

No. 619,940.

Patented Feb. 21, 1899.

H. L. CLARKE.
COMBINATION LOCK.

(Application filed Apr. 8, 1898.)

(No Model.)

3 Sheets—Sheet 1.

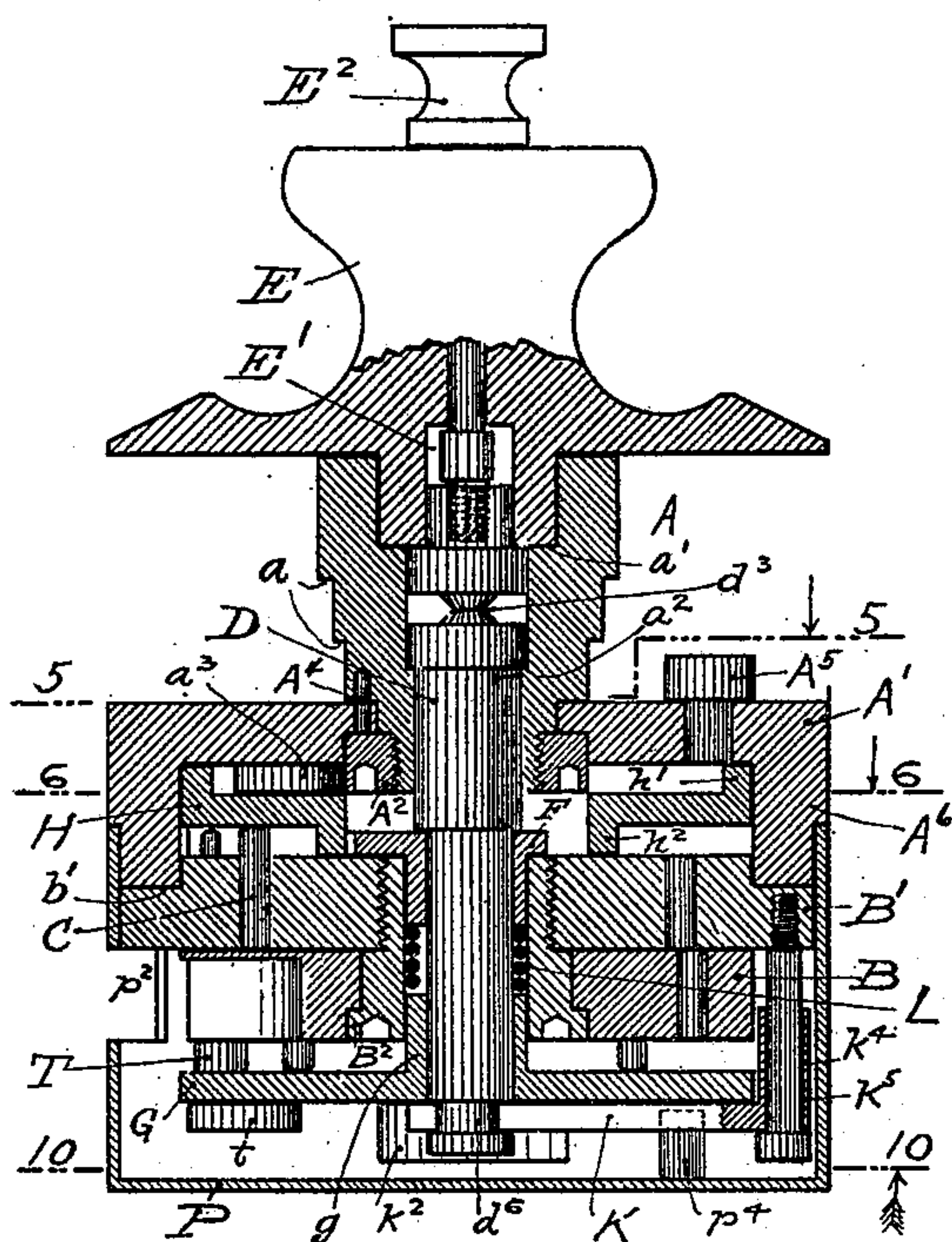


FIG. 1

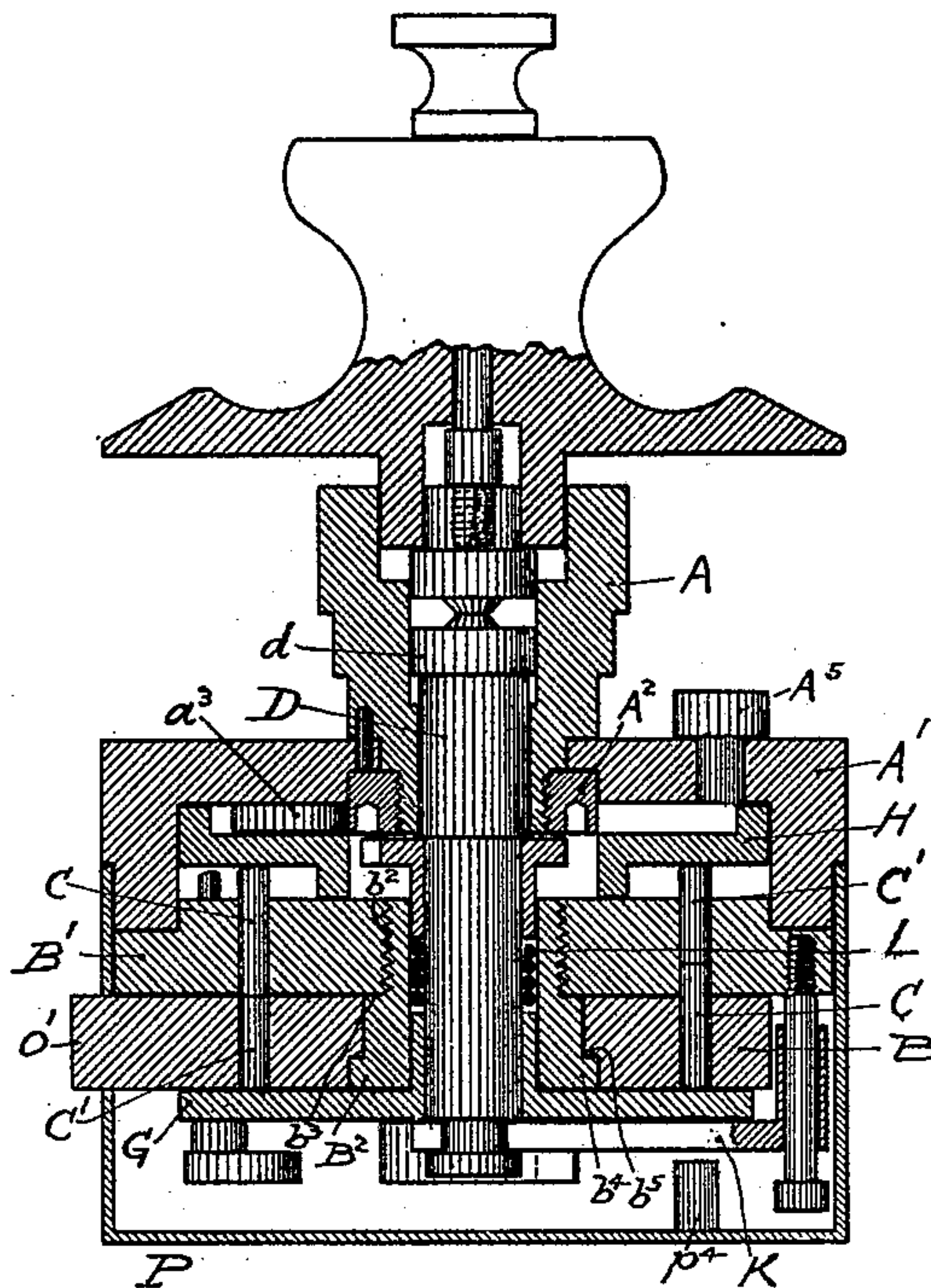


