

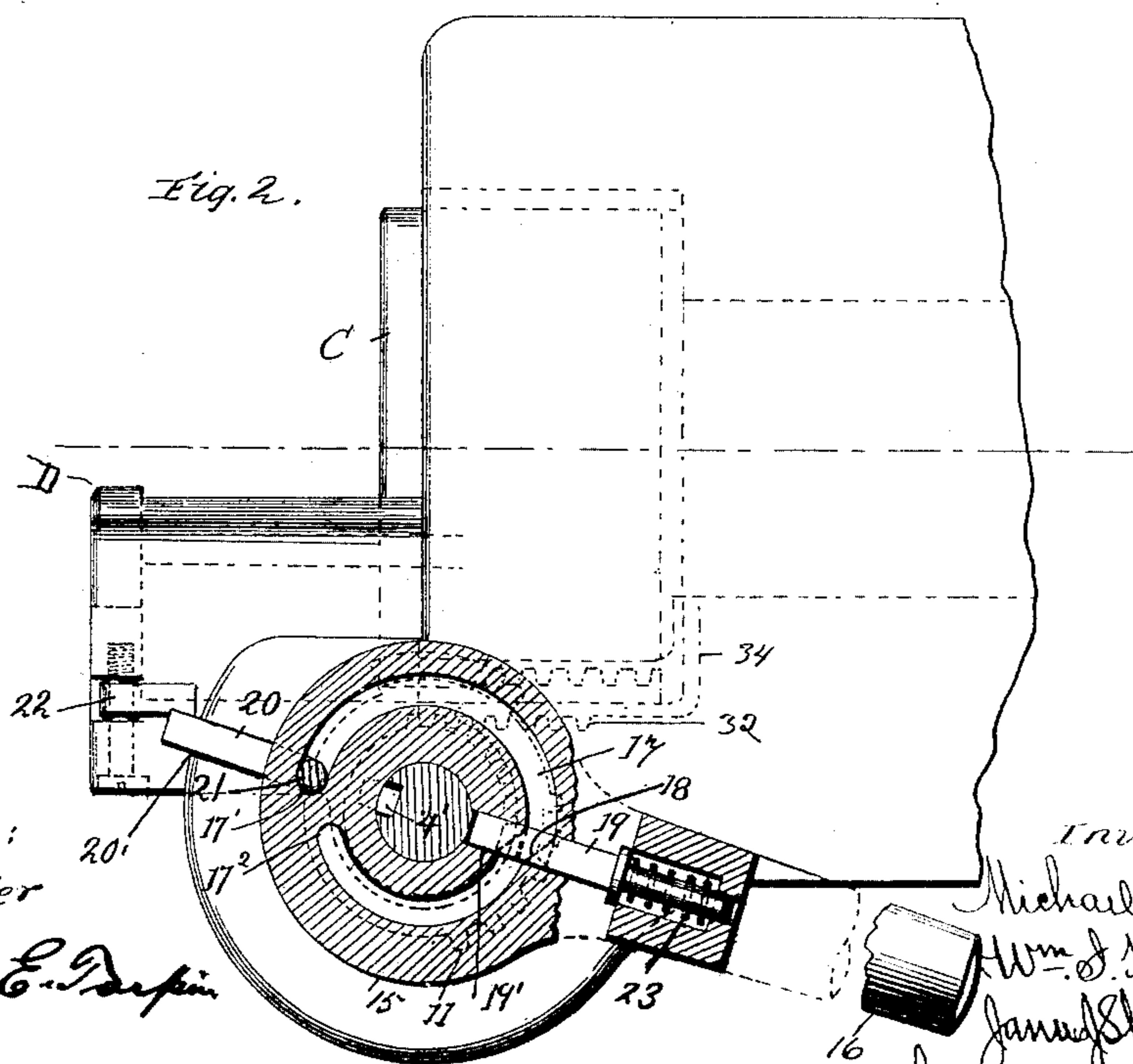
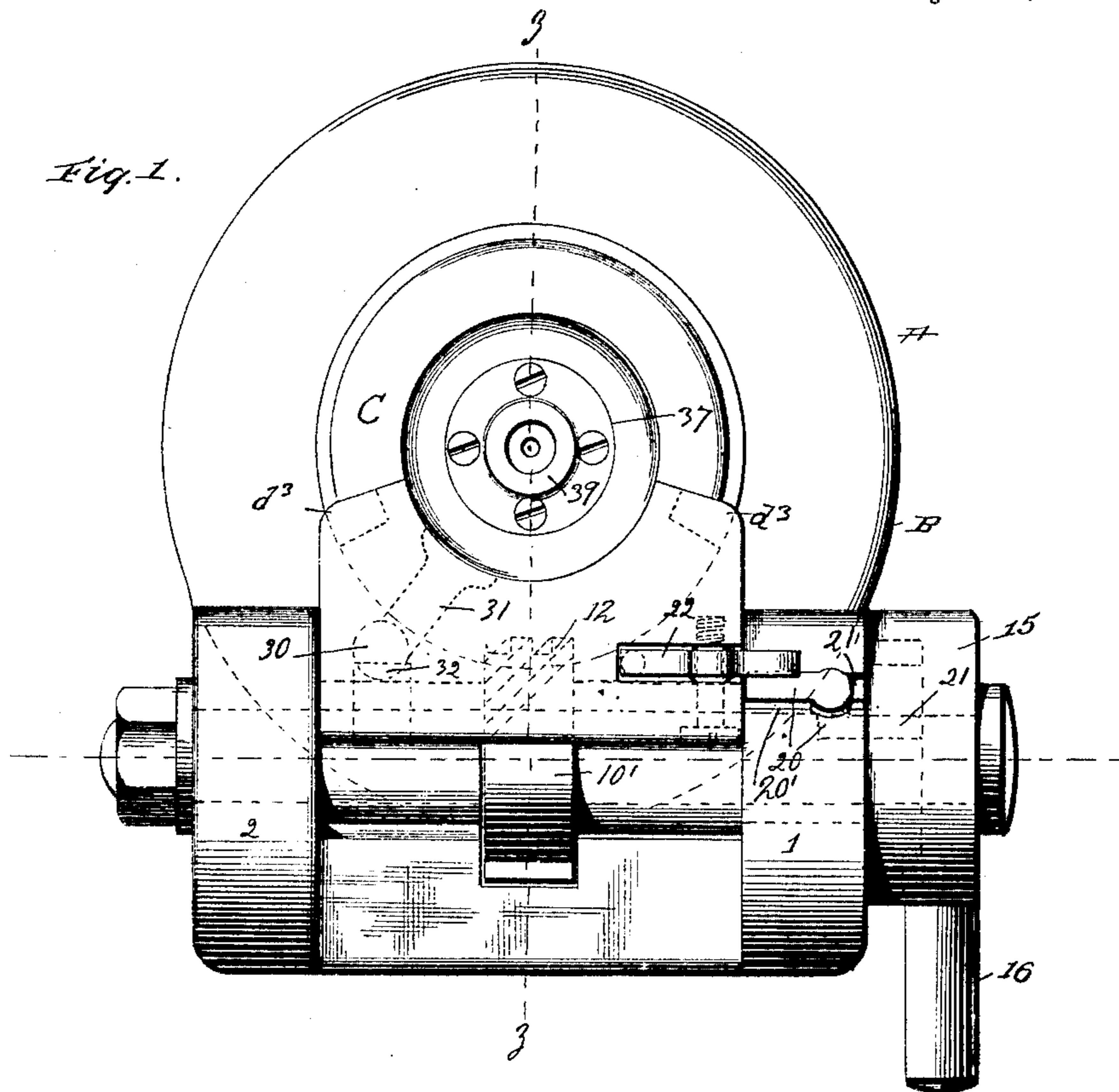
( Model. )

6 Sheets—Sheet 1.

M. A. LYNCH & W. I. HOUGH.  
BREECH MECHANISM FOR ORDNANCE.

No. 604,665.

Patented May 24, 1898.



Witnesses:

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16 ~~James Sheehy~~  
~~By their~~ Attorney

(Model.)

6 Sheets—Sheet 2.

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Fig. 3.

