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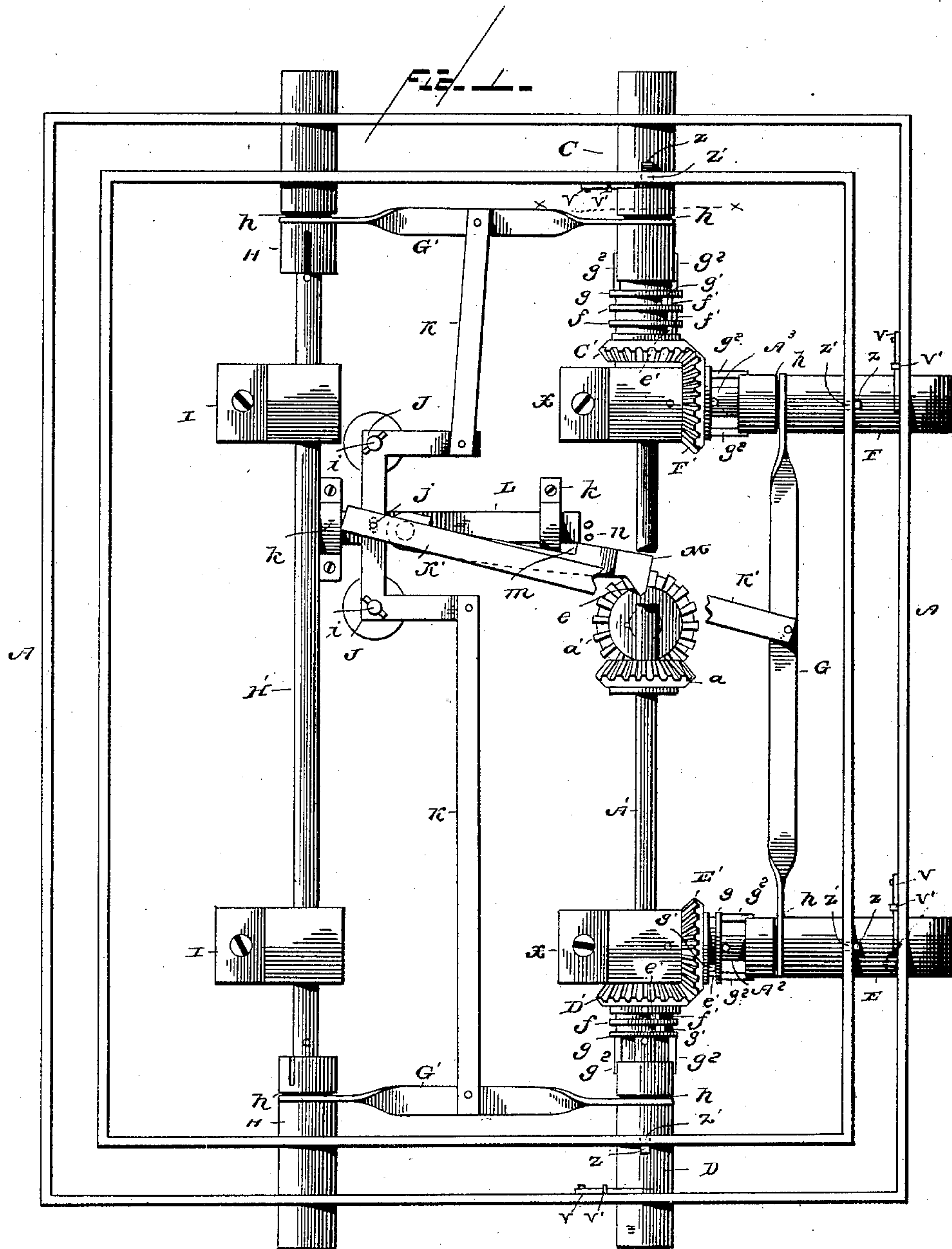
2 Sheets—Sheet 1.

H. W. TROGNITZ.

COMBINATION LOCK.

No. 353,238.

Patented Nov. 23, 1886.



Witnesses  
Thomas A. Clark  
John C. Schroeder

Inventor  
Herman W. Trognitz  
By his Attorney Geo W. Dyer.

(Model.)

