

W. N. Hall, 3. Sheets, Sheet 1.

Permutation Lock.

No. 107,775.

Patented Sept. 27. 1870.

Fig. 1.

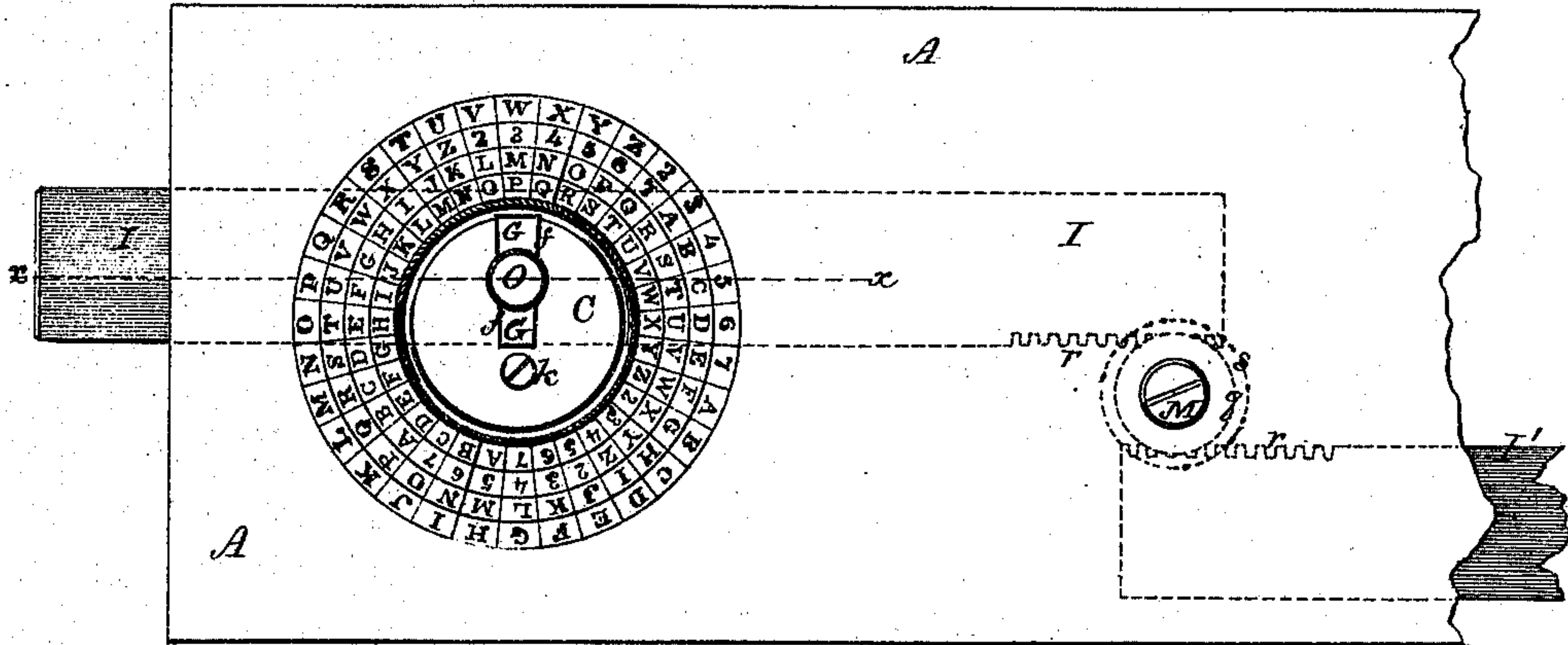
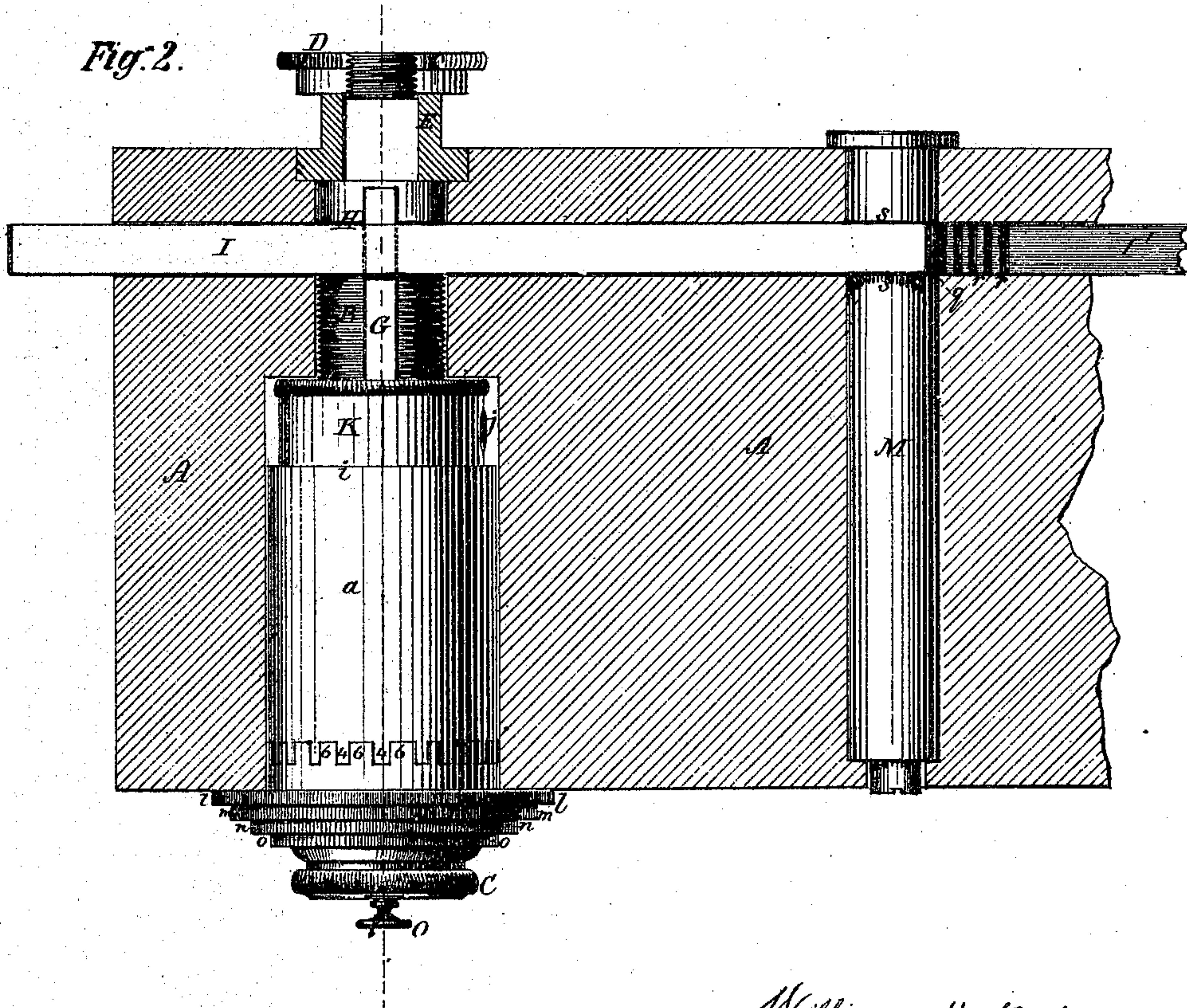


