

No. 737,840.

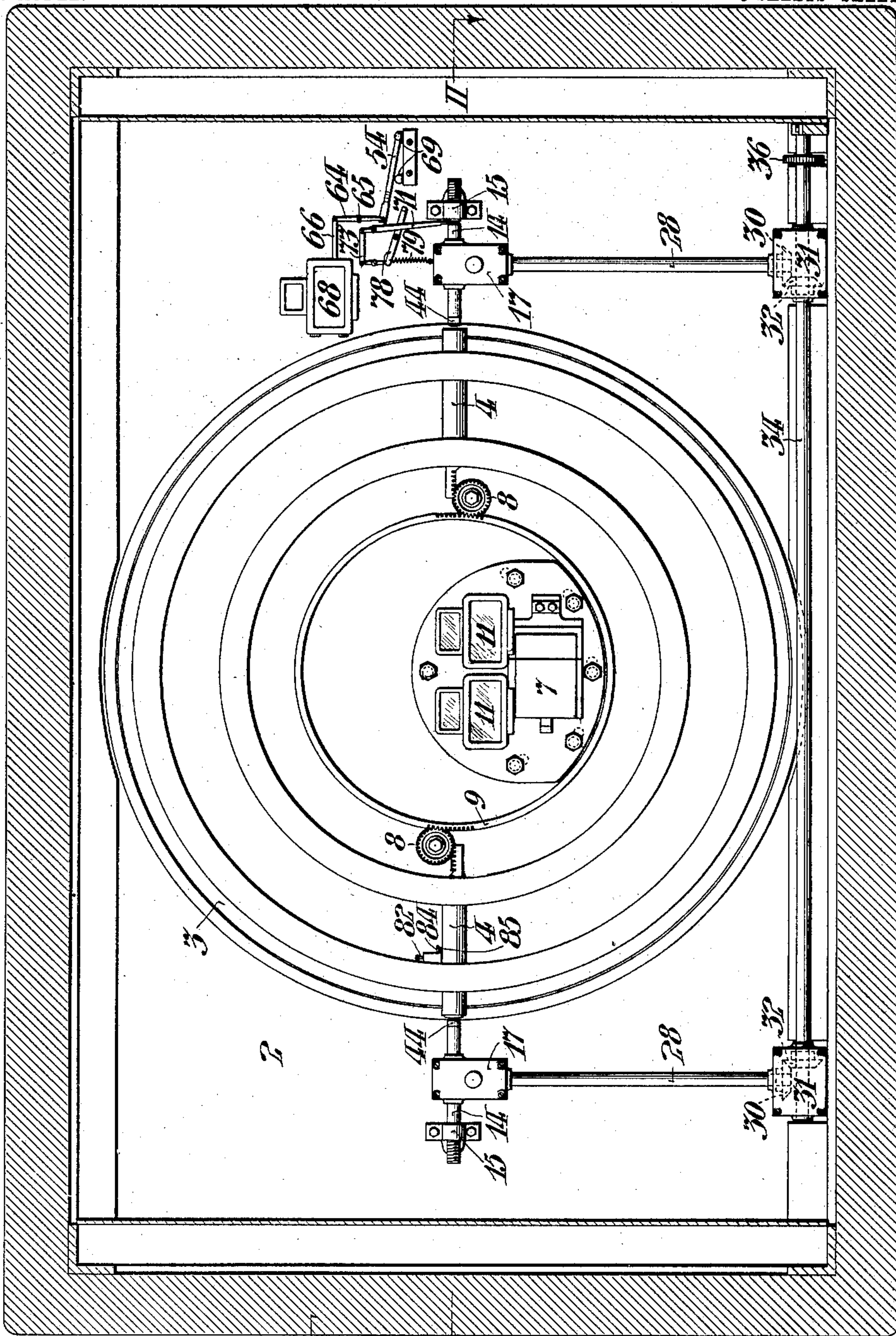
PATENTED SEPT. 1, 1903.

W. H. HOLLAR.  
ELECTRIC LOCK.

APPLICATION FILED MAR. 10, 1902.

NO MODEL.

5 SHEETS—SHEET 1.



WITNESSES:

Clifton C. Hallowell  
Edward Rittenhouse

INVENTOR:

WILLIAM H. HOLLAR,  
by Arthur E. Paige  
Atty



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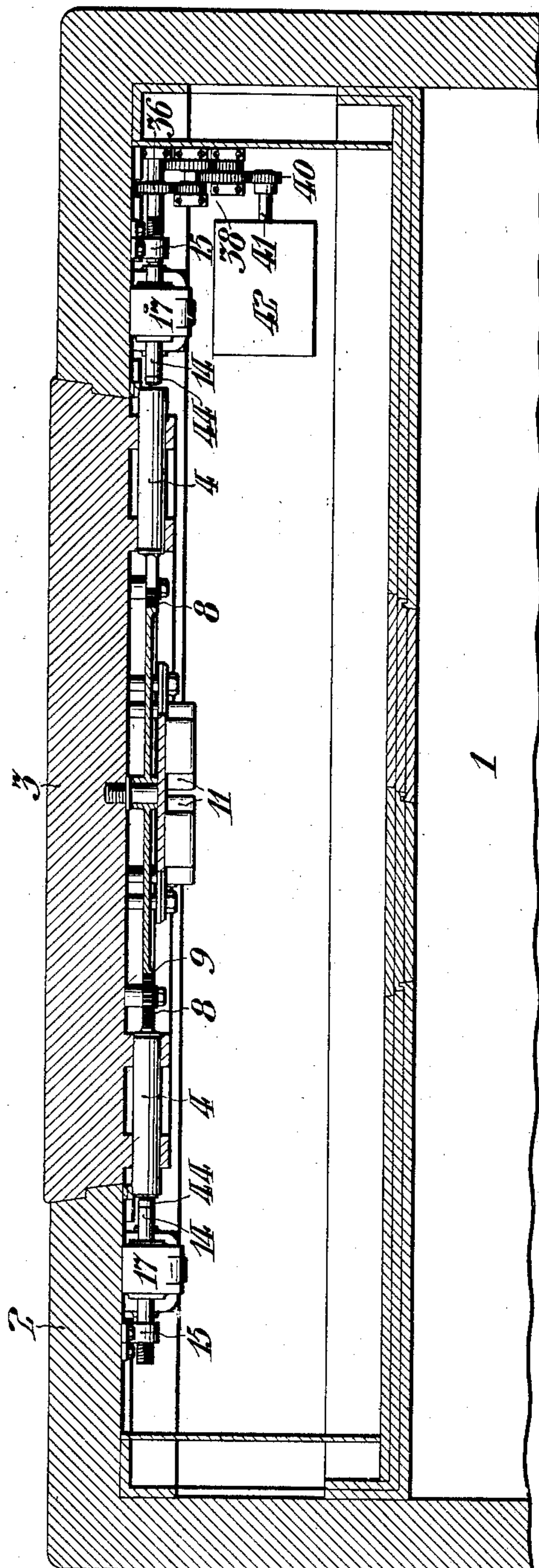
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5 SHEETS—SHEET 2.