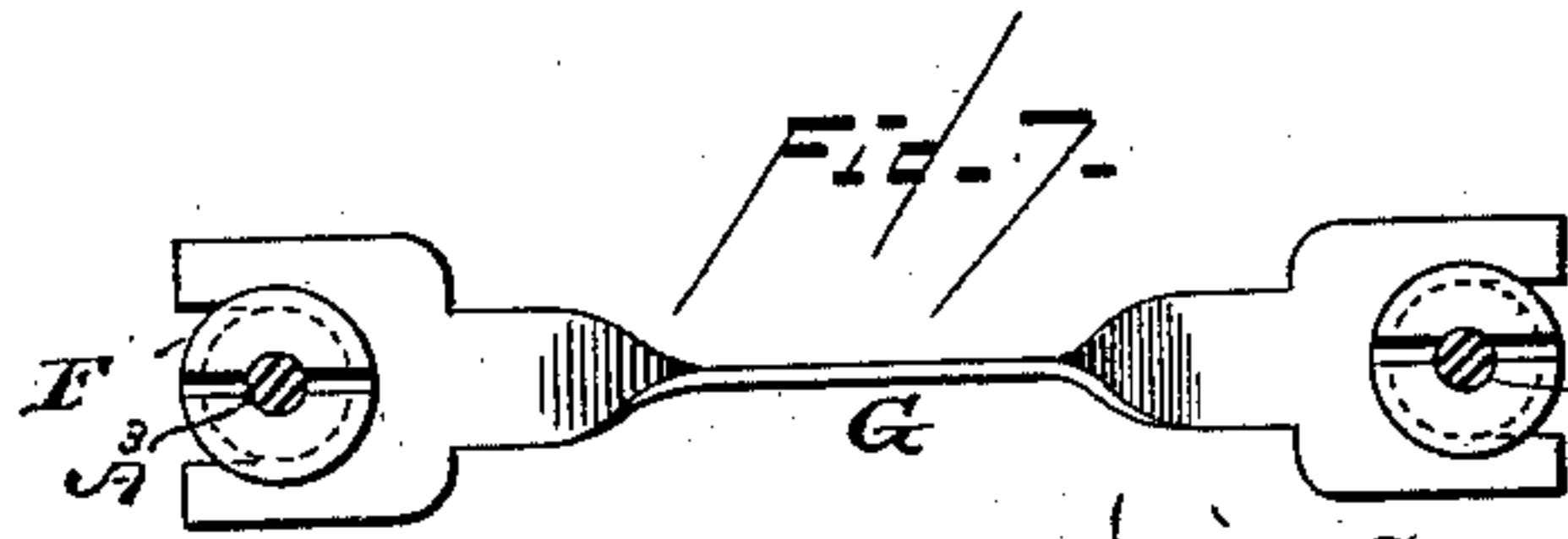
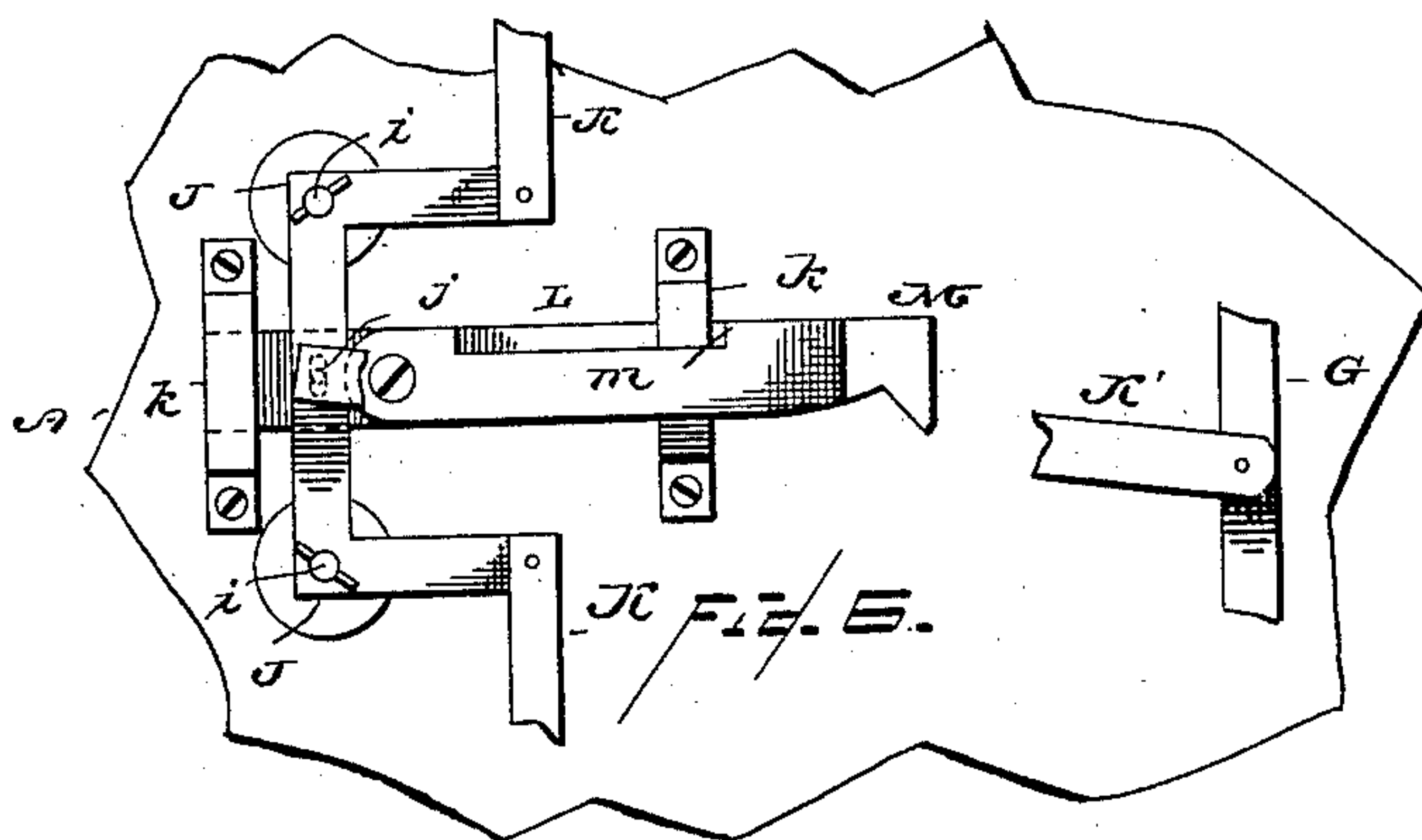