Fig. 2.



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Fig. 3.

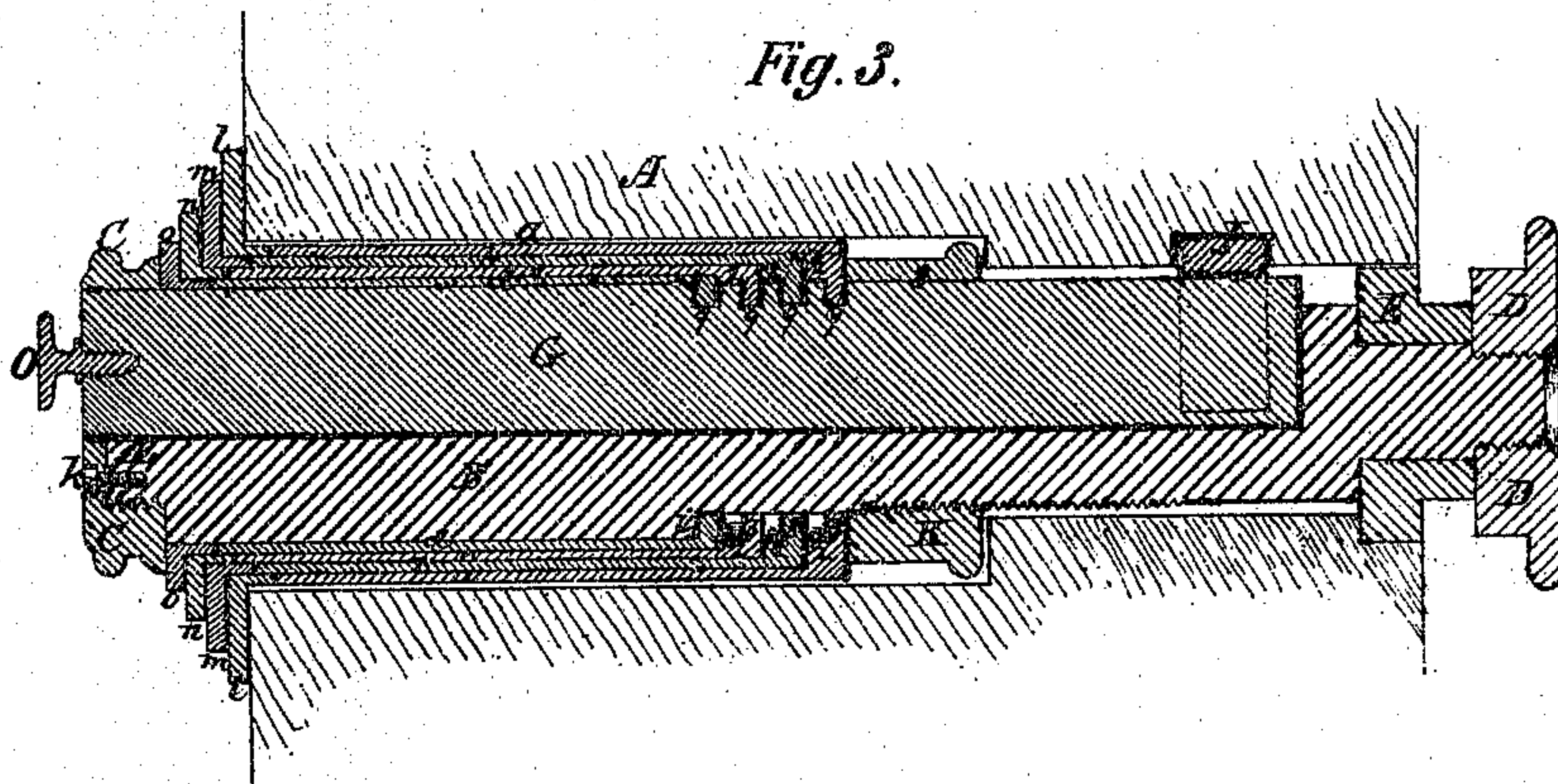


Fig. 4.