FIG. II.



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5 SHEETS—SHEET 3.

FIG. IV.

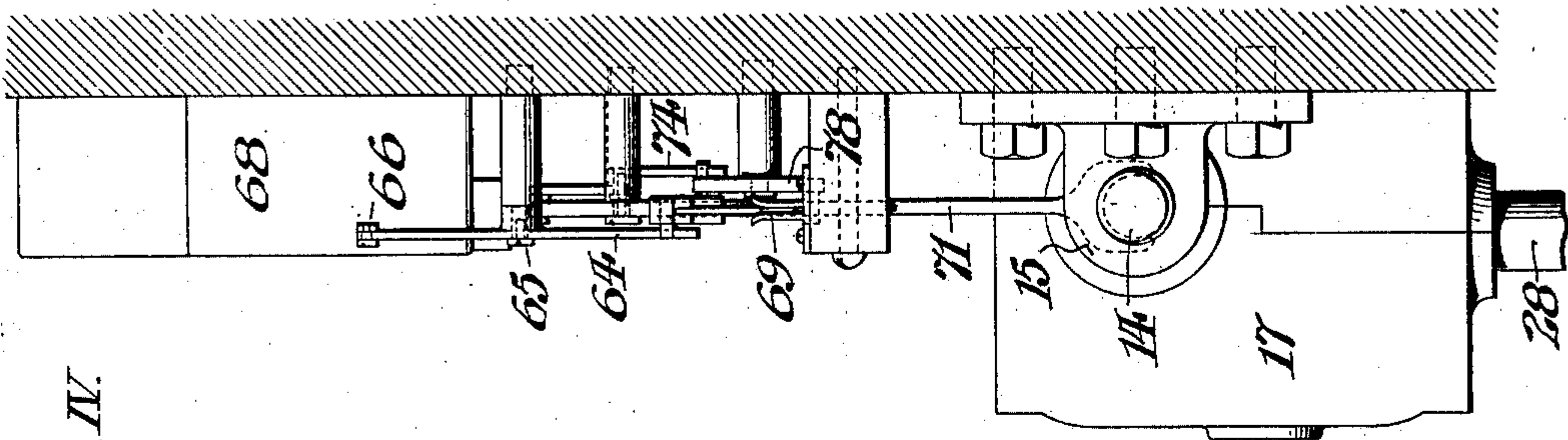
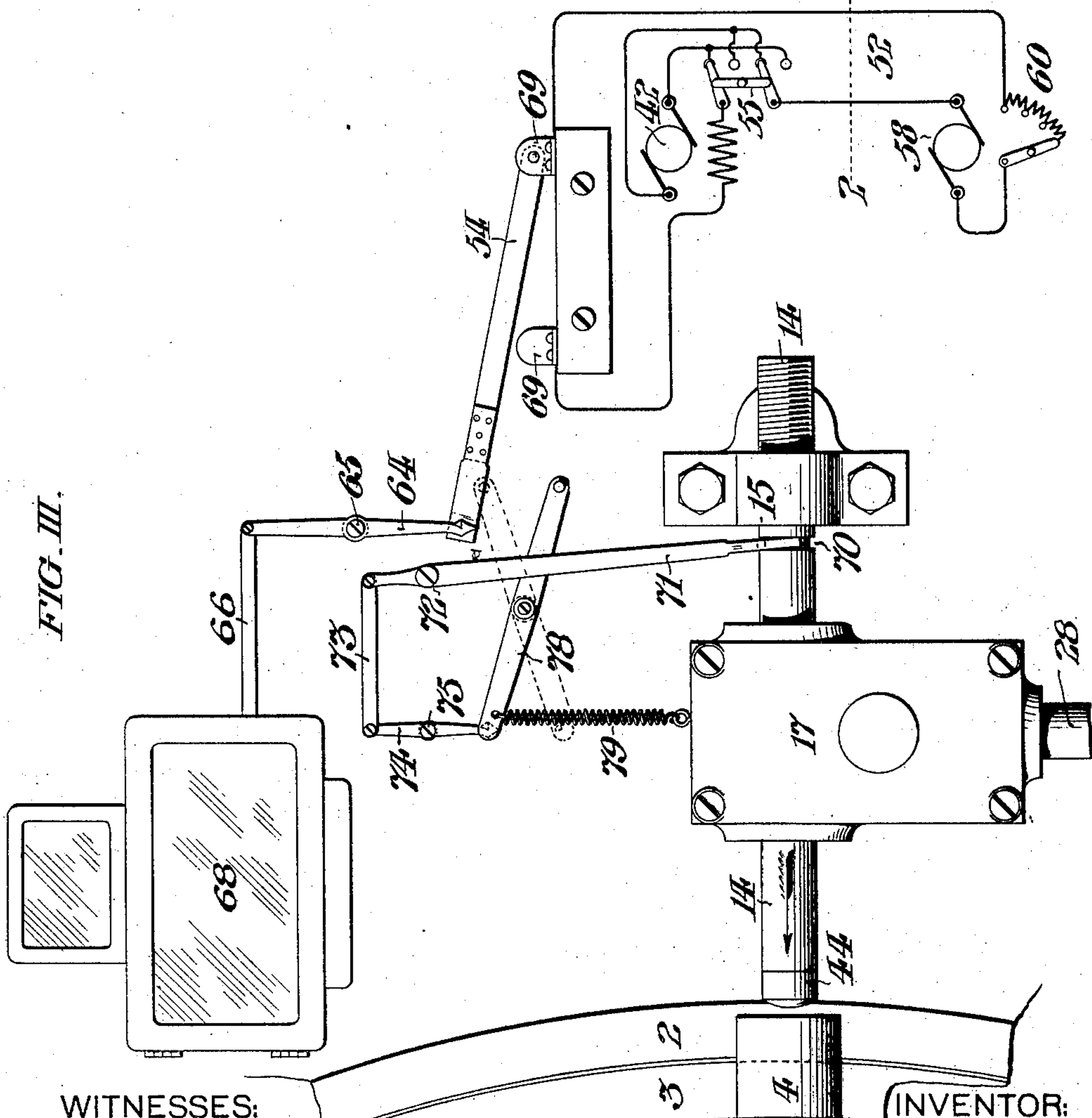


FIG. III.