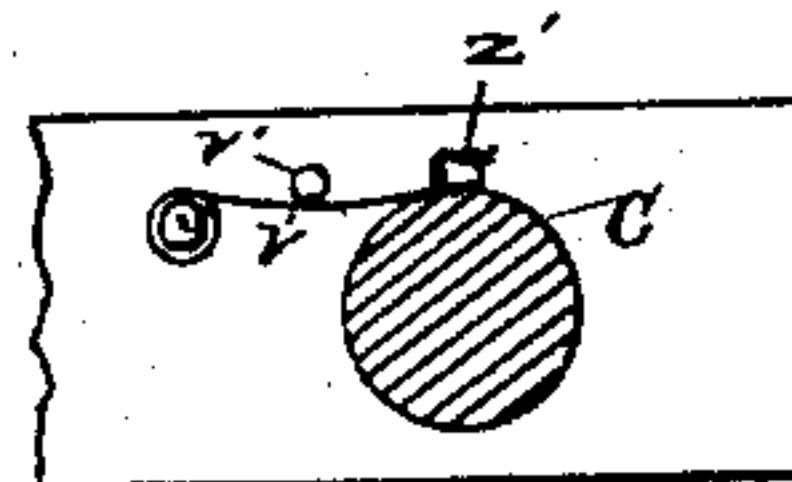
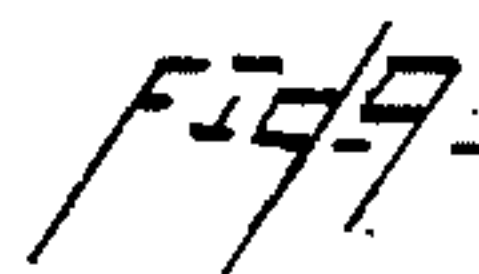
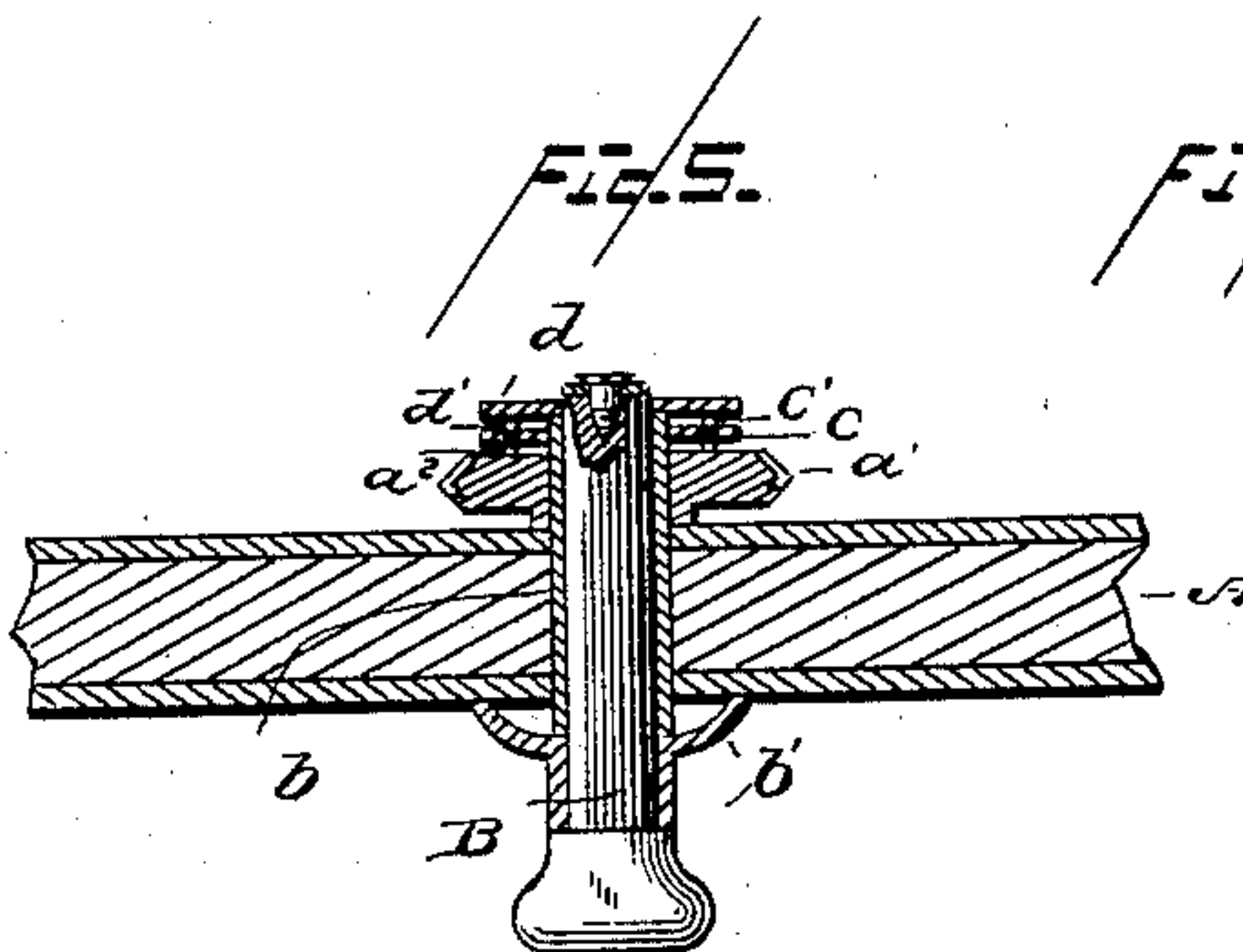
