side elevation similar to Fig. 1 showing a modified construction embodying two lifting pawls. Fig. 8 is a similar view showing a further modified construction in which the pawls engage the ratchet teeth of the raising and lowering bar. Fig. 9 is a diagrammatic view indicating the operation. Fig. 10 is a detail view similar to Figs. 1 and 7 showing a further modified construction. Fig. 11 is a cross sectional detail view on the line XI. XI. of Fig. 10, assuming the lever to be raised to the position shown in dotted lines. Fig. 12 is a detail view of the semi-rotatable pivoted shifting device for reversing the operation.

In the figures of Sheet 1 of the drawings, I have shown one application of the invention to an ordinary lifting jack of the rack and pinion type. In such construction 1 is the main frame of the jack having a suitable supporting base and embodying in its upper portion a housing for the reception of the movable jack bar or standard 2 arranged for vertical movement therein and for the pinion 3 and its shaft 5 engaging teeth 6 of bar 2, shaft 5 having secured upon it by a key or other suitable means, the ratchet wheel 4, mounted within the housing frame 1, which is suitably designed to receive it.

Pinion shaft 5 is mounted in suitable bearings 7 and 8 at opposite sides of the housing frame, bar 2 also being mounted within a vertical receiving slide-way therein, the housing frame being preferably provided with removable front and back plates for access to its interior.

9 is the operating lever of the jack, pivotally mounted on shaft 9′ in the housing, adapted to be actuated upwardly and downwardly in the manner of jacks of this type, by an extended handle.

10 is the lifting pawl mounted by pivoting pin 10′ in an extension of the lever 9 inwardly beyond its pivotal mounting 9′ as shown, the function of which pawl is to rotate the ratchet wheel 4 in one direction when lever 9 is lowered and pawl 10 raised, to raise bar 2, and also to lower the bar 2 by supporting engagement with one of the teeth of the ratchet wheel in its reverse travel, by lowering movement of the pawl.

11 is the holding pawl, pivotally mounted upon its bearing 11′ in the housing wall, the function of which pawl is to lock the ratchet wheel 4 and hold it against the weight on bar 2, during the time when pawl 10 is being ad-

justed for the next operation, the ratchet wheel remaining stationary.

The invention provides means connecting pawls 10 and 11 whereby each pawl will be automatically thrown outwardly from engagement upon the particular ratchet tooth, when the other pawl has been inserted, dependent upon the operation of pawl 10 and its effect on the intervening yielding controlling connections between the pawls. To accomplish this operation, I employ a rod 12 pivotally attached to pawl 11 by an adjustable pin or stud 13 engaging an annular slot 19, in which slot the adjustable stud, constituting a pivotal connection with rod 12, may be adjustably set, as indicated in dotted lines in Fig. 1, to operate at one side or the other of the pivotal center 11′, or for reversing the operation. Stud 13 is provided at its outer end with a thumb screw terminal 22 extending outwardly for convenience in reversing the action of the pawl mechanism through a slot 21 in the cover plate, corresponding in position to the slot 19 of pawl 11. The cover plate slot 21 is sufficiently wide to allow the thumb screw clamp 22, which holds the stud 13 in position, to pass freely through it and play loosely therein, so that the direction of motion of the jack may be readily controlled by quickly loosening the thumb screw, shifting stud 13 to the position shown in dotted lines indicated at 13′, where it is secured in place in the other end of slot 19.

For the purpose of imparting shifting motion to pawl 11 in either position, *i. e.*, for raising or lowering, I have utilized spring mechanism combined with rod 12 and pawl 10 whereby upward or forward movement will be imparted through said shaft by corresponding movement of pawl 10, acting through interposed springs. For such purpose pawl 10 is provided with a laterally extending arm 10″ carrying in its outer terminal stud 14, provided with a transverse opening 14′, annularly flared at each side by coniform clearance openings, so that it will freely pass along rod 12 in either direction, while surrounding stem 14 has a freely mounted sleeve 14″.