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5 SHEETS—SHEET 4.

FIG. VI.

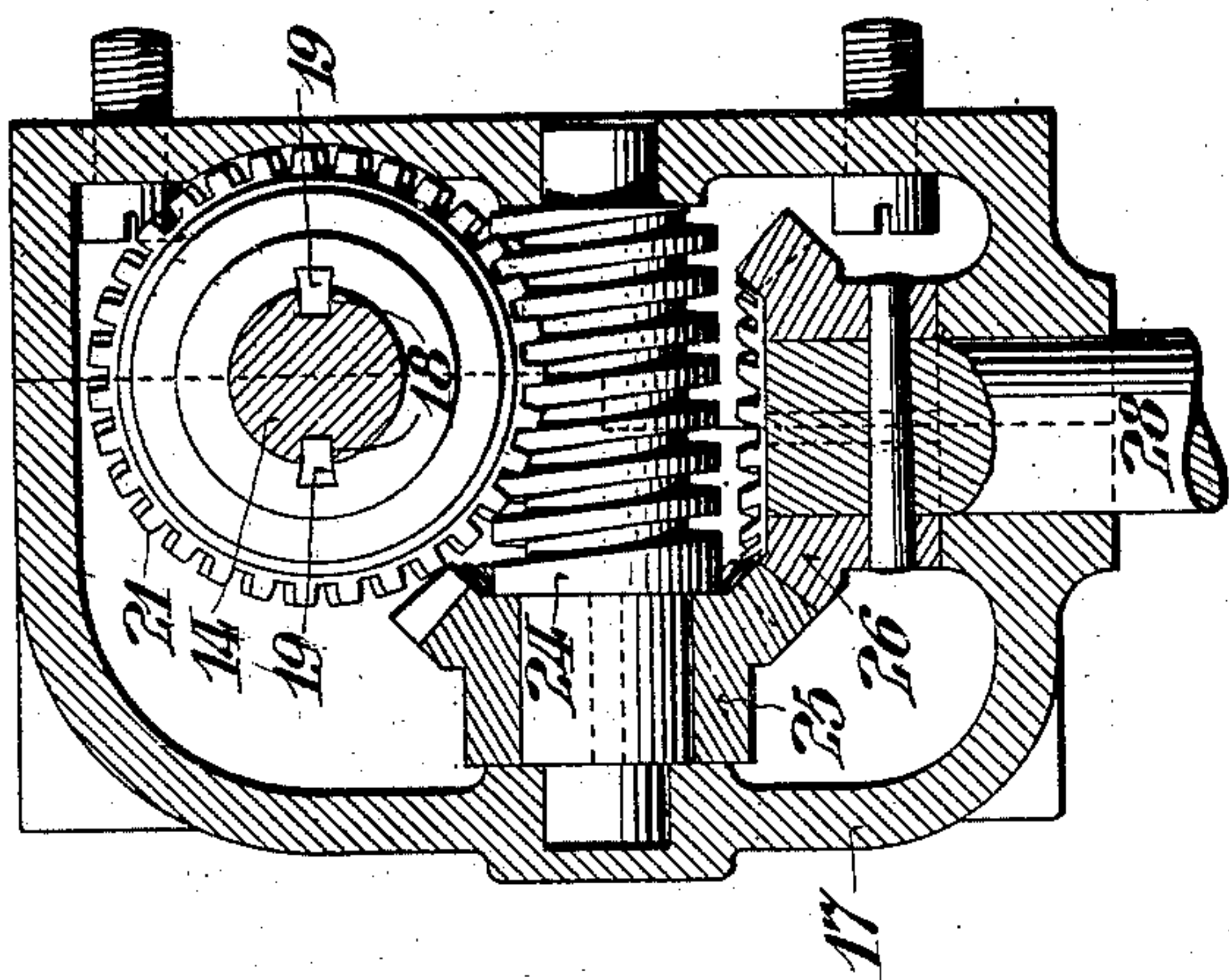


FIG. VIII.