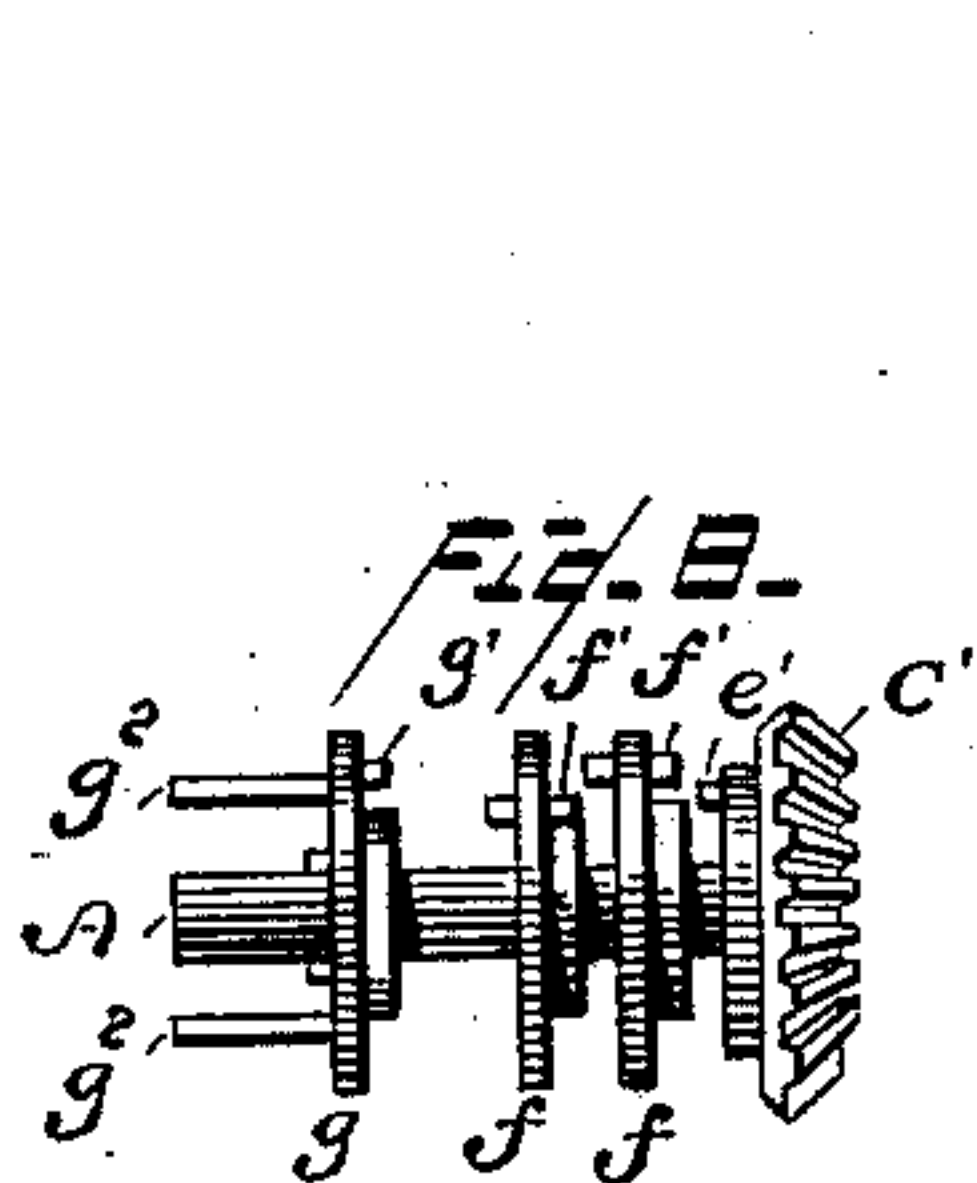
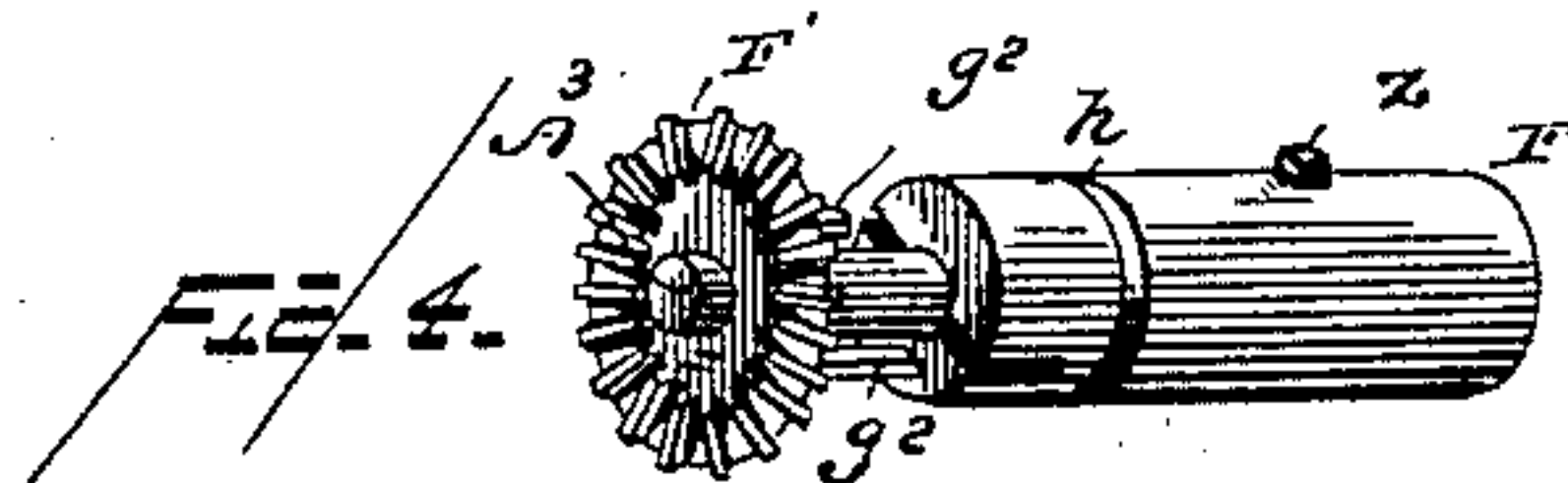
