

No. 677,615.

Patented July 2, 1901.

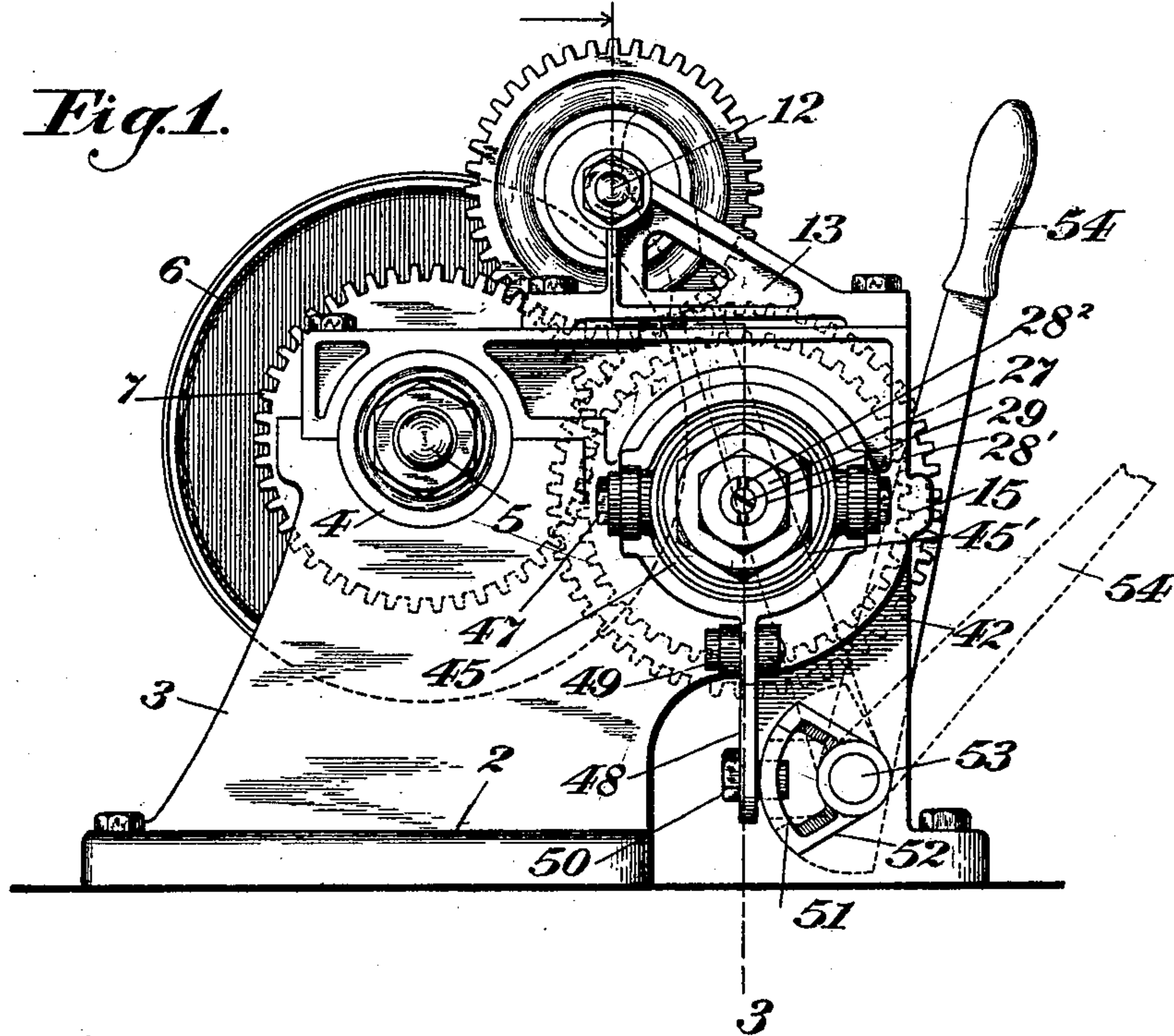
H. L. ARNOLD.  
CLUTCH.

(Application filed Dec. 17, 1900.)

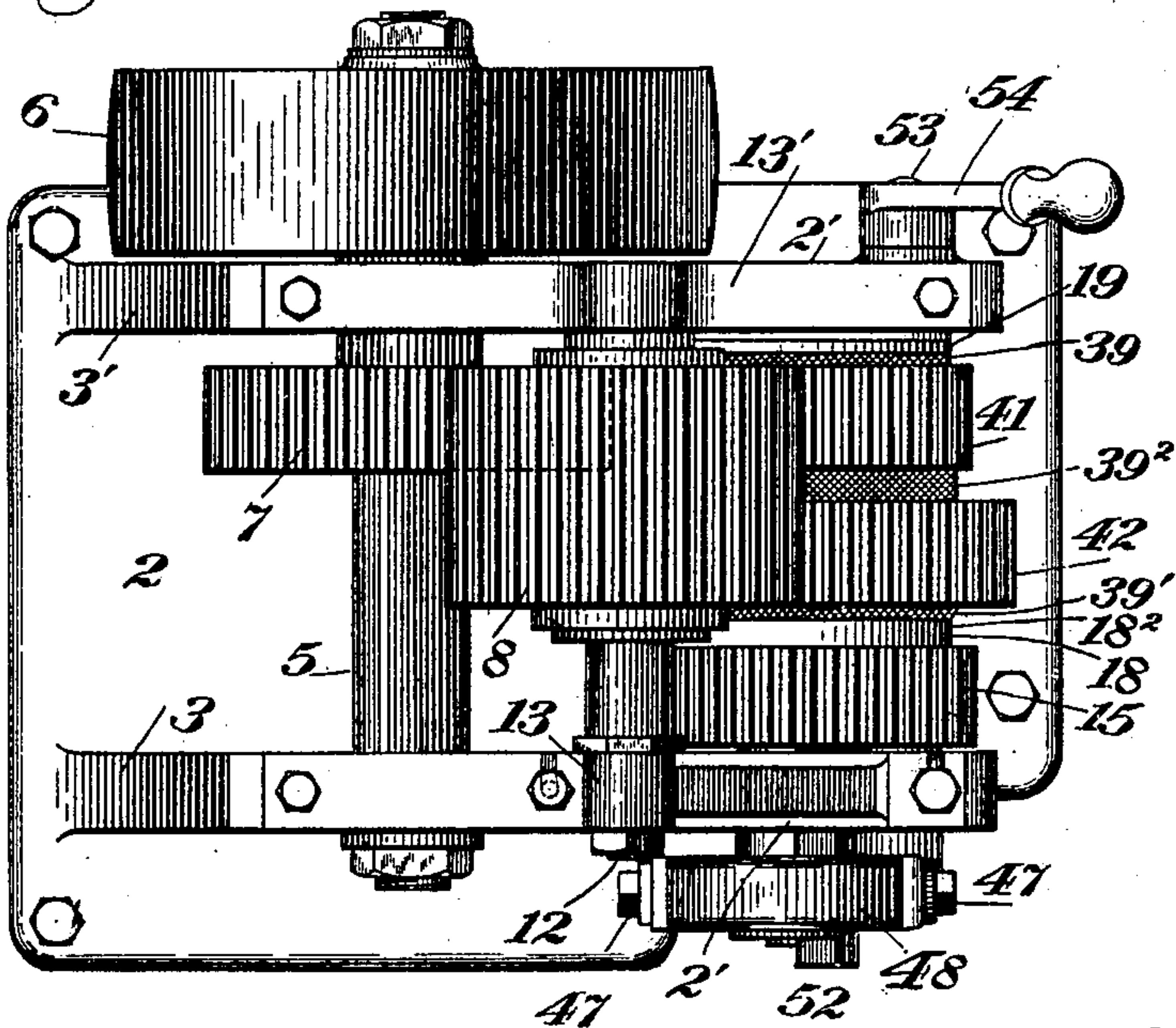
(No Model.)

3 Sheets—Sheet 1.

*Fig. 1.*



*Fig. 2.*



Witnesses:-  
T. C. Fiedner,  
G. H. Nantaul

Inventor,  
Horace L. Arnold,  
By his Attorney,  
J. H. Richards.