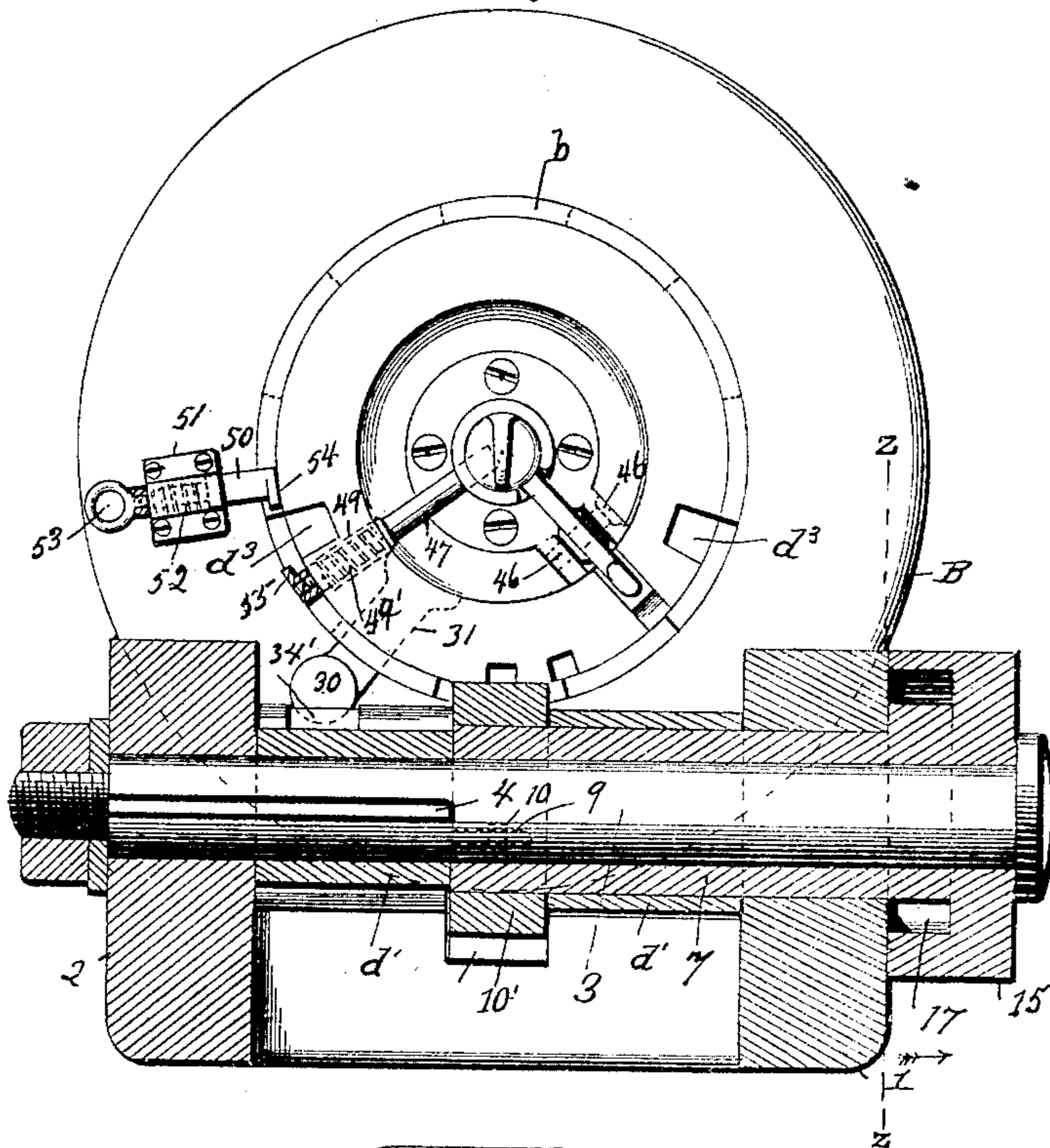
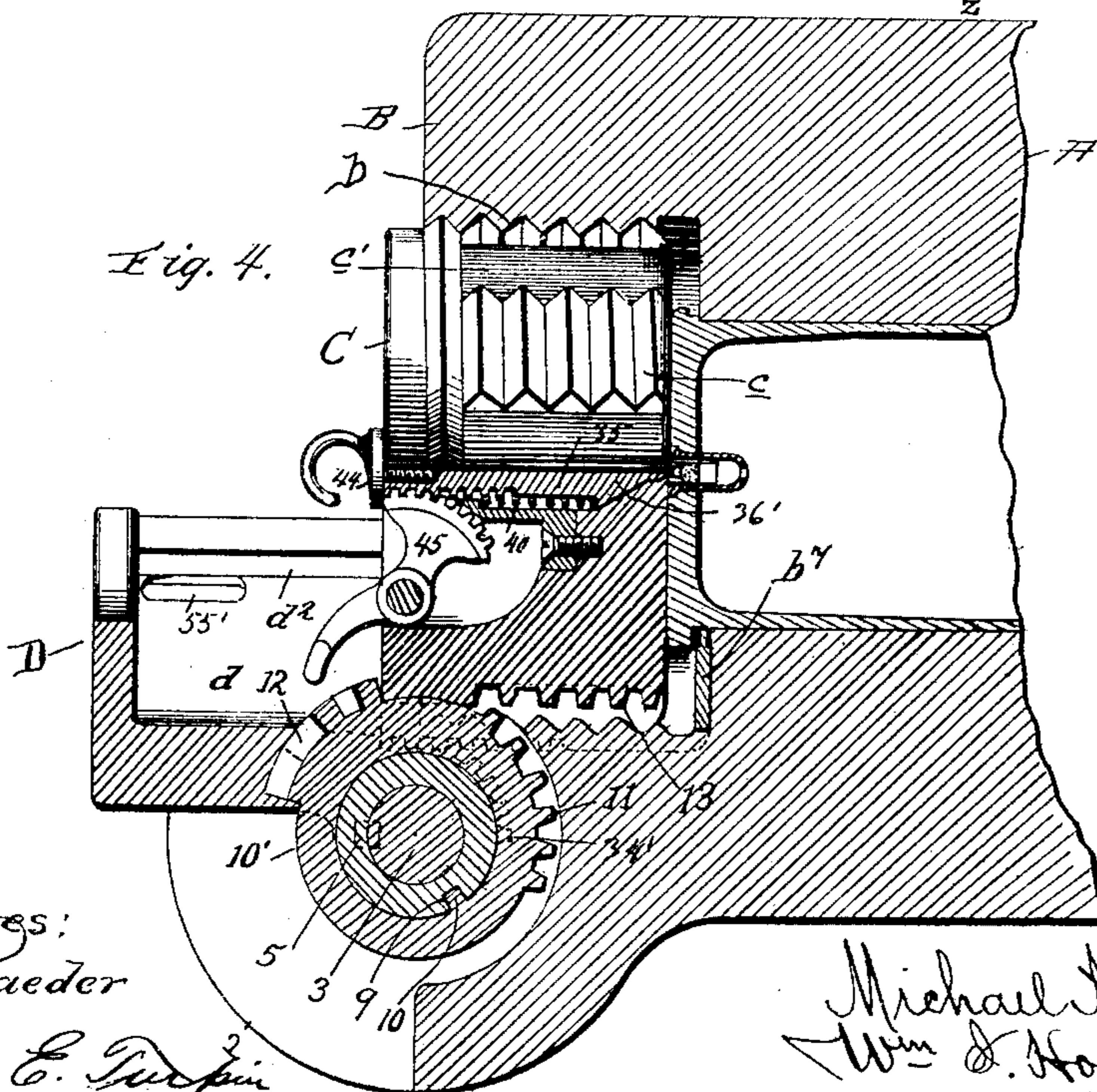


Fig. 4.



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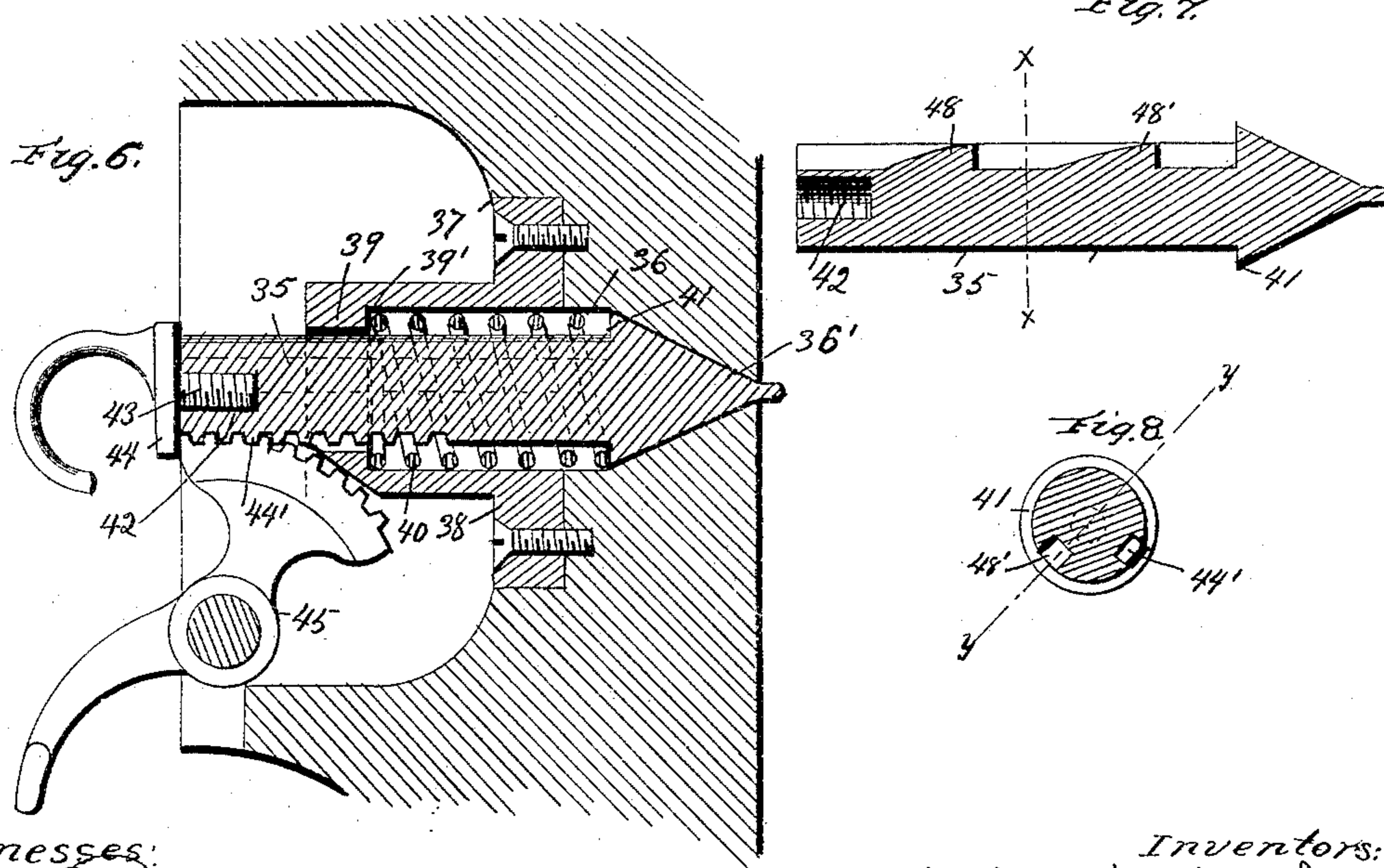
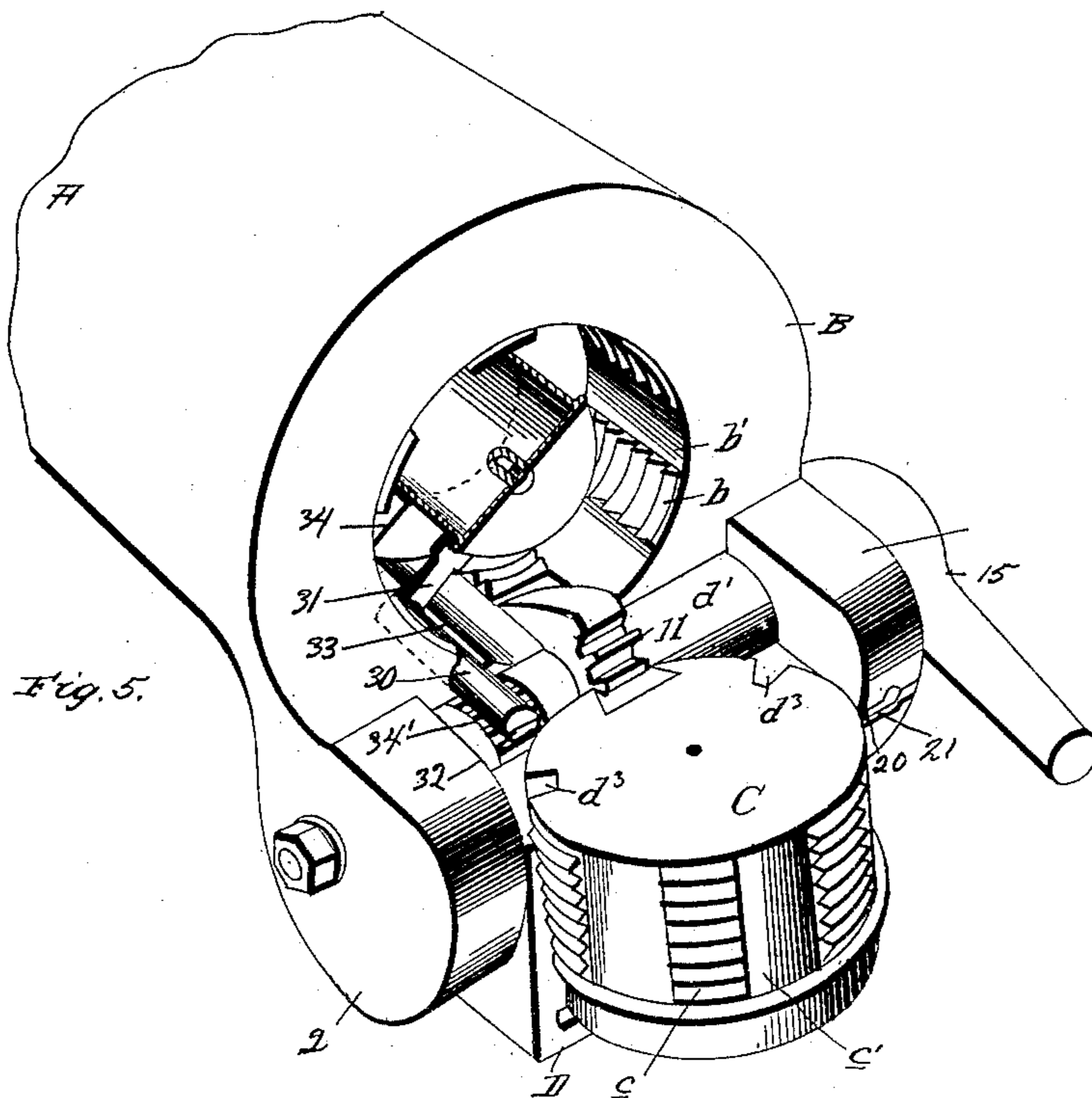
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6 Sheets—Sheet 4.