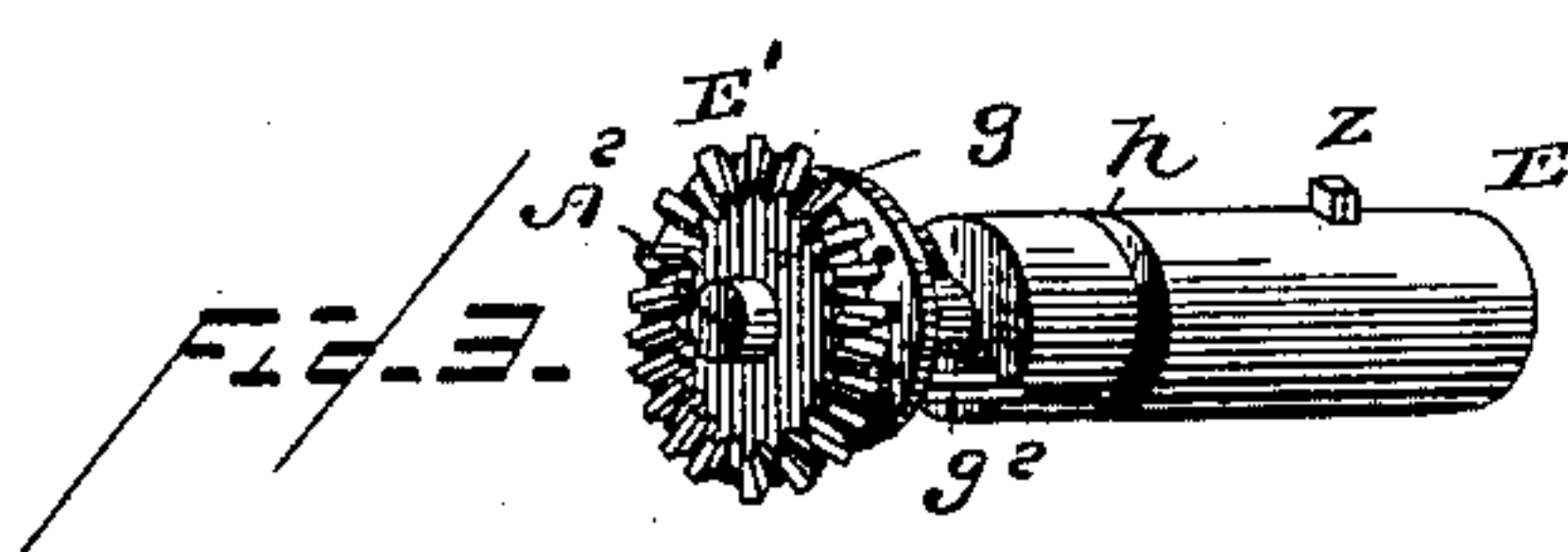
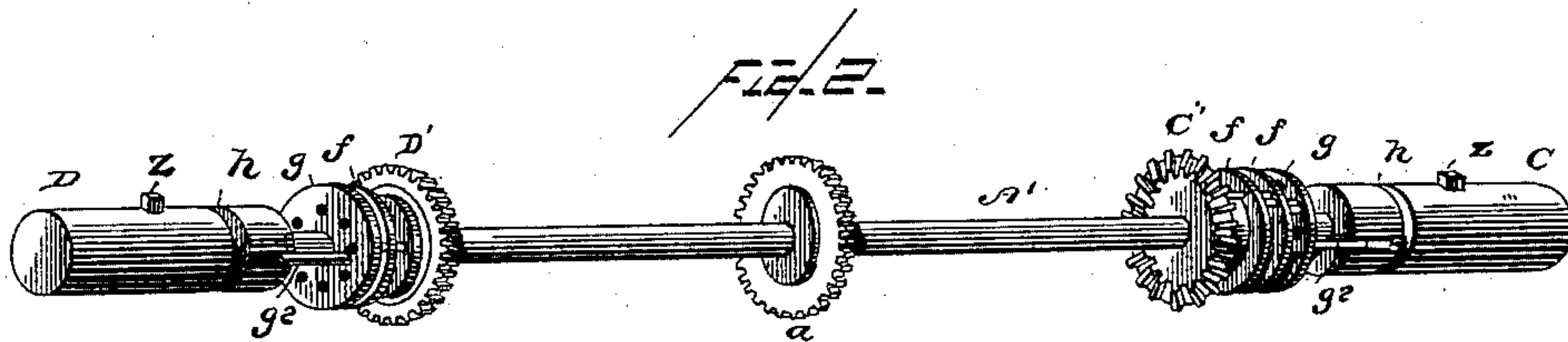
2 Sheets—Sheet 2.