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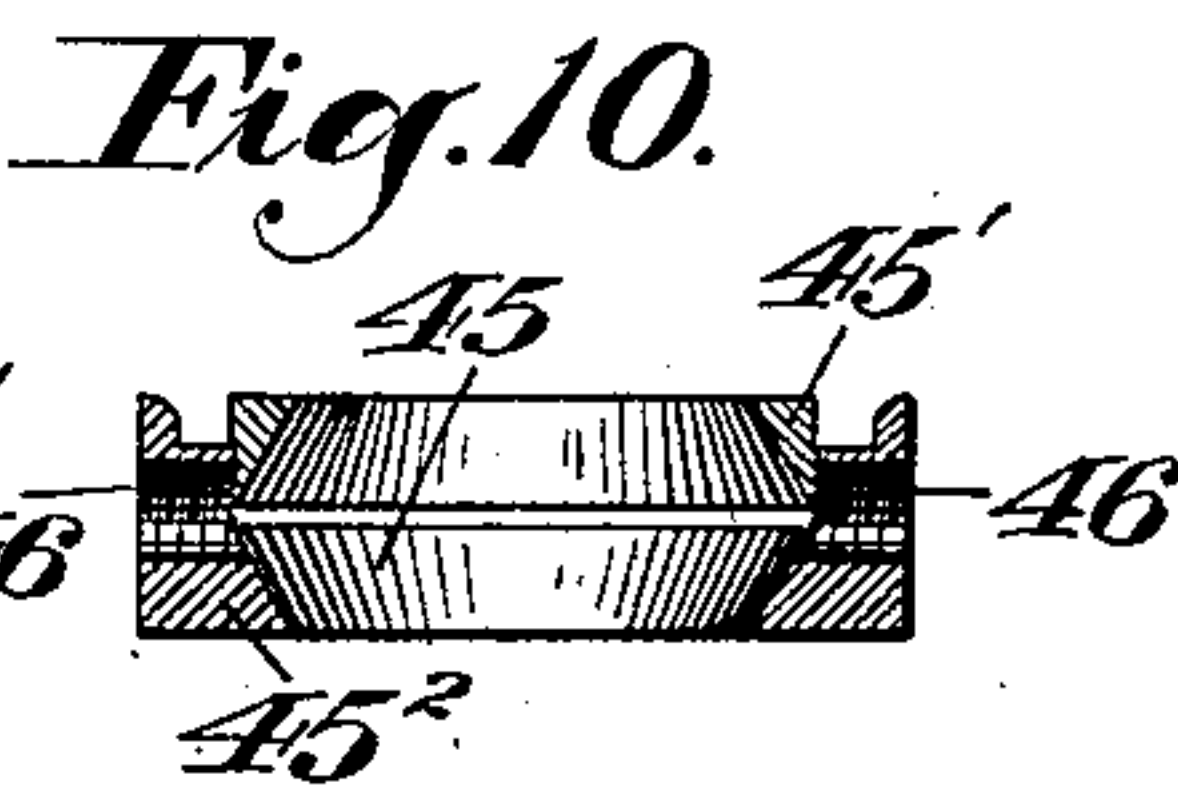
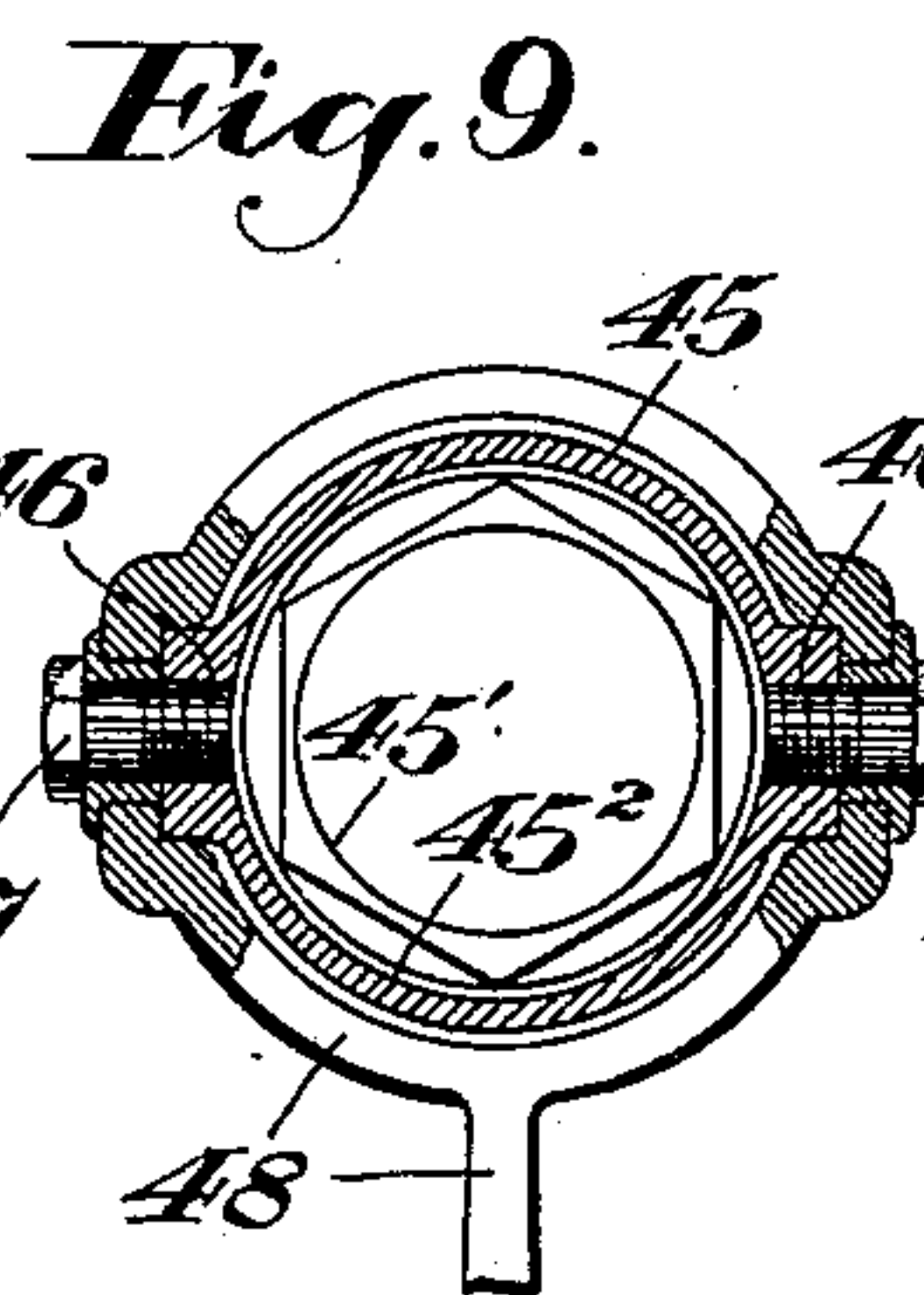