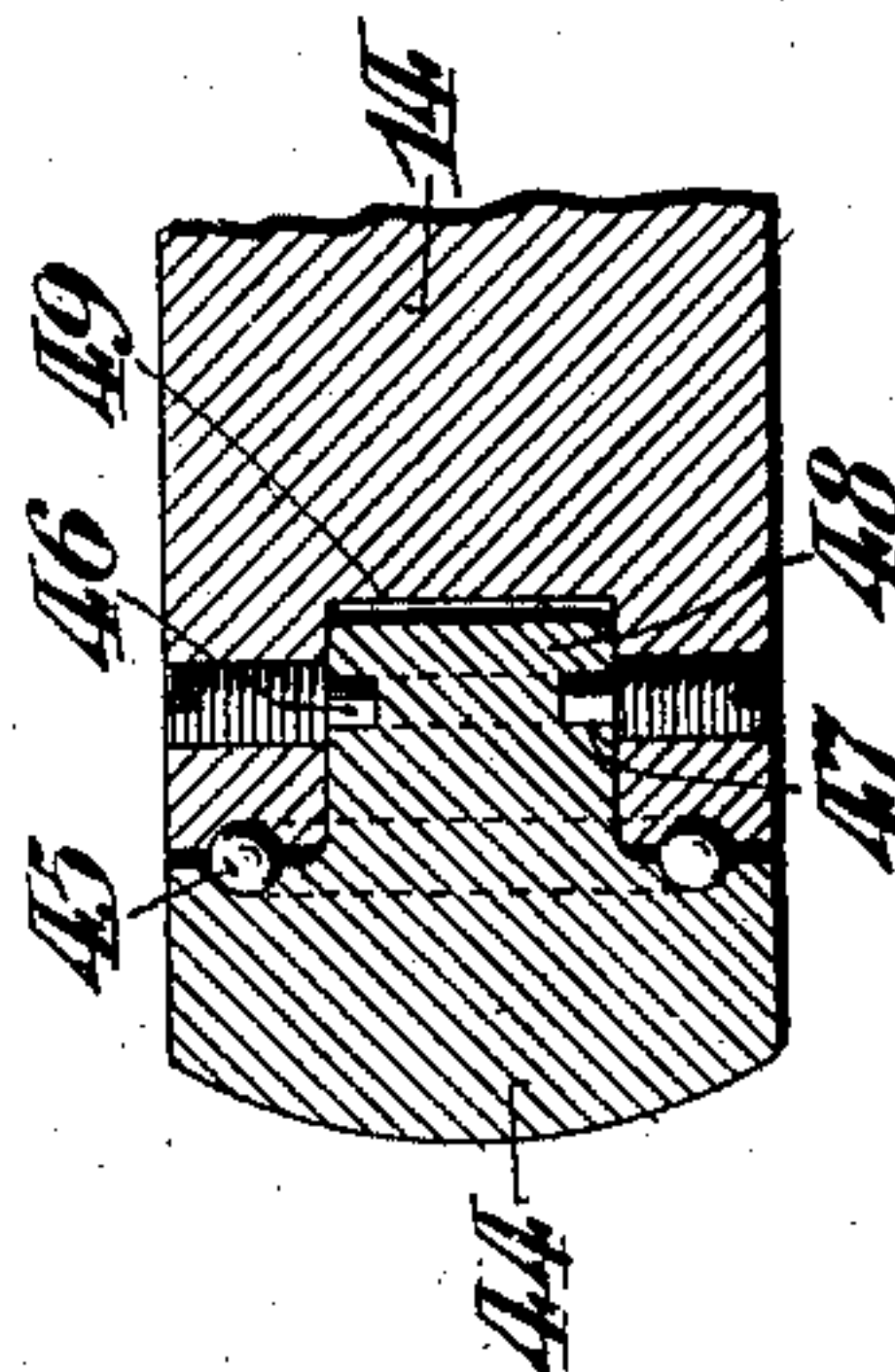


FIG. V.

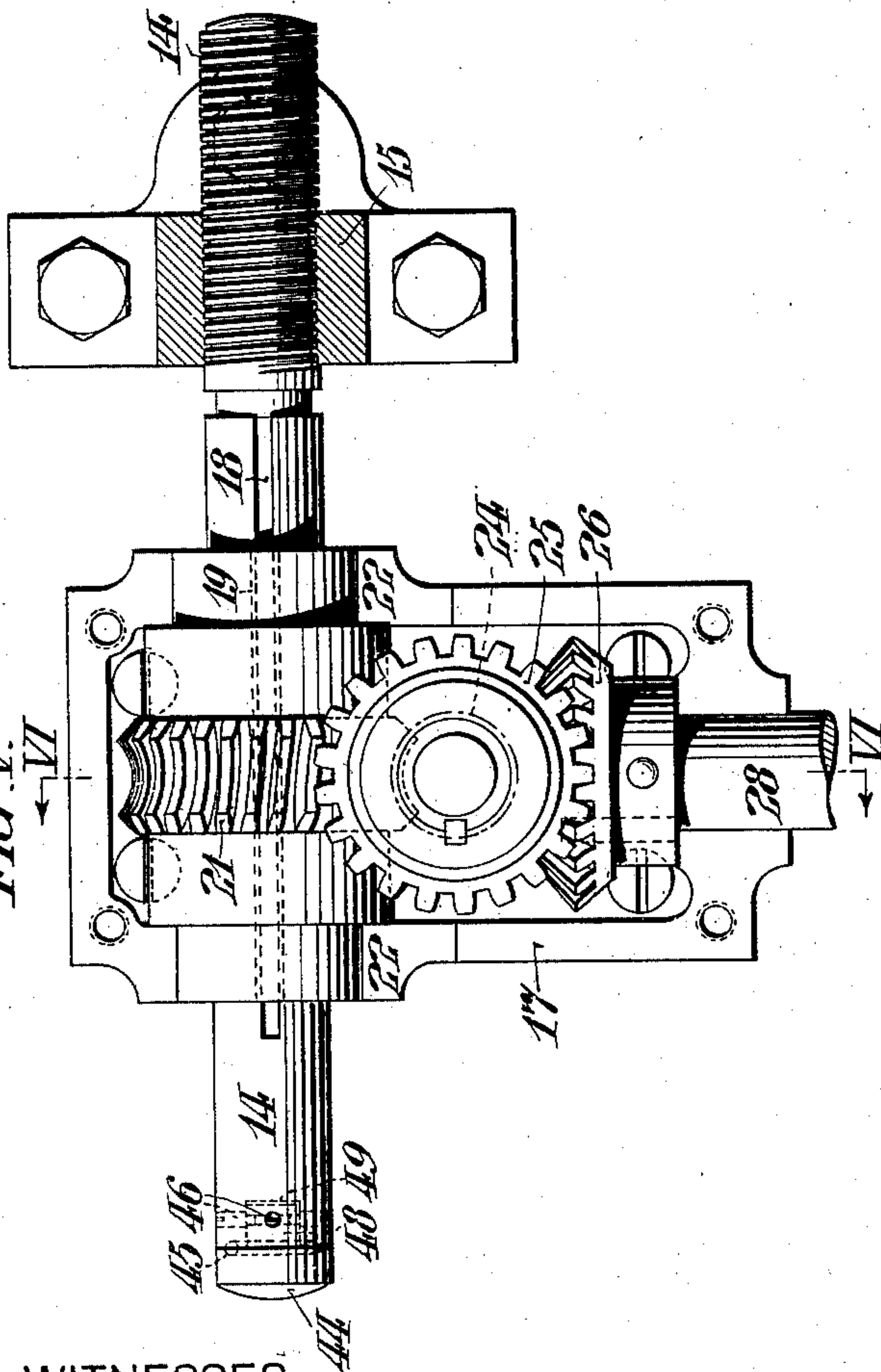
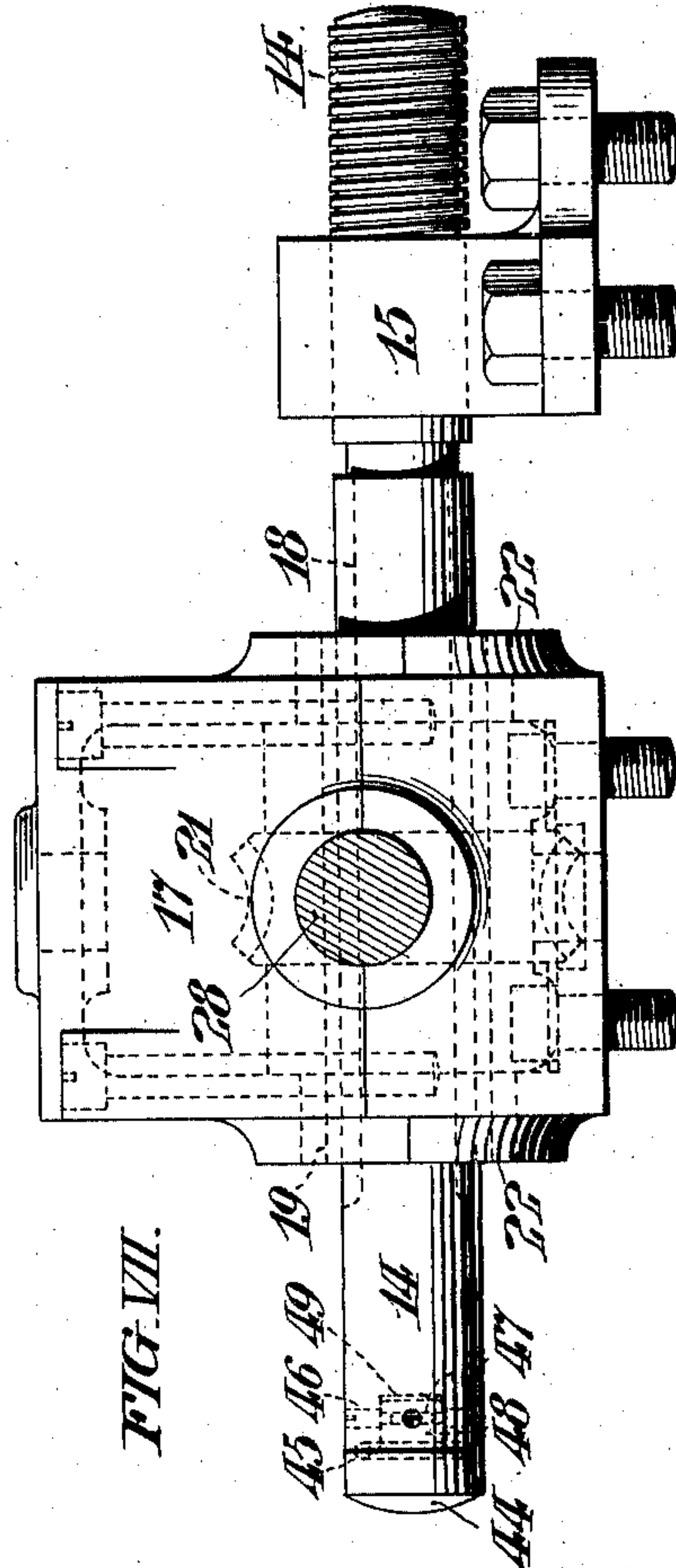


