

(No Model.)

5 Sheets—Sheet 1.

E. HAWLEY & C. L. BARRETT.
GRAIN BINDER.

No. 442,045.

Patented Dec. 2, 1890.

Fig. 1.

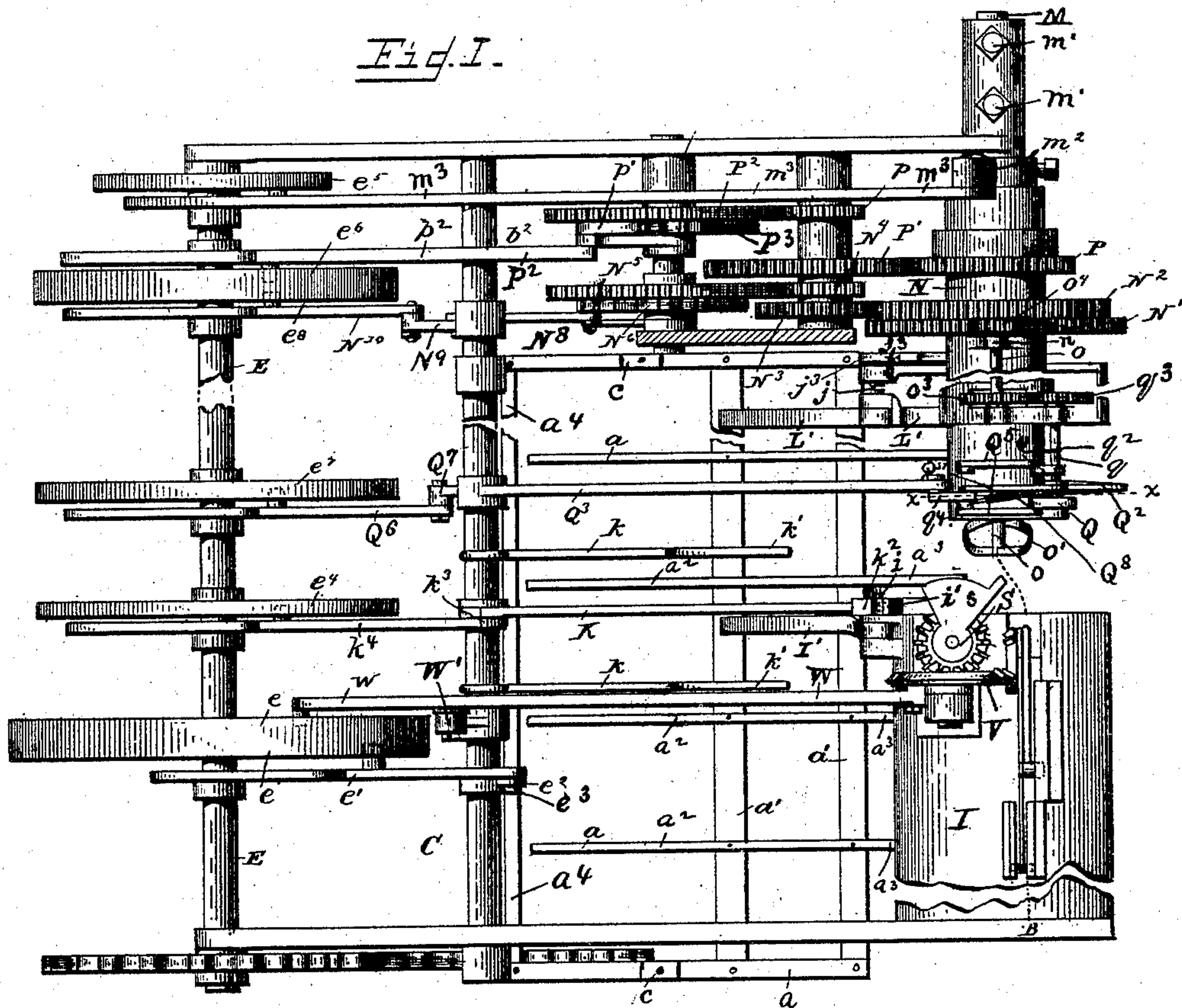


Fig. 5.