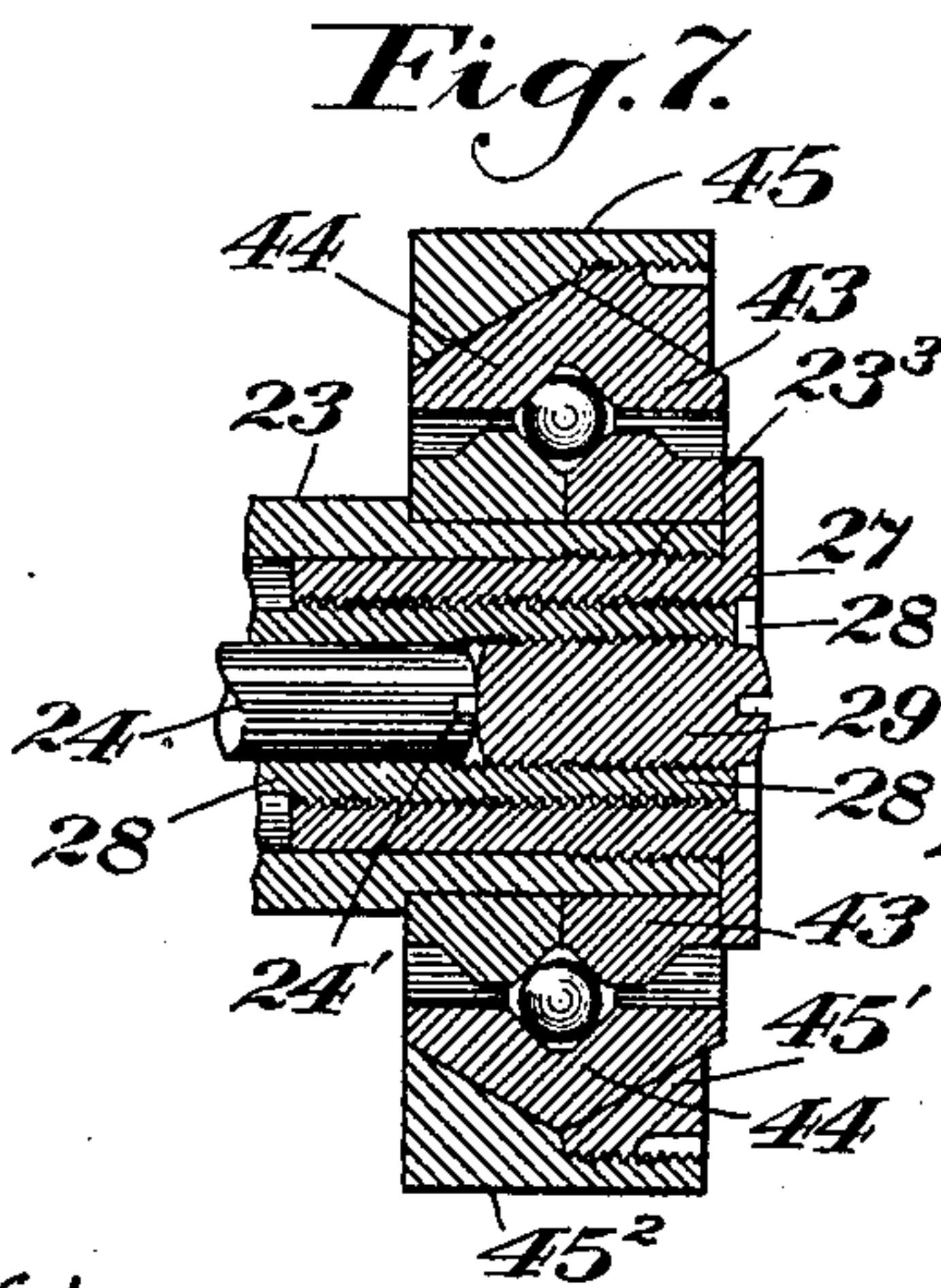
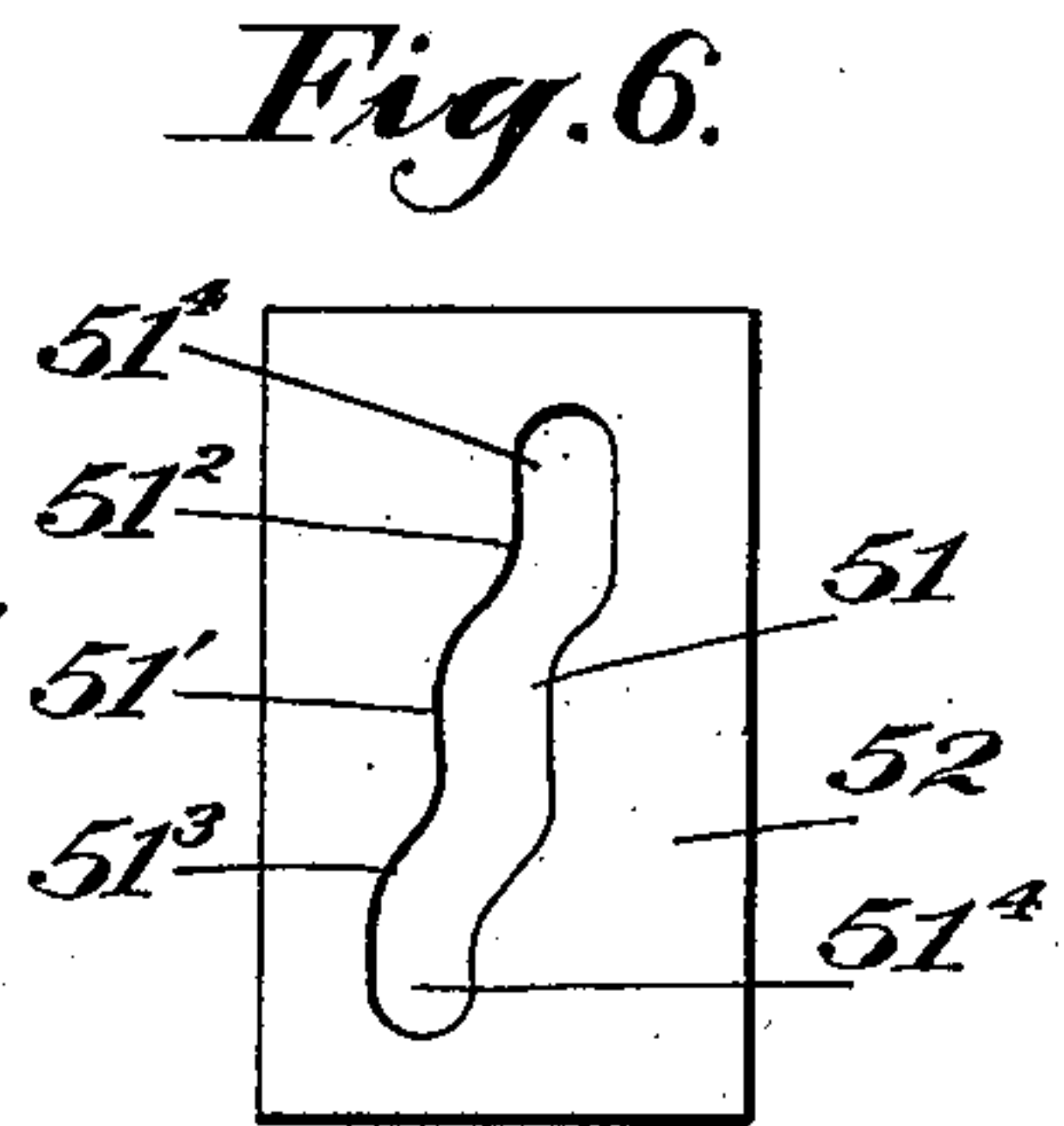
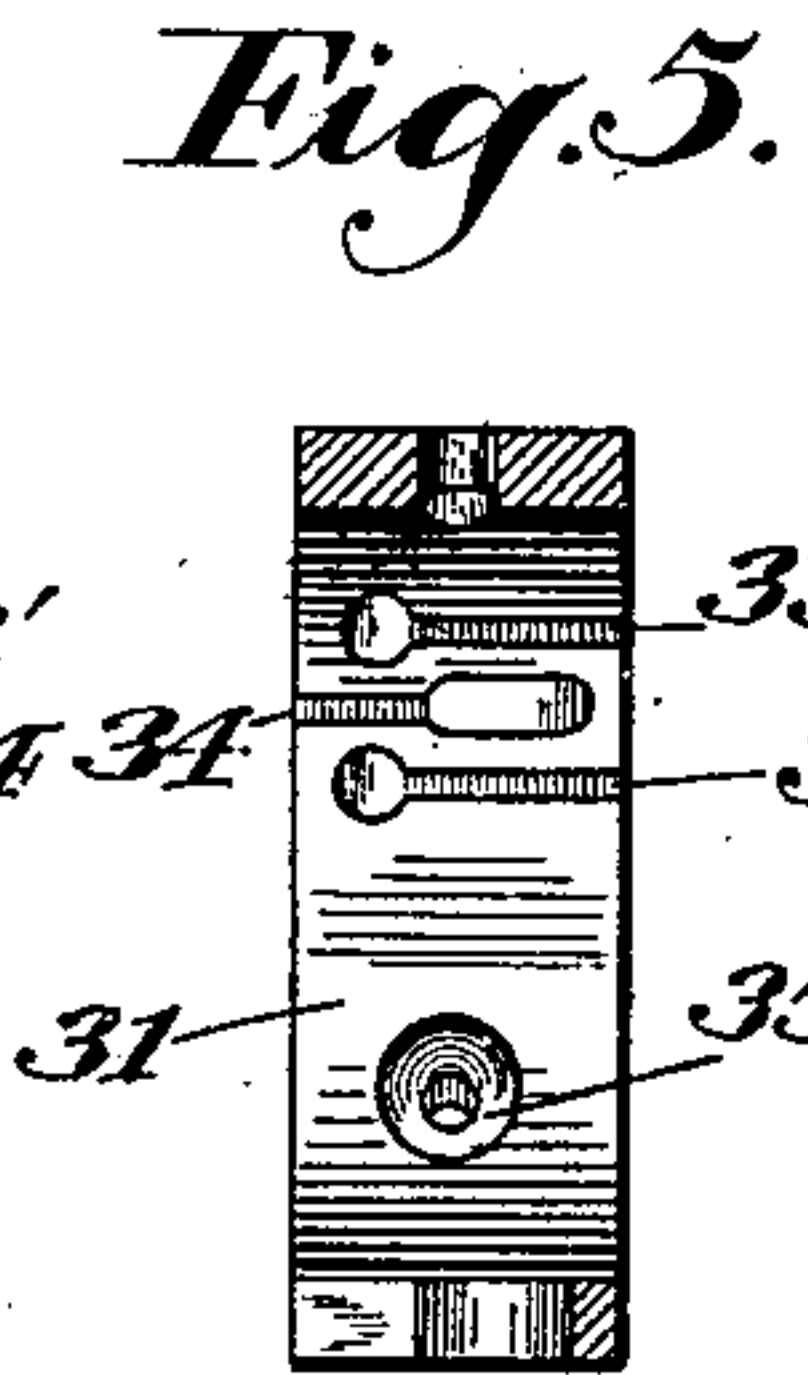
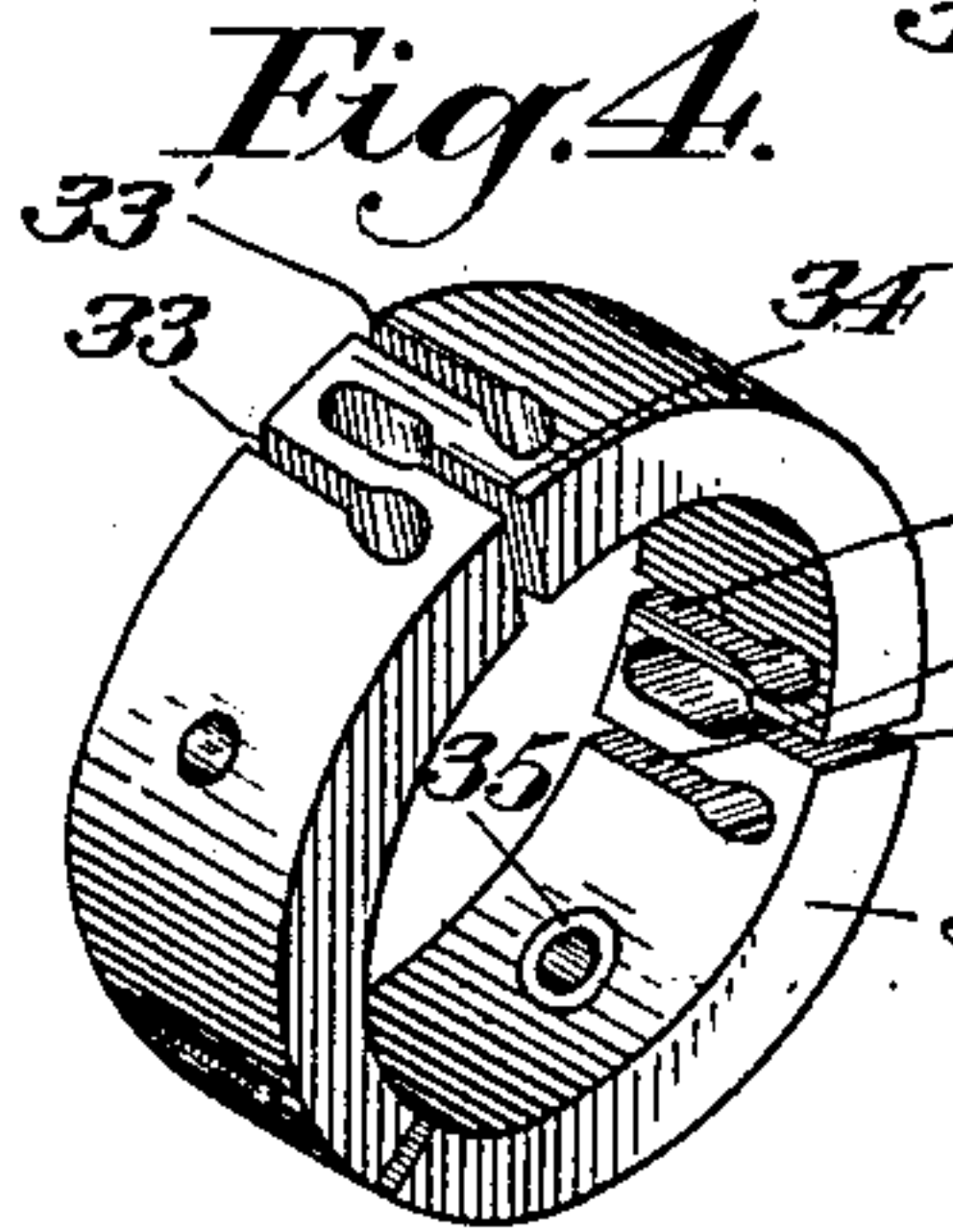