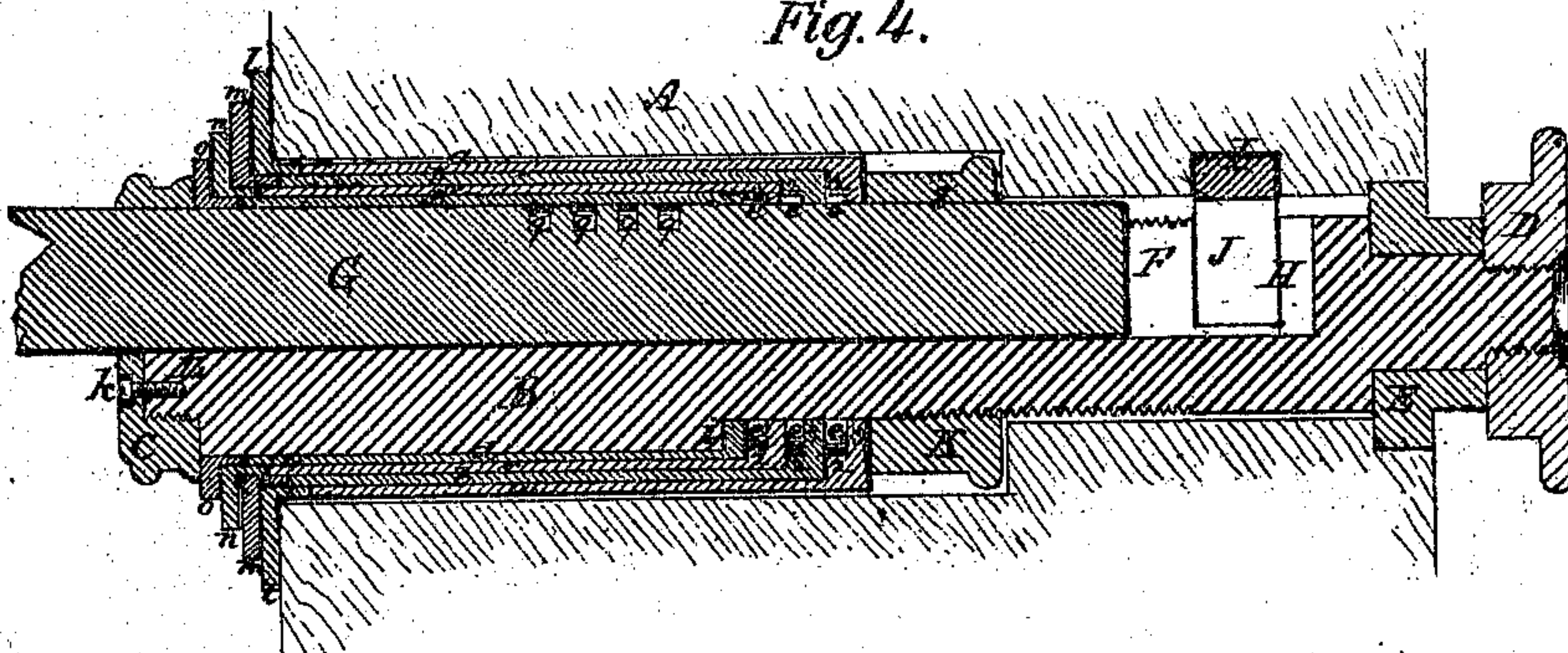


Fig. 5.

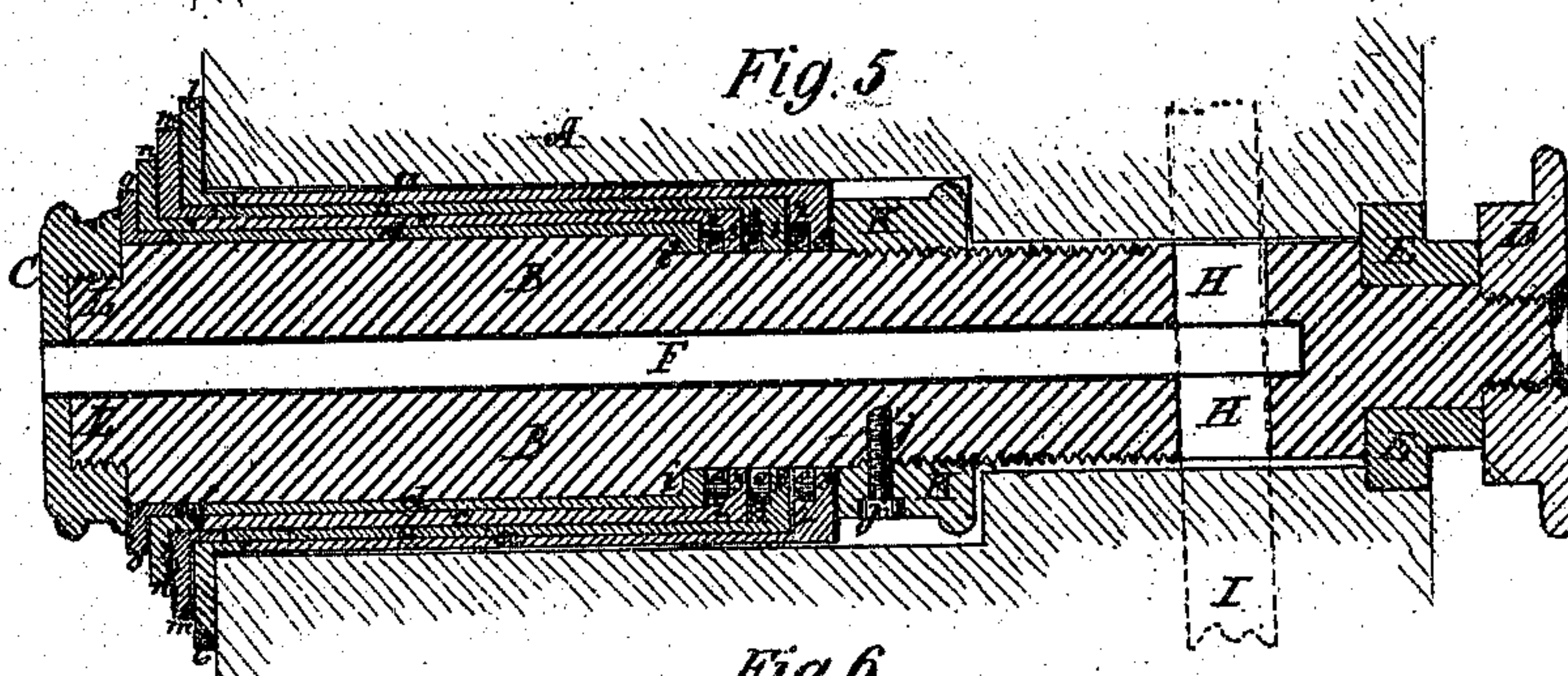
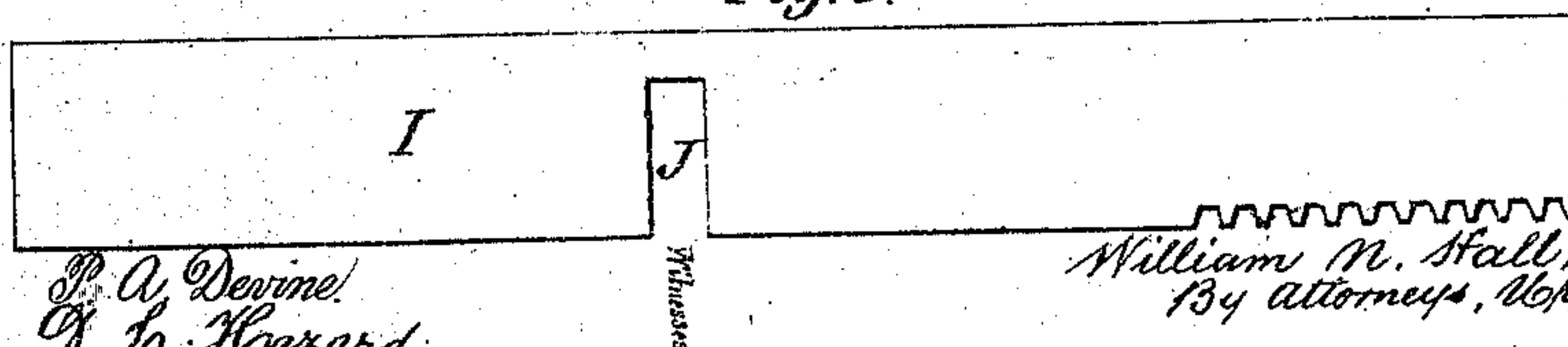