The rod 12 carries two adjustable collars 15, 16, and interposed between these collars and the sleeve 14″ are springs 17, 18, which provide yielding connections between said collars and rod 12 for desired motion of pawl 11.

The operation of the above described construction is as follows: With the parts arranged in the position shown in full lines in Fig. 1, for lowering of standard 2 and a superposed weight, and with the operating lever 9 in the lowermost position and pawl 10 engaging the ratchet teeth of wheel 4, pawl arm 10″ has exerted, through spring 17 and rod 12, lifting action to pawl 11 so that as the wheel 4 is eased upwardly, pawl 11 will be released and thrown to the raised position shown. Upon lowering the tooth engaged by pawl 10, causing reverse rotation of ratchet wheel 4 and resulting lowering of standard 2 by downward travel of pawl 10 upon raising lever 9 to the position shown in dotted lines, the point of the tooth adjacent to the point of pawl 11 is drawn forwardly underneath it. As arm 10″ passes down with pawl 10, it releases spring 17 and comes into contact with upper end of lower spring 18, compressing it, and exerting a downward pull through rod 12, throwing pawl 11 downwardly to the position shown in dotted lines, so that it will engage the next advancing ratchet tooth, arresting the wheel. A still further travel of pawl 10 downwardly advances it at the termination of the stroke of lever 9, releasing said pawl from engagement with its ratchet tooth, whereupon resiliency of spring 18 acting through arm 10″ will throw pawl 10 outwardly from engagement with its tooth and backwardly free therefrom, under the expansive action of the compressed spring 18. Reverse motion of lever 9 will now carry pawl 10 upwardly past its released tooth until arm 10″ again comes into contact with lower end of expanded spring 17, whereupon pawl 10 will be thrown inwardly to engage the next tooth and will impart a slight lifting action to the ratchet wheel, whereupon the upward thrust of rod 12, due to the expansive action of spring 17 acting on collar 15, will again thrust pawl 11 upwardly as described, and the operation is again repeated. When it is desired to actuate ratchet wheel 4 in the opposite direction to lift standard 2, stud 13 of pawl 11 is shifted along to the other end of slot 19, locating it beyond the pivotal center 11′ at the other side from the dead center line so that its operation and that of rod 12 on pawl 11 will be reversed. Such shifting action brings the stud 13 somewhat closer to stem 14, thereby increasing the compression of spring 17 and relieving spring 18. The compression of spring 17 now acts to hold both pawls into engagement with the ratchet wheel so that each will slip into engagement behind the next adjacent tooth automatically as wheel 4 is rotated to raise standard 2. Operation of lever 9 will therefore act to raise the adjacent side of ratchet wheel 4, each lift causing a successive locking engagement of pawl 11 so that the wheel will be held against reverse rotation until the next hold is taken by pawl 10, the operation continuing as long as desired.

In Fig. 7 I have shown a modified construction of the pawl mechanism applied to a lifting jack similar to that shown in Figs. 1 and 4, but wherein two lifting pawls are employed to provide for double action in either direction, capable of either lifting or lowering