FIG. VII.



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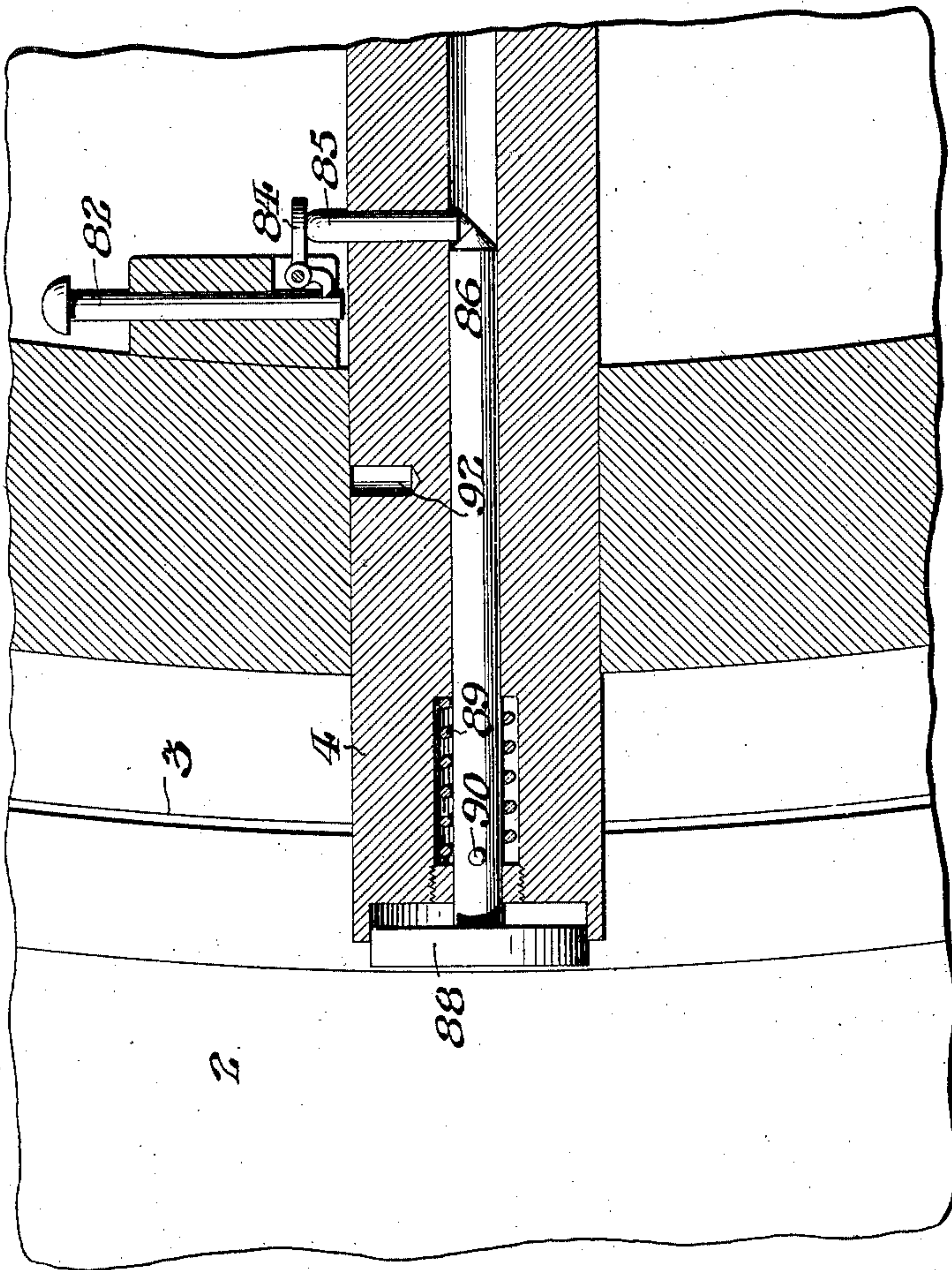
ELECTRIC LOCK.