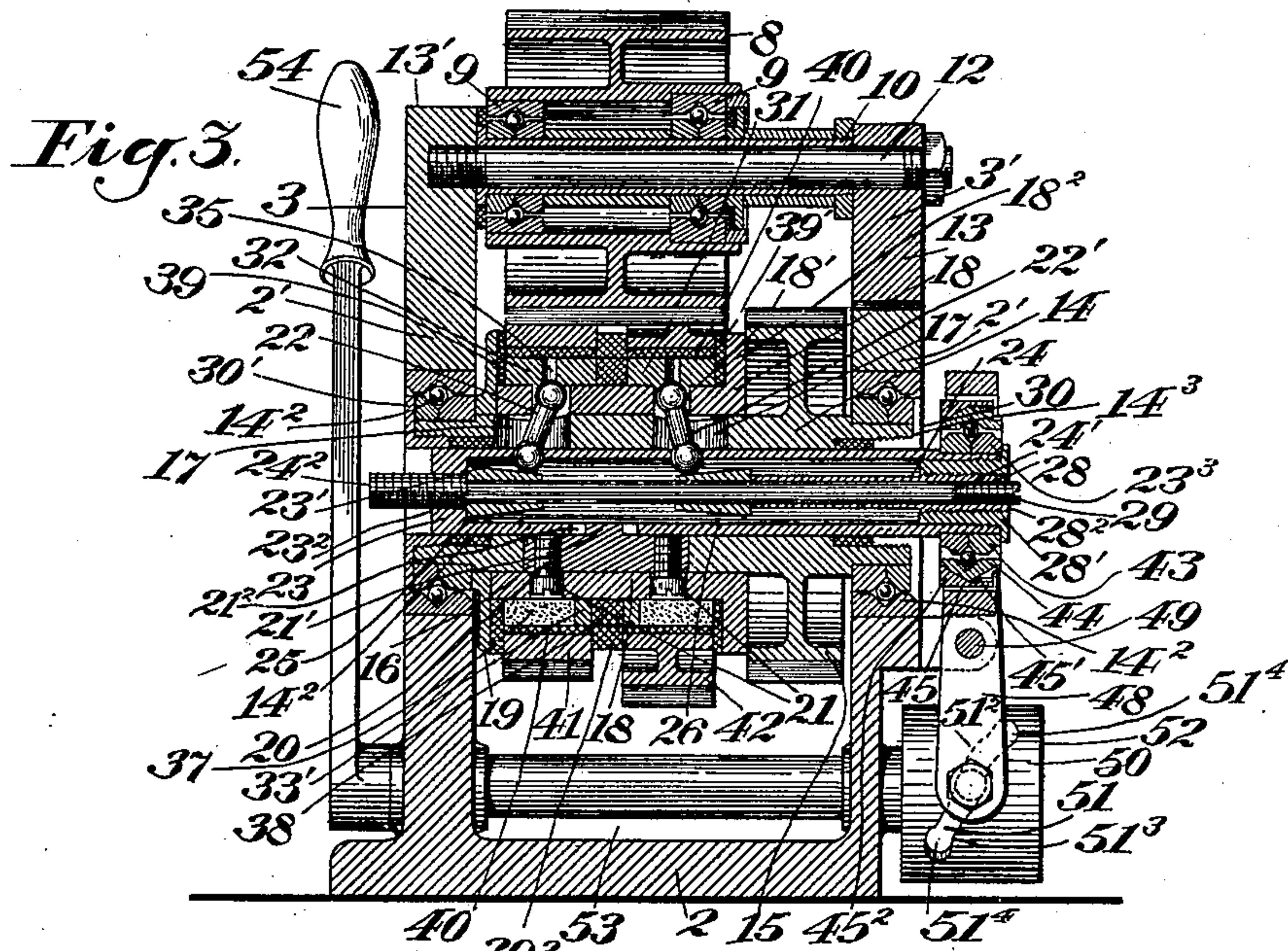
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H. L. ARNOLD.  
CLUTCH.