Fig. 6.



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134 attorneys, Wetherman Johnson.



W. N. Hall,

3. Sheets, Sheet 3.

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Fig. 7.

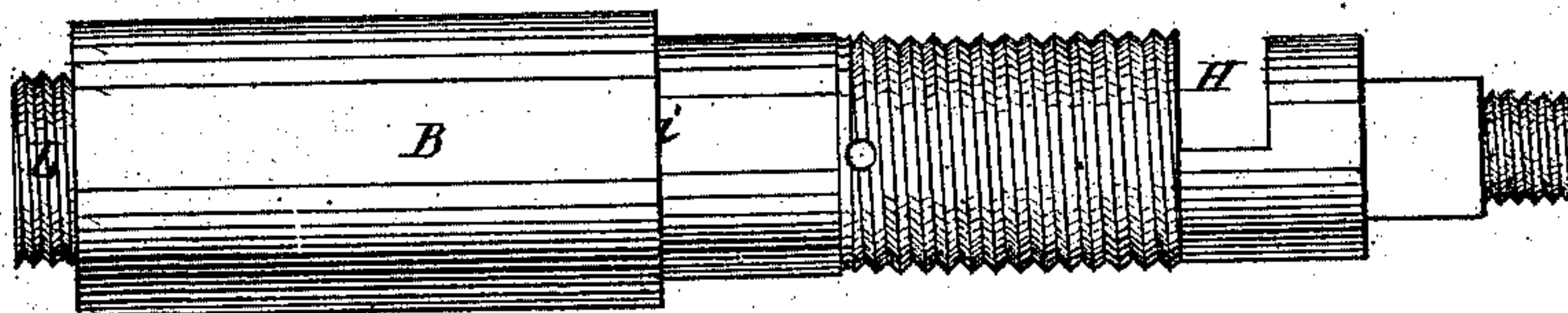


Fig. 8.

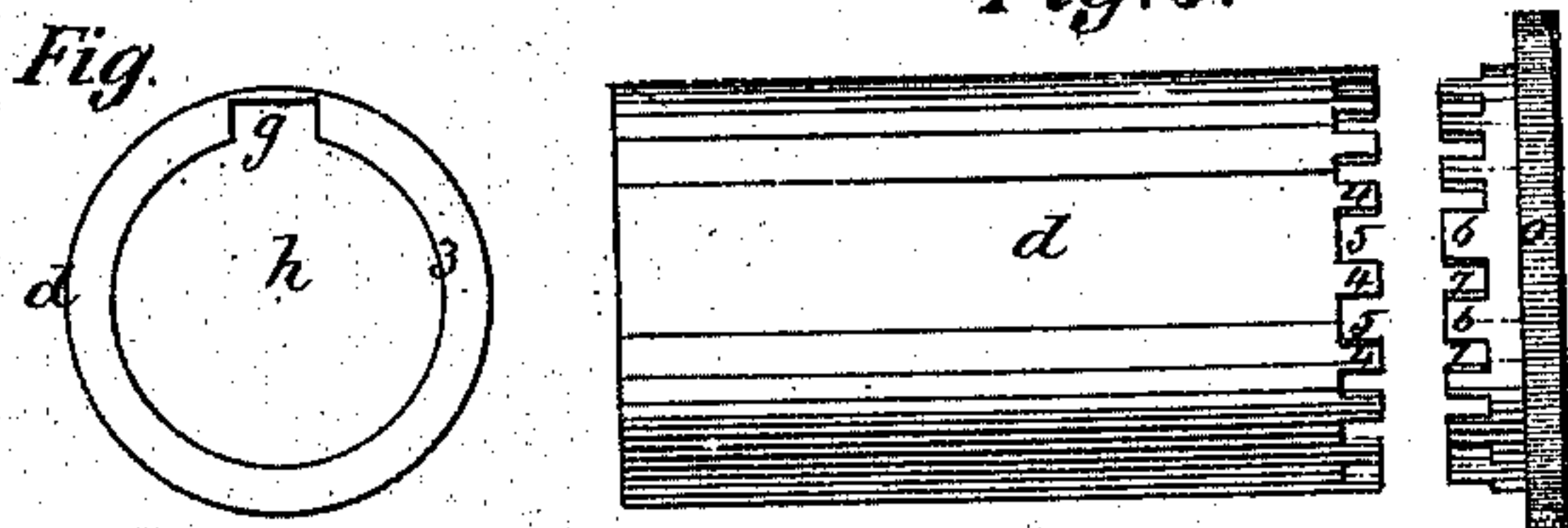


Fig. 9.