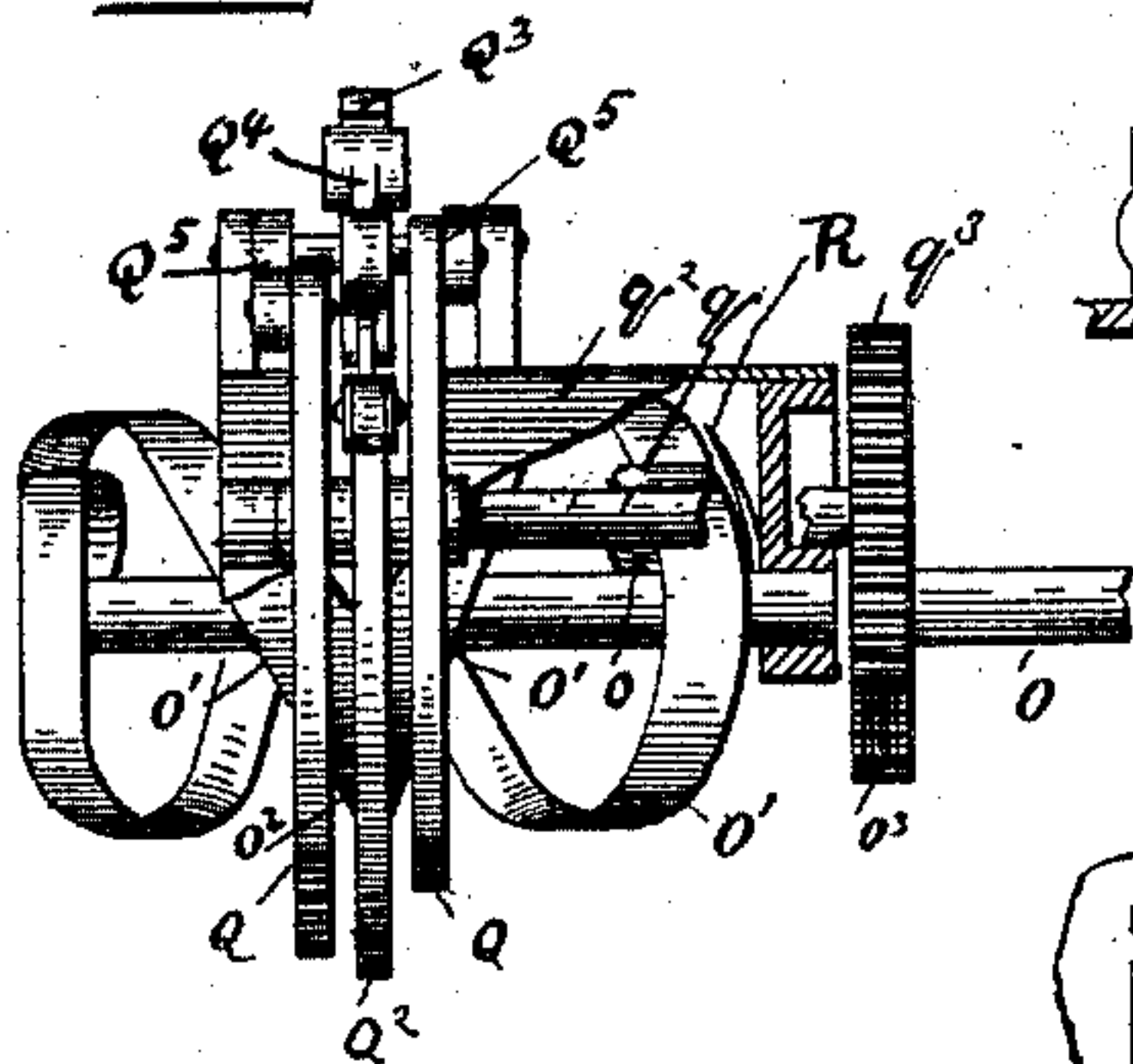


Fig. 6.