on both the up and down stroke. In order to obtain such results with my improved mechanism, it is only necessary to add a second lifting pawl 24 pivoted at 25 on operating lever 9^a, shown at its highest position. This second lifting pawl 24 is connected with the holding pawl 11^a, arranged as described in Fig. 1, by a second yielding connection consisting of the rod 26 mounted within the slotted tube 27 having surrounding compression springs 28 and 29. The upper end of rod 26 may be pivoted directly on stud 13^a or it may be conveniently pivoted, as shown, at 30 on a short arm extension 12′ of rod 12^a. The tube 27 is pivoted to an extension 24′on pawl 24 and is slotted intermediate of its ends for clearance of a transverse pin 31 extending through rod 26 and said slot at each side, extending beyond the peripheral surface of tube 27 to engage the inner end of spring 28 and 29 respectively. The alternative action of springs 28 and 29 on pawls 24 and 11^a, is the same as that of springs 17^a and 18^a on pawls 10 and 11^a. Thus as shown in Fig. 7 the stud 13^a is set on pawl 11^a in position for forward motion of ratchet wheel 4^a, for lifting plunger 2^a. As the operating lever 9^a is depressed the pawl 10 rises, partially rotating wheel 4^a and imparting upward movement to the standard. At the termination of the stroke pawl 24 will have dropped to a position suitable for engagement with one of the ratchet wheel teeth as the lever is lifted again, which pawl in turn advances the wheel in the same direction as before, so that it will thus be seen that each pawl operates alternatively, resulting in a practically continuous rotation of the ratchet wheel, with both up and down movement of the operating lever. For the purpose of reversing the operation to lower, stud 13^a is shifted to the other end of annular slot 19^a, as in Fig. 1, and the automatic movement of the pawls 10 and 11^a is secured and controlled exactly in the same manner as described, through the operation of springs 17^a and 18^a. The control of the third pawl 24 is effected in the same way by the alternate compression of the springs 29 and 28. Thus when the lever 9^a is near the top of its stroke, and the stud 13^a is in the lowering position at end of slot 19^a to the left side of fulcrum of pawl 11^a, the compression of spring 29 throws the pawl 24 into engagement with the teeth of ratchet wheel 4^a, while the compression of spring 18^a throws the pawl 10 out of engagement therewith. A further slight upward movement of the lever releases the thrust on the holding pawl 11^a and the compression of spring 29 re-acting against the fixed engagement of pawl 24 lifts pawl 11^a above the teeth of ratchet wheel 4^a and allows the latter to move backwardly as the lever 9^a is lowered. As the lowering motion proceeds spring 17^a is first compressed, bringing pawl 10 into position for engagement with the next tooth. When this engagement occurs the backward movement of ratchet wheel 4^a is arrested and the thrust on pawl 24 is released. In the meantime the downward movement of lever 9^a and pawl 24 has compressed spring 28 which acts, as soon as pawl 24 is relieved of pressure, to lift the latter away from the ratchet tooth with which it was in engagement. Simultaneously the compression of spring 17^a (which had acted to force pawl 10 into engagement with the ratchet teeth) re-acts after such fixed engagement to again lift pawl 11^a and allow the ratchet wheel 4^a to move backwardly another interval, following the pawl 10 as operating lever is lifted to its first position, when the operation above described is repeated.

In Fig. 8 I show an application of my improved pawl mechanism to a ratchet bar jack of the type in which the lifting pawl and holding pawl act directly on the vertically movable standard 2^b. In such construction the lifting pawl 10^b may be conveniently mounted directly on an eccentric 34 turned on the fulcrum shaft 35 of the operating lever 9^b. This lifting pawl 10^b is provided as before described with a projecting arm 10^{bb} carrying a stud 14^b similar to the stud construction shown in Figs. 2 and 3, through which slides the rod 12^b pivoted in the movable stud 13^b. Said stud 13^b is slidingly mounted in an inclined transverse slot 19^b of a removable cap 33 mounted upon the outer portion of the pivotal terminal of holding pawl 11^b, as clearly shown. Springs 17^b and 18^b are adjusted as described to bear against either side of the thimble surrounding the stud 14^b and to bear at their opposite ends against collars 15^b and 16^b, being arranged and adapted to operate in the same manner generally as has been already described, forming the yielding and alternately acting flexible connections between the upper and lower pawls. With the stud 13^b set to the left side of slot 19^b and beyond the pivotal center of pawl 11^b as shown, the mechanism is adapted for lowering operation of standard 2^b as the lever 9^b is raised. Upon throwing stud 13^b to the right side of slot 19^b and to the other side of pivotal center of pawl 11^b, and downwardly along the said inclined slot, thereby compressing spring 17^b, the mechanism is adapted for upward or lifting travel of the standard 2^b as the operating lever is depressed. In such construction the lifting pawl may be readily secured in the offset eccentric portion of fulcrum shaft 35 or removed therefrom by means of a separate cap 34 and screws 37 and 38.