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5 SHEETS—SHEET 5.

FIG. IX.



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# UNITED STATES PATENT OFFICE.

WILLIAM H. HOLLAR, OF PHILADELPHIA, PENNSYLVANIA.

## ELECTRIC LOCK.

SPECIFICATION forming part of Letters Patent No. 737,840, dated September 1, 1903.

Application filed March 10, 1902. Serial No. 97,408. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM H. HOLLAR, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Electrically-Controlled Safe-Locks, whereof the following is a specification, reference being had to the accompanying drawings.

My present improvements relate to safe or vault locks comprising boltwork arranged to be operated by mechanism within the safe-inclosure. Ordinarily the operating devices for boltwork of the class described comprise springs which must be compressed by the operator each time the door is to be locked.

It is the object of my invention to provide mechanism for positively operating such boltwork without the manual labor of the operator, and, further, to provide a motor for the boltwork capable of positively actuating the same by a force variable at the will of the operator in accordance with the resistance offered by the boltwork.

My invention comprehends the various novel features of construction and arrangement hereinafter set forth.

In the form of my invention hereinafter described I have arranged my device in auxiliary relation to the ordinary automatic spring bolt-operating mechanism to unlock the door. However, as described, my device is arranged to be operated independently of said spring mechanism, and it is to be understood that the latter may be dispensed with and the door locked and unlocked solely by my device.

In the accompanying drawings, Figure I is a sectional view showing the interior of a safe-inclosure provided with a door and a convenient embodiment of my invention applied to the latter. Fig. II is a sectional plan view taken on the line II II in Fig. I. Fig. III is a detailed view of the electric switch mechanism indicated in Fig. I, showing the wiring connections for the same. Fig. IV is a right-hand end view of the mechanism shown in Fig. III. Fig. V is an elevational view of the bolt-operating shaft and its driving-gear. Fig. VI is a sectional view taken on the line VI VI in Fig. V. Fig. VII is an inverted plan view of the mechanism shown in Fig. V. Fig. VIII is a sectional view showing the rotary cap at the end of the bolt-operating shaft.

Fig. IX is a fragmentary sectional view showing the bolt-detent mechanism.

Referring to Figs. I and II, 1 is the safe-inclosure, whose wall 2 is provided with the circular door 3, provided with boltwork of the type shown and described in my Letters Patent of the United States No. 621,341, dated March 21, 1899. Said boltwork comprises the radial lock-bolts 4, which are operatively connected with the spring automatic bolt-operating mechanism 7 by the pinions 8 and gear-wheel 9. Said bolt-operating mechanism 7 is operatively connected with the time-locks 11 and arranged to lock and unlock the door in the usual manner by springs compressed by the operator each time the door is to be locked.

My improved bolt-operating mechanism is conveniently mounted upon the wall 2 and comprises the screw-shafts 14, which are connected in threaded engagement with the stationary nuts 15 and arranged to be progressed longitudinally through said nuts and the gear-casings 17, in which they are mounted, as best shown in Figs. V, VI, and VII. Said Figs. V to VII, inclusive, show the detailed construction of the bolt-operating shaft. (Indicated at the right-hand side of Figs. I and II.) Each of said shafts 14 is provided with keyways 18, engaged with keys 19 within a worm-gear 21, which latter is provided with bearings 22 in the gear-casing 17. Said gear 21 is engaged by the worm 24, which is mounted for rotation in said casing 17 and provided with the beveled gear 25, engaged with the bevel-gear 26 upon the vertical shaft 28. The parts specified are duplicated in respective connection with the two shafts 14, and the two shafts 28 (shown in Fig. I) are connected by bevel-gears 30 within the casings 31 to the bevel-gears 32 upon the counter-shaft 34. Said shaft 34 is provided with the driving-gear 36, which latter, as shown in Fig. II, is connected by the train of gearing 38 with the gear 40 on the driving-shaft 41 of the motor 42.

It is to be understood that the arrangement above described is such that rotation of the motor-shaft 41 effects the rotation of the screw-shafts 14, which are opposed in alignment with the locking-bolts 4, and the effect of such rotation is to progress said shafts 14



radially inward through the nuts 15 to thrust the locking-bolts 4 radially inward, and thereby unlock the door 3. It is to be understood, however, that the bolts 4 and the parts connected therewith may be dispensed with and the shafts 14 be disposed in alinement with recesses in the door 3 and be engaged and disengaged with respect to said recesses to lock and unlock the door in accordance with the direction of rotation of the motor-shaft 41. To facilitate the rotation of said shafts 14 with the minimum amount of friction while thrusting against the bolts 4, I provide the extremities of said shafts 14 with rotary caps 44, which, as shown in Fig. VIII, are provided with ball-bearings 45 and retained against longitudinal displacement by the studs 46, which engage the groove 47 in the cap-shank 48, which is seated in the recess 49 in the extremity of the shaft 14.