FIG. 2

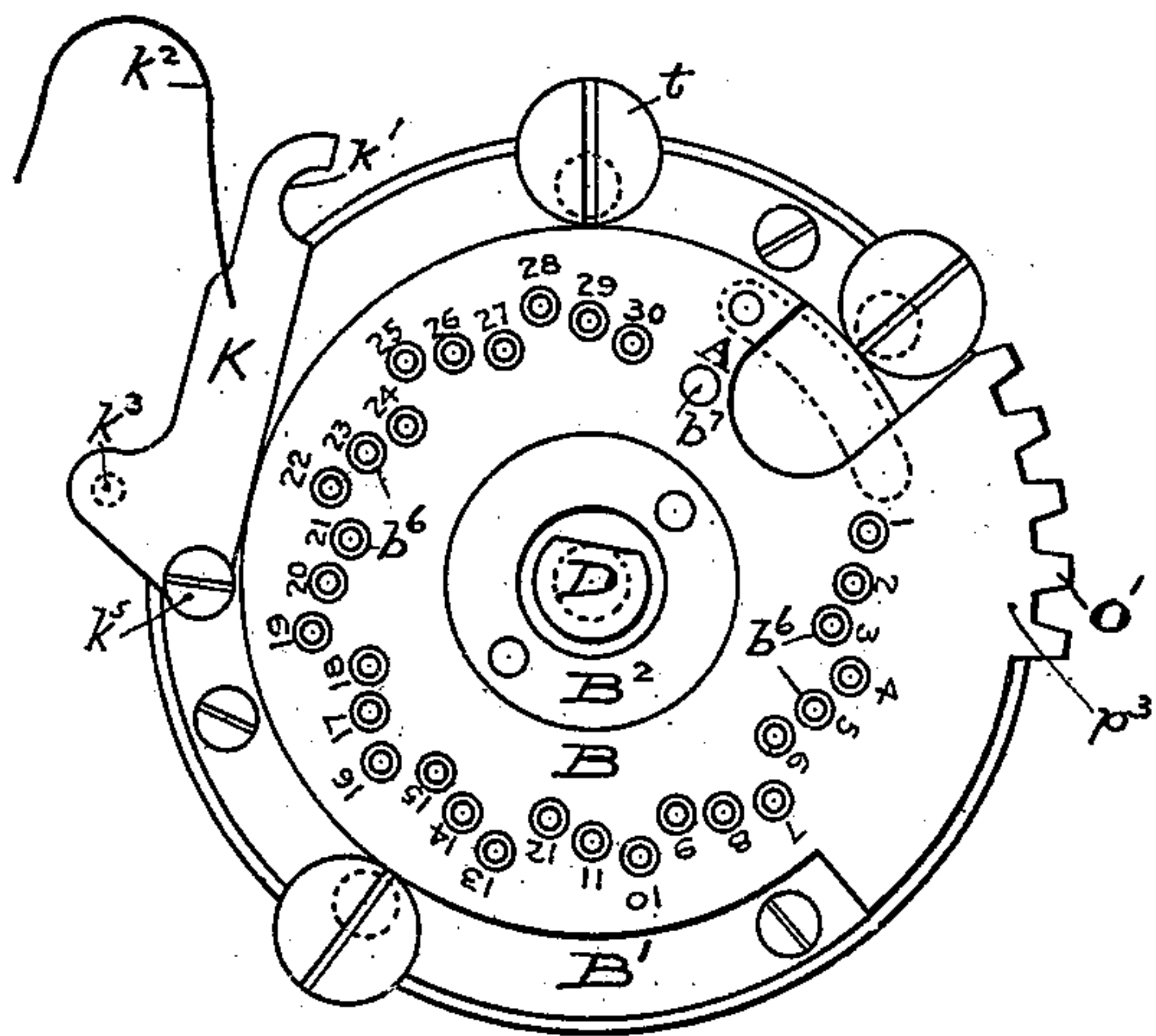


FIG. 12

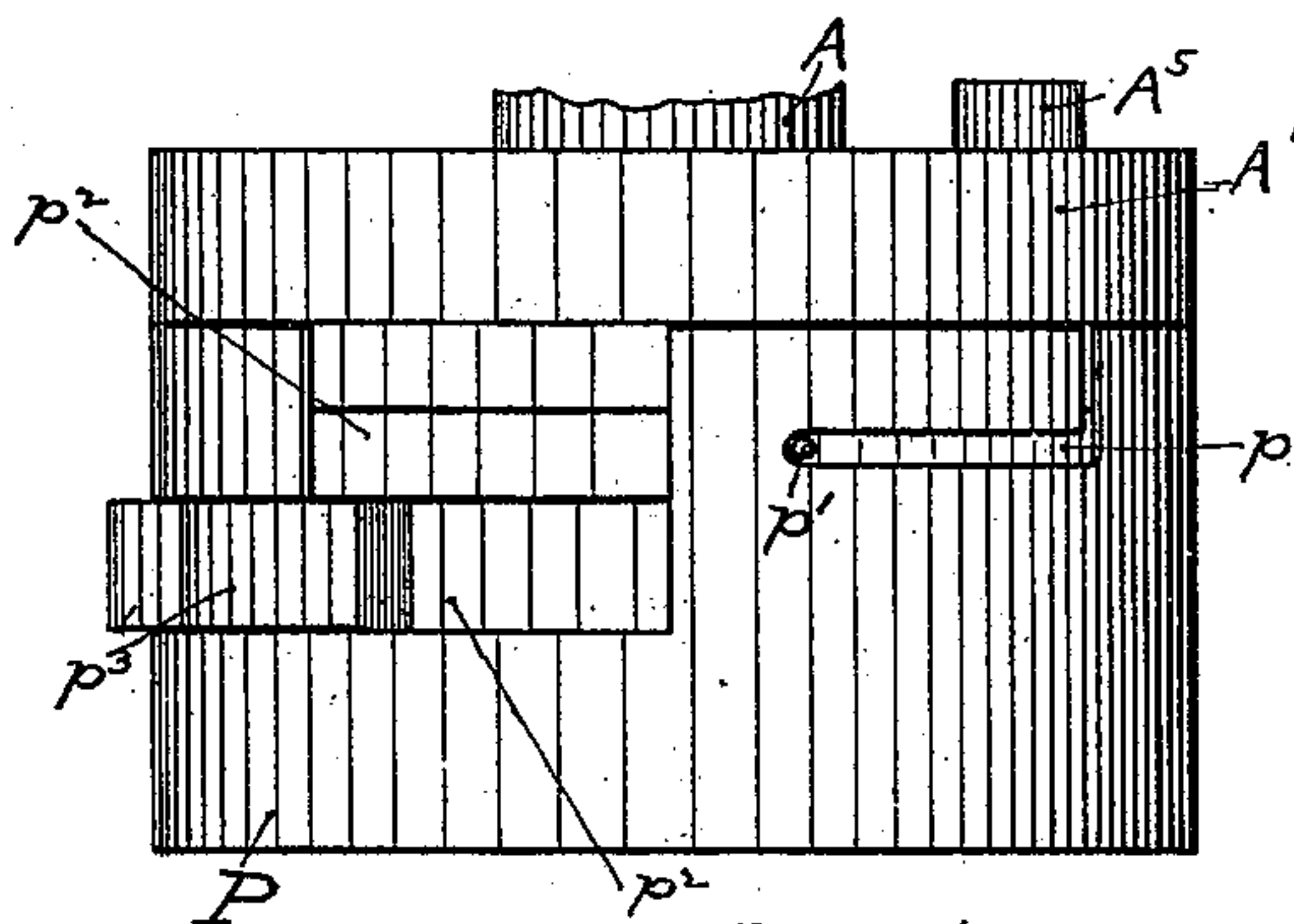


FIG. 13



FIG. 15

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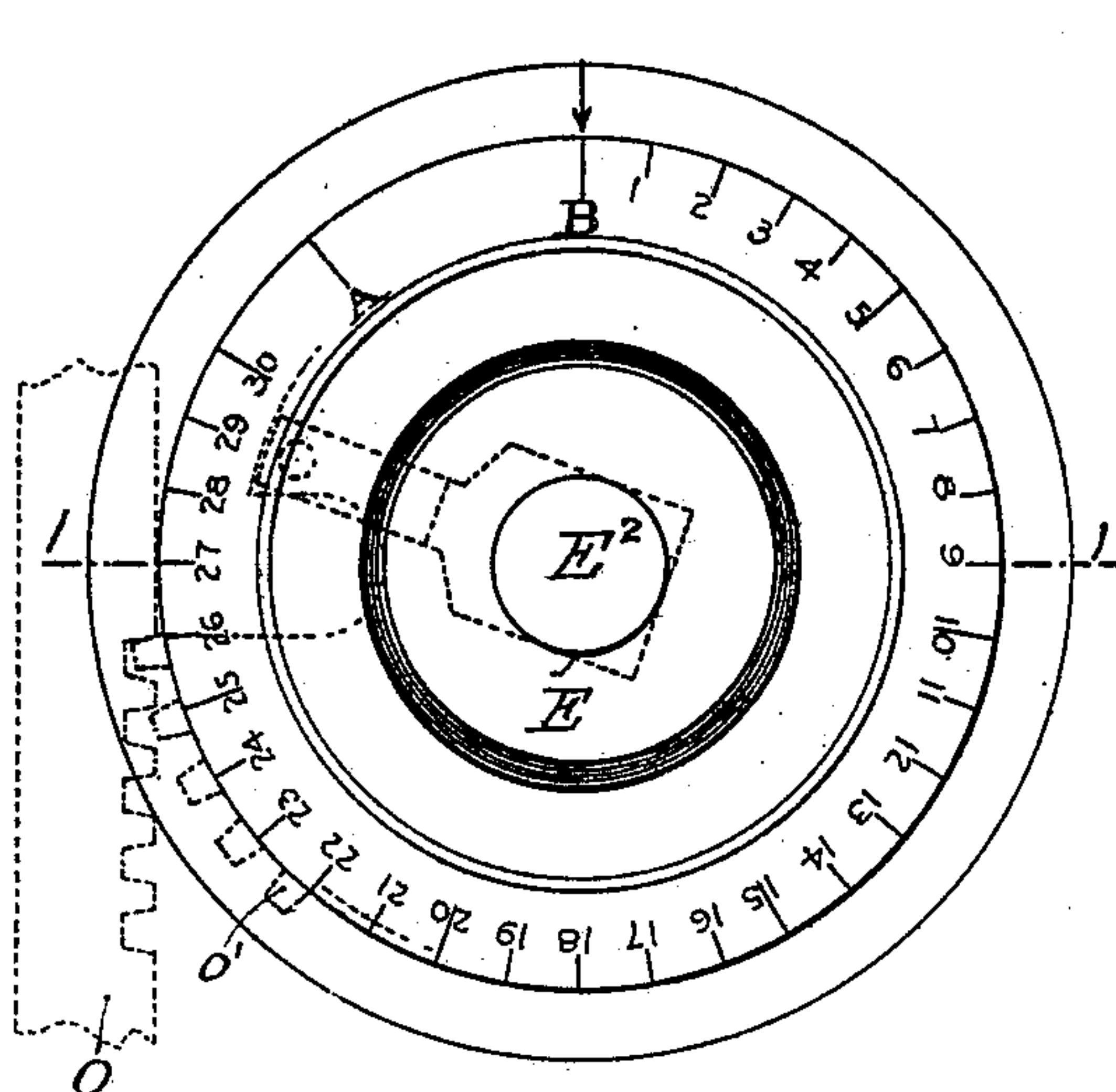