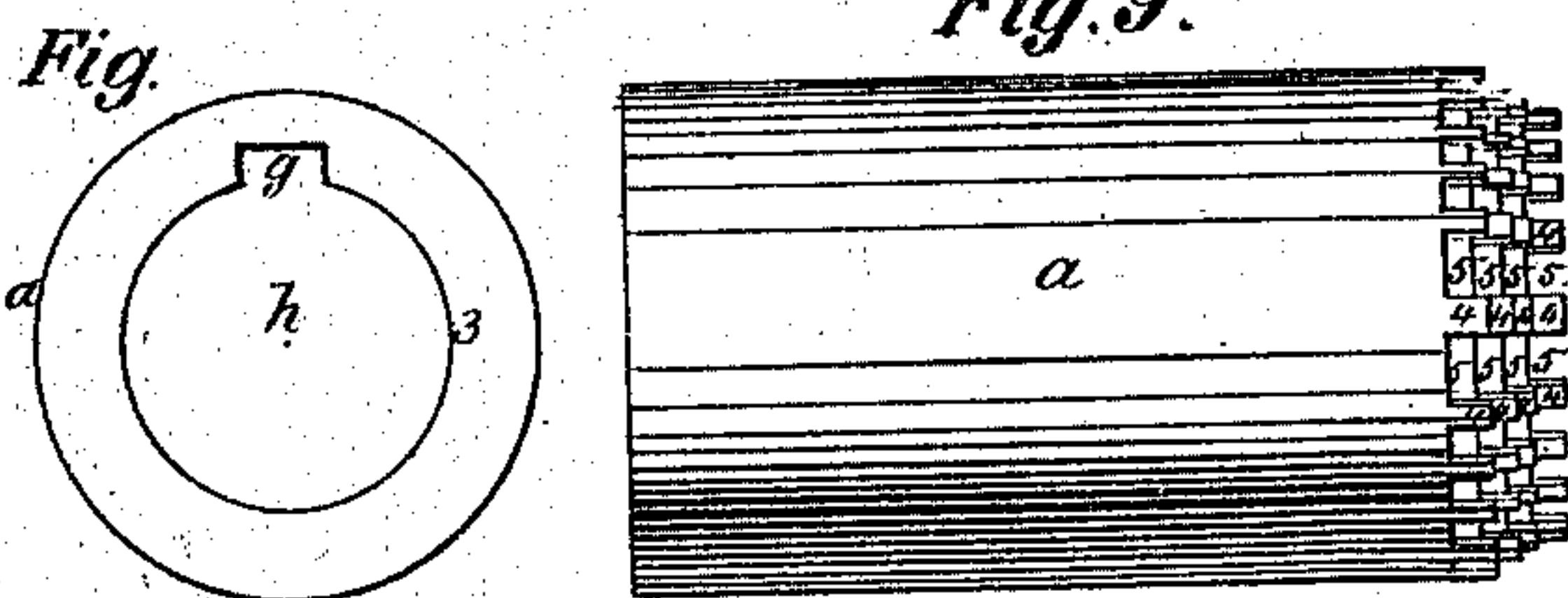


Fig. 10.