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3 Sheets—Sheet 2.



Witnesses:-  
J. C. Fiedner.  
J. H. Harland

Inventor,  
Horace L. Arnold,  
By his Attorney,  
F. W. Richards.

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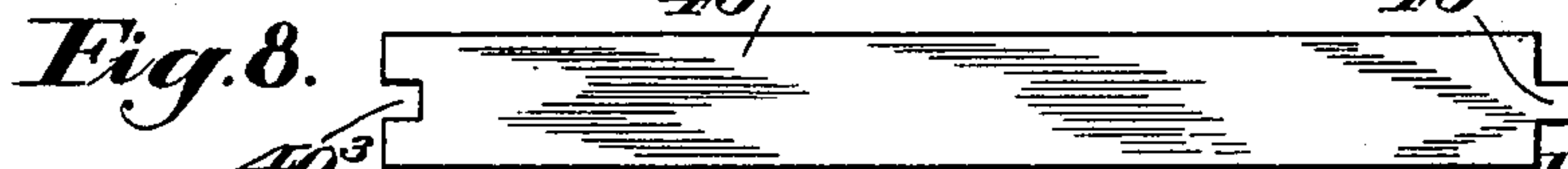
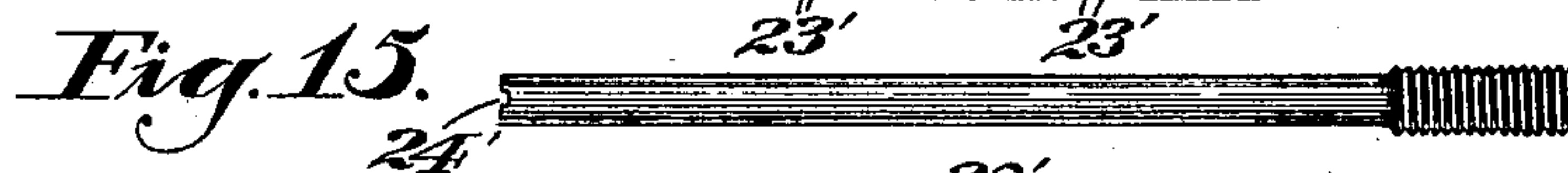
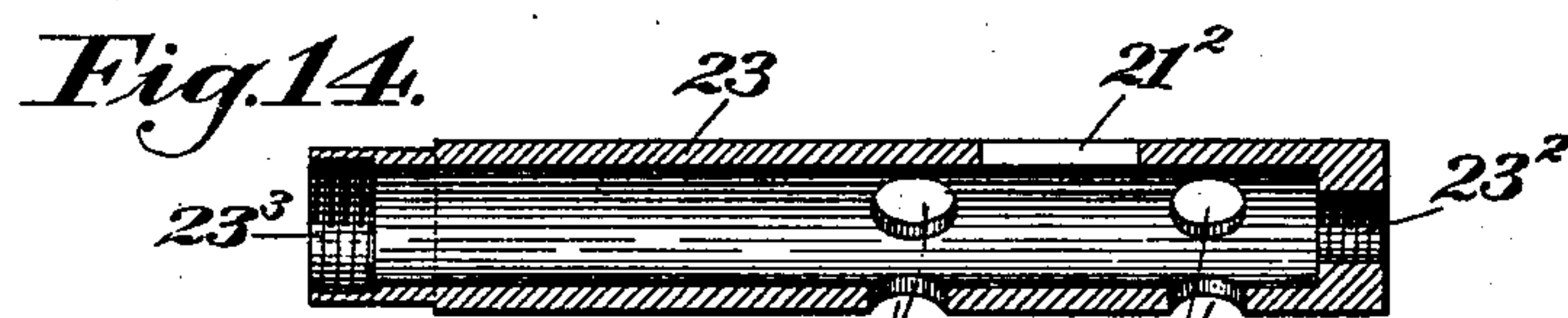
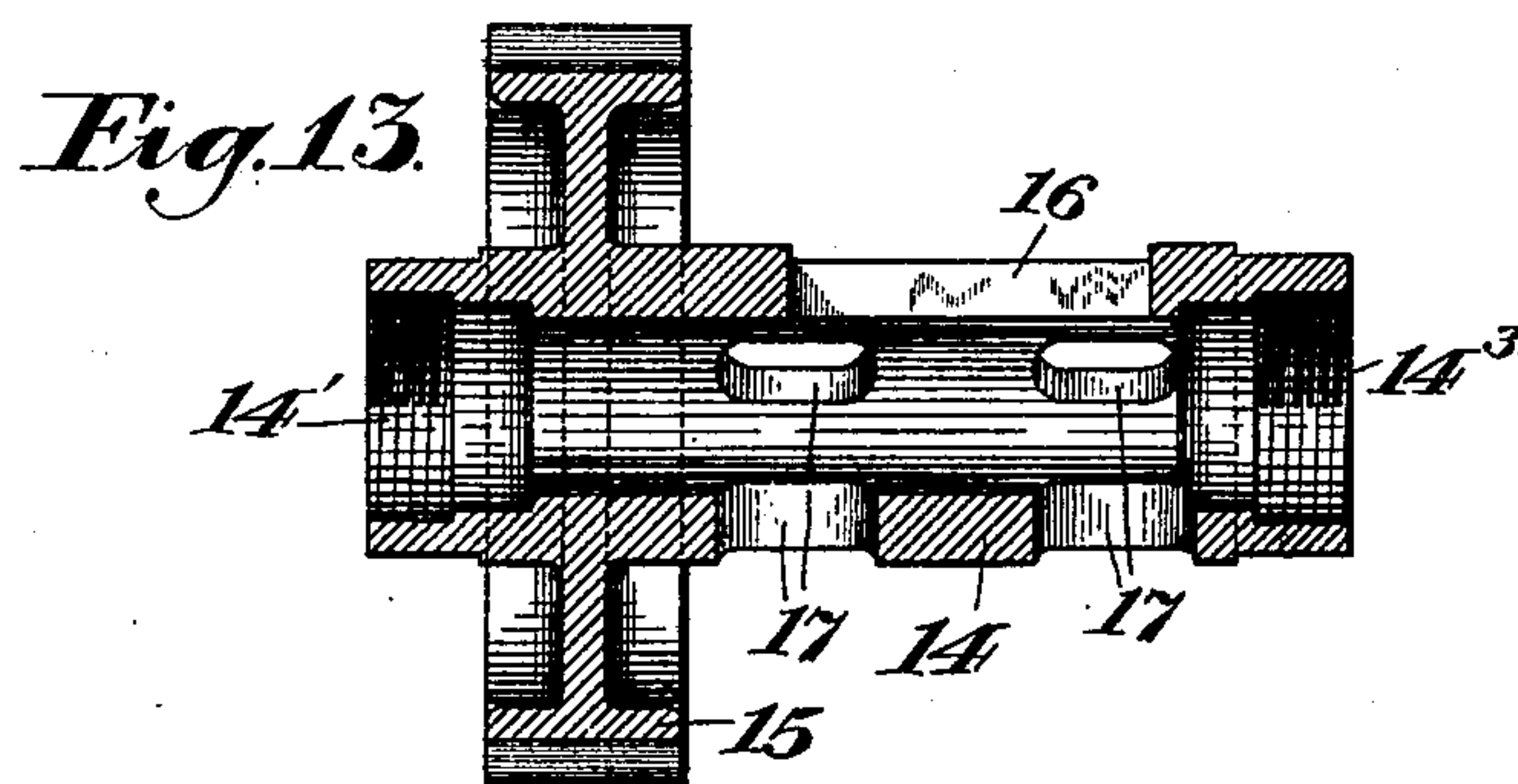
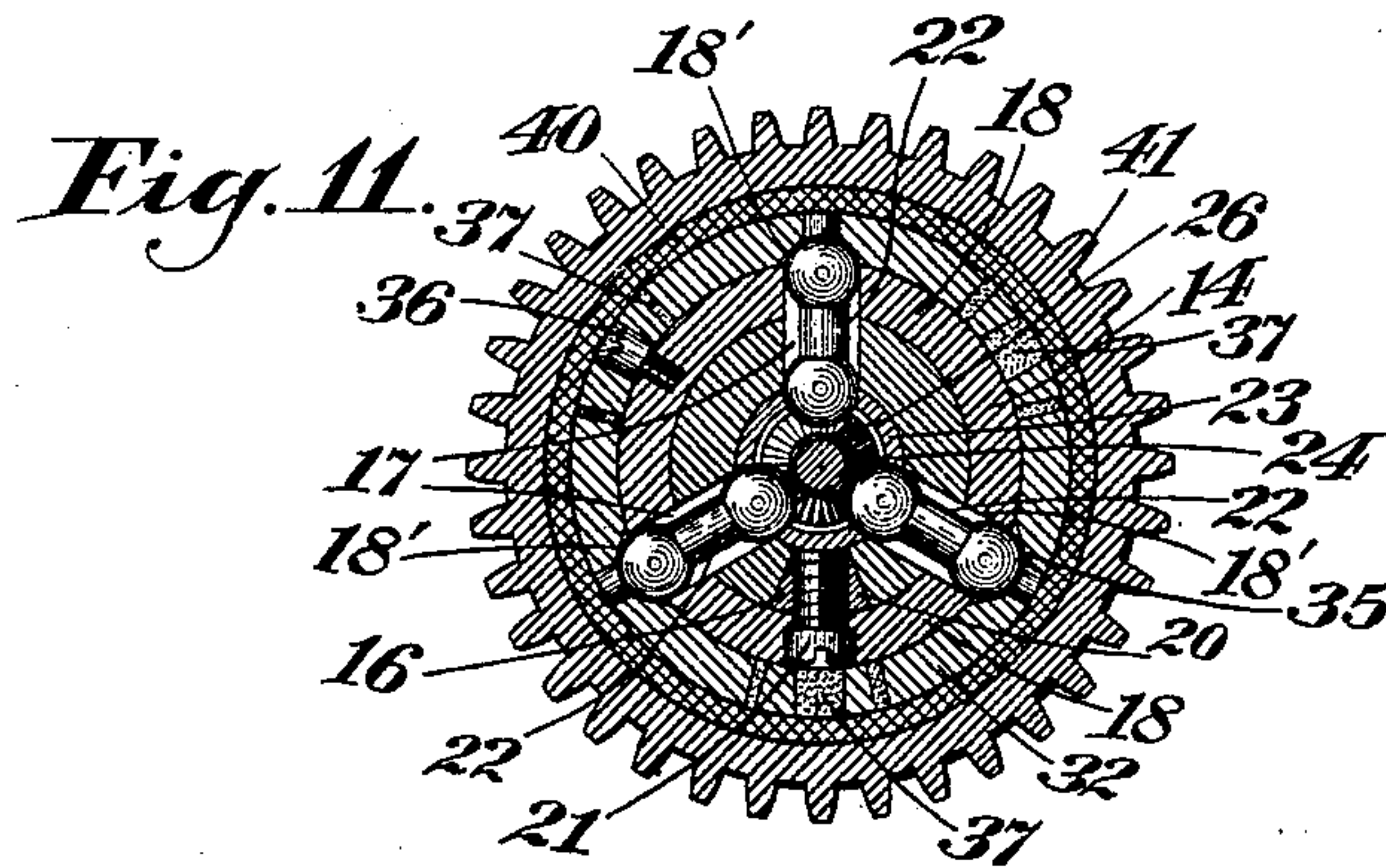
H. L. ARNOLD.