FIG. 3

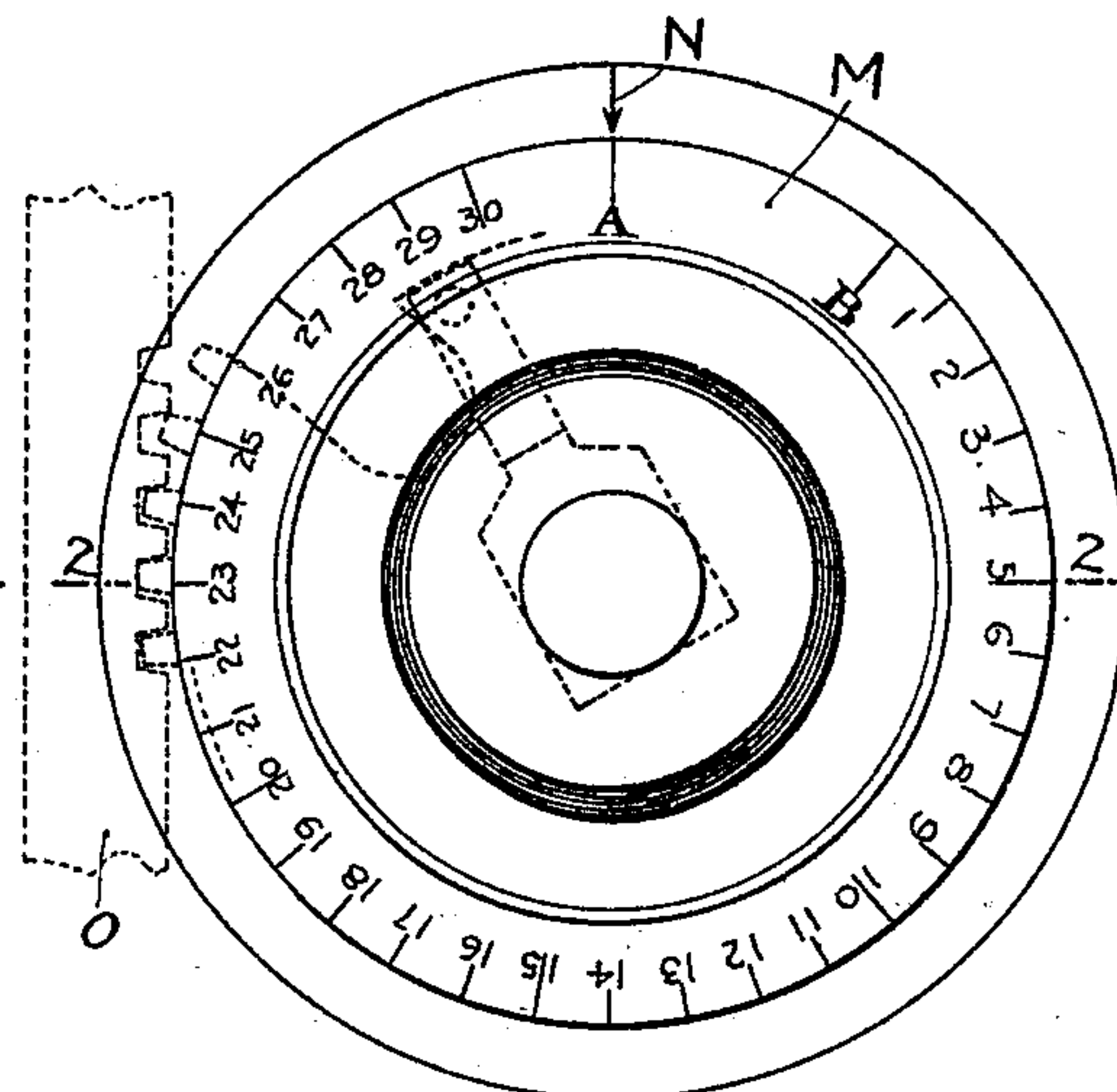


FIG. 4

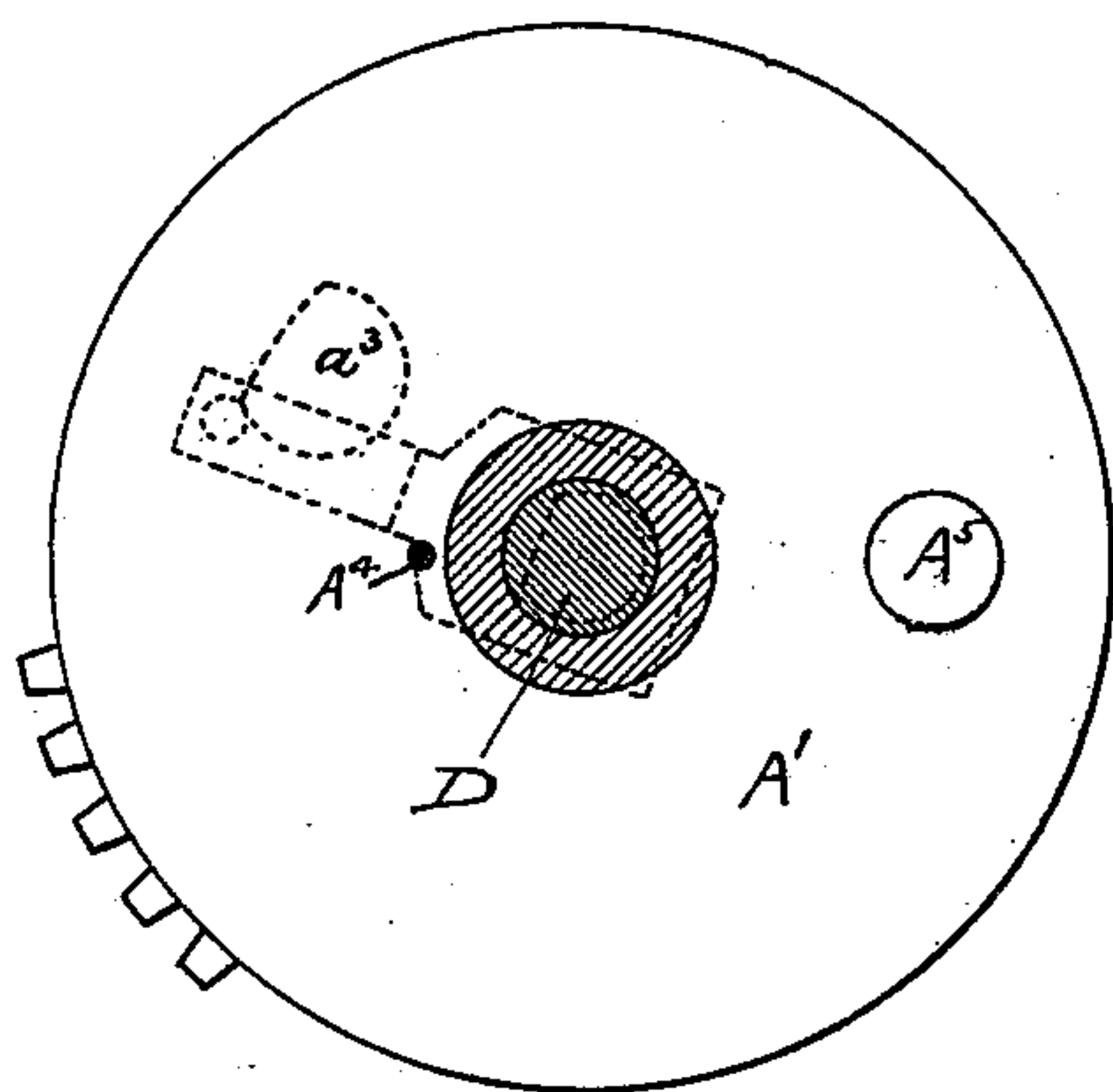


FIG. 5

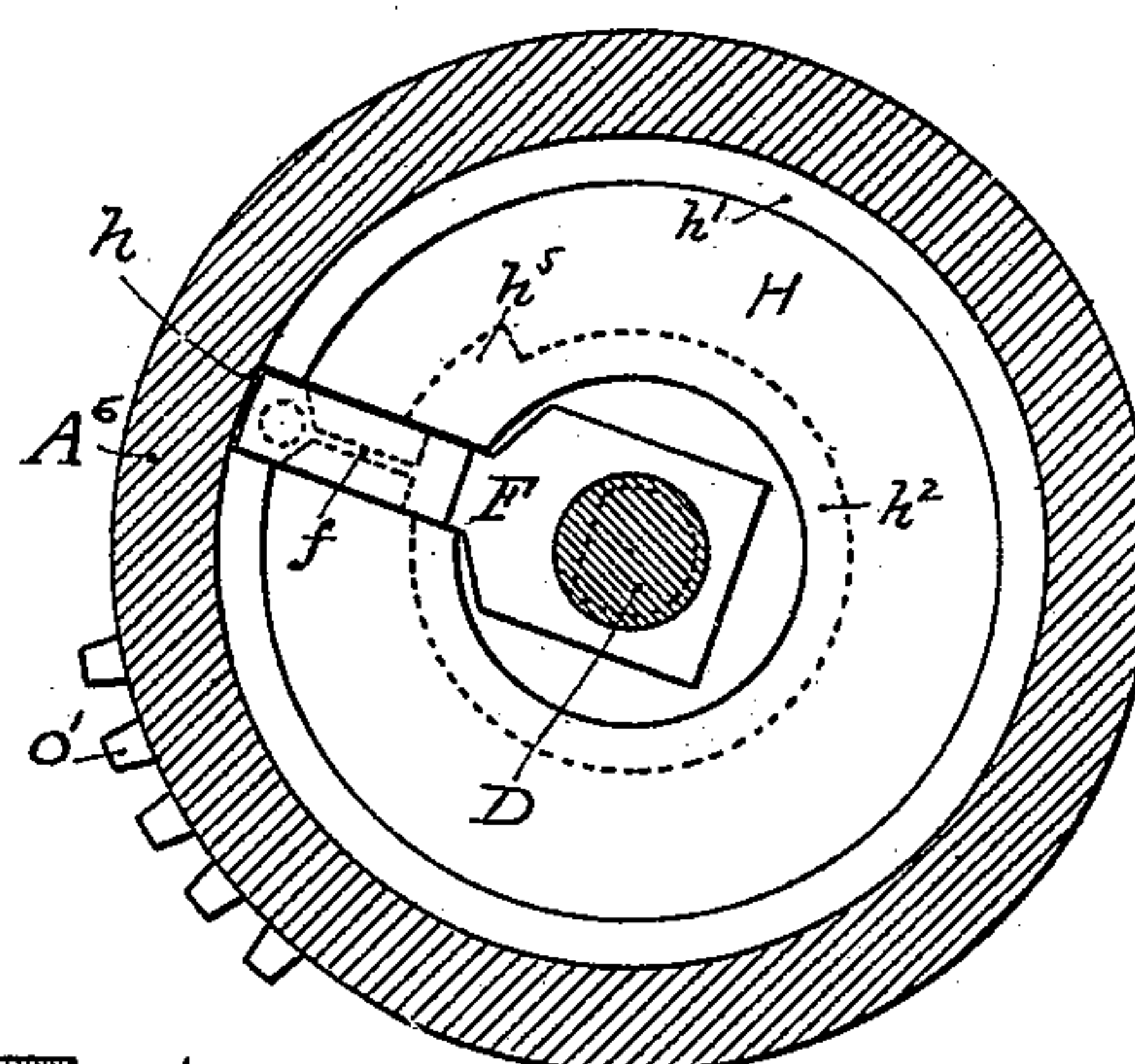


FIG. 6

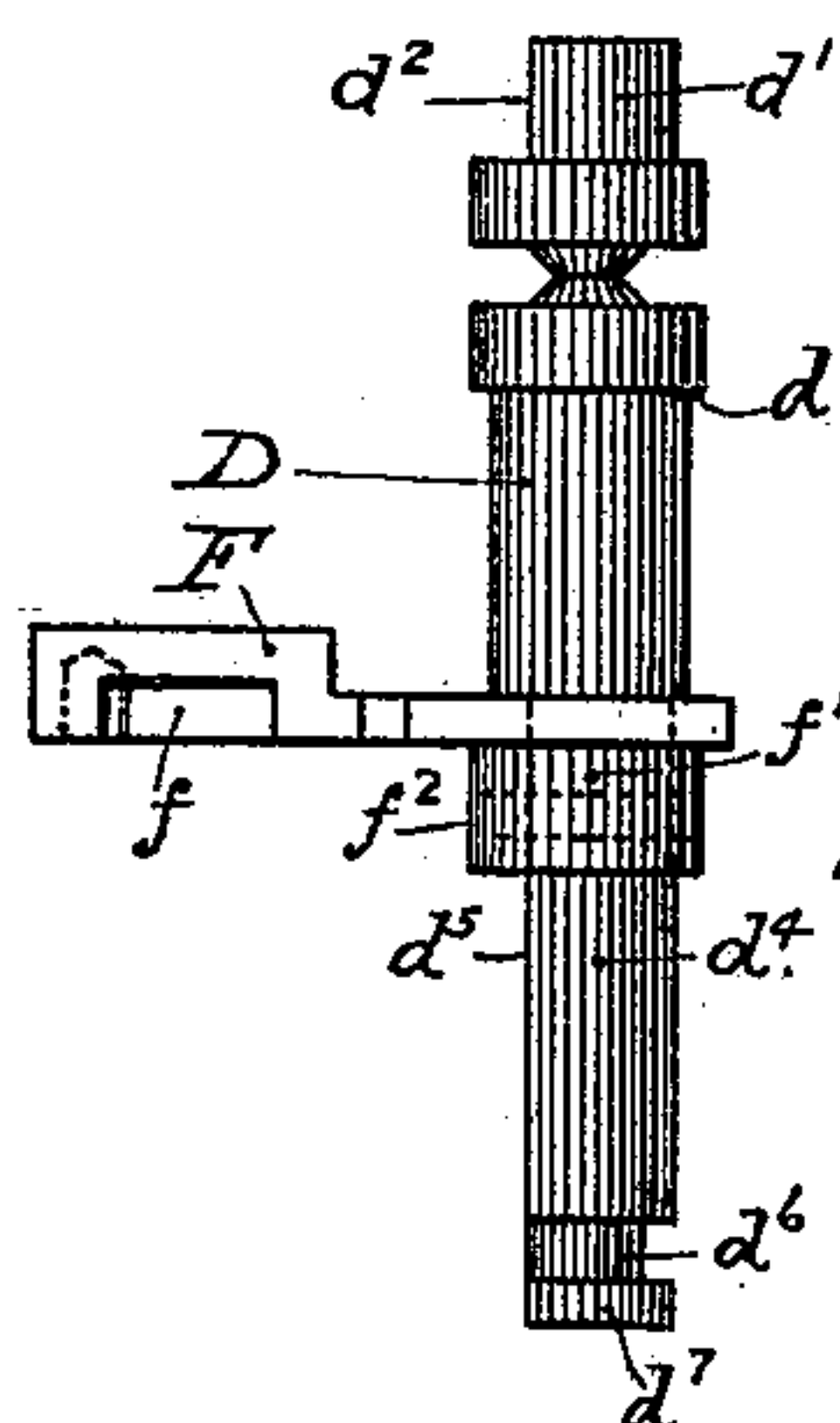


FIG. 14

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(Application filed Apr. 8, 1898.)