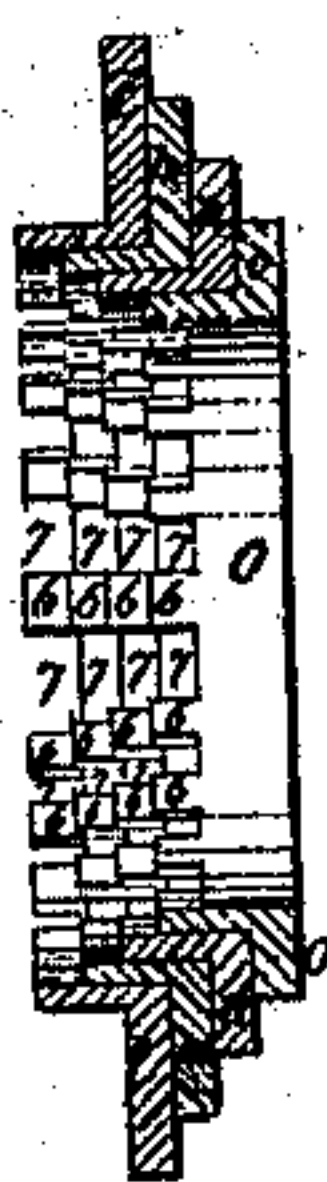
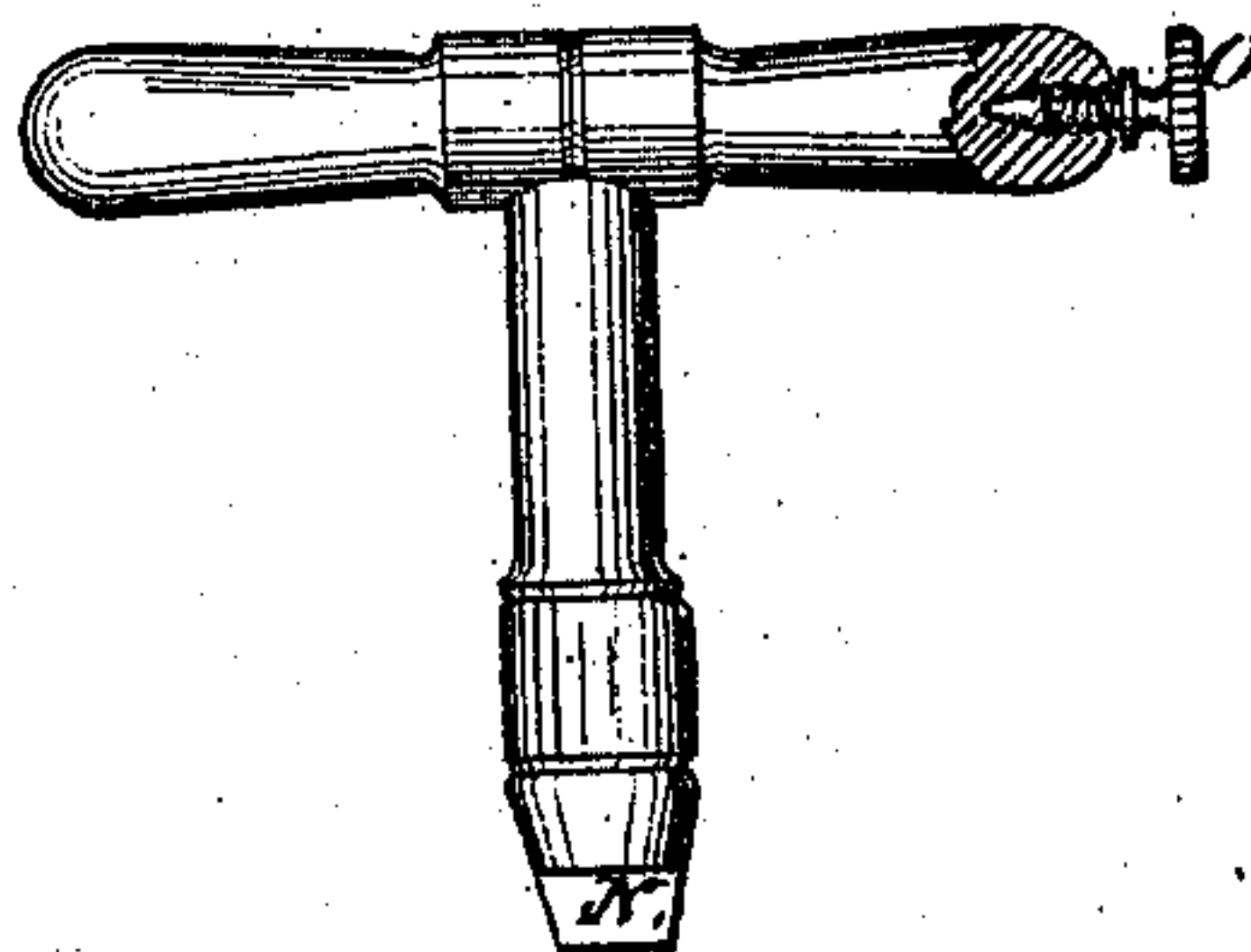


Fig. 11.



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# United States Patent Office.

WILLIAM N. HALL, OF SPRINGFIELD, TEXAS.

Letters Patent No. 107,775, dated September 27, 1870.

## IMPROVEMENT IN PERMUTATION-LOCKS.

The Schedule referred to in these Letters Patent and making part of the same.

*To all whom it may concern:*

Be it known that I, WILLIAM N. HALL, of Springfield, in the county of Limestone and State of Texas, have invented certain new and useful Improvements in Combination and Permutation-Locks; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawing of the same, which makes part of this specification, and in which—

Figure 1 represents an elevation of a portion of a door, showing the application thereto of a lock embracing my improvements, and the end of the spindle by which the bolts are actuated;

Figure 2 represents a horizontal section through a portion of a door, showing the lock, and the spindle for actuating the bolts, in elevation;

Figure 3 represents a vertical section through the lock, the locking bolt being in the position it occupies when the door-bolt is thrown and locked;

Figure 4 represents a similar section, showing the locking bolt partially withdrawn and the door-bolt unlocked;

Figure 5 represents a horizontal section of the lock, showing the locking bolt withdrawn;

Figure 6 represents a side elevation of the locking bolt;

Figure 7 represents a side view of the stationary slotted stem, separated from the operating parts;

Figure 8 represents an elevation of the inner notched sleeve and its combination and permutation-cap;

Figure 9 represents an elevation of the nest of the notched sleeves, detached from their stem or spindle;

Figure 10 represents a section of the combination and permutation-rings put together; and

Figure 11 represents a view of the handle or wrench by which the spindle is rotated to throw or withdraw the bolts.

In the accompanying drawing—

A designates a portion of the door of a safe or vault, to show the application of my improved lock and bolt or bolts thereto.

The lock consists of a stem, B, secured within a horizontal opening made in the door, and is of a length sufficient to project beyond the inner and outer sides thereof.

It is clamped by means of caps C and D, screwed upon its ends—the outer one, C, against the combination and permutation-rings, and the inner one, D, against a lock-nut, E, the purpose of which will be hereafter described.

This stem B is provided with a longitudinal groove or slot, F, open at its front end and closed at its inner

end, to limit the inward movement of the stem-bolt, and is of a depth equal to about two-thirds its diameter, for the purpose of receiving a bolt, G, equal in width, length, and the greatest depth of the slot.

The stem B is also provided with a transverse slot, H, which intersects the longitudinal slot F near its inner end, through which the door-bolt I passes, in order that it may be locked to the stem by the bolt G whenever a notch or slot, J, in the door-bolt I is brought in the line of the slot F and said bolt G, as will be more fully described hereafter.

The outer portion of this stem B is of a greater diameter than its inner part, and receives a series of inclosing notched sleeves, which, in the example represented, consists of four cylindrical changeable sleeves, a, b, c, and d, which fit, the one within the other, in the manner of a telescope, so that their inner ends will extend the one beyond the other, and leave annular spaces or grooves, e, between each contiguous end, except the inner one, which fits against a shoulder, i, on the stem B; while their front ends will project step-like in front of each other, the inner one having the greatest projection.

The annular spaces or grooves e are formed by means of annular shoulders, 2, on the interior and near the inner end of each sleeve, against which each sleeve abuts, except the inner one, and an annular rim, 3, on each end of the series of sleeves, as shown in figs. 3, 4, 5, 8, and 9, of the drawing.