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BREECH MECHANISM FOR ORDNANCE.

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Fig. 9.

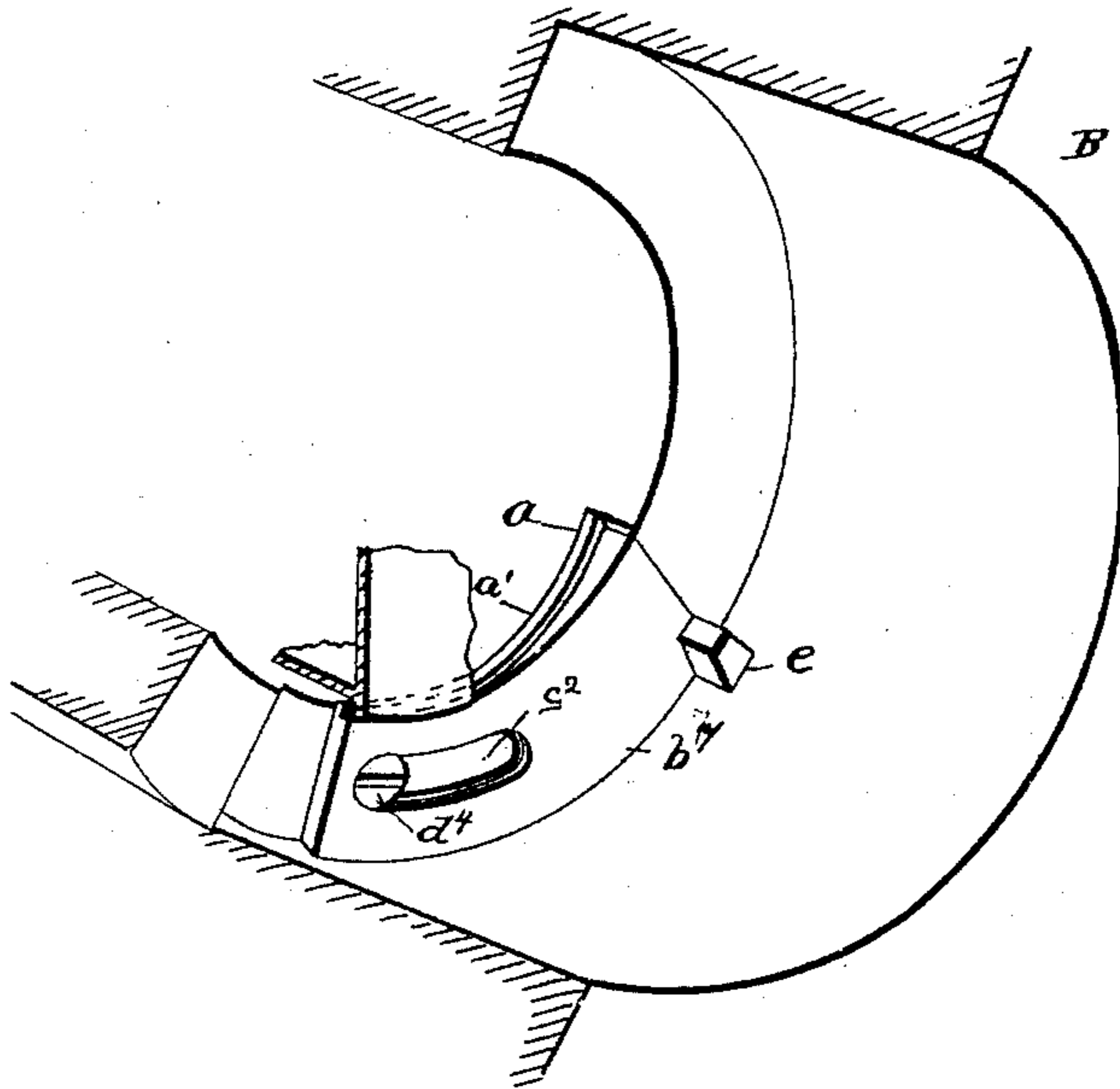
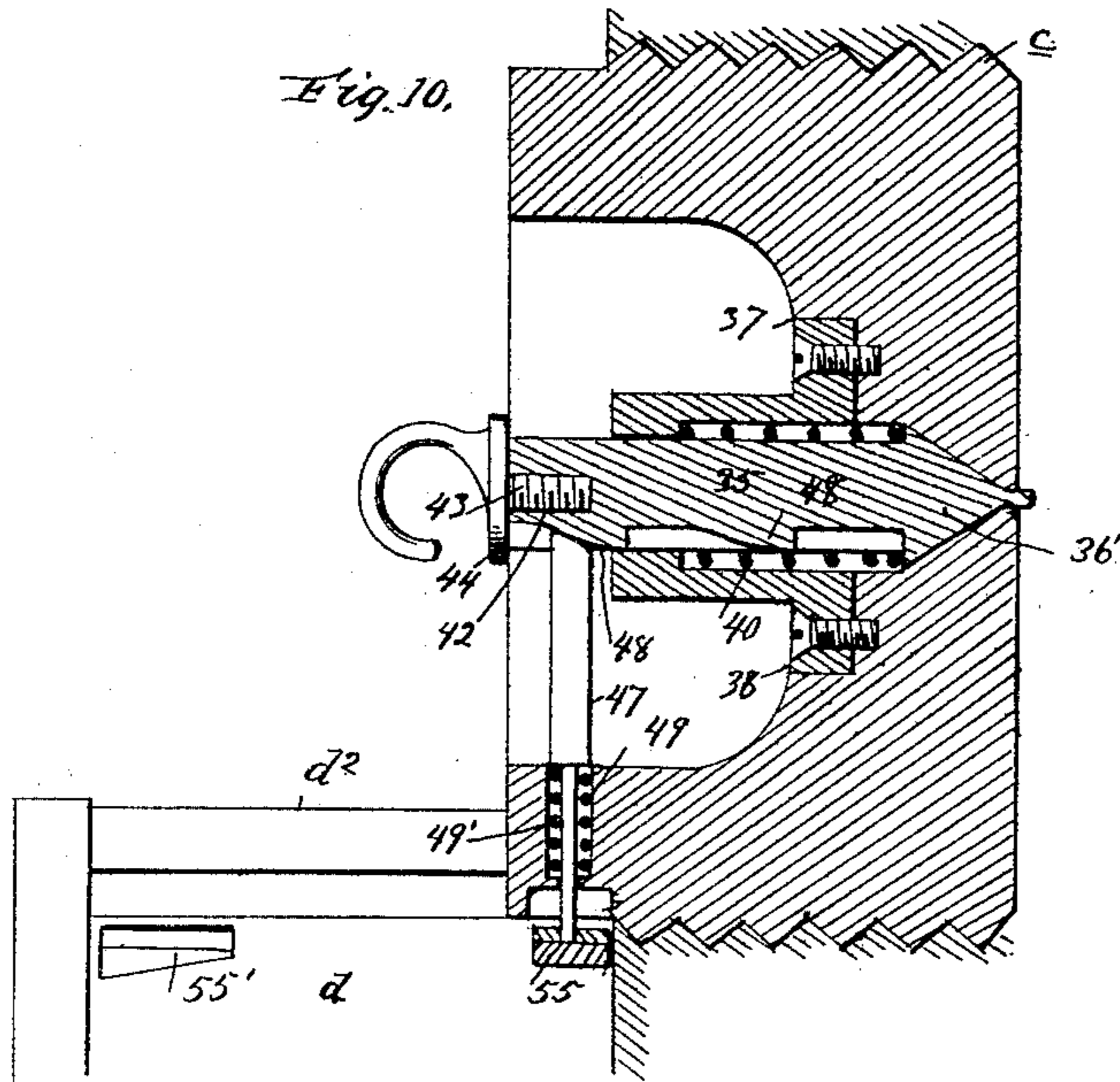


Fig. 10.



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6 Sheets—Sheet 5.

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Fig. 11.