(No Model.)

3 Sheets—Sheet 3.

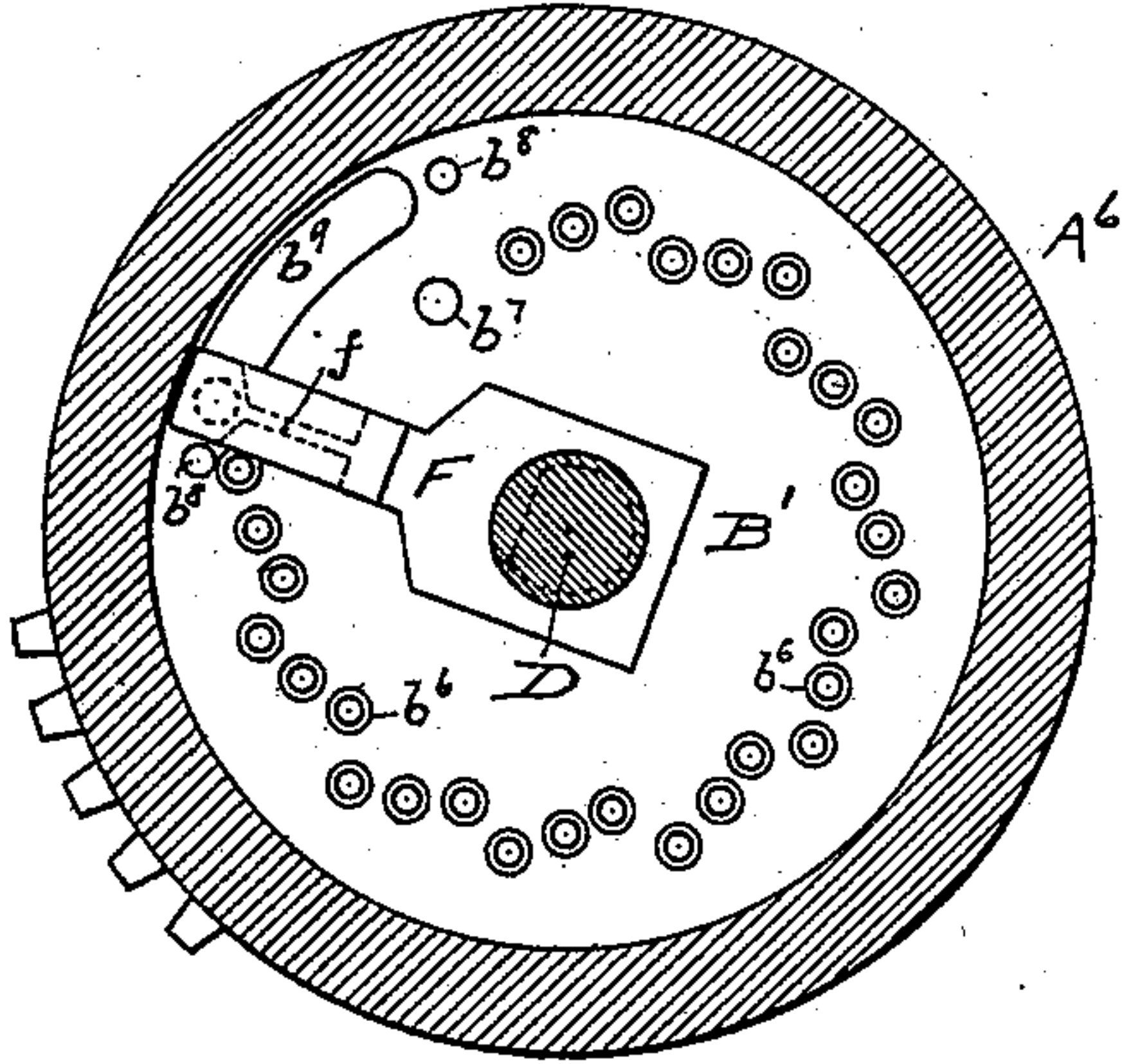


FIG. 7

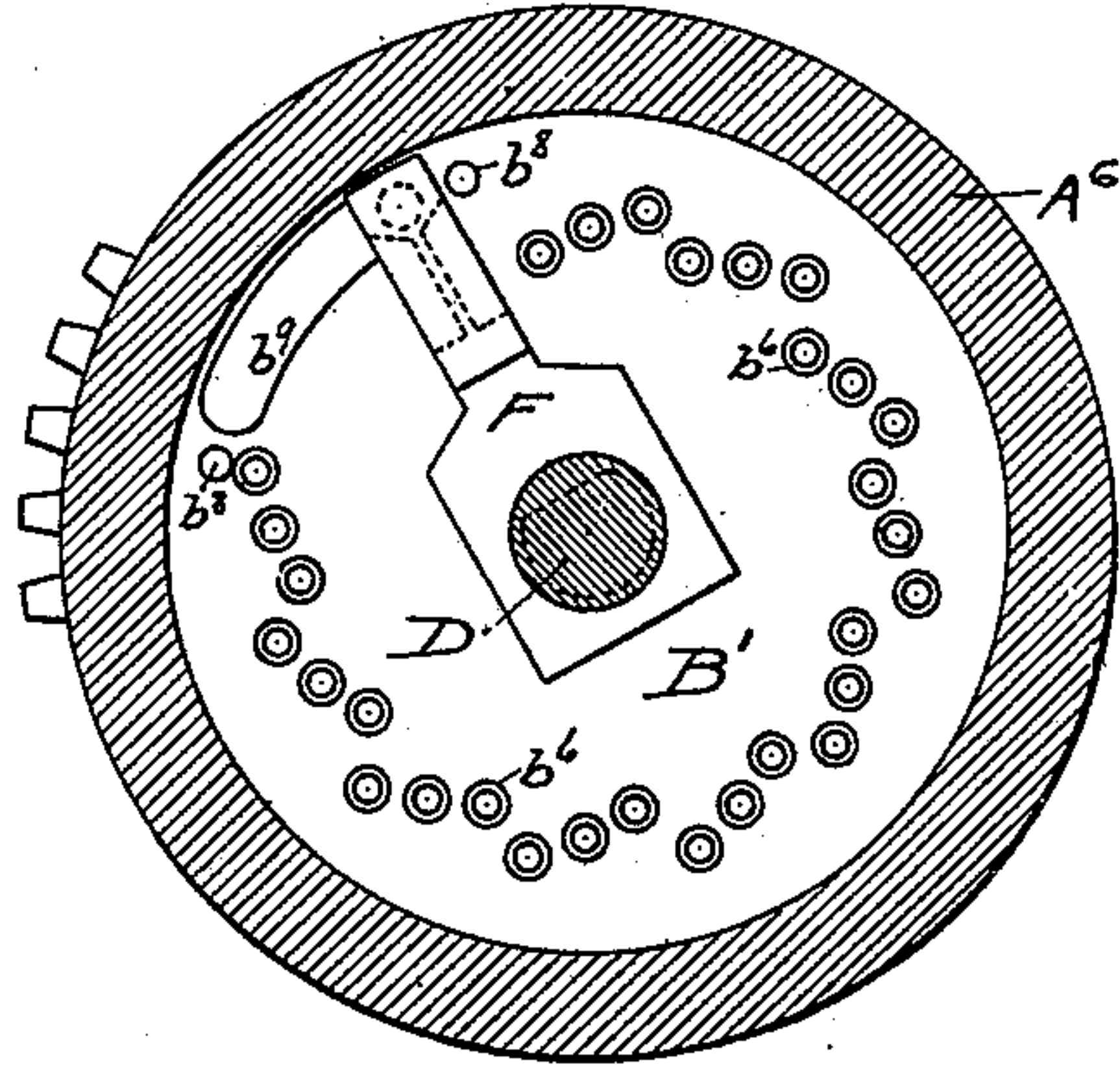


FIG. 8

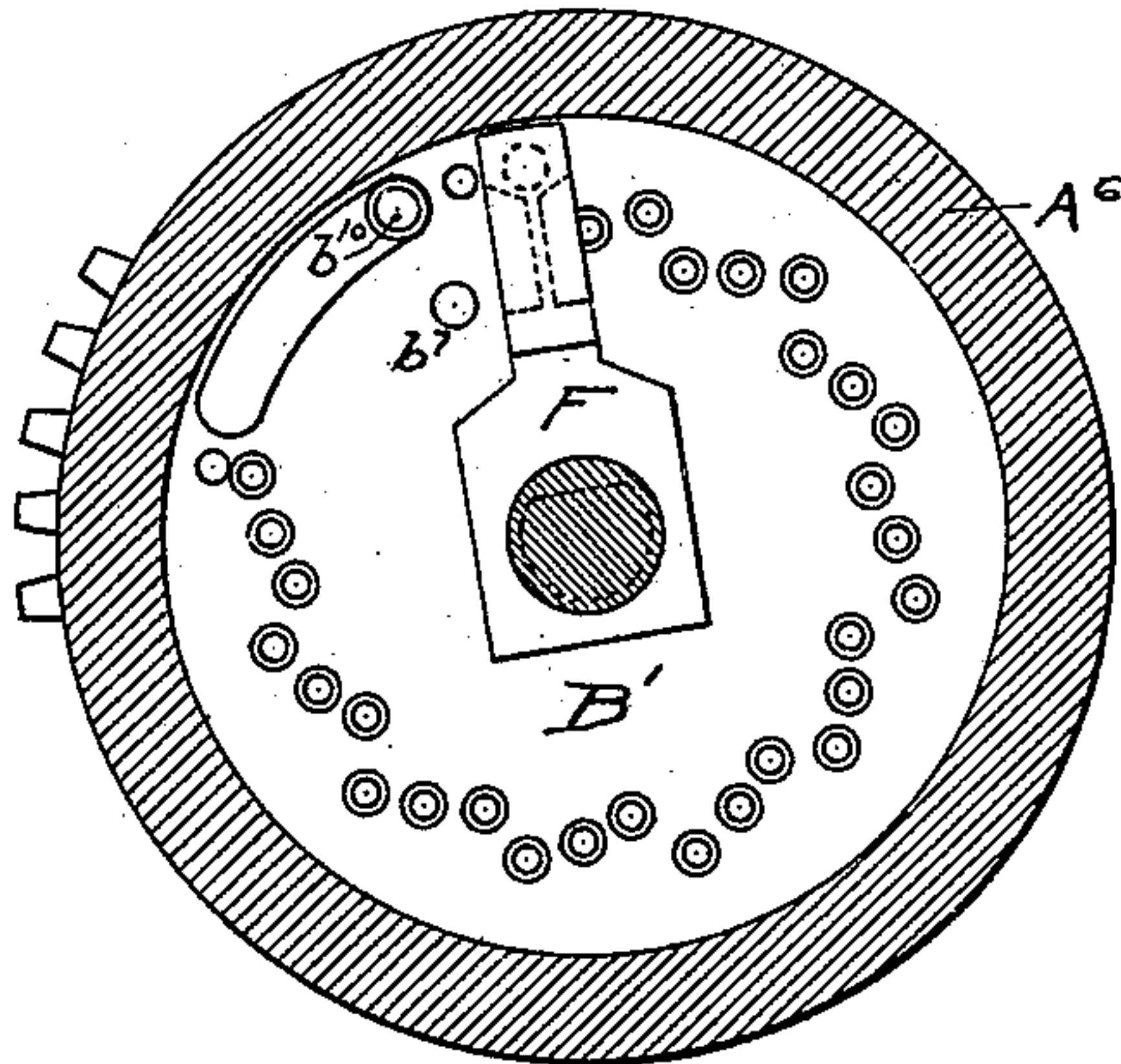


FIG. 9

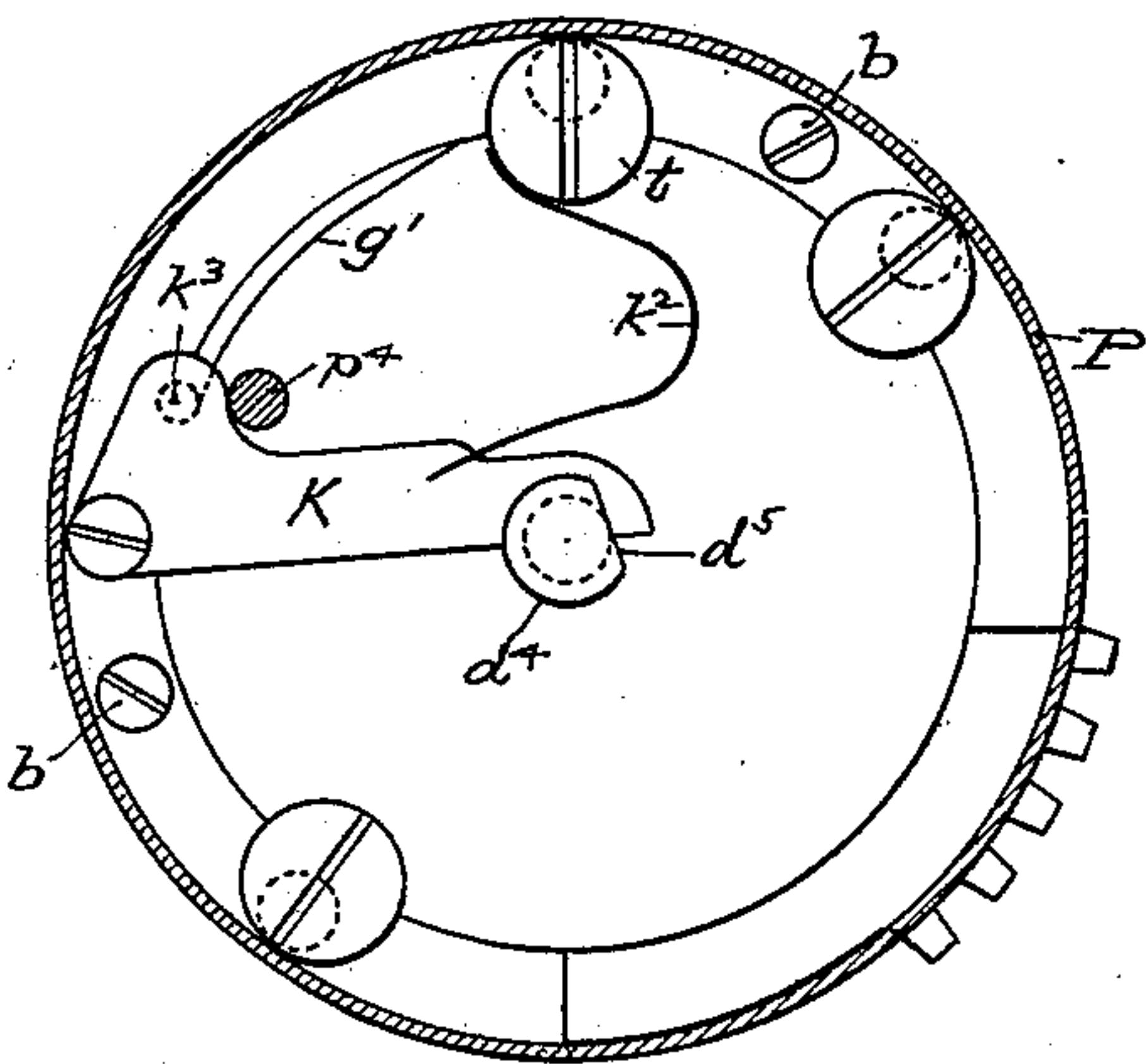


FIG. 10

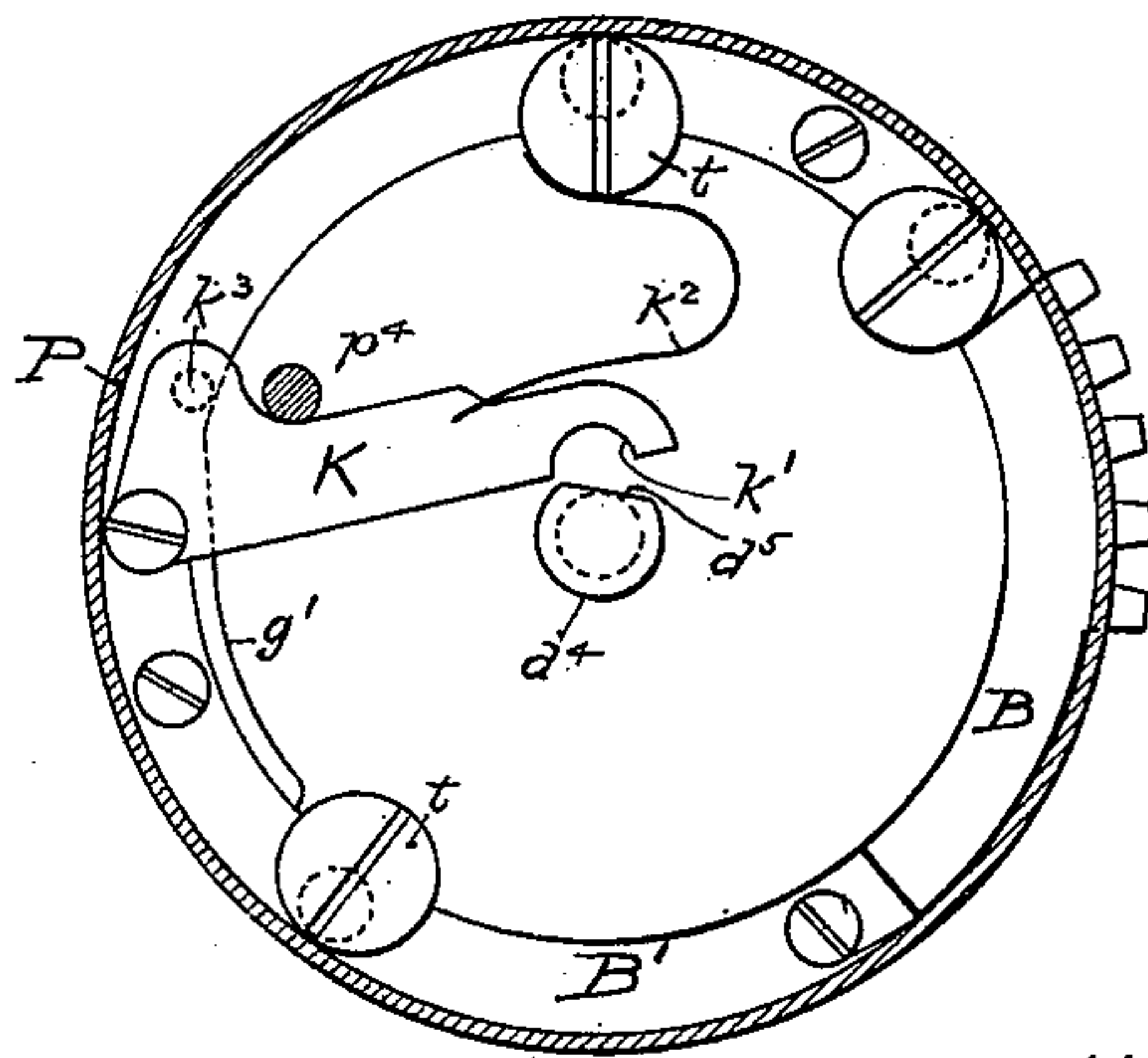


FIG. 11

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UNITED STATES PATENT OFFICE.

HENRY L. CLARKE, OF CHICAGO, ILLINOIS.

COMBINATION-LOCK.

SPECIFICATION forming part of Letters Patent No. 619,940, dated February 21, 1899.

Application filed April 8, 1898. Serial No. 676,951. (No model.)

To all whom it may concern:

Be it known that I, HENRY L. CLARKE, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Combination-Locks, of which the following is a specification.

My invention relates to improvements in combination-locks, and more particularly to improvements upon combination-locks wherein a pair of adjacent lock disks or cylinders are employed in connection with two series of lock-pins, the pins of the one series being longer than those of the other, the lock-pins fitting in suitable holes in the lock-disks—such, for example, as patented to Henry Clarke in Letters Patent Nos. 577,380 and 577,358, both of February 16, 1897.

The object of my invention is to improve and perfect the combination-lock of said Henry Clarke patents and adapt the same for use as vault or safe locks.

It consists in the combination, with the two lock-cylinders and the series of long and short lock-pins, of a single rotary and reciprocating push-arm for operating the pairs of lock-pins, the rotary movement of the push-arm serving to bring it into registry with any pair of pins desired, and the reciprocating movement serving to push the pair of pins into the position required.

It further consists in the combination, with the lock-cylinders and lock-pins, of a rotary and reciprocating setting-plate adapted to be engaged and disengaged from the operating-shaft in respect to the reciprocating movement of said shaft when required.

It further consists, in connection with these parts, of a latch or escapement for connecting and disconnecting the setting-plate and the operating-shaft.

It further consists in the combination, with the lock-cylinders and lock-pins, of a setting-plate and a guard ring or plate, the lock-cylinders and lock-pins being embraced between the setting-plate and the guard-ring, so that the guard-ring limits the movements of the pins in one direction, while the setting-plate limits their movement in the opposite direction.