The inner portion of the stem B is diminished in diameter, for the two-fold purpose of forming a shoulder, i, thereon, against which the inner annular rim 3 of the inner sleeve d fits, and to receive a screw-nut, K, by which to lock the series of sleeves against the shoulder i of the stem B, so as to prevent them from having any longitudinal movement, and thereby maintain their connection with the combination and permutation-rings.

The outer ends of the series of sleeves are notched, so as to form alternate projections or teeth, 4, and spaces, 5, of equal width and shape; and the combination and permutation-rings l, m, n, and o, are each provided with alternate projections or teeth, 6, and spaces, 7, which interlock with those of the series of sleeves. In order, therefore, that the combination-rings may match with their respective notched sleeves they are made so as to fit one within and upon the other, so that the projections or teeth of each will interlock with those of equal diameter, for the purpose of communicating the exact degree of movement of each combination and permutation-ring to its respective interlocking sleeve.

The combination and permutation-rings l, m, n, and o, occupy positions outside of and against the door, and as they are of unequal diameters, their projecting



teeth fit within each ring, while their outer rims overlap and are supported upon and against each other; and although they are separate and distinct from the series of sleeves, they are, nevertheless, the means by which the sleeves are operated to change the combination to lock and unlock the bolts.

The outer or smallest permutation and combination-ring, *o*, is fitted upon the stem *B* so as to be flush with the end thereof, as shown in figs. 3, 4, and 5.

This end has a projection, *L*, of less diameter than the stem, and is provided with a screw-thread, to receive the screw-cap *C*, which fits against the outer end of the stem and the outer *o* of the series of rings, and thus hold the latter in place upon the stem.

This screw-cap *C* is provided with an oblong opening, *f*, to receive the axial flat bolt *G* of the cylindrical stem; and when this bolt *G* is projected through the slot *J* of the door-bolt *I*, to lock the door, its outer end will be flush with the outer end of the screw-cap *C*, as shown in figs. 2, 3, 4, and 5.

The inner sleeve *d* is fitted upon the cylindrical stem *B*, so that it will easily turn thereon, and in like manner each sleeve is fitted upon the other, so as to be readily turned.

The toothed portions of the combination and permutation-rings are also fitted, so as to move freely, the one within the other, and their projecting circular rows of teeth are of diameters corresponding to the sleeves into the teeth of which they respectively interlock.

The sleeves being secured upon the stem, so that they cannot move thereon toward the front, are also prevented from moving inward upon the stem by means of the nut *K*, screwed upon said stem, so as to abut against the inner end of the outer sleeve *a*.

The inner end of each sleeve is provided with an annular rim, *3*, each having a notch, *g*, of a size just equal to the thickness of the locking bolt *G*, and the annular openings *h* in the ends of the sleeves, formed by the rims, are equal in diameter to that of the smallest end of the stem, so as to allow the sleeves to be fitted over and upon the stem, from the rear end thereof.

Now, it will be seen that, as the depth of the slot *F* in the greatest diameter of the stem *B*, is equal to the width of the locking bolt *G*, the latter must pass through the notches *g* in the rims *3* of the sleeves at the smallest diameter of the stem, and thus each sleeve is locked with the bolt.

The locking nut *K* is also notched, to allow the bolt to pass through it, and, in order that its notch *8* may always be presented exactly to the bolt, and to prevent it from changing its position, it is secured to the stem when properly adjusted against the sleeves, by a lock-screw, *j*, which serves to gauge such adjustment.

That part of the bolt *G* which projects beyond the smallest diameter of the stem, is provided with a series of notches, *9*, equal in width to the thickness of the annular rims *3*, and of equal number therewith, for the purpose of receiving said rims to lock each with the bolt, as it is obvious that when the rims *3* of the sleeves are thus interlocked with the notches of the bolt, the latter cannot be withdrawn until all the notches *g* in the rims *3* are brought in line with the bolt *G*.

In order to prevent the stem from being turned with the door, I make its inner end square, and fit thereon a square lock-nut or collar, *E*, which is countersunk on the inner side of the door, and thus renders it impossible to turn the stem in either direction; and to prevent the stem from being drawn out of the door its inner end is provided with a screw-thread, to receive a nut, *D*, which, when screwed against the square collar *E*, renders it impossible to pull the stem from its socket in the door.

The square collar *E* and the screw-nut *D*, therefore, form a perfect security against either turning or withdrawing the lock, when properly secured in the door; while the stem is prevented from being driven inward through the door, by means of the nut *K* abutting against a shoulder in the door, and also by the door-bolt.

The construction and arrangement of the several parts of the lock having been described, it remains now to describe and illustrate the method of locking and unlocking the bolt or bolts.

The combination and permutation-rings being fitted within each other, so that their outer faces overlap and leave a portion of each exposed, for the purpose of having cut thereon the letters of the alphabet and figures, as shown in fig. 1, the whole number of letters and figures of each ring being always equal to and corresponding with the whole number and position of the teeth and notches of each sleeve, and as these may be increased or diminished in number, according to the diameter of the sleeves or the size of the teeth, notches, and letters, and as the sleeves and combination-rings may also be of a greater or less number, it is obvious that the number of changes of which they are capable may be extended indefinitely, and become almost endless.

The letters and figures of each combination-ring or plate must be in exact line with the teeth and notches of their respective rings, and the center of the teeth or notches (either) of the sleeves must be exactly in the center of the notches *g* in the sleeves, in order to produce the exact movement to bring the locking notches *g* in line with the bolt, according to the combination of letters, figures, or both combined, upon which the bolt is locked.

The letters and figures of each combination-ring are equally divided into positives and negatives alternately, so that one half (those of the positive) of the letters and figures only of each ring act in unison with the sleeves and their notches *g*, to lock and unlock the bolt, while the other half are so many blanks or blinds to any person attempting to open the lock without the proper combination, as they cannot bring the notches *g* of the sleeve at no time in line with the bolt *G*.