CLUTCH.

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(No Model.)

3 Sheets—Sheet 3.



Witnesses:  
J. C. Thiedner,  
J. H. Nairland

Inventor,  
Horace L. Arnold,  
By his Attorney,  
F. W. Richards



# UNITED STATES PATENT OFFICE.

HORACE L. ARNOLD, OF BROOKLYN, NEW YORK, ASSIGNOR TO JOHN A. HILL, OF EAST ORANGE, NEW JERSEY.

## CLUTCH.

SPECIFICATION forming part of Letters Patent No. 677,615, dated July 2, 1901.

Application filed December 17, 1900. Serial No. 40,074. (No model.)

*To all whom it may concern:*

Be it known that I, HORACE L. ARNOLD, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Clutches, of which the following is a specification.

This invention relates to clutches, and involves among its details features of general application in the art and other features more especially intended for use with reversing mechanism, and more particularly that class of such mechanism employed with automobiles or motor-vehicles.

Primarily the object of the invention is the provision of a clutch of simple construction and one that will be effective in results and noiseless in action.

A further object of the invention is the provision, as an element of a clutch, of an expansible ring of peculiar construction, as will be hereinafter described.

A further object of the invention is the provision, in connection with a clutch, of means for indicating to the touch of the operator when the clutch is in its operative or inoperative position.

A further object of the invention is the provision, in connection with a clutch, of strips of indurated fiber, which are forced by the expansion of the clutch against the wall of the gear, pulley, or other element it is desired to secure to the shaft.

In the accompanying drawings, Figure 1 is an end view of reversing mechanism with which my improved clutch may be employed. Fig. 2 is a plan view of such mechanism. Fig. 3 is a section on line 3 3, Fig. 1, looking in the direction of the arrow. Figs. 4 and 5 are respectively perspective and sectional views of the clutch-ring. Fig. 6 is a detail in plan of the head for actuating the clutch-operating lever, showing the peculiar cam-slot therein. Fig. 7 is an enlarged sectional detail of one end of the sleeve, showing the parts to which the yoke of the clutch-operating lever is applied. Fig. 8 is a plan view of one of the antifriction-bands of vulcanized fiber or equivalent material which are applied to the peripheries of the expansible clutch-rings. Figs. 9 and 10 are sectional details of parts

carried by the clutch-actuating lever. Fig. 11 is a vertical section of the parts for clutching a gear-wheel to its shaft. Fig. 12 is a perspective view of a key employed in assembling the parts of my improved clutch, and Fig. 13 is a longitudinal vertical section of the driven shaft and gear-wheel. Figs. 14, 15, and 16 are views of details hereinafter described.

Similar characters designate like parts throughout the several views.

Referring to the drawings, the numeral 2 designates a bed-plate, and rising from said bed-plate are standards 3 3' for the reception of a driving-shaft 5, mounted in ball-bearings and carrying a pulley or other instrumentality 6, to which power may be applied. Secured to this driving-shaft is a gear-wheel 7, in mesh with a wide pinion 8, mounted on ball-bearings 9 of a sleeve 10, said sleeve being fitted on a tie-rod 12, connecting brackets 13 13' of the machine-frame.

Journaled in offset portions 2' of the standards 3 3' is a hollow shaft or spindle 14, carrying a gear-wheel 15, through which power may be transmitted to any desired gearing, and this shaft is provided with a key-slot 16 and with a series of short slots 17, for a purpose hereinafter stated, and surrounding this hollow shaft or spindle 14 is a sleeve 18, having a series of openings 18' and a flange 18<sup>2</sup>, said flange being forced against the side of the gear-wheel 15 by a threaded sleeve 30', hereinafter described, as illustrated in Fig. 3. At the end opposite from flange 18<sup>2</sup> this sleeve 18 bears against a collar or washer 19, which surrounds the end of the shaft 14 and is located between the end of the sleeve and the inner side of one of the offset portions 2' of the frame, and in these offset portions are ball-bearings 14<sup>2</sup>, in which the extremities of the spindle 14 are mounted. This sleeve 18 is secured to the spindle 14 so as to rotate therewith by means of a wedge-shaped key 20, having radial sides entering the slot 16 in the shaft 14, and a teat or projection 21', which enters a long slot 21<sup>2</sup> in a spindle 23, as illustrated in Fig. 3, screws 21 passing through said sleeve 18 and entering said key, as seen in said figure.

Designated, respectively, by the numerals



22 and 22' are sets of toggle members having hardened globular ends, the shanks of which toggle members are received in the slots 17 of the spindle 14 and the globular ends of which pass through the perforations 18' in the sleeve 18.

Fitted within the tubular shaft or sleeve 14 for endwise-reciprocatory movement is a sleeve or spindle 23, having perforations 23' for the reception of the globular ends of the toggle members or pins 22 22', and a slot 21<sup>2</sup> for the key, as above set forth, and located within this sleeve 23 is a rod 24, carrying oppositely-disposed cones 25 and 26 for a purpose hereinafter stated.

At one end the sleeve 23 is provided with an opening 23<sup>2</sup>, of small diameter, having threaded walls, and at its opposite extremity the sleeve is interiorly threaded at 23<sup>3</sup> for the reception of an externally and internally threaded thimble 27, within which is fitted a tube 28, having an enlarged externally and internally threaded end 28', in which is formed a nick or slot 28<sup>2</sup> for the reception of a screw-driver or suitable tool. At its end opposite the threaded portion the tube 28 bears against the cone 26, and by advancing said tube and forcing the cone inward the toggle members bearing against said cone may be adjusted to cause them to apply more enlarging effect to the expansible ring when the sleeve is reciprocated or to take up wear or lost motion.