As shown in Fig. III, the motor 42 is included in an electric circuit 52, which includes the automatically-operative switch 54 and the manually-operative switch 55 within the safe-inclosure. Said circuit 52 extends exterior to the safe-wall 2 (which is indicated by the dotted line in Fig. III) and includes a source of current 58 and means to vary the current supplied from said source to the motor 42 within the safe-inclosure, said means being indicated as a rheostat 60 in Fig. III. Said switch 54 is normally retained in open position, as indicated in Fig. III, by means of the hook-lever 64, which is fulcrumed at 65 and connected at its upper extremity by the link 66 with the time-lock 68, which may be of the ordinary construction, arranged to shift said link 66 at a time predetermined by the set of its clock mechanism to release the switch 54, which thereupon falls and bridges the terminals 69, thus closing the circuit including the source of current 58 and the motor 42, thereby energizing the latter and causing the mechanism above described to progress the screw-shafts 14 radially inward to unlock the bolts 4, and thus permit the door 3 to be opened at a time predetermined by the set of the time-lock 68.

The shaft 14, adjoining the switch 54, is provided with a circumferential groove 70, which engages the bifurcated end of the lever 71, which is fulcrumed at 72 and connected by the link 73 with the lever 74, which is fulcrumed at 75. The lower hooked extremity of said lever 74 normally upholds the switch-opening lever 78 against the stress of the spring 79, and the arrangement is such that when the shaft 14 is progressed in the direction of the arrow shown on Fig. III a sufficient distance to unlock the bolts 4 the hooked lever 74 releases the lever 78 and the latter is thrown to the position shown in dotted lines in Fig. III, in which position the switch 54 is uplifted to open the circuit 52, and thus stop the motor 42. The shafts 14 may be restored to the normal position (shown in Fig. III) by reverse rotation of the motor

42, such operation being effected by manipulation of the switch 55, which, as aforesaid, is conveniently located within the safe-inclosure. It is to be understood that the force applied to the boltwork by the mechanism above described may be augmented or diminished by variation in the current supplied to the motor 42, and such variation may be conveniently effected by manipulation of the rheostat 60.

In order that the bolts 4 may not be accidentally relocked by the spring bolt-operating mechanism 7 after being unlocked by the mechanism connected with the motor 42, I find it convenient to provide said bolts 4 with detent mechanism, as follows: Each of said bolts 4 is provided with a detent-pin 82, which is normally upheld in the position shown in Fig. IX by the pawl 84, whose free extremity is engaged by the plunger 85, which latter is in operative relation with the plunger 86, mounted to reciprocate longitudinally in the outer extremity of the bolt 4. Said plunger 86 is provided with the head 88 and is normally projected beyond the outer extremity of the bolt 4 by the spring 89, which bears against the pin 90. Said detent mechanism operates as follows: The shaft 14 encounters the head 88, shifts the plunger 86 inwardly, thereby uplifts the plunger 85, operates the pawl 84, and releases the detent-pin 82 before the head 88 encounters the end of the bolt 4. Thereafter the bolt 4 is carried by the head 88 into the unlocked position, in which position the recess 92 in said bolt 4 registers with the detent-pin 82, which latter falls in said recess and retains the bolt 4 in the unlocked position. Thereupon the shafts 14 may be withdrawn from engagement with the bolts 4 without permitting the latter to relock the door. It is to be understood that the particular construction of detent mechanism shown is not essential to the operation of my invention, as any suitable detent device may be employed for the purpose specified.

My improvements are advantageous in that the labor of the operator hitherto required to set the bolt-operating springs is dispensed with and the force applicable to effect the operation of the boltwork may be increased at the will of the operator to overcome any abnormal resistance. It is to be noted, however, that the facilities afforded for varying the force applicable to the boltwork by my invention do not permit any variation in the time of opening the lock, such time being predetermined solely by the set of the clock mechanism 68, which closes the electric circuit controlling the boltwork-motor 42.

It is obvious that various modifications may be made in the details of construction of my invention without departing from its essential features. Therefore I do not desire to limit myself to the particular form of my invention which I have shown and described.

I claim—



1. The combination with a safe-door; of a bolt arranged to lock said door; an electric motor provided with means to shift said bolt; an electric circuit including said motor, a source of current and a switch; and, mechanism arranged to close said switch automatically, and thereby energize said motor to shift said bolt, substantially as set forth.
2. The combination with a safe-door; of a bolt arranged to lock said door; an electric motor provided with means to shift said bolt; an electric circuit including said motor, a source of current and a switch; and, clock mechanism arranged to close said switch automatically, and thereby energize said motor to shift said bolt at a time predetermined by the set of said clock mechanism, substantially as set forth.
3. The combination with a safe-door; of a bolt arranged to lock said door; an electric motor provided with means to shift said bolt; an electric circuit including said motor, a source of current and a switch; and, means operated by said motor to open said switch and stop said motor after a predetermined interval of operation, substantially as set forth.
4. The combination with a safe-door; of a bolt arranged to lock said door; an electric motor provided with means to shift said bolt; an electric circuit including said motor, a source of current and a switch; mechanism arranged to close said switch automatically; and, means operated by said motor to open said switch and stop said motor after a predetermined interval of operation, substantially as set forth.
5. The combination with a safe-door; of a bolt arranged to lock said door; an electric motor; a nut; and, a screw-shaft operatively connected with said motor and arranged to shift said bolt, by progression through said nut, substantially as set forth.
6. The combination with a safe-door; of a bolt arranged to lock said door; an electric motor; a nut; a screw-shaft operatively connected with said motor and arranged to shift said bolt by progression through said nut; and, a rotary cap interposed between said shaft and said bolt, substantially as set forth.
7. The combination with a safe-door; of a bolt arranged to lock said door; a screw-shaft in alinement with said bolt; a nut engaged with said shaft; and, means to effect the relative rotation of said screw-shaft and nut to shift said bolt, substantially as set forth.
8. The combination with a safe-door; of a bolt arranged to lock said door; a screw-shaft in alinement with said bolt; a nut engaged with said shaft; a gear keyed to said shaft and arranged to slide thereon; and, means to rotate said gear, substantially as set forth.
9. The combination with a safe-door; of a bolt arranged to lock said door; a screw-shaft in alinement with said bolt; a nut engaged with said shaft; a worm-gear keyed to said shaft and arranged to slide thereon; a worm operatively engaged with said worm-gear; and means to rotate said worm, substantially as set forth.
10. The combination with a safe-door; of a bolt arranged to lock said door; means to shift said bolt by thrusting against the end thereof; a detent for said bolt; and, a plunger mounted in the extremity of said bolt in operative relation with said detent, substantially as set forth.
11. The combination with a safe-door; of a bolt arranged to lock said door; mechanism arranged to unlock said door by thrusting against the extremity of said bolt; and, a detent for said bolt arranged to be operated by said unlocking mechanism, substantially as set forth.
12. The combination with a safe-door; of a bolt arranged to lock said door; an electric motor; a longitudinally-movable shaft, operatively connected with said motor and arranged to shift said bolt; an electric circuit including said motor, a source of energy and a switch; a spring adapted to open said switch; and, mechanism operatively connecting said shaft with said spring, arranged to automatically release said spring and thereby open said switch when said shaft is longitudinally shifted to a predetermined position, substantially as set forth.
13. The combination with a safe-door; of boltwork arranged to lock said door; a normally idle electrically-controlled motor, arranged to operate said boltwork; clock mechanism arranged to start said motor automatically; and means to stop said motor automatically, substantially as set forth.
14. The combination with a safe-door; of boltwork arranged to lock said door; spring automatic bolt-operating mechanism; a time-lock arranged to control said spring mechanism; and, unlocking mechanism independent of said spring mechanism, comprising a motor and means to electrically control said motor, substantially as set forth.
15. The combination with a safe provided with a door and bolts arranged to lock the same; of mechanism to shift said bolts to locking position; an electric motor within the safe; mechanical connections from said motor to said bolts to move the latter into unlocking position; a time-lock within the safe; means controlled by said time-lock arranged to automatically start said motor at a predetermined time; and means controlled by said unlocking connections arranged to automatically stop said motor when the bolts reach unlocking position, substantially as set forth.
16. The combination with a safe-door; of boltwork arranged to lock said door; spring-actuated mechanism and connections therefrom to said boltwork to move the latter into locking position; an electric motor; connections from said motor arranged to move said boltwork into position to unlock said door; a time-lock; means controlled by said