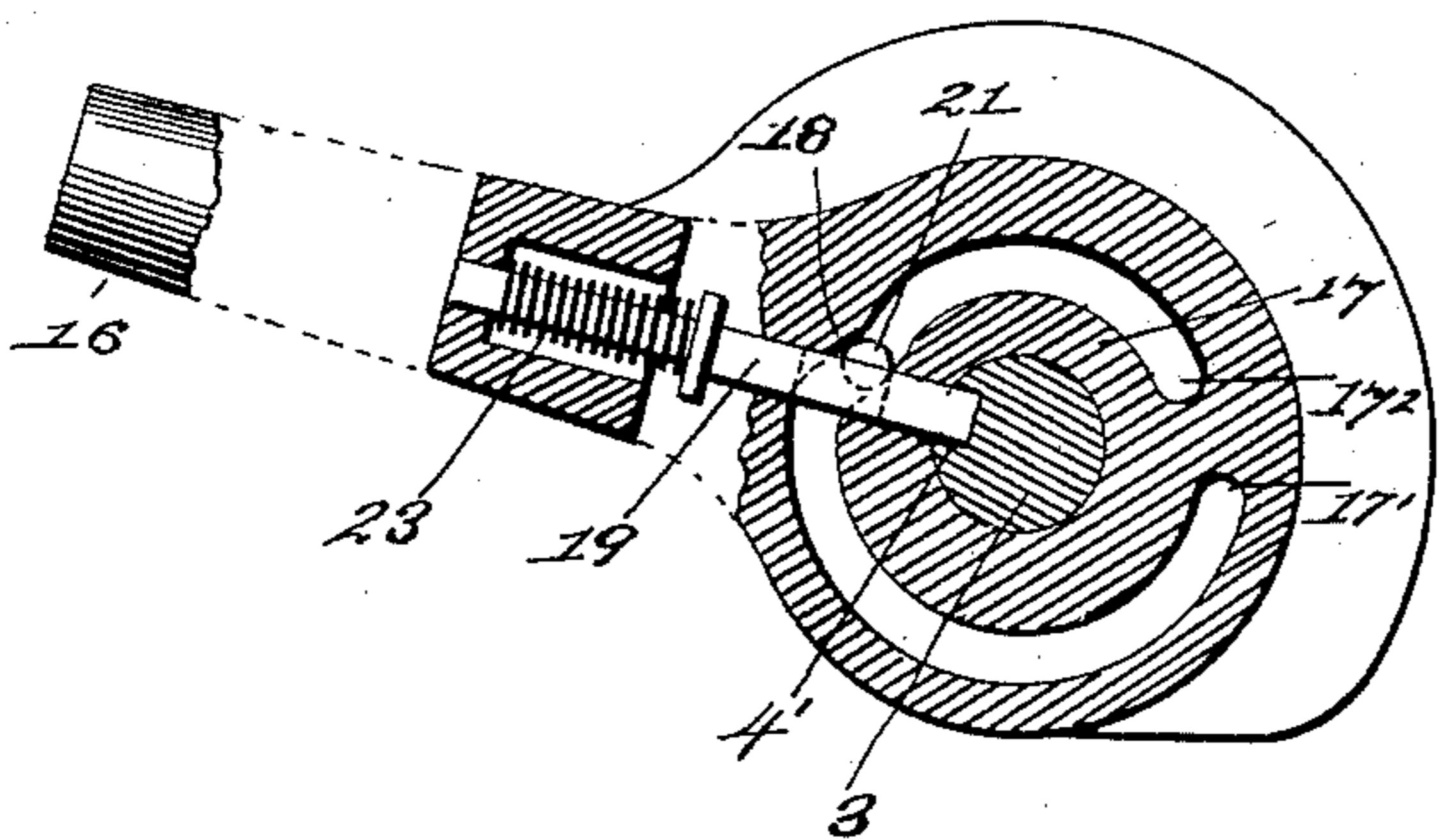


Fig. 13.

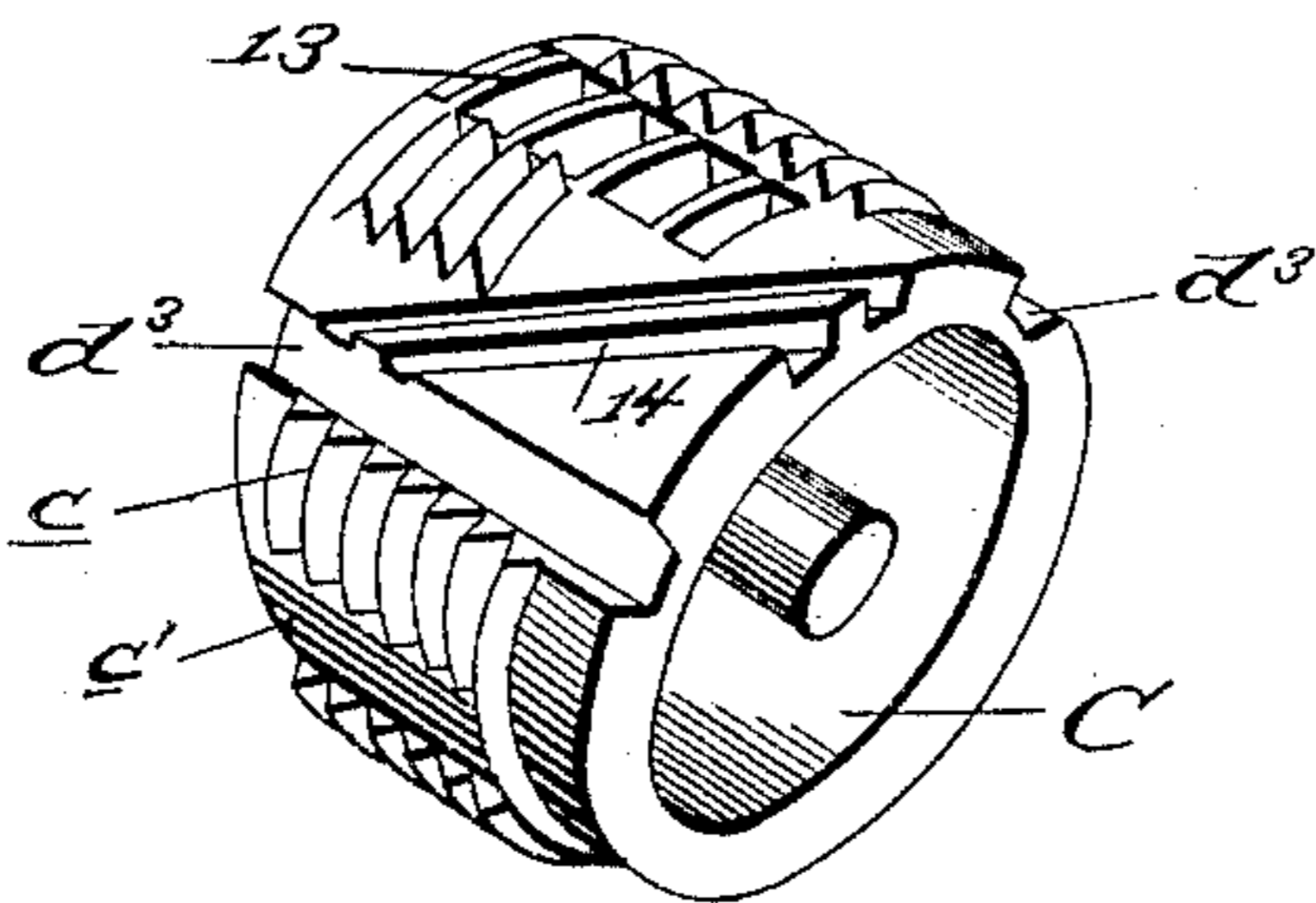
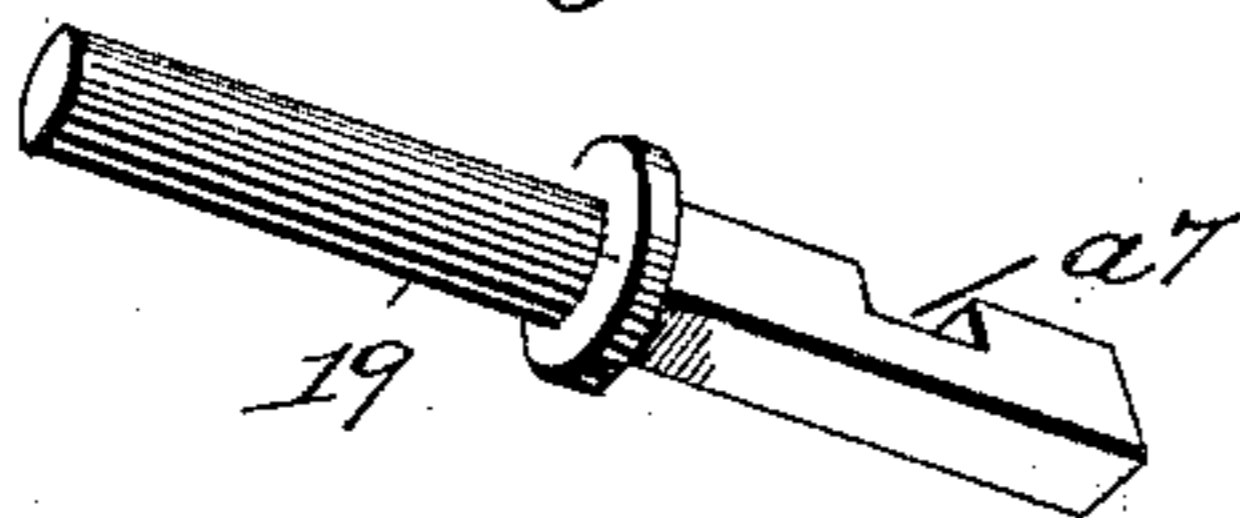


Fig. 12.