At one end the rod 24 is provided with a notch 24' (see Fig. 15) for the reception of a screw-driver, and the opposite end of said rod is enlarged and externally threaded at 24<sup>2</sup> to fit the internal thread 23<sup>2</sup> in the sleeve 23. As the cone 25 is secured to the rod adjacent to the threaded end 24<sup>2</sup>, it will be seen that by turning the rod said cone may be moved to adjust the toggles bearing against it when desired. To lock the tube 28 and rod 24 and at the same time close the end of said tube, a screw-plug 29, having a smooth end and bearing against the rod, is threaded into said tube 28, as shown in Fig. 3, and when it is desired to adjust said rod and tube for the purpose stated the screw-plug is withdrawn, and when the adjustment is accomplished it is replaced in the position shown.

To secure the lower sections of the ball-bearings in place on the hollow shaft or spindle 14, short externally-threaded flanged sleeves 30 30' are inserted in the internally-threaded ends 14' 14<sup>3</sup> of said shaft or spindle, as illustrated in Fig. 3, the other sections of said bearings being connected to the framework in any desired way.

Surrounding the sleeve 18 between the flange 18<sup>2</sup> and the collar or washer 19 are expansible clutch-rings 31 32 of peculiar construction, each consisting of an annulus of metal, usually steel, provided with a series of separated sets of slots of keyhole shape, two of the slots, 33 33', of each set being cut from one side of the ring, their enlarged ends terminating near the opposite side of said ring,

and the third intermediate slot, 34, being cut from said opposite side of the ring, and its enlarged end being located adjacent to the side from which the other two slots commence. Between each set of slots a socket 35 (which may be bushed, if desired) is formed in the inner wall of the ring for the reception of the globular ends of the toggle members. To attach these expansible rings to the sleeve 18, a screw 36 is inserted through the enlarged portion of one of the slots, 34, in each ring, the threaded end of said screw entering said sleeve 18, as illustrated in Fig. 11, and to secure proper lubrication between the parts the slots 33, 33', and 34 are filled with felt packing 37, saturated with a suitable lubricant, as shown in said figure. Located upon the sleeve 18 and between these expansible rings 31 32 is a washer 38, of indurated, preferably vulcanized, fiber, and between the sides of said rings, the flange 18<sup>2</sup>, collar 19, and the gear-wheels 41 42, hereinafter described, are flat rings, of similar fiber 39 39', said rings serving not only properly to position the clutch-rings upon the sleeve 18, but also as antifriction-surfaces against which the sides of the expansible rings and gear-wheels bear when revolving.

Fitted over the expansible clutch-rings 31 32 are bands 40 40' of antifriction material and of peculiar construction, each of which bands consists of a flat strip of indurated fiber having a tenon 40<sup>2</sup> at one end and a slot 40<sup>3</sup> at its opposite extremity for the reception of said tenon, the bands being simply lapped around the expansible rings, their tenoned ends being inserted in the slots 40<sup>3</sup>. Normally loosely surrounding these antifriction-bands are gear-wheels 41 and 42, the former of which is in mesh with the wide pinion 8, above described, and the latter with the gear 7, one of said gear-wheels being intended when locked to its shaft for driving said shaft in one direction and the other gear-wheel when similarly locked for operating said shaft in the opposite direction. It will be observed by reference to Fig. 3 that the sets of toggle members 22 22' cant or tilt toward each other and that therefore when the sleeve 23 is reciprocated in one direction one set of toggles will be made to approach an effective vertical position and the other set will be thrown still further out of action, the result being that the shaft or spindle 14 will be driven in one direction or in the other direction when the desired set of toggles is straightened to lock the gear controlled thereby to the shaft by the reciprocation of said sleeve. In Fig. 3 the toggles are shown in a neutral position, and the gear-wheels 41 and 42 therefore revolve loosely upon the antifriction-bands 40 40'. Fitted in a seat formed on the outer end of the sleeve or hollow spindle 23 are ball-bearing cup-sections 43, which are secured in position by the flange of the thimble 27, as illustrated in Fig. 3, and located over the sections 43 are the complementary ball-cup sections 44 of the ball-



bearings employed. Surrounding the sections 44 of said bearings is a cap-ring 45, having conical internal walls, said cap-ring being formed of sections 45' 45<sup>2</sup>, the former being threaded into the latter. (See Figs. 3 and 7.) In the section 45<sup>2</sup> of this cap-ring threaded seats 46 are provided for the reception of studs or trunnions 47, carried by the yoke-shaped end of a lever 48, pivoted at 49 to a bracket projecting from the side of the machine-frame, (see Figs. 3 and 7,) and at its lower end this lever 48 is provided with a stud 50, which may bear an antifriction-roller and which is received in and operated by a cam 51 of peculiar construction formed in the head 52 of a rock-shaft 53, journaled in bearings of the machine-frame, to which shaft an operating-lever 54 is applied. As will be seen by reference to Figs. 3 and 6, the cam-slot 51 in the head 52 is of peculiar formation, it having a neutral portion 51' intermediate its length and oppositely-inclined active portions 51<sup>2</sup> 51<sup>3</sup> adjacent to said neutral portions and also having at each extremity other neutral and locking portions, 51<sup>4</sup>, which will when the head is shifted to extreme locations serve to lock the lever in the position to which it has been thrown.

When employed with reversing mechanism, the operation of my improved clutch is as follows: Power is applied to the pulley 6 or other element attached to the shaft 5 and is transmitted by the pinion 7 to the gear 41 and the wide pinion 8, which is, as before stated, in constant engagement with the normally loosely rotating gear 42. In Fig. 3 the lever 54 and cam-slot 51 are shown in their inoperative positions, the roller carried by the lever being in the neutral middle portion 51' of said slot. If it should be desired to start the shaft 14 in a forward direction, the lever 54 should be shifted, and the cam-slot 51 in head 52 will as said head turns under the influence of the shaft 53 throw the lower end of the lever 48 to the left and its upper end to the right, thereby reciprocating the sleeve 23 within the tubular shaft or spindle 14 and causing said sleeve to throw the set of toggles 22 to a perpendicular position, thereby causing the globular ends of said toggles, which are fitted in sockets 35 of the clutch-ring 32, to expand said ring and crowd the band 40, surrounding the same, tightly against the inner surface of the gear-wheel 41, thereby locking said gear-wheel securely to its shaft. If at any time it should be desired to reverse the motion of the shaft 14, and consequently the gearing with which the pinion 15, carried by said shaft, is in engagement, a reverse motion of the lever 54 will cause the sleeve 23 to be reciprocated toward the left and will throw the toggles 22 out of action and the toggles 22' into action, thereby expanding the clutch-ring 31 and causing the band 40, surrounding the same, to be compressed and forced under pressure against the inner side of the gear-wheel 42, thus locking said

gear-wheel to the shaft, causing, as stated, the mechanism to be driven in the reverse direction. If it is desired to decrease the speed of the mechanism when driven in either direction, this may be accomplished by so manipulating the lever 54 that the sleeve 23 will be partially reciprocated, thereby slightly relieving the pressure of the toggles upon the clutch-ring, which has been expanded, and causing a dragging or brake action of the parts, which will result in slowing down the motion. As will readily be seen, this slipping engagement of the clutch is when the reversing mechanism is employed with a motor-vehicle of great utility, the clutch acting as a brake, and thus retarding the movement of the driving-wheels without stopping them, and also in this connection the clutch engagement, although it must be capable of being very rapidly established, must not be positive in action, since an instantaneous and rigid clutch engagement would result in breakage of the gear-wheels and a too-sudden stoppage of the driving-wheels.

By adjusting the cones 25 26, against which the inner globular ends of the toggles bear, a speedy, delicate, and certain adjustment of pressure on the clutch-engaging surfaces may be effected, and said cones also prevent the toggles from resisting disengaging impulse even when they are located at right angles with the clutch-engaging surfaces. By locating all the clutch-engaging surfaces and their actuating parts inside the driving-gears, which only occupy the normal space demanded by the faces of their teeth and their suitable pitch diameters, a compact construction reliable in operation and efficient in use is provided and one which will occupy the least possible space—an important desideratum in motor-vehicles.

It is distinctly to be understood that my invention is not limited to the machine in which for purposes of illustration it is shown embodied, for many of its details are applicable to various forms of clutches and may be applied to shafts and gearing designed for movement in but one direction and not intended for reversal.