In the example represented in the drawing, the affirmative letters commence with *A* on the inner and third rings, and with *B* on the second and fourth rings; hence, the letters *B* on these rings are negatives or blinds, and also the letter *A* on the second and fourth rings, (the outer ring being the fourth of the series,) while the figures 2 on the first-named two rings represent the positives, and the figures 3 the negatives or blinds on the second and fourth rings, and in this manner they alternate with each other throughout the letters and figures of each ring.

The bolts are locked and unlocked on any of the four positive letters or figures, separately or combined, or upon any word which any four of the positive letters will spell; for example, it may be locked and unlocked upon the letters: *A*, of the inner ring; *B*, of the second ring; *A*, of the third ring; and *B*, of the fourth or outer ring; or with figures 2 on the inner; 3, on the second; 2, on the third; and 3, on the fourth or outer ring; or with letters and figures combined, such as 2, on the inner; *B*, on the second; *A*, on the third; and 3, on the outer or fourth ring, when such examples are set for that purpose.

In cutting the letters and figures upon each combination-ring, care must be taken to have each exactly in a line with the center of each tooth, or notch of each ring, and the center of the locking notch *g* at the rear end of each sleeve; and the positive letters and figures are ascertained by this arrangement.

The lock, therefore, only locks and unlocks on the positives, which bring the notches *g* of the sleeves all in a line with each other, when on the word to which



it is set; but, so long as one of the notches *g* of any one of the sleeves is out of such line, the lock cannot be opened, because they will be either on negatives, or not on the proper combination.

In order to change the combination, it is only necessary to unscrew the outer cap *C*, so as to allow the combination-ring or rings to be withdrawn sufficiently to permit the teeth *6* thereof to be separated from and to pass those, *4*, of the sleeve, so as to be turned the distance of one notch, or any number of notches, and be again interlocked, and the combination may be thus changed by shifting one ring only, or all may be changed in like manner.

When the desired changes of the combination-rings are made, the cap *C* is again screwed on, and the opening *f* therein brought opposite that of the stem *B*, and held in such position by a locking screw, *k*, passed through said cap into the end of the stem, and which may be easily taken out to unscrew the cap.

The door-bolt *I*, as has already been described, has a transverse slot, *J*, which, when brought opposite the slot *E* in the stem, allows the locking bolt *G* of said stem to be projected into the notch *J* of the door-bolt *I*, and thus lock the two bolts and the stem together, as shown in figs. 2 and 3 of the drawing.

The door-bolt or bolts are operated by a spindle, *M*, secured within the door parallel to the lock, and provided near its inner end with cogged teeth, *q*, into which the cogged teeth *r*, formed on the inner ends of the door-bolts *I I'* match, so that the turning of the spindle *M* will throw or withdraw the bolt or bolts, which, being arranged on opposite sides of the spindle, admits of their parallel movement.

The throw of the bolt is limited by the recess in the door or jamb, against which the end of the bolt abuts, in order to bring its locking slot *J* always opposite that in the stem; or this may be accomplished by pressing the locking bolt *G* in when throwing the door-bolts.

The inner ends of the bolts are guided between shoulders *s* on the spindle, which serve also as a lock to the spindle, to prevent it from being drawn out of its bearings, or driven inside of the door.

The front end of this spindle also has a shoulder on it to prevent it from being drawn out, and its end is flush with the face of the door. It is also notched, to receive a wrench or key, *N*, by which to turn it, to operate the bolt or bolts; or it may be provided with a knob or handle of any description.

Two, four, or more bolts may be arranged so as to be operated by one and the same spindle, and two or more door-bolts may be arranged so as to be locked with the locking bolt of the grooved stem.

By this arrangement of a toothed operating spindle, *M*, the bolts may be placed at any suitable angle without interfering with the operation of the lock.

A small milled head-screw, *O*, is screwed into the outer end of the locking bolt *G*, when it is desired to

draw it out of the range of the door-bolt *I*, when unlocked.

For convenience, this screw *O* is kept with the wrench *N*, being screwed in one end of its handle, as shown in fig. 11, and may be carried in the pocket, or kept in any convenient place for use.

The end of the door-bolt or bolts *I I'*, may be provided with a vertical bar, so as to form a *T*, to fit into recesses both in the door and jamb, so as to perfectly close the joint of the door by halving the bar within the door and jamb, and in this way the joint may be protected from the entrance of either tool or powder by the bolt itself.

Every part of the lock may be put on and taken from the door with great facility, and all the parts separated and put together at once, without the slightest injury to the door or lock; for, when the door is unlocked, the removal of the inner screw-nut will allow the stem *B* and all its parts to be drawn out.

The lock can be used for a trunk, in which case the locking bolt *G* must have a horizontal slot, to receive arms made with the hasp, to interlock with said slot.

Instead of the negatives or blinds being indicated by letters and figures, they may be indicated by spaces only.

Having described my invention,  
I claim—

1. The axial locking bolt, *G*, arranged within the fixed stem *B*, so as to be withdrawn partially or entirely therefrom, through the screw-cap *O*, when released from the sleeves to unlock the door-bolts, substantially as described.

2. The fixed stem *B*, secured within the door, so as to prevent it from turning therein, by means of the angular collar *E*, secured upon the inner angular end of the stem *B*, and within a recess in the door, by means of the nut *D*, substantially as herein described.

3. The operating cogged spindle *M*, constructed with shoulders *s s*, in such manner as to embrace the cogged ends of the door-bolts *I I'*, and thus prevent said spindle from being forced either in or out of the door, and also to form guides to said bolts, as herein described.

4. In a permutation-lock, the combination and arrangement of the fixed stem *B*, the axial bolt *G*, the notched and toothed sleeves *a b c d*, the toothed permutation-rings *l m n o*, having positive and negative letters and figures arranged in divisions, the screw-caps *C D* and collar *E*, the transverse slot *H*, with the door-bolts *I I'*, having a slot, *J*, and the cogged spindle *M*, by which the door-bolts are operated, the several parts being constructed, arranged, and operating substantially as herein described.

In testimony whereof I have hereunto set my hand.  
WM. N. HALL.

Witnesses:

T. H. UPPERMAN,  
A. E. H. JOHNSON.