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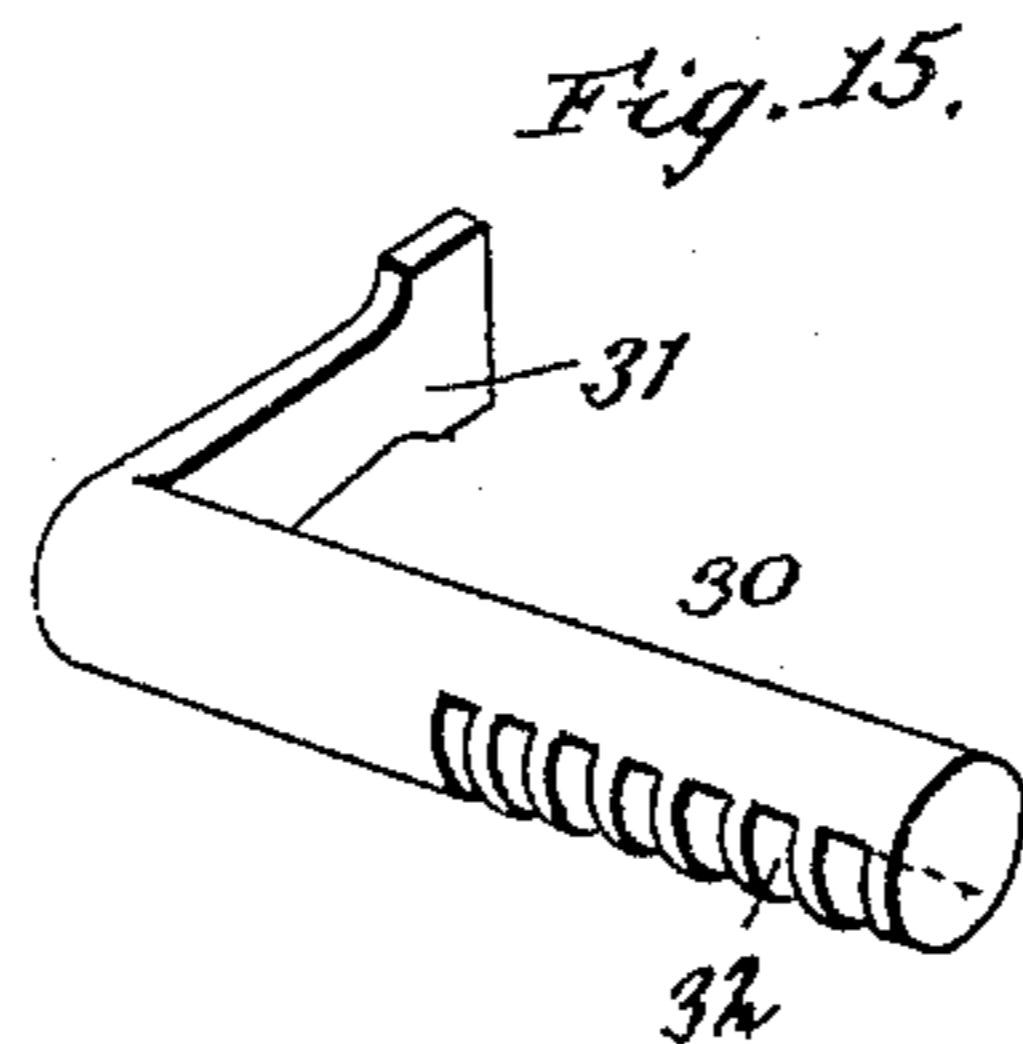
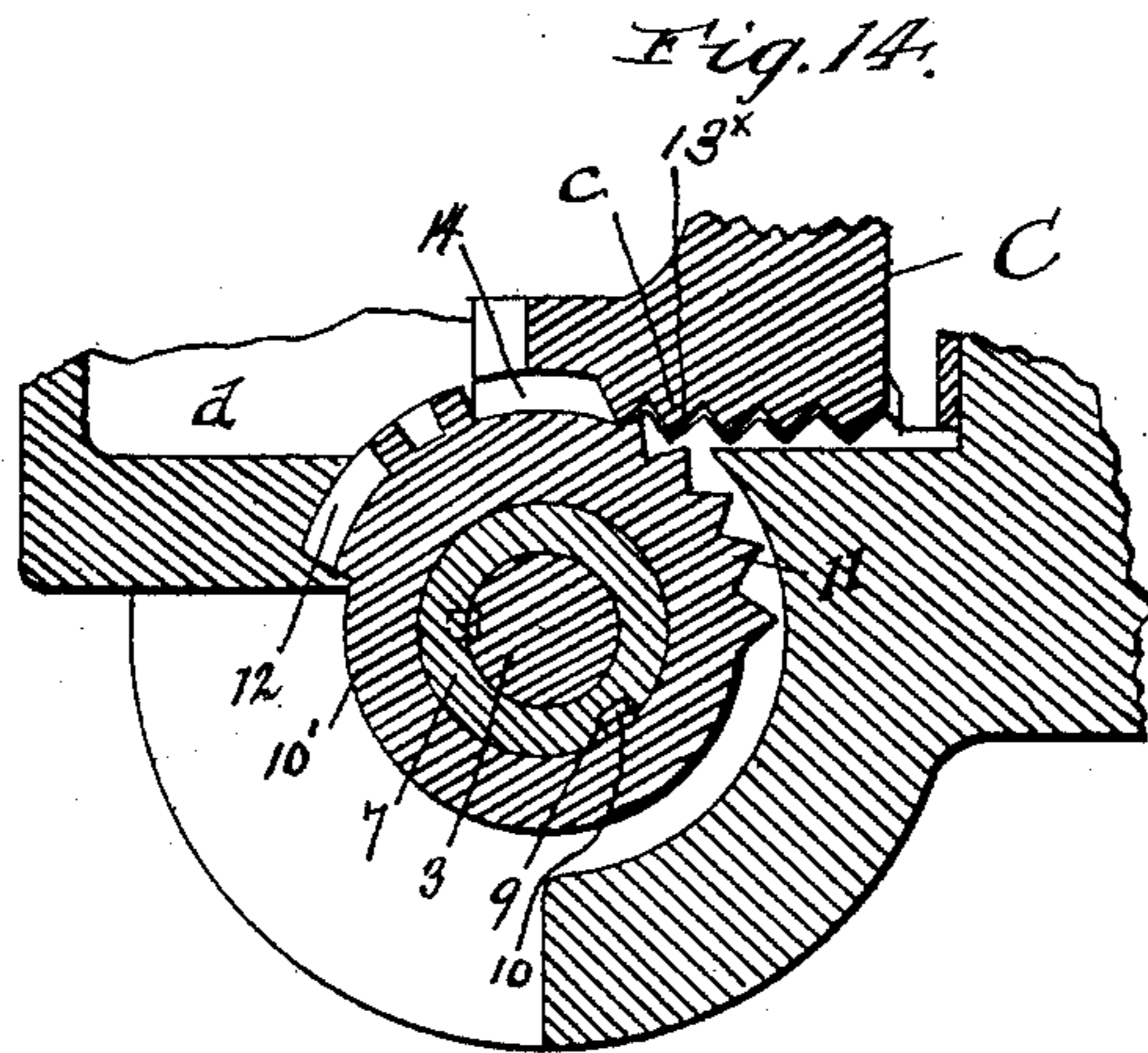
(Model.)

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# UNITED STATES PATENT OFFICE.

MICHAEL A. LYNCH AND WILLIAM I. HOUGH, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO JAMES J. SHEEHY, A. A. THOMAS, AND E. J. TURNER, OF SAME PLACE.

## BREECH MECHANISM FOR ORDNANCE.

SPECIFICATION forming part of Letters Patent No. 604,665, dated May 24, 1898.

Application filed October 16, 1890. Serial No. 368,319. (Model.)

*To all whom it may concern:*

Be it known that we, MICHAEL A. LYNCH and WILLIAM I. HOUGH, citizens of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Breech-Loading Cannon; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in breech-loading cannon; and its novelty and advantages will be fully understood from the following description and claims when taken in conjunction with the annexed drawings, in which—

Figure 1 is a rear elevation of a cannon with the breech-plug locked in place therein and the carrier raised. Fig. 2 is a side elevation with the cannon broken away and showing the lever in transverse section to illustrate the clutch mechanism. Fig. 3 is a rear elevation of the breech of the cannon with the breech-plug-operating mechanism in longitudinal section and the firing mechanism in elevation. Fig. 4 is a vertical sectional view taken longitudinally through the cannon on the plane indicated by the dotted line  $z z$  of Fig. 1. Fig. 5 is a perspective view of the cannon with the breech-plug and its operating mechanism thrown out of line with the bore of the cannon and showing the cartridge in sectional elevation. Fig. 6 is an enlarged sectional view of a portion of the breech-plug and the firing-pin. Fig. 7 is a detail sectional elevation of the firing-pin detached from the breech-plug, the section being taken on the plane indicated by the line  $y y$  of Fig. 8. Fig. 8 is a cross-section taken through the firing-pin on the line  $x x$  of Fig. 7. Fig. 9 is a perspective view of a portion of the breech, showing the shell-starter and a portion of the shell. Fig. 10 is a vertical sectional view of the breech-plug and firing-pin with a portion of the tray. Fig. 11 is a detail transverse section taken in the plane indicated by the line  $z z$  of Fig. 3, the movable key being shown in the position it occupies when in engagement with the rock-shaft.

Fig. 12 is a detail perspective view of the movable key for fixing the operating-lever and the spindle or sleeve to the rock-shaft. Fig. 13 is a perspective view of the breech-plug removed. Fig. 14 is a detail section illustrating a modification. Fig. 15 is a detail perspective view of the shell-extractor removed.

Like numerals and letters of reference denote corresponding parts in all of the several figures of the drawings, referring to which—

A designates the cannon, and B is the breech thereof, which is larger in diameter than the bore of the cannon, as is usual. The interior surface or wall of the breech is formed or provided with a mutilated screw-gear formed by the coincident threads  $b$ , which are arranged in series and each series separated by an intervening groove or recess  $b'$ .

C is the breech plug or block, cylindrical in form and of a suitable size to fit snugly into the breech B, and this plug or block is, like the breech, formed on its surface with a mutilated screw-gear, consisting of the series of the coincident threads  $c$ , separated by the longitudinal grooves  $c'$ . This plug or block is fitted into the breech so that the threads  $c$  thereon enter the channels or grooves  $b'$  in the breech, and it is then forced home therein, after which the plug is turned on its axis to cause its threads to lock with the threads of the breech, and thereby lock the plug in the breech, as is usual in this class of cannon, the removal of the plug being effected by first rotating the same to unlock it and then withdrawing it in a rearward direction. In connection with this plug we employ the usual breech-block carrier D, which is fitted snugly between the supports or pillow-blocks 1 2, rigid with the cannon and arranged at one side of the breech thereof. The breech-plug carrier is pivotally connected to the supports and so arranged relatively to the breech that it can adjust the breech-plug properly into the breech as said carrier is raised, and when it is lowered as the breech is withdrawn it removes the plug out of line with the breech and bore of the cannon, so that the charge or cartridge can be readily placed therein, as is necessary. This breech-plug carrier com-

prises the tray or pan  $d$ , which receives the breech-plug, and the tubular bearings  $d'$ , and in the sides of the tray guide flanges or ribs  $d^2$ , Figs. 4 and 5, are provided, which fit in  
 5 grooves  $d^3$  in the surface of the breech-plug, and thereby serve to hold said plug in proper position within the tray of the carrier.

A rock-shaft or bolt 3 extends longitudinally through the tubular bearings  $d'$  of the breech-  
 10 plug carrier and the supports 1 2 thereof, Fig. 3, and in this shaft is formed the longitudinal keyway 4, which receives the key or lip 5 on the breech-plug carrier, whereby said carrier and the rock-shaft or bolt are keyed together  
 15 to secure simultaneous movement or adjustment of said parts, and in the outer end of said rock-shaft or bolt is formed threads for the engagement of a securing-nut; but this construction is optional, and an equivalent  
 20 construction can be employed to confine the shaft against endwise displacement.