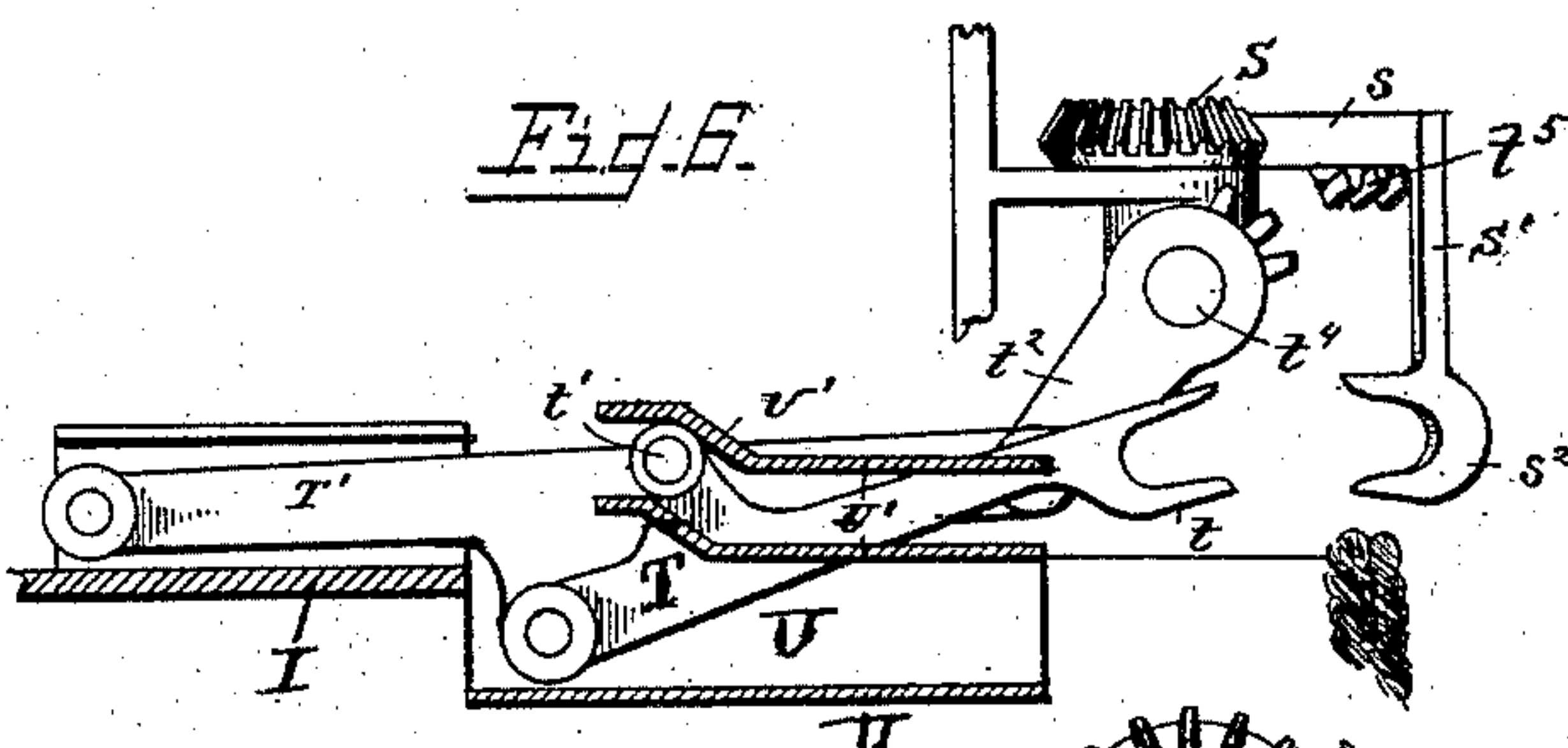
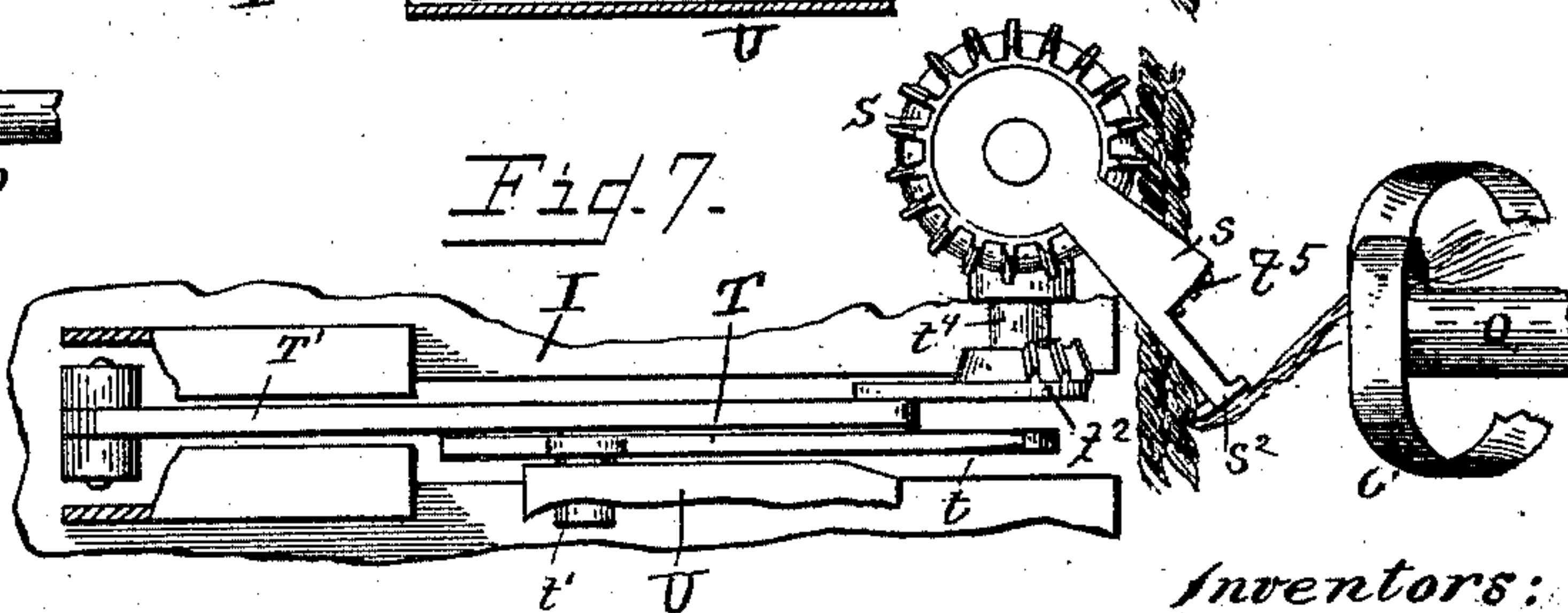