Under some circumstances it is feasible to omit the sleeve surrounding the tubular shaft, and through which the ends of the toggles pass, and to apply the expansible clutch-ring and the gear or other element surrounding said ring directly to said shaft.

The invention is not limited to the exact details of construction shown and described, for many modifications could be made which would be within the purview thereof.

No claim is herein made to the combination, with reversing mechanism, of the clutch described, for it constitutes the subject-matter of my application filed October 11, 1900, Serial No. 32,717.

Having thus described my invention, what I claim is—

1. The combination, with a tubular shaft



having a series of openings, of a sleeve secured to said shaft and also having a series of openings registering with those of the shaft; an expansible ring surrounding the sleeve; 5 an antifriction-strip covering the ring; a device loosely mounted over the ring and adapted to be locked to the sleeve when the ring is expanded; toggles for expanding the ring; and means for actuating said toggles.

10 2. The combination, with a tubular shaft having a series of openings, of a sleeve secured to said shaft and also having a series of openings; an expansible ring surrounding said sleeve; an antifriction-strip covering the 15 ring; a device loosely mounted over the ring and adapted to be locked to the sleeve when said ring is expanded; toggles operating through the openings of the shaft and sleeve and adapted to expand said ring; means for 20 actuating said toggles and means for adjusting the toggles.

3. The combination, with a shaft, of an expansible ring provided with sets of slots; one slot of each set being intermediate the other 25 slots and opening into the side of the ring opposite to that into which said other slots open; a member surrounding said ring and adapted to be locked thereto when the ring is expanded; and means for expanding the ring.

30 4. In a clutch, the combination, with a shaft, of an expansible ring provided with sets of slots, some of which open into one side of the ring and others into the opposite side of said ring; a member surrounding said ring; 35 and means for expanding the ring.

5. An expansible clutch-ring having slots with enlarged inner ends said slots opening into the sides of the ring.

6. An expansible clutch-ring having a set 40 of slots of keyhole shape, one of said slots being located intermediate the other slots, and two of said slots being cut from one side of the ring and the other from the opposite side of said ring.

45 7. An expansible clutch-ring having separated sets of slots opening into the sides of the ring, one slot of each set being intermediate the other slots of the set and opening into the opposite side of the ring from the 50 other slots.

8. An expansible clutch-ring provided with sets of slots with enlarged ends, said slots being filled with lubricating material, and some of the slots opening into one side of the ring 55 and others into the opposite side of said ring.

9. An expansible clutch-ring having sets of slots of three each, two slots of each set being cut from one side of the ring, and the third and intermediate slot of each set being cut 60 from the opposite side of said ring.

10. An expansible clutch-ring having sets of slots with enlarged ends, each set consisting of three slots two of which open into one side of the ring, and the third and intermediate slot of each set opening into the opposite 65 side of said ring.

11. In a clutch, the combination, with a

shaft having openings, of an expansible clutch-ring having sets of slots, one slot of each set being located intermediate the other 70 slots of the set, and said clutch-ring also having sockets; of lubricating packing filling the slots; toggles passing through the openings in the shaft and having their ends seated in the sockets of the ring; and a reciprocatory device 75 within the shaft for actuating the toggles.

12. In a clutch, the combination, with a tubular shaft having openings in its periphery, of a sleeve keyed to said shaft and having openings registering with those of the shaft; 80 an expansible ring having a series of sets of slots filled with lubricating material; toggles in engagement with said ring; a device for actuating the toggles and located within the tubular shaft; and a lever for reciprocating 85 said device.

13. In a clutch, the combination, with a tubular shaft having a series of openings, of an expansible ring carried by said shaft, said ring having slots with enlarged ends, some 90 of which open into one side of the ring and others into the opposite side of said ring; devices for expanding the ring; means located within the shaft for actuating said devices; a member surrounding the ring and adapted 95 to be locked to the shaft when said ring is expanded; and antifriction-washers located at each side of said ring and said member.

14. The combination, with a clutch, of means for actuating said clutch; a pivoted lever 100 for operating the clutch-actuating means; a rocker having a cam-slot with intermediate and terminal neutral portions and with active portions for operating said lever; and means 105 for actuating the rocker.

15. The combination, with a tubular shaft having openings, of an expansible ring; a sleeve on said shaft and having openings; a band of antifriction material covering said ring; a gear-wheel sleeved upon said band 110 and ring; sets of toggles having globular ends; a hollow spindle movable within the shaft and having openings for the reception of one end of the toggles; a pivoted lever connected to said spindle; and a cam for actuating 115 said lever.

16. The combination, with a tubular shaft having openings and a slot, of a sleeve surrounding said shaft; a key secured to the sleeve and entering the slot of the shaft, said 120 key having a projection; an expansible ring surrounding the sleeve; a member adapted to be locked to rotate with the shaft when the ring is expanded; toggles for expanding the ring; a hollow spindle for actuating the toggles and having a slot for the reception of 125 the projection on the key; a lever for reciprocating said spindle; and a cam for actuating said lever.

17. The combination, with a tubular shaft 130 having openings, of toggles working through said openings; an expansible ring with which the ends of the toggles are in engagement; a reciprocatory spindle having openings for the



reception of the opposite ends of the toggles; means for actuating said spindle; a rod having a cone bearing against the toggles; means for adjusting said rod; and means for locking the rod and spindle together after the rod has been adjusted.

18. The combination, with a tubular shaft having openings, of an expansible ring; toggles passing through the openings of the shaft and engaging the ring; a member sleeved upon the ring; a spindle within the shaft and having openings for the reception of the ends of the toggles, said spindle having a nut at one end; an adjustable rod having a threaded end inserted in said nut; and means for reciprocating the spindle.

19. In a friction-clutch, the combination, with a tubular shaft having openings, of an expansible ring; toggles passing through the openings of the shaft and in engagement with said ring; a member sleeved upon the ring; a reciprocatory spindle having a series of openings for receiving the ends of the toggles and having internally-threaded surfaces at each end; an adjustable rod having a threaded end inserted in one of the internally-threaded surfaces of the spindle; a thimble threaded into the opposite end of the spindle; a tube carried by the thimble and surrounding the rod; and a plug threaded into the tube and bearing against the end of the rod.

20. The combination, with a tubular shaft, of an expansible ring loosely mounted with relation to said shaft; a device mounted over the ring; sets of toggles passing through openings in the shaft and engaging with sockets on the inner side of said device; a tubular spindle for actuating said toggles; means within the spindle for adjusting the toggles; a pivoted lever for actuating the tubular spindle; and a rocker having a cam-slot with neutral and active portions for actuating said lever.

21. The combination, with a tubular shaft having a series of openings, of a sleeve keyed to said shaft and also having a series of openings; an expansible ring loosely mounted upon the sleeve and having sockets on its inner side; a series of toggles having globular

ends; a hollow spindle mounted within the shaft and having openings for the reception of the inner ends of said toggles; a pivoted lever for actuating said spindle; and a movable head having a cam-slot with neutral and active portions for actuating said lever.

22. The combination, with a tubular shaft having a slot and a series of openings, of a wedge-shaped key inserted in the slot, said key having a projection on its inner side; a sleeve surrounding said shaft; screws passing through the sleeve and entering the key; a tubular spindle having a slot for the reception of the projection on the key and a series of openings; toggles passing through the openings of the shaft, their inner ends being located in the openings of the spindle; an expansible ring with which the outer ends of the toggles engage; a member sleeved on said ring; means for adjusting the toggles; and means for reciprocating the tubular spindle.

23. The combination, with a friction-clutch, of toggles for actuating said clutch; a reciprocatory spindle for actuating the toggles; a yoke connected to said spindle; a lever carrying the yoke; a head having a cam-slot with neutral and active portions for actuating said lever; and means for actuating said head.

24. The combination, with a tubular shaft having openings, of a sleeve keyed to said shaft and having openings in registration with those of the shaft; toggles passing through the openings of the sleeve and shaft; an expansible ring surrounding the sleeve; a gear loosely mounted on the ring; an antifriction-band between said gear and ring; a tubular spindle having openings for the reception of the inner ends of the toggles; a rod carrying a cone for adjusting said toggles; a pivoted lever; a yoke carried by the lever and connected to the spindle; a rock-shaft; and a head carried by said rock-shaft and having a cam-slot with neutral, active and locking portions in which the end of the lever is received.

HORACE L. ARNOLD.

Witnesses:

FRED. J. DOLE,  
CHARLES FINKLER.