It further consists in the combination, with the long and short series, of lock-pins with

two lock disks or cylinders, each of the same thickness and equal in thickness to the length of the short lock-pins.

It also consists in the combination, with the two lock-disks, of hollow lock-pins to permit the passage of air and prevent the pins being moved by compressed air and also to facilitate the removal of the lock-pins for the purpose of changing the combination.

It also consists in the combination, with the rotary and reciprocating knob and the connecting-shaft, of the rotary and reciprocating push-arm and the setting-plate.

It also consists in the combination, with the long and short lock-pins, of a pair of lock or disk cylinders having the lock-pin holes arranged in segmental groups, the pins of each segmental group being at different radial distances from the center to prevent the lock-pin holes in the one disk registering with those in another when one lock-disk is being turned in respect to the other, as required in unlocking or locking the lock.

It also consists in the combination with the lock cylinders and pins and other parts of the lock with a guard-case to prevent tampering with the lock when the door is open, said guard-case having a detachable connection with the lock, adapted to be removed only by first locking and then unlocking the lock.

It also consists in the novel construction of parts and devices and in the novel combinations of parts and devices herein shown and described, and more particularly pointed out in the claims.

In the accompanying drawings, forming a part of this specification, Figure 1 is a central longitudinal section of my improved lock, showing the parts in the unlocked position. Fig. 2 is a similar section showing the same in the locked position. Fig. 3 is a front view in the unlocked position. Fig. 4 is a front view in the locked position. The sectional view Fig. 1 is taken on the line 1 1 of Fig. 3, and the sectional view Fig. 2 is taken on the line 2 2 of Fig. 4. Fig. 5 is a section taken on the line 5 5 of Fig. 1. Fig. 6 is a section on the line 6 6 of Fig. 1. Figs. 7, 8, and 9 are sections taken on the line 6 6 of Fig. 1 with guard-ring removed and showing the parts in different positions. Figs. 10 and 11 are sections on the line 10 10 of Fig.