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Witnesses  
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By his Attorney

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# UNITED STATES PATENT OFFICE.

HERMAN W. TROGNITZ, OF WILLIAMSPORT, PENNSYLVANIA.

## COMBINATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 353,238, dated November 23, 1886.

Application filed April 15, 1886. Serial No. 198,954. (Model.)

*To all whom it may concern:*

Be it known that I, HERMAN W. TROGNITZ, a citizen of the United States, residing at Williamsport, in the county of Lycoming and State of Pennsylvania, have invented certain new and useful Improvements in Combination-Locks; and I do hereby 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.

My invention relates to an improvement in combination-locks for safe-doors; and the object I have in view is to render it impossible for the bolts to be drawn by any one unacquainted with the combination, or by destroying any part comprising the combination; and the invention therein consists, mainly, in a series of locking-bolts, each requiring individual adjustment before it is in a position to be drawn, and all adapted to be drawn simultaneously; and it further consists in the means through which the bolts are so adjusted and drawn, and in the details of construction and arrangement of the component parts of the lock, all as will be more fully hereinafter described and claimed.

For the better understanding of the construction and operation of my lock in detail, attention is invited to the accompanying drawings, in which—

Figure 1 represents a plan view of the lock as applied to the inside of a safe-door and having the bolts in position to be drawn; Fig. 2, a detail in perspective of the main shaft, the upper and lower vertical bolts on its ends, and intermediate attachments; Fig. 3, a similar detail of the lower horizontal bolt, its shaft, and the several attachments to the same; Fig. 4, a similar detail of the upper horizontal side bolt, its shaft, and the beveled gear upon the same; Fig. 5, a longitudinal section of the spindle or arbor which passes through the door and its attachments; Fig. 6, a detail in plan of the mechanism for operating the bolts back or forth; Fig. 7, an end view of a pair of bolts and the yoke for coupling the same together; Fig. 8, a detail of the upper end of the main shaft and its gear and tumblers; and Fig. 9 is a transverse section of one of the locking-bolts on the line  $xx$  of Fig. 1, looking toward the top of the door.

Like letters of reference denote corresponding parts in the several views.

A denotes the safe door, having double walls filled in between with any suitable fire-proof material, and provided each with suitable openings to receive and guide the locking-bolts, presently to be described.

A' is the main shaft, running parallel with the length of the door, and having loose bearings in a pair of posts or brackets,  $xx$ , secured to the inside of the door, as shown in Fig. 1. This shaft carries at or near its center a fixed beveled gear,  $a$ , which meshes with a similar but loose gear,  $a'$ , upon the sleeve  $b$ , which surrounds the spindle or arbor B, that passes through the door to the outside, where there is the usual indicating-dial,  $b'$ , marked with a circle of letters or numbers, as described. On the inner end of this sleeve  $b$  is a loosely-mounted annular perforated tumbler,  $c$ , having a pin,  $c'$ , adapted to engage with a pin,  $a^2$ , on the gear  $a'$ , and with a pin,  $d'$ , of an adjoining annular tumbler,  $d$ , fixed upon the inner end of the spindle or arbor B, which protrudes a little beyond the inner end of its sleeve  $b$ , as shown in Fig. 5. Both of these tumblers  $c$  and  $d$  have a notch,  $e$ , cut in their peripheries, which adapts them to receive and engage with a pawl or dog of the bolt-operating mechanism, to be hereinafter described.

In addition to the main shaft A', there are two other short shafts, A<sup>2</sup> and A<sup>3</sup>, the former being fixed in the lower post or bracket  $x$  and the latter in the upper post or bracket, both at right angles to the main shaft A'.

C is the upper vertical bolt, D the lower vertical bolt, E the lower horizontal side bolt, and F the upper horizontal side bolt, all of like construction, and all passing through the two walls of the safe-door, as shown in Fig. 1. Each bolt is made round, is bored out longitudinally at its inner end to fit loosely over its respective shaft, so as to have both longitudinal and rotary play thereon, and is provided on its exterior, between the two walls of the door, with a pin or stud,  $z$ , which is required to be opposite a slot,  $z'$ , cut in the inner wall of the door above each bolt, before the bolt can be drawn to unlock the door.

The upper vertical bolt, C, is fitted over the upper end of the main shaft A', and upon this shaft, next above the upper post or bracket



$x$  is secured a beveled gear,  $C'$ , having a pin or stud,  $e'$ , projecting from its hub, and next above this gear, between it and the bolt  $C$ , are three loose disks or tumblers,  $f f$  and  $g$ , having short hubs to hold them apart. The two disks or tumblers  $f f$  are alike in construction, each having a pin or stud,  $f'$ , passing through it and protruding on each side, while the top or outer disk or tumbler,  $g$ , is perforated with an annular series of holes corresponding in number to the letters or numbers on the indicating-dial  $b'$ , and lettered or numbered accordingly. With this disk or tumbler  $g$  is used a pin or stud,  $g'$ , to be inserted from the inside into any one of the perforations to effect the desired combination, and on the top or outside of this disk or tumbler  $g$  are provided two pins,  $g^2 g^2$ , which enter a slot cut in the inner end of the bolt  $C$ .