In Fig. 10 I have shown a further modified construction in which the reversing mechanism is mounted in the raising and lowering lever itself instead of in the locking pawl.

Operating lever 9^c is mounted in the case by its fulcrum 9^{cc} and its inner weight-lifting or lowering terminal is provided with a fixed pivoting stud 39 for pawl 10^c upon the outer end of which stud is sleeved a thimble 40 adapted to be rotated one half revolution to reverse the operation of the pawls. Thimble 40 is provided with a key housing 41 and a key 42 therein adapted to be inserted by its inner end in a suitable receiving socket in the outer end of stud 39, to hold the thimble and a pivoting extension 43 thereof, in either position; as shown in full and dotted lines respectively, Fig. 10. 12^c is the lifting stem for locking pawl 11^c, pivoted to said extension 43 as shown and extending upwardly through a stud 19^c of pawl 11^c with an encircling compression spring 17^c located between said stud and a collar 15^c fixed to the stem. 18^c is a tension spring, secured at one end to the pawl 11^c as shown at the same side of its pivotal mounting as stud 19^c and at its other end to collar 15^c or an extension thereof, as shown, and designed to draw the pawl into engagement with the tooth of the ratchet wheel 4^c.

The operation of such construction is similar to that of the single pawl construction of Fig. 1. Assuming the standard of the jack to be lowered and the locking pawl 11^c and operating pawl 10^c in engagement as shown, with the stem 12^c thrust upwardly and spring 17^c compressed against stud 19^c, a slight further raise of pawl 10^c, due to corresponding lowering action of lever 9^c, will cause holding pawl 11^c to be released, due to the intermittent reverse rotation of the ratchet wheel, and to be thrust upwardly, as indicated in dotted lines. Raising of lever 9^c to the uppermost position, as shown in dotted lines, resulting in lowering of pawl 10^c, will correspondingly lower the engaged face of the ratchet wheel and also of stem 12^c, drawing downwardly with it lower end of tension spring 18^c, thereby again throwing pawl 11^c downwardly for engagement of the next on-coming tooth. Upon said tooth being arrested by the holding pawl, a further slight downward travel of pawl 10^c will cause its release from the engaged tooth, due to the tension of spring 18^c upwardly on stem 12^c, tending to throw the pivoting bearing arm 43 around in a direction to disengage the point of the pawl from the tooth. The pawl 10^c will be so held until upon again reversing the lever to raise, the tension of spring 18^c will be overcome and spring 17^c again compressed, reversing the pressure on bearing 43 and again throwing the point of the pawl into engagement with the next adjacent tooth, to the position at the commencement of the operation just described which may then be repeated. When it is desired to reverse the operation to lift the jack standard, key 42 is withdrawn and bearing 43 thrown half way around to the position shown in dotted lines in Fig. 10, the key and its housing assuming the position shown in dotted lines in Fig. 12. The distance between stud 19^c and bearing 43 is thereby increased, as in the former constructions, thereby releasing compressive pressure on spring 17^c and extending spring 18^c so that it is constantly under tension and will normally hold the locking pawl 11^c in engaging relation to the ratchet teeth as they pass successively underneath and away from the locking pawl. Likewise, the reversal of bearing 43 and the constant normal tension of spring 18^c will constantly exert an inward thrust on lifting pawl 10^c so that it will normally engage each successive ratchet tooth for lifting. The operation will be readily understood, each downward motion of lever 9^c thrusting the ratchet wheel periphery engaged upwardly, locking pawl 11^c taking a new hold, whereupon lifting pawl 10^c may be likewise given a new hold by raising the lever, the operation being continued as long as desired.

In all of the constructions shown, it will be observed that the operation of the pawls, *i.e.*, lifting or lowering pawl and locking pawl are dependent upon each other by reason of the resilient intervening spring connections, and that reversal of the conditions from tension to compression, or vice versa, will reverse the relative operations of the pawls as desired. Also that the operation of one or more of the springs is resultant from the lengthening or shortening of the distance between the point of connection on the locking pawl and the connection with the operating mechanism.