1, looking in the direction of the arrow and showing the parts in different positions. Fig. 12 is an end view with the outer case and setting-plate removed. Fig. 13 is a detail elevation showing the outer case. Fig. 14 is a detail view showing the rotating and reciprocating shaft and the push-arm connected therewith. Fig. 15 shows a headed wire or tool for removing the lock-pins.

10 In the drawings, A represents a stationary sleeve or bearing, which is ordinarily secured in and extends through the safe or vault door, and A' is the base-plate of the lock, which is likewise rigidly secured to the safe or vault door and on the inside thereof.

15 B and B' are the two adjacent lock disks or cylinders, the inner one, B, being rotary or movable in respect to the outer one, B', and preferably through a limited arc—as, for example, a one-sixth circumference, as illustrated in the drawings.

C and C' are two series of lock-pins, the pins C being slightly longer than the pins C'.

20 D is a rotary and reciprocating shaft, and E the knob or handle by which the shaft D is rotated and reciprocated to operate the rotary and reciprocating push-arm F and a rotary and reciprocating setting-plate G.

30 H is a slotted guard-ring which limits the outward movement of the pins C C' and in the radial slot *h* of which the push-arm F reciprocates, the slotted ring having no reciprocating movement, but turning with the shaft D and push-arm F.

35 K is the escapement, M the dial-ring, N the index, and O a rack-bar or other device connecting the movable lock disk or cylinder of the lock with the bolts or other fastening devices of the door.

40 The sleeve or bearing A may be of any suitable construction adapted to give support or bearing to the shaft and to connect or apply the lock to the door. It is preferably of a circular or cylindrical form in cross-section and provided with one or more shoulders *a a* to prevent any possibility of this sleeve being driven through the plates of the door or other part to which the lock is attached. Its interior bore is also preferably stepped or provided with shoulders *a' a'* to receive the shoulder *d* on the shaft D, which prevents the shaft D from being driven through the sleeve or bearing A, and for the inner end of the knob E to abut against.

55 The stationary base-plate A' of the lock is preferably secured on the inner face of the door to which the lock is applied through the medium of the hollow sleeve or bearing A and the threaded nut A² and the pin or dowel A⁴, which locks the base-plate A' and sleeve A from turning in respect to each other. A stud A⁵, fixed in the base-plate A' and fitting in a suitable recess in the inner face of the door, prevents the sleeve A and base-plate A' from turning in respect to the door. The base-plate A' is provided or preferably provided with an integral flange A⁶ to form a hol-

low chamber to receive the slotted ring II, push-arm F, and the projecting portions of the lock-pins. The base-plate A' is also furnished on its inner face with a guard-stud *a*³, that limits the rotary movement of the push-arm when the same is in its outermost position and also prevents its reciprocating movement in a certain case, as will be hereinafter more fully explained. 70 75

The stationary lock disk or cylinder B' is rigidly secured to the base-plate A', preferably by screws *b*, extending through said plate and under the flange A⁶ of the plate A'. The stationary lock disk or cylinder B' is also provided with an annular recess or shoulder *b'*, fitting the flange A⁶ to form a strong and rigid connection between the two parts. The rotary or movable lock disk or cylinder B is rotatably connected to the stationary lock-cylinder B' by a sleeve B², having screw-threads *b'*, engaging the threaded bore of the stationary lock-cylinder B', and provided with a shoulder *b*³, engaging said lock-disk B', and with a head or shoulder *b*⁴, engaging the shoulder or recess *b*⁵ in the movable lock-disk B. The two lock-disks B B' are thus held with their movable faces adjacent to each other, while the movable lock-cylinder B is permitted to turn or rotate in respect to the stationary one. The rotary movement of the movable lock-cylinder B in respect to the stationary one, B', is limited by a curved slot *b*⁹ in the stationary cylinder B', in which fits a guide-pin *b*¹⁰, secured to the movable cylinder B. The length of the curved slot *b*⁹ is preferably somewhat less than one-sixth of the circumference. The lock-cylinders B B' are each preferably provided with thirty lock-pin holes *b*⁶ and one guard lock-pin hole *b*⁷, making thirty-one lock-pin holes in all. All the lock-pin holes of one disk register with those of the other disk when the two disks are in a certain position, and the thirty lock-pin holes *b*⁶ are arranged, preferably, in five different similar groups, the six holes of each group being at different distances from the center, so that when the movable lock-disk B is rotated through the limited arc controlled by the curved slot *b*⁹ and guide-pin *b*¹⁰ the lock-pin holes in the one disk will never register with those in the other, thus rendering it impossible for the pins in either disk to be pushed or moved except when the two disks B B' are in one certain position with relation to each other, as before mentioned. The guard lock-pin hole *b*⁷ is also located slightly nearer the center than any of the lock-pin holes *b*⁶, and it is likewise located radially in line with the guide-pin *b*¹⁰ when the movable lock-cylinder B is turned to its limit of movement in one direction, the position in which the lock is locked. The stationary locking disk or cylinder B' is likewise provided with two fixed studs or pins *b*⁸ *b*⁸, one near each extremity of the curved slot *b*⁹, for a purpose that will be understood when the operation of the lock is explained. The lock-disks B B' 80 85 90 95 100 105 110 115 120 125 130

are both of the same thickness and each equal in thickness to the series of short lock-pins C'.

The lock-pins C C' are alike, with the single exception that the pins C are longer than the pins C' by the engagement or extent that it is desired to have such longer pins project across the meeting faces of the lock-cylinders B B' to interlock said cylinders together. All the lock-pins C, excepting those constituting the particular combination in use, are placed in the stationary lock-cylinder B', and in like manner all the short lock-pins C', excepting those of the combination, are in the movable cylinder B, as will be readily understood from Figs. 1 and 2. The lock-pins C C' are each preferably a hollow cylinder or tube, so that the central opening in the lock-pin may afford means for escape of air in the operation of the lock and thus prevent any danger of the pins being moved by air-pressure and also to enable the pins to be readily removed and changed for the purpose of changing the combination without the necessity of taking the lock much apart for this purpose. As the pair of lock-pins C C' which fit in the guard lock-pin hole b^7 in the lock-disks B B' is always a member of the combination and does not require to be changed, I ordinarily make this pair of pins solid. This also readily distinguishes the guard lock-pin from the others.

The rotary and reciprocating shaft D, by which the movable parts of the lock are operated, may be of any suitable construction adapted to communicate the necessary movements from the knob or handle E to the other moving parts of the lock. As represented in the drawings, I have illustrated it as a single straight shaft extending in a straight line through the door and sleeve or bearing and through the center of the lock-disks. It will be understood, however, by those skilled in the art that this rotary and reciprocating shaft may be made in two or more rotary and reciprocating sections in cases where it is desired to avoid a continuous straight hole through the door, the several sections being connected together by any suitable mechanism, so that the rotary and reciprocating movements communicated to one section will be imparted to the others. The shaft D and knob E may be connected together in any suitable manner, either by making the two parts integral with each other or in separate pieces and detachably connected. I prefer, however, to make the knob and shaft in separate pieces and detachably connect them together by a stem d' , having a flat side d^2 on the end of the shaft, which fits in a socket E' in the knob E, in connection with a thumb-screw E², the threaded end of which is screwed into the shaft D. The shaft D is also preferably provided with a weakened portion d^3 , so that the shaft would break at this weakened point d^3 under great force applied to the knob, and thus render it impossible to pull the shaft D out of the lock proper. The shoulder d on the shaft D prevents the shaft D being

driven through the lock or sleeve A. The inner portion d^4 of the shaft D is also preferably made of a smaller diameter to form a shoulder for the push-arm F to fit against and with a flat side d^5 where the shaft passes through the push-arm F and the setting-plate G. The shaft D is likewise provided with an annular groove or recess d^6 at its extreme end to receive the escapement K.

The rotary and reciprocating push-arm F has a narrow rib f on its inner face adapted to engage the end of a single one of the push-pins at a time when said push-arm is turned radially into proper position to register with any particular pin. It is also provided with a hole or socket on its inner face adapted to engage the guide-pin b^5 when said push-arm is turned into position to register with the guard lock-pin, which is in the same radial line as said guide-pin b^5 when the lock is locked. The push-arm by thus engaging the guide-pin b^{10} is adapted to turn the movable lock-disk B to the extent allowed by the curved guide-slot b^9 when the lock has thus been completely unlocked. The rotary and reciprocating push-arm F is rigidly secured to the shaft D by a pin f^2 and by the flattened shaft passing through the hub f' of the push-arm. The push-arm F fits in the radial slot h of the slotted guard-ring H.

The slotted guard-ring H has two oppositely-projecting flanges h' h^2 , the flange h' fitting against the inner face of the base-plate A' and the inner flange h^2 fitting against the stationary lock-cylinder B', so that this slotted guard-ring can have no reciprocating movement, and thus operates to limit the outward movement of the push-pins C C' in the holes of the lock-disks B B'. The length of the inner flange h^2 of the slotted guard-ring should just equal the engagement of the lock-pins—that is to say, the extent to which the long pin C is longer than the short pin C'. The outer flange h' should just about equal in length the extent to which the guard-stud a^3 projects from the inner face of the base-plate A'. The slotted guard-ring H is free to rotate about the shaft A when it is so turned by the operating or push arm F, which fits in the radial slots h . The cylindrical hub f' of the push-arm F fits within the threaded sleeve B², and a spring L, surrounding the shaft D, is interposed between the end of said push-arm hub f' and the cylindrical hub g of the setting-plate G, so that the spring operates at the same time to push the shaft D outward to its normal position, as shown in Fig. 2, and also to push the setting-plate G inward to its normal position, as illustrated in Fig. 1.

The setting-plate G is a circular disk having a cylindrical hub fitting within the threaded sleeve B² and bearing against the spring L, the interior bore of its hub fitting the flat-sided portion of the shaft D, so that the setting-plate G will turn with the shaft D, while the shaft D may reciprocate in respect to the setting-plate without reciprocating the set-

ting-plate. The setting-plate is reciprocated in one direction by the spring L, and at certain times it is caused to reciprocate in the other direction with the shaft D by means of the escapement K, which fits in or engages the annular groove d^6 in the end of the shaft D. By its reciprocating movement with the shaft D the setting-plate pushes or restores all the lock-pins to their normal position.

The movement of the setting-plate in the opposite direction under the action of the spring L is limited by the eccentric heads t of the removable screws T. The setting-plate when in this position against the heads t of the screws T serves also as a stop to limit the movement of the lock-pins C C' in this direction. The movement of the lock-pins C C' is thus limited in both directions, in one direction by the setting-plate G and in the other direction by the slotted guard-ring H.

The device which I employ to engage and disengage the setting-plate G in respect to a reciprocating movement with the shaft D, I term the "escapement" or "latch," which may consist, preferably, of a flat pivoted lever or arm adapted to fit in the annular groove or recess d^6 in the shaft D or under the flange or head d^7 at the extreme end of said shaft. It is preferably provided with a half-round socket k' to fit the diminished diameter of the shaft formed by the groove d^6 . It is actuated in one direction by a spring k^2 , which tends to throw it into engagement with the shaft D. It is moved in the opposite direction by a cam g' on the setting-plate G, the periphery of the setting-plate G itself serving to normally hold the escapement out of engagement with the shaft D. A pin k^3 on the escapement or latch k rides against the cam g' and the periphery of the setting-plate. The escapement or latch K has a hub k^4 , adapted to both turn and reciprocate on a pivot-pin k^5 , secured to the stationary lock-cylinder B'.