The lower vertical bolt,  $D$ , is fitted over the lower end of the main shaft  $A'$ , and upon this shaft, next below the lower post or bracket  $x$ , is secured a beveled gear,  $D'$ , having projecting from its hub a pin or stud,  $e'$ , and similar in all respects to the top gear,  $C'$ . Between this gear  $D'$  and the bolt  $D$  are two loose disks or tumblers,  $f$  and  $g$ , precisely like the corresponding parts described with relation to the upper vertical bolt,  $C$ , and having the same attachments and connecting in the same way with the bolt.

The lower horizontal side bolt,  $E$ , is fitted over the end of the lower fixed shaft,  $A^2$ , and upon this shaft, next to the post or bracket  $x$ , is mounted a beveled gear,  $E'$ , which meshes with the gear  $D'$ , and is in all respects like the same, except that it is loose and has the usual pin or stud,  $e'$ , projecting from its hub. Between this gear  $E'$  and the bolt  $E$  there is but one disk or tumbler,  $g$ , of the same construction and having the same attachments and connecting with its bolt in the same way as the corresponding part described with relation to the upper and lower vertical bolts.

The upper horizontal side bolt,  $F$ , is fitted over the end of the upper fixed shaft,  $A^3$ , and upon this shaft, next to the post or bracket, is a loosely-mounted beveled gear,  $F'$ , which meshes with the upper gear,  $C'$ , of the main shaft  $A'$ . This gear has no pin or stud  $e'$  projecting from its hub; nor are there any disks or tumblers mounted between it and the bolt  $F$ ; but said gear is provided with the two pins  $g^2 g^2$ , like and for a similar purpose as those used on the three perforated disks or tumblers  $g g g$  formerly described.

The two upper and lower side bolts,  $E$  and  $F$ , are coupled together by a yoke,  $G$ , having forked ends, which embrace the bolts within a groove,  $h$ , cut in the outside of each, and the upper and lower vertical bolts are coupled in a similar way and by similar yokes,  $G' G'$ , with a pair of dummy bolts,  $H H$ , mounted loosely upon the ends of a shaft,  $H'$ , running parallel with the shaft  $A'$ , and having fixed bearings in a pair of posts or brackets,  $J J$ , secured to

the inside of the door, and being preferably like those used in mounting the shaft  $A'$ .

$J J$  are two bell-cranks, which are pivoted at the corners by two pins,  $i i$ , which extend out from the inside of the door. The inner ends of these bell-cranks overlap each other, and are slotted to have free play around a pin,  $j$ , which passes through such slots, while the outer ends of said bell-cranks have pivoted connections with the yokes  $G' G'$  by means of two links,  $K K$ . Another link,  $K'$ , pivoted by means of the pin  $j$ , which connects the two inner ends of the bell-cranks  $J J$ , extends across over the main shaft  $A'$ , and is pivotally attached to the yoke  $G$ , which couples the side bolts,  $E$  and  $F$ . The pin  $j$ , which passes through the inner ends of the bell-cranks  $J J$  and the inner end of the link  $K'$ , is secured to a sliding bar,  $L$ , arranged on a line parallel with the side bolts within proper guides,  $k k$ , secured to the inside of the door, and this bar  $L$  carries a pivoted pawl or dog,  $M$ , (hereinbefore referred to,) the outer end of which is adapted to engage with the notches  $e e$  on the tumblers  $c$  and  $d$  of the spindle or arbor  $B$ .

The object of the yoke-and-link connections with the several bolts is to enable the latter to be drawn simultaneously after each has been adjusted to the required position, which adjustment is effected, in a general way, by turning the spindle or arbor  $B$  to the right and left in successive operations to the point at which the combination is set, which operations bring about an engagement of the pins or studs on the gears and tumblers and cause the several bolts to be brought successively into positions in which their studs  $z$  are opposite the slots  $z'$  in the inner wall of the door, and ready to be drawn.

The bolts are adjusted in the following order and in the following particular way. Supposing the door to be locked with the combination set as follows: the pins or studs  $g'$  and  $e'$  set, respectively, in holes 1, 5, 10, and 15 of the disks or tumblers  $g g g$  and  $c$  of the bolts  $C$ ,  $D$ , and  $E$  and spindle-sleeve  $b$ , respectively. Turning the spindle or arbor not less than six times around to the right and stopping at 1 on the indicating-dial will bring the stud  $z$  of the bolt  $C$  directly opposite its hole or slot  $z'$  in the inner wall of the door. Turning the same to the left not less than five times and stopping at 5 on the indicating-dial will bring the bolt  $D$  and its stud  $z$  into proper position. Turning the same to the right again not less than four times and stopping at 10 on the indicating-dial will bring the bolt  $E$  and its stud  $z$  into proper position, and turning the same to the left again not less than three times and stopping at 15 on the indicating-dial will bring the last bolt,  $F$ , and its stud  $z$  into proper position, and then all the bolts are in proper position to be drawn. By then turning the spindle or arbor twice to the right and stopping at 15 on the indicating-dial, the notch  $e$  in its tumbler  $c$  is brought



into engagement with the dog or pawl M, and then by turning the spindle once to the left and stopping at the same number the notch *e* in its tumbler *d* is also brought into engagement with the pawl or dog M, and by turning the spindle to the right again all the bolts are simultaneously drawn, and the door is unlocked and ready to be opened.