It will be obvious that the principle of the invention may be variously applied to different mechanisms to suit particular conditions or constructions, and that different arrangements or changes may be made by the skilled mechanic to utilize the invention, either in its application to the class of jacks or to any other mechanism in which it may be employed; or that other changes or modifications may be made in the form or arrangement of the yielding connections or in other details of the invention, but all such changes are to be considered as within the scope of the following claims.

What I claim is:—

1. In automatic pawl mechanism, a holding pawl, a lifting pawl, a longitudinally yielding connection between the two, and means for actuating the lifting pawl.

2. In automatic pawl mechanism, a holding pawl, a lifting pawl, interposed yielding connecting mechanism, means for varying the distance between the points of attachment of said mechanism with the pawls, and means for actuating the lifting pawl.

3. In automatic pawl mechanism, a hold-

ing pawl, a lifting pawl, a yielding connection between said pawls arranged to act alternately in compression and in tension dependent on the movement of the lifting pawl, and means for actuating the lifting pawl.

4. In automatic pawl mechanism, a holding pawl, a lifting pawl, a yielding connection between said pawls arranged to act alternately in compression and in tension dependent on the movement of the lifting pawl, means for shifting the point of adjustment of the said connection on one of said pawls, and means for actuating the lifting pawl.

5. In automatic pawl mechanism, a holding pawl, a lifting pawl, a yielding connection between said pawls arranged to act alternately in compression and in tension dependent on the movement of the lifting pawl, a connecting rod pivotally attached to one pawl and sliding loosely through the connection to the other pawl, springs interposed between the sliding connection and fixed points of the link, and means for actuating the lifting pawl, substantially as described.

6. In automatic pawl mechanism, a holding pawl, a lifting pawl, interposed yielding connecting mechanism, means for shifting the connection of said mechanism with one of said pawls to vary the action on said pawl, and means for actuating the lifting pawl.

7. In automatic pawl mechanism, a pivoted holding pawl, an actuating element having a pivoted lifting pawl, interposed yielding connecting means embodying spring mechanism, and means for shifting the connection of said means with one of the pawls from one side of its pivot to the other, substantially as described.

8. In automatic pawl mechanism, a pivoted holding pawl, an actuating element having a pivoted lifting pawl, interposed yielding connecting means embodying spring mechanism, and means for varying the relative position of the connecting means as to one of said pawls to change its action on the other pawl, substantially as described.

9. In automatic pawl mechanism, a pivoted holding pawl, an actuating element having a pivoted lifting pawl provided with an arm, yielding connecting mechanism attached to the holding pawl and engaging said arm, and spring devices incorporated with the connecting mechanism, substantially as described.

10. In automatic pawl mechanism, a pivoted holding pawl, an actuating element having a pivoted lifting pawl provided with an arm, yielding connecting mechanism attached to the holding pawl and engaging said arm, spring devices incorporated with the connecting mechanism, and means for shifting the point of attachment of the connecting mechanism with the holding pawl, substantially as described.

11. The combination with a ratchet toothed element, of a holding pawl, an actuating element having a lifting pawl, and longitudinally yielding connecting mechanism interposed between the holding pawl and the lifting pawl, substantially as described.

12. The combination with a ratchet toothed element, of a holding pawl, an actuating element having a lifting pawl, yielding connecting mechanism interposed between the holding pawl and the lifting pawl, and means for shifting the position of attachment of said connecting mechanism on one of said pawls, substantially as described.

13. In automatic pawl mechanism, a holding pawl, a lifting pawl, yielding connecting mechanism between the pawls arranged to draw the holding pawl toward the lifting pawl when said pawl is moving away from the holding pawl, and to thrust the holding pawl in the opposite direction when the lifting pawl is moving toward it, and means for actuating the lifting pawl.

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

FRANK L. O. WADSWORTH.

Witnesses:
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C. M. CLARKE.