The dial-ring M is preferably formed integral with the knob E and is provided with a numbered series of graduations numbered from "1" to "30," extending through five-sixths of the circumference of the ring and corresponding to each of the thirty pair of lock-pins C C' in the lock-pin holes b^6 . This dial-ring also has a graduation (preferably marked "A") corresponding to the guard lock-pin and another graduation (marked, for example, "B") indicating the open position of the lock.

The index N may be simply a stationary pointer or mark. It is preferably on a stationary ring surrounding the dial. It may be supported either on the dial or from the stationary sleeve or bearing A. When the knob E is turned to bring any particular figure on the dial M—as, for example, "21"—into register with the index N, that indicates that the push-arm F, which rotates with the knob, is turned into position to register with the particular pair of lock-pins C C' that corresponds to this particular dial-number "21,"

and if said particular pair of pins is in the combination, by then pushing the knob inward this particular pair of pins will be moved, so that the long pin of the pair will no longer be partly in both lock-disks B B'.

O represents the device by which motion is communicated to the bolts or other fastenings of the door by movement of the movable lock-cylinder B after the lock-cylinders B B' have been disengaged from each other by properly operating the particular pairs of pins constituting the combination. This connecting device may be of any suitable kind or construction, and movement may be communicated to it from the movable lock-cylinder B by any suitable means. As illustrated in the drawings, the device consists of a simple rack-bar engaged by teeth O', formed on a short segment of the movable lock-cylinder B.

The case P, covering the moving parts of the lock proper to guard against the lock being tampered with when the vault or safe door is open or prevent the combination being changed, may be of any suitable kind or construction adapted to be removed only when the lock is locked or when it is unlocked or only by first locking and then unlocking the lock. The last gives the greatest protection, and this is the form that I have therefore illustrated in the drawings. This case P consists of a cylindrical cup or shell provided with a right-angled slot p , engaging a pin p' on the stationary lock-cylinder B', and a large right-angled slot p^2 , engaging a segmental projection p^3 on the movable lock-cylinder B, which, in connection with a pin or stud p^4 on the inside of said case, make necessary two movements to remove the case, the one rotary and the other a pull to detach the case, the one movement being interfered with by the position of the moving lock-cylinder B when the lock is unlocked and the other interfering when the lock is locked, the movements being required to be made in the order given.

In operation as the knob E and its connected shaft D are rotated the push-arm F is passed successively over all of the lock-pin holes, and when the shaft is fully pushed in in operating the lock the arm F in turn pushes down the pair of lock-pins in the lock-pin hole over which the said arm may at the time be standing, so that the outer end of the outer pin of said pair becomes flush with the outer face of the stationary cylinder. If the outer pin in said pair is the shorter of the pair, then the other or inner and longer pin of the said pair will be pushed entirely out of the stationary cylinder, and so far as that pair of pins is concerned the cylinders will be mutually unlocked or free to move with respect to each other about their common axis. In the reverse case, that of the outer pin being the longer of the pair the said outer pin is pushed across the plane of contact of the two cylinders and into the moving cylinder, and the cylinders are thus interlocked. This last and the immediately-preceding statement re-

specting the unlocking and interlocking of the cylinders by the movement of the lock-pins apply exactly when put in reverse form to the movement of the pins in the reverse direction by the setting-plate. When the setting-plate G is connected by the escapement K with the shaft, so as to be moved outwardly by said shaft, it is brought into contact with substantially the whole inner face of the moving cylinder, and thus brings the inner ends of all the inner lock-pins simultaneously flush with the said inner face of the moving cylinder. When this last-mentioned distribution of the lock-pins is effected, it is evident that the lock-pin cylinders will be interlocked by each and all of these "longer" lock-pins that are the inner of the pairs of which they are respectively members; but no other of the longer lock-pins will be in the interlocking position, and the shorter pins may never in any way act to interlock the cylinders, inasmuch as their length is exactly equal to the thickness of each of the equally thick cylinders, and as the total possible movement back and forth of the pairs of lock-pins is limited to the amount of the excess length constituting the "maximum possible engagement" of the longer pins. This limitation of movement is accomplished in one direction by the "setting-plate," which may be withdrawn from the moving cylinder by reason of the heads *t* or screws T only so far that there is a uniformly-wide interspace between the outer face of the said setting-plate and the inner face of the moving cylinder of a width just equal to the said maximum engagement of the longer lock-pins, and the movement of the lock-pins in the opposite or outer direction is accomplished in part by the push-arm F and in part by the slotted guard-ring H, as the "push-arm" F may be withdrawn from the outer face of the stationary cylinder only to the same amount as that specified immediately above, thus limiting the movement outward of the pair of lock-pins over which the said arm may at any time be, and the outward movement of all the other pairs of lock-pins is limited in exactly like manner by the "slotted guard-ring H," which revolves with the push-arm in the cavity between the outer face of the base-plate, but, unlike the push-arm, has no back-and-forth movement.

The unlocking of the cylinders is accomplished by pushing down with the push-arm until their outer ends are flush with the outer face of the stationary cylinder all those pairs of pins, and none other, whose outer member is a "short" pin. The relocking of the cylinders is accomplished by the return of these certain pairs of pins to their previous position by the action of the setting-plate, and these certain pairs in their pin-holes and designated by number or letter constitute the "combination" on which the lock is set, a combination that may be changed by a redistribution of all or part of the lock-pins, reversing the relation

of the long and short members in any or all pairs.

The movement of the moving cylinder B when the two lock-pin cylinders B B' are unlocked involves the "guide-pin" *b*¹⁰, that projects through and out of the stationary cylinder from the moving cylinder and engages the push-arm when the latter is in due position and which is always on the same radius of the cylinders with the guard lock-pin hole *b*⁷, but on a different radius or radial segment from all the other lock-pin holes. This guide-pin engages thus the push-arm when the push-arm is pushed down over it by entering a suitable hole in the said push-arm to a depth just equal to the maximum possible engagement of the lock-pins, and the same movement that thus engages the guide-pin with the push-arm also by the push-arm pushes down the guard lock-pin pair of lock-pins, which are always a member of the combination, just enough to free the interlocking of the cylinders by this said pair of guard lock-pins, and as this pair of lock-pins is always the last member of the combination used in the operation of the lock it is thus impossible for the moving cylinder to move or be moved until the push-arm has positively and fully engaged the moving cylinder's guide-pin *b*¹⁰, the moving cylinder thus being entirely under the control of the operator of the lock. The guard-stud *a*³ is fixed upon the inner face of the base-plate A', directly over the slot *b*⁹, for limiting the guide-pin's movement in the stationary cylinder B', and the guard-stud *a*³ serves, first, to bring the rotary movement of the push-arm F to a positive stop at each end of the somewhat less than complete revolution of which it is capable while the cylinders B B' are locked, and, second, prevents by contact with the outer face of the push-arm the withdrawal of the push-arm from its engagement with the guide-pin of the moving cylinder, while the moving cylinder is moved out of its interlocking position to an extent sufficient to bring the series of lock-pin holes in the two cylinders out of registry with each other. Any contact between the guide-pin *b*¹⁰ and push-arm F in any other manner than by the engagement of the said guard-pin in the hole registering with it in the push-arm is prevented by the two fixed guard pins or projections *b*⁸ *b*⁸ in the outer face of the stationary cylinder, one immediately adjacent to each end of the slot *b*⁹, by which the movement of the guide *b*¹⁰ is limited, and, lastly, in this connection a projecting portion *h*⁵ of the slotted ring H is adapted to retain the outer member of the pair of guard lock-pins, before mentioned, entirely within its lock-pin hole in the stationary cylinder, so as to prevent any accidental movement of the said guard lock-pin from interfering with the subsequent free movement of the push-arm.

The spiral spring L acts simultaneously to retain the setting-plate G and the push-arm

F, with the shaft D, on which the push-arm is secured, in their proper positions—viz., the setting-plate pressed “inwardly” with reference to the other lock parts and the shaft and its attached outer knob pressed outwardly as far as possible. This said position of the setting-plate puts the setting-plate out of the way of the free movement of the lock-pins out of the inner side of the moving cylinder, and the tendency of the shaft to spring outward again when pushed in facilitates the rapid operation of the lock.

By reversing the position of the heads of the eccentric-headed screws T by turning said screws the setting-plate may be entirely withdrawn from the lock, so as to give access to the lock-pins for the purpose of changing the lock's combination.

When the knob E and shaft D are pulled “outward” to operate the setting-plate G, the escapement K, bearing directly against the setting-plate and engaging the recess d^6 in the shaft D, will carry the setting-plate with the outward movement of the shaft, so as to bring the outer face of the setting-plate in contact with the inner face of the moving cylinder, and thereby push all of the lock-pins that may be projecting from the moving cylinder's inner face back into their lock-pin holes. Either gravitation or a spring, or both, tend constantly to make the escapement K thus engage the end of the shaft D; but the engagement is controlled by the adaptation of the pivotal end of the escapement to bear constantly upon the periphery of the circular setting-plate, and this peripheral margin of the setting-plate is so shaped that these three limitations are provided for the said engagement of the escapement with the shaft D, viz: In the common rotation of the setting-plate and “shaft” and push-arm the escapement is allowed to engage the shaft end only and always just when the push-arm is engaged with or is immediately withdrawing from its engagement with the guide-pin b^{10} of the moving cylinder, and as soon as the rotation of the shaft has carried the disengaged push-arm away from the guide-pin through an arc somewhat less than the angular distance to the lock-pin other than the guard lock-pin, next adjacent to the position of the said guide-pin then the escapement is freed by a cam action at its bearing with the periphery of the setting-plate from its engagement with the shaft end and the setting-plate becomes free to slide back on the shaft to its original position. Referring back to the explanation of the effect of the outward movement of the setting-plate in distributing the pins, it is now evident that it is impossible to disengage the push-arm from the guide-pin and by means of the said push-arm sensitize the position of the arm of the lock-pins while the lock is unlocked, and when the lock is locked, the pins being distributed, it is not possible to sensitize the combination, because of the difficulty of

bringing strain on the interlocking pins, and even a theoretical possibility of such a strain may be removed by counterboring to a depth equal to just the maximum engagement of the pins all of the lock-pin holes except the guard lock-pin hole, the counterbore to be at the inner ends of the holes in the stationary cylinder and at the outer ends of the holes in the moving cylinder.

The devices external to the lock proper and moved by the moving cylinder may act upon the bolt system of the door either by blocking or by dogging the said boltwork or by entirely disconnecting the boltwork from the handle operating the boltwork from the outside of the door. The connection of these devices with the moving cylinder may be either mere contact or a joint or a gear system.

To unlock, push in the dial-knob at all the numbered graduations on its circumference that are in the combination and at none others and then push it in on the number or letter corresponding to the guard lock-pin, and while pushed in turn it as far as possible in the direction in which it is free to turn. To lock, return knob to guard-pin number and pull it out. It may then be turned back, if desired, through all the other numbers.

To remove the guard-case P, the lock is first locked. The case P is then turned or rotated as far as the horizontal portion of the right-angle slot p permits. The case P can be thus rotated when the lock is locked, as will be readily understood from Fig. 2; but it is prevented from being thus rotated at other times by reason of the pin or projection p^4 on the guard-case P engaging the escapement K, as will be readily understood by reference to Figs. 1, 2, and 10. After the case P has been thus rotated the lock is unlocked, and then the case P can be withdrawn from the lock by a longitudinal movement, as the vertical portion of the right-angle slot p^2 then registers with the projecting segment p^3 of the movable lock-cylinder B.