Between the rock-shaft and the bearings  $d'$  of the breech-plug carrier (see Fig. 3) we arrange the tubular spindle or sleeve 7, which  
 25 actuates the gear or gear-segment of the breech-plug. This sleeve fits snugly around the rock-shaft, concentric therewith, and is free to turn on said shaft; but it does not extend the entire length of said shaft, so that  
 30 provision is thus made for effecting the rigid connection of the shaft to the breech-plug carrier, and in the inner end of this tubular spindle or sleeve is formed a keyway or groove 9 to receive the key or other securing device  
 35 10 on the inner wall of the bore or passage of the gear or gear-segment, thereby securing said gear-segment to the tubular spindle or sleeve, so as to turn therewith. This gear-segment 10' is formed with a series of gear-teeth  
 40 11, which extend nearly one-half way around its circumference, and between the termini of such gear-teeth and on the plain face of the gear or gear-segment are formed one or more worm screw or gear teeth 12. The trans-  
 45 verse gear or rack teeth 11 engage with the preferably-depressed rack-teeth 13, formed on the circumference of the breech-plug, and are for the purpose of withdrawing the breech-plug rearward and out of the breech, accord-  
 50 ing to the direction in which the gear-segment is being rotated, whereas the worm-gear teeth mesh or engage with similar worm-gear teeth 14 on the breech-plug, (see Fig. 13,) such teeth 14 extending diagonally from one end  
 55 of the plug and above the terminus of the rack-teeth 13 on said plug. When the plug is forced home and locked in the breech, the gear 12 on the gear-segment engages the worm-gear 14 on the plug, so that as soon as the le-  
 60 ver is turned the gear-segment operates to rotate the breech-plug and unlock the same from the breech before the said segment is turned sufficiently far enough to bring its rack-teeth 11 into engagement with the similar teeth 13 on the plug to effect the with-  
 65 drawal of the plug in a rearward direction, and after said plug has been forced home into

the breech by a reverse movement of the lever and the rack-teeth 11, engaging the similar teeth 13, the gear is turned to again bring  
 70 the worm-teeth 12 and 14 on said gear and plug, respectively, into engagement, thereby operating in the final movement of the lever to rotate the gear-segment and the breech-  
 75 plug to lock the plug securely in the breech.

The outer end of the tubular spindle or shaft 7 is enlarged to form an integral disk-shaped head 15, and the lever 16 is made integral with said head, so as to turn with the sleeve or tubular spindle. In the inner face  
 80 of this flattened or disk-shaped head 15 we provide a channel or groove 17, (see Figs. 2 and 11,) which has an eccentric or cam portion 18 therein at a suitable point, so that the groove or channel is not concentric with the shaft; 85  
 but this groove does not extend continuously around the disk-shaped head, as its extremities terminate in abrupt walls 17' 17<sup>2</sup>, situated close to each other, as indicated in Fig. 2. In this flat head of the tubular spindle  
 90 and lever is formed, at a point opposite to the eccentric portion or shoulder 18 of the channel 17 therein, a radially-disposed aperture 19', and in the said aperture is seated a movable key 19, which extends across the chan- 95  
 nel and is adapted to engage with the seat or groove 4' in the end of the rock-shaft at the desired time and when the lever has been moved far enough around to cause said movable key to come opposite to the seat or key- 100  
 way 4' in the shaft. This movable key, which turns with the tubular spindle, is raised or released from the rock-shaft when the lever is returned to its normal position by means of a tripping device 20, which consists of a 105  
 plate or strip seated in a groove 20' in one of the supports or pillow-blocks 1, and said plate or strip is provided with a right-angled arm 21, which extends outwardly or laterally from the support 1 and enters the channel or groove 110  
 17 in the flat head of the tubular spindle and lever, the swinging or rocking movements of the lever and tubular spindle being limited by the breech-block carrier coming against the breech and the lugs on said breech. 115

The tripping device or piece 20 is retained in place by means of a spring-pressed tray-latch 22, carried by the carrier D, (see Fig. 1,) and at the same time said tripping device 20 is free to have the necessary movement, as the 120  
 tray-latch yields or gives to the same. We prefer to retain the movable key 19 in place by means of a spring 23, either a coiled or flat spring, and thus insure positive return movement to such key; but the spring may be dis- 125  
 pensed with and the key adapted to be operated by gravity, in which event a suitable cap or lever should be employed to keep the movable key in proper place.

The movable key 19, as better illustrated in 130  
 Fig. 12, is provided in its inner side at an intermediate point in its length with a recess  $a'$ , the purpose of which will be presently described.

When the breech-plug is locked in the breech, the lever is in the position substantially as indicated in Fig. 2, with the trip against the wall 17' of the groove and with the worm-threads on the gear-segment in mesh with the similar threads on the breech-plug. The lever is lifted and turned rearward, and this movement rotates the tubular spindle and operates the gear-segment to rotate the breech-plug and unlock the same from the breech; but this initial movement of the lever does not affect the rock-shaft, because the key is not in a position to engage therewith and also because the breech-plug must be unlocked from the breech before the breech-plug carrier is moved. As the movement of the lever is continued after the gear-segment has unlocked the breech-plug from the breech the rack-teeth 11 on the gear-segment engage the rack-teeth 13 of the breech-plug and move the same rearward into the carrier D, and at this time the carrier is swung on its pintle and the plug is carried out of alinement with the bore by reason of the movable key 19 taking into the seat 4' in the rock-shaft 3, as shown in Fig. 11.

As the lever 16 is turned upwardly and rearwardly before the key 19 engages with the rock-shaft, the portion of the groove 17 farthest from the rock-shaft is carried out of engagement with the trip 20, and, the recess  $a^7$  in the key 19 enabling the key to pass the trip, the eccentric or cam portion of the groove 17 and the concentric portion of said groove nearest the rock-shaft are brought into engagement with the trip in succession. When the concentric portion of the groove 17 nearest the rock-shaft is brought into engagement with the trip, the key 19 enters the seat or groove 4' in the rock-shaft, and thereby effects the coupling of said rock-shaft to the sleeve 7 and the lever, the continued rearward movement of the lever operating to turn the rock-shaft and move the breech-plug carrier and the breech-plug therein away from the breech, the further movement of the lever being limited by the breech-block carrier coming in contact with the rear face or breech of the gun and the end wall 17<sup>2</sup> of the groove 17 coming against the trip-piece.

The primary portion of the reverse movement of the lever 16 operates to lift the breech-plug carrier up to the breech and carries the eccentric or cam portion 18 of the groove 17 to the trip-piece, (see Fig. 11,) and the continued movement of the lever 16 causes the trip-piece to move up the cam portion 18 and engage the upper wall of the recess  $a^7$  in the key 19 and raise said key out of engagement with the rock-shaft, after which the portion of the groove 17 that is farthest from the rock-shaft engages the trip-piece, and the continued movement of the lever turns the spindle or sleeve 7 sufficiently for the gear-segment to force the breech-plug home into the breech and to lock the same therein, as is obvious.

It will thus be seen that by a few simple parts which are compactly arranged we are enabled by a single movement of a lever in one direction to unlock the breech-plug in the breech, move said plug rearwardly out of the breech, and carry it out of alinement with the bore of the gun, so as to permit of the ready placement of a charge therein.

We do not limit ourselves to the particular number of mutilated screw-threads on the breech-plug and breech herein shown as an embodiment of our invention, as they can be increased to twice the number shown, more or less, and if so increased we may dispense with the separate rack-threads 13 on the breech-plug and utilize locking-threads 13<sup>x</sup> thereon as the means by which the gear-segment is enabled to effect the forward or rearward movement of the breech-plug, as shown in Fig. 14. When thus utilized, the locking-threads 13<sup>x</sup> serve the additional function of rack-teeth, and therefore they may be properly denominated "combined rack-teeth and locking-threads;" nor do we confine ourselves to the use of a series of worm-threads on the gear-segment and breech-plug, as the number can be diminished or increased at will and as may be found most expedient.

We will now proceed to describe the mechanism for extracting the cartridge-shell after the cartridge has been fired, which extraction is accomplished automatically and by the rearward movement of the breech-plug carrier.

The extractor (see Fig. 5) comprises a sliding piece 30, having a toe 31 at its inner end and a series of rack-teeth 32 on its under side, and the extractor is fitted in a groove or channel 33, cut in the wall of the breech adjacent to one of the fixed supports of the breech-plug carrier. The sliding extractor is guided in the groove or way, and at the inner terminal of said way a prolongation of the groove or a recess 34 is formed in the annular wall between the breech and the bore of the cannon, in which recess is seated the right-angled toe of the sliding extractor, so that the said toe is adapted to engage the inner side of the flange on the cartridge-shell as the latter is forced into the cannon, and thereby adapt the extractor to withdraw the shell. The rack 32 is formed on the face of the extractor pin or slide adjacent to one of the tubular bearings of the breech-plug carrier, and on said bearing is formed the segmental gear-teeth 34', (see Fig. 5,) with which the rack meshes, whereby the back and forth movements of the breech-plug carrier operate to force the extractor into the breech and to withdraw the same partially to remove the cartridge-shell from the bore of the cannon. The extractor being geared directly to the breech-plug carrier and being seated wholly within the breech, the operation or adjustment thereof depends wholly upon the movement of the carrier, and said extractor is thus rendered entirely automatic in its actions.

In order to assist the extractor 30 in effecting the extraction of the cartridge-shell from the breech, we contemplate the employment of means for starting the shell in the breech on the first or primary movement of the breech-plug in withdrawing the same from the breech. In the practical embodiment of this part of our invention we form a recess  $a$  in the breech of the cannon at the rear of the bore therein, (see Fig. 9,) and one face or wall of this recess is inclined or beveled at  $a'$ . Within this recess is seated a wedge-shaped shell-starting plate  $b^7$  for giving a slight rearward movement to the cartridge-shell on the initial movement of the breech-plug and to enable the extractor proper to effectually remove the shell without liability of the extractor failing to work. This starting-plate is segmental in form and made wedge-shaped in section, and it is firmly seated in the inclined recess to insure a uniform contact or bearing in the flange of the shell, said segmental form of the plate serving to insure a long contact-surface with the flange or head of the cartridge and effectually overcome all tendency of the cartridge-shell to hang in the breech.

In the shell-starting plate we provide a segmental slot  $c^2$ , through which passes the screw  $d^4$  for securing the plate in position, and at one end of this plate is an outwardly-extending lug  $e$ , which is received within one of the grooves or recesses  $d^3$  in the side of the breech-plug when it is forced home into the breech and by which said starting-plate is operated. As the cartridge is inserted into the breech the starting-plate takes beneath the flange or head of the cartridge, and when the breech-plug is forced into the breech the lug  $e$  takes in the groove  $d^3$ , so that the plate  $b^7$  is turned with the breech-plug when the latter is locked in the breech. After the cannon has been fired the breech-plug is rotated, as described, to first unlock the same from the breech, and this rotation causes the starting-plate to ride on the cam-surface and give the initial rearward movement to the cartridge-shell and free the same in the breech, so that the extractor proper can readily remove the cartridge from the breech; but when the breech-plug is withdrawn in a rearward direction the starting-plate is disengaged from the plug, as its lug slips out of the groove or recess in said plug.

The third part of our invention relates to a novel firing mechanism especially adapted for use in a breech-loading cannon for firing shells, which will be hereinafter more fully described; but we take occasion to here remark that our improvements are not exclusively confined to cannon for firing fixed-ammunition cartridges, as the usual gas-check and mushroom mechanism may be employed in connection with the gun.