time-lock arranged to automatically start said motor; and means actuated by said unlocking connections arranged to automatically stop said motor when the boltwork reaches unlocking position, substantially as set forth.

17. The combination with a safe-door; of bolts arranged to lock said door; means to shift said bolts into locking position, comprising a source of electric current, an electric motor; a switch, and a circuit including said source, motor and switch; a time-lock; connections from said time-lock to said switch, whereby the latter is automatically closed at a predetermined time; and means arranged to automatically open said switch when said bolts reach unlocking position, substantially as set forth.

18. The combination with a safe-door; of bolts arranged to lock said door; mechanism to shift said bolts into locking position; mechanism to shift said bolts into unlocking position, comprising shafts arranged to abut against the ends of said bolts; an electric motor and connections therefrom to said shafts, whereby the latter are forced against the ends of said bolts; an electric circuit for said motor, including a switch; a time-lock; connections from said time-lock to said switch, arranged to automatically close the latter at a predetermined time; and means controlled by the movement of one of said shafts to automatically open said switch and thereby stop the motor when the bolts reach unlocking position, substantially as set forth.

19. The combination with a safe having a door and bolts arranged to lock the same; of unlocking mechanism comprising an electric motor and a time-lock, both located within the safe; an electric circuit for said motor including means located outside the safe arranged to control the current in said circuit; a switch within the safe; connections from said time-lock arranged to automatically close said switch at a predetermined time; means controlled by the movement of said bolts into unlocking position arranged to automatically open said switch and thereby stop the motor when the bolts reach unlocking position; and, a reversing-switch in said circuit whereby the direction of rotation of said motor can be changed, substantially as set forth.

20. The combination with a safe having a door and bolts arranged to lock the same; of an unlocking mechanism comprising an electric motor and a time-lock both located within the safe; an electric circuit for said motor including means located outside the safe arranged to vary the strength of the current in said circuit; a switch within the safe; connections from said time-lock arranged to automatically close said switch at a predetermined time; and, means controlled by the movement of said bolts into unlocking position, arranged to automatically open said switch and thereby stop the motor when the

bolts reach unlocking position, substantially as set forth.

21. The combination with a safe-door; of bolts arranged to lock said door; spring mechanism tending to force said bolts into locking position; means to move said bolts into unlocking position against the force of said springs, comprising an electric motor, connections therefrom to said unlocking means; a switch and a circuit including said motor and switch; a time-lock; means controlled by said time-lock to automatically close said switch at a predetermined time; mechanism controlled by the movement of said unlocking means to automatically open said switch when the bolts reach unlocking position; and means arranged to automatically retain said bolts in unlocking position, substantially as set forth.

22. The combination with a circular safe-door; of a bolt arranged to lock said door; means to move said bolt into locking position; means to move said bolt into unlocking position, comprising a shaft arranged to abut against the end of said bolt; a motor and connections therefrom to said shaft; a time-lock arranged to control the operation of said motor; a spring-pressed plunger, axially mounted in said bolt, so that said shaft abuts against the head of said plunger before engaging the end of the bolt; a pin slidably mounted in said door and arranged to engage an aperture in said bolt to retain it in unlocked position; a pivoted detent arranged to sustain said pin and prevent its entering said aperture, and means actuated by the movement of said plunger with respect to said bolt, to release said detent, substantially as set forth.

23. The combination with a circular safe-door; of diametrically opposite bolts arranged to lock said door; automatic spring mechanism arranged to shift said bolts radially outward to lock said door; a time-lock arranged to control the operation of said spring locking mechanism; mechanism to shift said bolts radially inward to unlock said door, comprising shafts arranged to abut against the outer ends of said bolts; an electric motor and gearing connections therefrom to said shafts, whereby the latter are contemporaneously forced against said bolts; an electric circuit for said motor including a switch; a second time-lock and connections therefrom to said switch, arranged to automatically close the latter at a predetermined time; and, means actuated by the movement of one of said shafts arranged to automatically open said switch and thereby stop the motor when the bolts reach unlocking position, substantially as set forth.

In testimony whereof I have hereunto signed my name, at Philadelphia, Pennsylvania, this 8th day of March, 1902.

WILLIAM H. HOLLAR.

Witnesses:

ARTHUR E. PAIGE,  
MILDRED BARNHART.