To remove the hollow lock-pins C C' from the lock-cylinders B B' to change the combination or for other purpose, the guard-case P is removed, and then the setting-plate G is removed in the manner already described by turning the eccentric-headed screws or pins T, and then a headed wire X is inserted through the longitudinal opening or passage in the push-pins and the same are pulled out.

I claim—

1. In a combination-lock, the combination with two adjacent lock disks or cylinders and two series of lock-pins mounted therein, of a rotary and reciprocating push-arm, substantially as specified.

2. The combination with two adjacent lock-cylinders and the series of pairs of long and short lock-pins, of a rotary and reciprocating setting-plate, substantially as specified.

3. The combination with two adjacent lock-cylinders and the series of pairs of long and short lock-pins, of a rotary and reciprocating

push-arm, and a rotary and reciprocating setting-plate, substantially as specified.

4. The combination with two adjacent lock-cylinders and the series of pairs of long and short lock-pins, of a rotary and reciprocating push-arm, a rotary and reciprocating setting-plate, and a rotary and reciprocating shaft for operating said push-arm and setting-plate, substantially as specified.

5. The combination with two adjacent lock-cylinders and the series of pairs of long and short lock-pins, of a rotary and reciprocating push-arm, a rotary and reciprocating setting-plate, a rotary and reciprocating shaft for operating said push-arm and setting-plate, and a latch or escapement for connecting and disconnecting said shaft with said setting-plate as required, substantially as specified.

6. The combination with two adjacent lock-cylinders and the series of pairs of long and short lock-pins, of a rotary and reciprocating push-arm, a rotary and reciprocating setting-plate, a rotary and reciprocating shaft for operating said push-arm and setting-plate, and a latch or escapement for connecting and disconnecting said shaft with said setting-plate as required, said setting-plate being provided with a cam for controlling the movement of said latch or escapement, substantially as specified.

7. The combination with two adjacent lock-cylinders and the series of pairs of long and short lock-pins, of a rotary and reciprocating push-arm, a rotary and reciprocating setting-plate, a rotary and reciprocating shaft for operating said push-arm and setting-plate, a latch or escapement for connecting and disconnecting said shaft with said setting-plate as required, said setting-plate being provided with a cam for controlling the movement of said latch or escapement, and a spring for moving said latch or escapement in one direction, substantially as specified.

8. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, a rotary and reciprocating push-arm, and a guide-pin secured to the movable lock-cylinder and adapted to engage said push-arm to enable the movable lock-cylinder to be turned by the push-arm, substantially as specified.

9. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, a rotary and reciprocating push-arm, a guide-pin secured to the movable lock-cylinder and adapted to engage said push-arm to enable the movable lock-cylinder to be turned by the push-arm, and a pair of guard lock-pins mounted in said lock-cylinders in position to be engaged or operated by said push-arm simultaneously with said push-arm's engagement with said guide-pin, substantially as specified.

10. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, with a rotary and reciprocating push-arm and a guide-

pin secured to the movable lock-cylinder and adapted to engage said push-arm to enable the movable lock-cylinder to be turned by the push-arm, the stationary lock-cylinder having a curved slot for said guide-pin to work in, substantially as specified.

11. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, a guard-ring for permitting a limited movement only of the lock-pins in one direction, and a reciprocating setting-plate permitting a limited movement only of the lock-pins in the opposite direction, substantially as specified.

12. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, a slotted guard-ring, and a rotary and reciprocating push-arm fitting in the slot of said guard-ring, substantially as specified.

13. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, a slotted guard-ring, a rotary and reciprocating push-arm fitting in the slot of said guard-ring, and a rotary and reciprocating setting-plate, substantially as specified.

14. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, a slotted guard-ring, a rotary and reciprocating push-arm fitting in the slot of said guard-ring, and a rotary and reciprocating setting-plate, said lock-cylinders being each equal in thickness to the length of the short lock-pins, and the guard-ring and push-arm limiting the movement of the lock-pins in one direction to the extent of their difference in length, and the setting-plate limiting the movement in the opposite direction to the same extent, substantially as specified.

15. The combination with two adjacent lock-cylinders, of a series of pairs of long and short hollow or tubular lock-pins mounted therein, substantially as specified.

16. The combination with two adjacent lock-cylinders, of a series of pairs of long and short lock-pins mounted therein, each lock-pin when in its lock-cylinder having a longitudinal opening or passage for air and to admit an instrument for removing the pin from the lock-cylinder, substantially as specified.

17. The combination with two adjacent lock-cylinders and a series of pairs of long and short lock-pins mounted therein, of a guard-case having a pair of right-angle slots, one engaging a pin or projection on the stationary lock-cylinder, and the other engaging a projection on the movable lock-cylinder to prevent the removal of the guard-case except by the locking and unlocking of the lock, substantially as specified.

18. In combination, two adjacent lock-cylinders, one rotatable in respect to the other through a limited arc only, and provided with a series of lock-pin holes arranged in a series of segmental groups, the lock-pin holes of

each segmental group being at different distances from the center to prevent the lock-pin holes in the one cylinder from registering with those in the other except when the movable lock-cylinder is turned into its locked position, substantially as specified.

19. In combination, two adjacent lock-cylinders provided each with a series of lock-pin holes which register with each other when the two lock-cylinders are in their locked positions, said lock-pin holes being arranged at different radial distances from the center to prevent the holes in the one cylinder from registering with those in the other when the movable cylinder is turned or being turned into other positions than its locked position, substantially as specified.

20. The combination with two adjacent lock-cylinders and a series of pairs of long and short lock-pins, of a rotary and reciprocating push-arm, and a rotary and reciprocating shaft to which said push-arm is secured, substantially as specified.

21. The combination with two adjacent lock-cylinders and a series of pairs of long and short lock-pins, of a rotary and reciprocating push-arm, and a rotary and reciprocating shaft to which said push-arm is secured, and a knob and graduated dial-ring connected to said shaft, substantially as specified.

22. The combination with two adjacent lock-cylinders and a series of pairs of long and short lock-pins, of a rotary and reciprocating push-arm, and a rotary and reciprocating shaft to which said push-arm is secured, and a knob and graduated dial-ring connected to said shaft, and an index, substantially as specified.

23. The combination with stationary sleeve or bearing A, of base-plate A', lock-cylinders B B', long and short lock-pins C C', rotary and reciprocating operating-shaft D, knob E, push-arm F, setting-plate G, and slotted guard-ring H, substantially as specified.

24. The combination with stationary sleeve or bearing A, of base-plate A', lock-cylinders B B', long and short lock-pins C C', rotary and reciprocating operating-shaft D, knob E, push-arm F, setting-plate G, slotted guard-ring H, and escapement K, substantially as specified.

25. The combination with stationary sleeve or bearing A, of base-plate A', lock-cylinders B B', long and short lock-pins C C', rotary and reciprocating operating-shaft D, knob E, push-arm F, setting-plate G, slotted guard-ring H, and spring L operating to push said setting-plate in one direction and said shaft and push-arm in the opposite direction, substantially as specified.

26. The combination with stationary sleeve or bearing A, of base-plate A', lock-cylinders B B', long and short lock-pins C C', rotary and reciprocating operating-shaft D, knob E, push-arm F, setting-plate G, slotted guard-ring H, spring L operating to push said setting-plate in one direction and said shaft and

push-arm in the opposite direction, and escapement K, substantially as specified.

27. The combination with stationary sleeve or bearing A, of base-plate A', lock-cylinders B B', long and short lock-pins C C', rotary and reciprocating operating-shaft D, knob E, push-arm F, setting-plate G, slotted guard-ring H, spring L operating to push said setting-plate in one direction and said shaft and push-arm in the opposite direction, escapement K, and cam g on said setting-plate, and spring k^2 , substantially as specified.

28. The combination with stationary sleeve or bearing A, of base-plate A', lock-cylinders B B', long and short lock-pins C C', rotary and reciprocating operating-shaft D, knob E, push-arm F, setting-plate G, slotted guard-ring H, and guide-pin b^{10} , substantially as specified.

29. The combination with stationary sleeve or bearing A, of base-plate A', lock-cylinders B B', long and short lock-pins C C', rotary and reciprocating operating-shaft D, knob E, push-arm F, setting-plate G, slotted guard-ring H, guide-pin b^{10} , and a device O connected to the moving lock-cylinder B for controlling the movement of the door bolts or fastenings, substantially as specified.

30. In a combination-lock, the combination with a rotary and reciprocating operating-shaft D, having a non-circular stem d , with a removable knob E, having a socket fitting said stem, and a thumb-screw detachably connecting said shaft and knob, substantially as specified.

31. The combination with two adjacent lock-cylinders and a series of long and short lock-pins, of a rotary and reciprocating shaft, a push-arm secured to said shaft, a setting-plate adapted to reciprocate both with and independently of said shaft, and a spring tending to push the setting-plate in one direction and the push-arm and shaft in the opposite direction, substantially as specified.

32. The combination with two adjacent lock-cylinders, and a series of pairs of long and short lock-pins mounted therein, a reciprocating setting-plate, an operating-shaft, and removable eccentric-headed screws for limiting the movement of said setting-plate away from said lock-cylinders and permitting the setting-plate to be readily removed from the lock to change the combination by simply turning the eccentric-headed screws, substantially as specified.

33. The combination with two adjacent lock-cylinders and a series of pairs of long and short lock-pins mounted therein, of a rotary and reciprocating operating-shaft D, having a non-circular portion d^5 , a rotary and reciprocating setting-plate having a non-circular hole or hub fitting and adapted to reciprocate on said non-circular portion of the shaft, and an escapement K adapted to engage a recess d^6 at the end of said shaft to cause the setting-plate to reciprocate with the shaft, substantially as specified.

34. The combination with two adjacent lock-cylinders and a series of pairs of long and short lock-pins mounted therein, of a rotary and reciprocating operating-shaft D, 5 having a non-circular portion d^5 , a rotary and reciprocating setting-plate, having a non-circular hole or hub fitting and adapted to reciprocate on said non-circular portion of the shaft, and an escapement K adapted to en- 10 gage a recess d^6 at the end of said shaft to cause the setting-plate to reciprocate with the shaft, said escapement K having a pin k^3 engaging the rim of said rotary setting-plate, and said rim being also provided with a cam, 15 substantially as specified.

35. The combination with two adjacent lock-cylinders and a series of pairs of long and short lock-pins mounted therein, of a rotary and reciprocating operating-shaft D, 20 having a non-circular portion d^5 , a rotary and reciprocating setting-plate, having a non-circular hole or hub fitting and adapted to reciprocate on said non-circular portion of the shaft, and an escapement K adapted to en-

gage a recess d^6 at the end of said shaft to 25 cause the setting-plate to reciprocate with the shaft, said escapement K having a pin k^3 engaging the rim of said rotary setting-plate, said rim being also provided with a cam, and a spring k^2 for throwing the escapement into 30 engagement, with said shaft, substantially as specified.

36. The combination with base-plate A' having guard-stud a^3 on its inner face, with two adjacent lock-cylinders B B', a series of pairs 35 of long and short lock-pins C C', a rotary and reciprocating shaft D, a push-arm F secured thereto, a slotted guard-ring H, a guide-pin b^5 adapted to engage said push-arm, and a pair of guard lock-pins mounted in said lock- 40 disk in position to engage said push-arm when said push-arm is in position to engage said guide-pin b^5 , substantially as specified.

HENRY L. CLARKE.

Witnesses:

EDMUND ADCOCK,
H. M. MUNDAY.