The drawing of the bolts brings their studs *z* within the confines of the slots *z'*, so that the bolts cannot turn or be turned until they are thrown forward to lock the doors, when they can be then disarranged by simply turning the spindle or arbor either to the right or left. But to further secure the bolts against turning, so that they may not voluntarily change their positions, I prefer to employ in connection with each a leaf-spring, *v*, secured, preferably, to the inner wall of the door in a horizontal position, with its free end bearing upon the top of the bolt and held in contact therewith by a pin, *v'*, projecting from the wall out over said spring about midway between the point of contact, and where the spring is secured.

The pawl or dog M, through which the bolts are drawn and thrown, has a shoulder, *m*, on its upper edge, formed by cutting out a portion of the same, and as the bolts are thrown this shoulder *m* passes beyond a pin, *n*, secured to the inside of the door, and thus affords sufficient space between the pin and the pawl or dog M to allow the latter to rise and disengage itself from the notched tumblers *c* and *d* of the spindle or arbor B, at which time of action the shoulder *m* catches behind the pin *n*. To more fully explain: If it were not for the recess or cut-out on the upper edge of the pawl or dog M, when the time comes for said pawl or dog to rise and disengage itself from the notched tumblers *c* and *d*, (in rising,) its upper edge would come into contact with the pin *n* before the hooked end of the pawl or dog could free itself from said tumblers; but as it is this action takes place before the base of the recess or cut-out comes into contact with the pin *n*, because at this point the upper edge of the pawl or dog M is lowered sufficiently. The operation of the spindle or arbor B is about the same in all combinations.

It will be understood that my improved lock is not confined to a door with double walls, as described and shown, but can be used as well on other doors by employing an inside bracket, post, or plate for each bolt, with the proper bolt-holes, and with a slot, *z'*, for receiving the stud *z*, and in fact such a substitute is preferable, because it is cheaper and easier to make than a double wall; and the claims in this particular should be construed in such broad sense.

While I have used two dummy bolts, the same can be dispensed with; or many more could be employed between the bolts by simply connecting them in an appropriate way with the coupling-yokes.

I might state, further, that although I have shown and described four active bolts, which number gives the best security, slight changes in arrangement without the exercise of invention would enable me to reduce the number to three, two, or even one, commencing with the bolt using the largest number of disks or tumblers, and hence I do not wish to be confined to the use of four bolts.

The principal advantage of my lock, as before stated, is that each and every bolt must be properly adjusted before the safe-door can be opened, and can only be opened by one acquainted with the combination, and consequently such a lock affords unlimited security.

What I claim, and desire to secure by Letters Patent, is—

1. In a combination-lock, a series of locking-bolts adapted to successive individual adjustment by means of a single spindle or arbor, substantially as and for the purposes set forth.

2. In a combination-lock, a series of locking-bolts adapted to successive individual adjustment by a single spindle or arbor, and to be drawn or thrown simultaneously by means of said spindle or arbor, substantially as and for the purposes set forth.

3. In a combination-lock, a series of individually-adjustable locking-bolts, a pair of pivoted bell-cranks having intermediate connections with the bolts, a pivoted sliding pawl or dog, and a spindle or arbor with notched tumblers, all combined and arranged substantially as and for the purposes set forth.

4. In a combination-lock, a series of adjustable bolts, a pair of dummy bolts, a series of coupling-yokes for the bolts, a pair of pivoted bell-cranks having pivotal connections with the yokes, a sliding bar carrying a pivoted pawl or dog, and a spindle or arbor carrying a beveled gear and a pair of notched tumblers provided with engaging pins or studs, all combined and arranged substantially as and for the purposes set forth.

5. In a combination-lock, the combination of a series of adjustable sliding bolts, each provided with a stud on the outside thereof, and the inside wall of the door provided with a slot over each bolt, substantially as and for the purposes set forth.

6. In a combination-lock, the combination, with the spindle or arbor B and its attachments, of the shaft A<sup>3</sup>, its bolt F, and its beveled gear F', provided with two pins, *g*<sup>2</sup> *g*<sup>2</sup>, substantially as described.

7. In a combination-lock, the combination, with the spindle or arbor B and its attachments, of the shaft A<sup>3</sup>, its bolt F, and its gear F', the shaft A<sup>2</sup>, its bolt E, gear E', and the intermediate perforated disk, *g*, and gearing for turning said gears E' and F', substantially as described.

8. In a combination-lock, the combination, with the spindle or arbor B and its attachments, of the shafts A', A<sup>2</sup>, and A<sup>3</sup> and their



respective bolts, gears, and disks or tumblers provided with pins or studs, substantially as described, and for the purpose set forth.

9. In a combination-lock, the combination  
5 of a series of adjustable sliding bolts, each provided with a stud on the outside, a series of slots in the inside wall, one above each bolt, and a spring for each bolt, bearing upon the same so as to hold the studs opposite the slots,  
10 substantially as described.

10. In a combination-lock, the horizontal leaf-spring *v* and pins *v'*, in combination with the locking-bolts, substantially as and for the purposes set forth.

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

HERMAN W. TROGNITZ.

Witnesses:

JNO. C. SCHROEDER,  
GEO. H. COOPER, Jr.