When the gun is to be used for firing charges of powder, we employ the plate and tube in the breech-plug shown in Fig. 1 of

the drawings, which is of the usual form and need not be more fully referred to in this specification.

To enable the cannon to fire charged shells, we employ the construction shown in Figs. 3, 4, 6, 7, and 8, in which an endwise-movable or reciprocating firing-pin 35 is arranged axially in relation to the breech-plug. A bore or passage 36 is cut through the plug, with its forward end reduced or tapering at 36', Fig. 6, and to the rear of the plug and within a chamber 37 therein is applied and secured a plate 38, said plate having a tubular boss 39, which alines with the passage in the breech-plug. The rear end of said plate or boss is contracted in diameter to form the annular shoulder 39' around the passage in said boss, and through this boss 39 passes the rear end of the reciprocating firing-pin. This firing-pin when retracted is held under the tension of an impelling-spring 40, which is inclosed within the passage in the breech-plug and the tubular boss of the fixed plate, and one end of said coiled spring engages with a shoulder or flange 41 on the firing-pin near its forward end, while the rear end of the spring bears against the annular shoulder 39' of the tubular boss, as shown. In the rear end of the firing-pin, which protrudes beyond the tubular boss, is an internally-threaded socket 42 to receive the threaded shank of a hook 43, which has a head or disk 44 of greater diameter than the firing-pin, and the forward end of said firing-pin is tapered to a conical point, as shown. In one side of the firing-pin we provide a series of rack-teeth 44', with which meshes the toothed segment of an automatic setting-lever 45, which lever is journaled or fulcrumed between suitable lugs 46 on the breech-plug within the chamber in the rear side thereof. This setting-lever has its free end extended beyond the chamber of the breech-plug, as shown in Figs. 4 and 6, and in the path of the protruding end of said setting device is arranged the breech-plug carrier, which, being fixed, or substantially so, while the breech-plug is being adjusted therein, operates to turn the setting-lever, and thereby move the firing-pin rearward and compress its impelling-spring, said firing-pin being held in its retracted position by a sear 47, as will be presently described. In the side of the firing-pin, separate from the rack-teeth, are formed two or more shoulders or notches 48 48', which represent, respectively, the "half-cock" and "full-cock" positions of the firing-pin, and the sear is adapted to engage with either of these shoulders or notches and hold the firing-pin in the desired position.

We prefer in practice to provide the firing-pin with the two shoulders or notches 48 48' in order that the said pin may be fixed in the half-cock and full-cock positions. We do not desire, however, to be understood as confining ourselves to the use of the two notches or shoulders, as when desired the half-cock notch or shoulder 48 may be dispensed with,

since it is not essential to the operation of the gun. The sear comprises a sliding bolt or pin arranged at right angles to the axis of the firing-pin and to the direction in which  
 5 said firing-pin is operated, and the sear is fitted and guided in a fixed case or support 49 on the breech-plug, and it is held in contact with the firing-pin by a coiled spring 49', arranged within said case 49 and suitably  
 10 connected to the sear and the case to operate the pin.

On the breech of the gun, separate from the breech-plug and at one side of the sear when the breech-plug is in its position to be forced  
 15 home into the breech and before it is locked therein, is arranged the trigger or discharging-detent 50. This trigger is seated into a slide in a suitable support or casing 51, fixed to the breech of the gun, and it is held in position  
 20 by a spring 52, so that normally the trigger or discharging-detent is in the path of the sear. At its outer end the trigger has an eye or loop 53, to which a lanyard is to be attached, and at the inner end of the trigger is an an-  
 25 gular lip or flange 54, which is adapted to engage with a similar lip or flange 55 on the outer end of the sear to adapt the sear to be operated by the trigger when the lanyard is pulled and thereby cause the sear to release  
 30 the firing-pin and cause said pin to be projected under the action of its impelling-spring against the fulminate of the cartridge and explode the same. It will thus be seen that the firing-pin is automatically set or adjusted for  
 35 use by the setting-lever as the breech-plug is withdrawn and that it is held in such retracted position by the sear while the breech-plug is being adjusted rearwardly out of the breech to load the cannon; but when the breech-plug  
 40 is forced home into the breech and rotated to be locked therein the sear is automatically engaged with the trigger or firing-detent as said breech-plug is rotated, so that the cannon can be fired at once by a simple pull on  
 45 the lanyard, which pull of the lanyard withdraws the sear from the firing-pin, and the latter is impelled by its spring against the cartridge or shell.

In order to effectually prevent a premature  
 50 discharge of the cannon while the breech-plug is being adjusted to its position in the breech, we make the sear of such a length and so arrange the same that when the breech-plug is being moved toward the breech and the inner  
 55 end of the sear is seated in one of the notches 48 or 48' of the firing-pin the outer end of said sear will rest very close to the wall of the carrier and will be prevented thereby from falling out of engagement with the firing-pin and  
 60 releasing the same in case its spring 49' should break. In order to permit the sear to move outwardly, so as to ride up the beveled portion of the firing-pin and seat in the notches thereof when said pin is drawn rearwardly by  
 65 the setting-lever engaging the rear wall of the carrier, we provide the slot or opening 55' in the carrier. This slot or opening 55' is dis-

posed in the same direction as the sear when the sear comes opposite the same, and it will therefore be seen that no obstruction is offered  
 70 to the sear moving out sufficiently to enable it to ride over the beveled portions of the firing-pin, so as to get into the notches 48 48' thereof. When the sear is seated in either one of the notches of the firing-pin, its outer  
 75 end will rest within and close to the side wall of the carrier and will not interfere in any way with the forward movement of the plug when the same takes place. It will be obvious from the foregoing that the sear cannot  
 80 be casually released from the firing-pin until the breech-plug is locked in the breech, since when the plug is turned to lock it in the breech and the sear is moved upward with the same to engage the trigger 50 there is no  
 85 likelihood of the sear falling by gravity out of engagement with the firing-pin should its spring break.

The operation of the several mechanisms forming our improvements in breech-loading  
 90 cannon will be readily understood by those skilled in the art from the foregoing description, taken in connection with the drawings, and need not be repeated here.

Changes in the form and proportion of parts  
 95 and details of construction of the mechanisms herein shown and described as an embodiment of our invention can be made without departing from the spirit or sacrificing the advantages of our invention, and we there-  
 100 fore reserve the right to make such modifications as fairly fall within the scope of our invention.

Having described our invention, what we claim, and desire to secure by Letters Patent, 105 is—

1. The combination of a breech of a cannon, a breech-plug, a rock-shaft supported on the cannon, a breech-plug carrier fixed with respect to the rock-shaft, a gear movable inde-  
 110 pendent of the rock-shaft and engaging the breech-plug, a lever connected with said gear, and mechanism independent of the breech-plug adapted, at intervals, to effect a rigid connection of the lever to the rock-shaft, sub-  
 115 stantially as specified.

2. The combination of a breech of a cannon, a breech-plug, a rock-shaft supported on the cannon, a breech-plug carrier fixed to the rock-shaft, a gear movable independent of the rock-  
 120 shaft and engaging the breech-plug, and suitable mechanism for transmitting motion to the gear and rock-shaft.

3. In a breech-loading cannon, the combination with a breech and the breech-plug; of  
 125 a breech-plug carrier hinged to the breech, the gear-segment engaging the breech-plug to rotate the same axially and also move said breech-plug in a forward and backward di-  
 130 rection, and a single lever which is rigid with the gear-segment and is fixedly connected at suitable intervals with the breech-plug carrier by mechanism independent of the breech-plug to cause the carrier to coöperate with the

gear-segment in moving the breech-plug toward or from the breech, substantially as specified.

4. In a breech-loading cannon, the combination with a breech and the breech-plug, of a breech-plug carrier hinged to the breech, a gear-segment engaging the breech-plug to successively rotate the same and move the same rearward, a single lever rigid with said gear-segment, and a clutch mechanism independent of the breech-plug for rigidly connecting said breech-plug carrier to the lever during a portion of its movement both in a backward and forward direction and operated to release said carrier from the lever as the breech-plug is being locked or unlocked in the breech, substantially as specified.

5. In a breech-loading cannon, the combination with a breech and a mutilated-gear breech-plug adapted to lock with suitable threads in the breech, of a breech-plug carrier hinged to the breech, a gear engaging the breech-plug to successively rotate and impart endwise movement to the breech-plug, a lever normally rigid with said gear, and clutch mechanism independent of the breech-plug for securing a rigid connection between the lever and the breech-plug carrier after the gear has operated the breech-plug to unlock the same from the breech, substantially as described.

6. In a breech-loading cannon, the combination with a breech and a breech-plug, of a breech-plug carrier hinged to the breech, the gear-segment having the separate rack-teeth and worm-teeth to mesh with similar teeth on the breech-plug, and a lever connected, substantially as described, with said gear-segment and the breech-plug carrier to operate said parts conjointly and independently in the manner and for the purpose described.

7. In a breech-loading cannon, the combination with a breech and a breech-plug, of the rock-shaft supported on the breech, the breech-plug carrier rigid with said rock-shaft, the tubular spindle concentric with the rock-shaft and carrying the gear-segment, a lever rigid with the tubular spindle, and a clutch mechanism carried by the lever to rigidly connect the rock-shaft to said lever at suitable intervals during the forward and backward motions of the lever, substantially as and for the purpose described.

8. In a breech-loading cannon, the combination with the breech and the breech-plug, of a rock-shaft carrying the breech-plug carrier, a tubular spindle having the gear-segment rigid therewith and engaging the breech-plug, a lever rigid with the tubular spindle and provided with the groove or channel, the locking-key carried by said lever and adapted to engage the rock-shaft, and a trip to release the locking-key from the rock-shaft, for the purpose described, substantially as set forth.

9. In a breech-loading cannon, the combination with the breech and the breech-plug; of a rock-shaft carrying the breech-plug car-

rier, the tubular spindle having the gear-segment rigid therewith and engaging the breech-plug, the lever rigid with the tubular spindle and having the concentric annular groove provided with an offset, the locking-key carried by the lever, and the sliding trip supported on the breech and riding in the groove of the lever to operate the movable key, substantially as specified.

10. In a breech-loading cannon, the combination with the breech and the breech-plug, of the rock-shaft carrying the breech-plug carrier, the tubular spindle having the rigid lever and provided with the concentric groove which is provided with an offset and has its ends terminating in abutments located near each other, the gear-segment operating in a slot in the breech-plug carrier and rigid with the tubular spindle, the movable key seated in the lever opposite to the offset portion in the groove of the lever and adapted to enter a recess in the rock-shaft, and the trip-piece seated in a groove in the breech and having the angular arm that rides in the groove of the lever to release the movable key at the desired intervals, substantially as specified.

11. In a breech-loading cannon, the combination with the breech and the breech-plug, of the breech-plug carrier hinged to the breech, the segmental gear movable with the carrier, and an extractor-piece seated in the breech and provided with a rack which engages with the segmental gear for the purpose described, substantially as set forth.

12. In a breech-loading cannon, the combination with the breech having the extended groove therein, and the breech-plug; of the breech-plug carrier hinged to the breech, the segmental gear movable with the carrier, and the extractor-piece fitted in the groove of said breech and having its right-angled toe entering the extension of the groove and the rack meshing with the segmental gear, substantially as specified.

13. In a breech-loading cannon, the combination with a breech the breech-plug, and the breech-plug carrier; of the spring-pressed firing-pin supported in said breech-plug and having the rack-teeth, the setting-lever having the segmental toothed surface which meshes with said rack on the firing-pin and which lever is journaled in the breech-plug with its free end extending rearwardly beyond said breech-plug and adapted to strike against the breech-plug carrier on the rearward movement of the breech-plug, the sear arranged to engage with the firing-pin as it is retracted, and the discharge-detent connected to the sear, substantially as specified.

14. In a breech-loading cannon, the combination of the breech, the breech-plug, the breech-plug carrier provided with the slot or groove, the firing-pin carried by said breech-plug, means for automatically setting the firing-pin for action on a rearward movement of said breech-plug, and a sear also carried by the breech-plug and adapted to

take into the recess or slot in the breech-plug carrier as the breech-plug is withdrawn in a rearward direction into said carrier, substantially as and for the purpose set forth.

5 15. In a breech-loading cannon, the combination with the breech, and the breech-plug, of a breech-plug carrier provided with the slot or groove 55', the firing-pin carried by said breech-plug, the setting-lever engaging with  
10 the firing-pin, and the sear also carried by the breech-plug and having its head adapted to take into the recess or slot in the breech-plug carrier as the breech-plug is withdrawn in a rearward direction into said carrier, substan-  
15 tially as described.

16. In a breech-loading cannon, the combination with a breech and a breech-block; of a shell-starter arranged within the breech to have a circumferential contact with a car-  
20 tridge-shell and movable in a line transverse of the cannon, and operated by the breech-block as the latter is unlocked to release the shell from the breech and give the same its initial movement in extracting it from the  
25 breech, substantially as described.

17. In a breech-loading cannon, the combination with a breech and breech-plug, of a shell-starting plate fitted within the breech to have a circumferential contact with a car-  
30 tridge-shell and movable in a line transverse of the cannon, and means for imparting movement to the plate and starting the cartridge-shell in the breech as the breech-plug is rotated.

35 18. In a breech-loading cannon, the combination with a breech and a breech-plug; of a segmental shell-starting plate fitted in the breech and movable in a line transverse of the cannon, and connected to the breech-plug  
40 to be seated and unseated in the breech as said breech-plug is locked and unlocked therein, substantially as specified.

19. In a breech-loading cannon, the combination with a breech; of a breech-plug, the  
45 shell-starting plate movable in a line transverse of the cannon and having the cam seated in the breech, and means for connecting the plate to the breech-plug while the latter is locked or unlocked in the breech and which  
50 disengages said plate from the breech-plug as the latter is withdrawn in a rearward direction, substantially as specified.

20. In a breech-loading cannon, the combination of a breech having the cam-face recess  
55 or seat therein, the grooved breech-plug, and the segmental wedge-shaped shell-starting plate seated in said cam-groove within the breech and having the lug to fit into the groove of the breech-plug, substantially as described.

60 21. In a breech-loading cannon, the combination with a breech and an endwise-movable and rotary breech-plug having a recess; of a segmental shell-starting plate fitted in the breech and movable in a line transverse of  
65 the cannon and having a projection adapted to engage the recess of the breech-plug, substantially as specified.

22. In a breech mechanism of the slotted-screw system, the combination with a breech-block provided with combined rack-teeth and  
70 screw-threads thereon for locking the same in the gun and worm-threads in rear of said screw-threads, of a gear-segment provided with teeth to engage in said worm and other  
75 teeth to engage in said combined rack-teeth and screw-threads, and a hand-lever connected with said gear-segment, substantially as described.

23. In a breech mechanism of the slotted-screw system, the combination with a breech-  
80 plug provided with combined rack-teeth and screw-threads thereon for locking the same in the gun and worm-threads in rear of said screw-threads; of a gear-segment pivoted to the gun and provided with teeth to engage in  
85 said worm and other teeth to engage in said combined rack-teeth and screw-threads, and a hand-lever connected with said gear-segment, substantially as specified.

24. In a breech-loading cannon, the combination with a breech and a breech-plug hav-  
90 ing rack-teeth and worm-gear teeth; of a gear having rack-teeth and worm-gear teeth adapted to engage the rack-teeth and worm-gear teeth respectively of the plug, and a suitable  
95 means for rotating or partially rotating the gear.

25. In a breech-loading cannon, the combination with a breech and a mutilated-gear  
100 breech-plug adapted to lock with suitable threads in the breech and having rack-teeth and worm-gear teeth; of a gear having rack-teeth and worm-gear teeth adapted to engage the rack-teeth and the worm-gear teeth re-  
105 spectively of the plug, and a suitable means for rotating or partially rotating the gear.

26. In a breech-loading cannon, the combination with a breech-plug having a series of  
110 rack-teeth and also having another series of worm-gear teeth; of a gear having a series of rack-teeth and also having another series of worm-gear teeth adapted to engage the series of rack-teeth and the series of worm-gear  
115 teeth respectively of the plug; the said rack-teeth and the worm-gear teeth being so arranged on the gear and plug that a single partial revolution of the gear will completely un-  
lock and withdraw or replace and lock the breech-plug, substantially as specified.

27. In a breech-loading cannon, the combination with a breech and a mutilated-gear  
120 breech-plug adapted to lock with suitable threads in the breech and having a series of rack-teeth and also having another series of worm-gear teeth; of a gear having a series of  
125 rack-teeth and also having another series of worm-gear teeth adapted to engage the series of rack-teeth and the series of worm-gear teeth respectively of the plug; the said rack-teeth and worm-gear teeth being so arranged  
130 on the gear and plug that a single partial revolution of the gear will completely unlock and withdraw or replace and lock the breech-plug, substantially as and for the purpose set forth.

28. In a breech-loading cannon, the combination with the breech, the breech-plug, and the breech-plug carrier; of the spring-pressed firing-pin carried by said breech-plug, the  
5 setting-lever arranged to retract the firing-pin on the backward movement of the plug, the sear to engage the firing-pin as it is retracted and having an angular branch at its outer end, and the discharge-detent supported  
10 on the breech and having a branch at its inner end adapted to engage that of the sear to release the latter from the firing-pin when the lanyard is pulled, substantially as specified.

29. In a breech mechanism in which a  
15 breech-block is rolled or turned to lock it in the breech, the combination of a breech-block, rotating and translating means thereon, and a partially-revoluble gear-segment meshing as described with both said rotating and trans-  
20 lating means as set forth.

30. In a breech mechanism in which a breech-block is rolled or turned to lock it in the breech, the combination of a breech-block, a partially-revoluble gear-segment, coacting  
25 devices on the block and gear-segment for translating the block, and other, distinct coacting devices on the block and gear-segment for rolling or turning the said block on its axis as described, whereby the block may be  
30 placed and locked in the breech or unlocked and removed from the breech by a single, partial revolution of the gear-segment as set forth.

31. In a breech mechanism in which a  
35 breech plug or block is rolled or turned to lock it in the breech, the combination of a breech plug or block having the translating-rack and also having worm-teeth thereon, and a partially-revoluble gear-segment having the  
40 rack and also having worm-teeth thereon to engage the translating-rack and the worm-teeth, respectively, of the plug or block as set forth.

32. In a breech-loading gun in which a  
45 breech plug or block is rolled or turned to lock it in the breech, the combination of a breech plug or block, and a gear-segment; said plug or block and the gear-segment having coacting devices for translating the block  
50 and other coacting devices for rolling or turning the said block on its axis, a cartridge-extractor, a handle for operating the gear-segment, and suitable means, operative by the handle, for actuating the extractor.

33. In a breech-loading gun in which a  
55 breech plug or block is rolled or turned to lock it in the breech, the combination of a breech-block, a partially-revoluble gear-segment, coacting devices on the block and gear-segment  
60 for translating the block, other, distinct coacting devices on the block and gear-segment for rolling or turning the said block on its axis as described, firing mechanism carried by the block, and an actuating device arranged on the breech of the gun in juxtaposition to and adapted to register with the

firing mechanism when the plug is turned to lock it in the breech.

34. In a breech-loading gun in which a breech plug or block is rolled or turned to lock  
70 it in the breech, the combination of a breech plug or block, and a partially-revoluble gear-segment; said plug or block and the gear-segment having coacting devices upon them for translating the block, and other coacting de-  
75 vices upon them for rolling or turning the said block on its axis, a firing-hammer carried by the block, a sear also carried by the block, and a trigger arranged on the breech of the gun in juxtaposition to and adapted  
80 to be engaged by the sear when the plug is turned to lock it in the breech.

35. In a breech-loading gun in which a breech-block is rolled or turned to lock it in the breech, the combination of a breech-block,  
85 and a partially-revoluble gear-segment; said block and gear-segment having coacting devices upon them for translating the block and other coacting devices upon them for rolling or turning the said block on its axis,  
90 a spring-pressed firing-hammer carried by the block, a sear also carried by the block, a trigger arranged on the breech in juxtaposition to and adapted to be engaged by the sear when the block is turned, a breech-plug carrier,  
95 and a lever, for setting the firing-hammer, arranged to engage the carrier.

36. In a breech-loading gun in which a breech-block is rolled or turned to lock it in the breech, the combination of a breech-block,  
100 a spring-pressed firing-hammer carried thereby, a sear also carried by the block, a trigger arranged on the breech in juxtaposition to and adapted to be engaged by the sear when the block is turned to lock it in the breech,  
105 a hinged breech-plug carrier having a recess 55' to receive the sear, a device, for setting the firing-hammer, carried by the plug and arranged to engage the carrier, a partially-revoluble gear-segment, coacting devices on  
110 the block and gear-segment for translating the block, other, distinct coacting devices on the block and gear-segment for rolling or turning the said block on its axis as described, and suitable means for operating the breech-  
115 plug carrier and the gear-segment conjointly and independently, substantially as specified.

37. In a breech mechanism in which a breech-block is rolled or turned to lock it in the breech, the combination of a breech-block,  
120 a gear, coacting sets of teeth on the block and gear for translating the block, and other distinct coacting sets of teeth on the block and on the gear for rolling or turning the said block on its axis.  
125

In testimony whereof we affix our signatures in presence of two witnesses.

MICHAEL A. LYNCH.  
WILLIAM I. HOUGH.

Witnesses:

THOMAS E. TURPIN,  
JOHN HOGAN.