Fig. 7.



Witnesses

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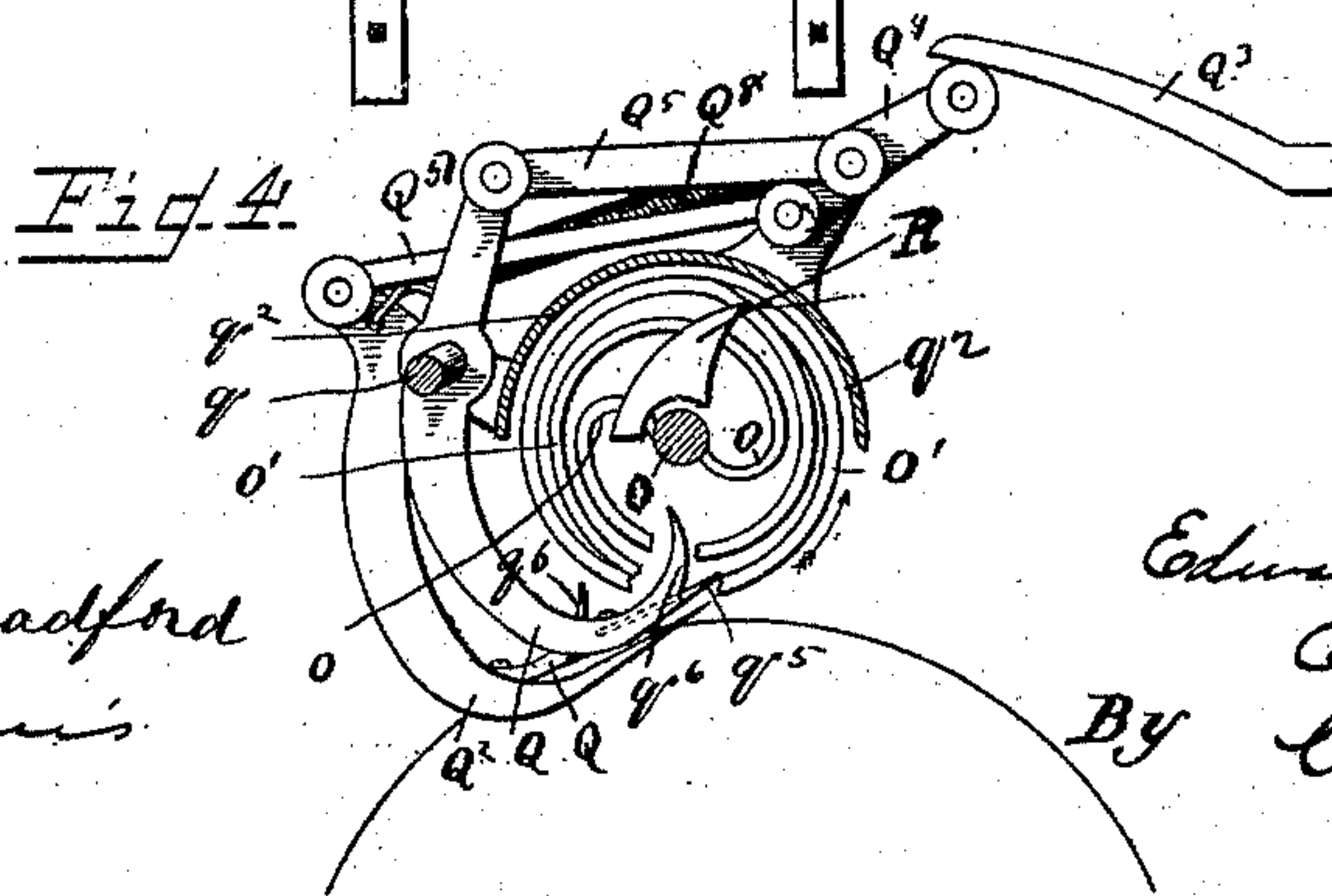
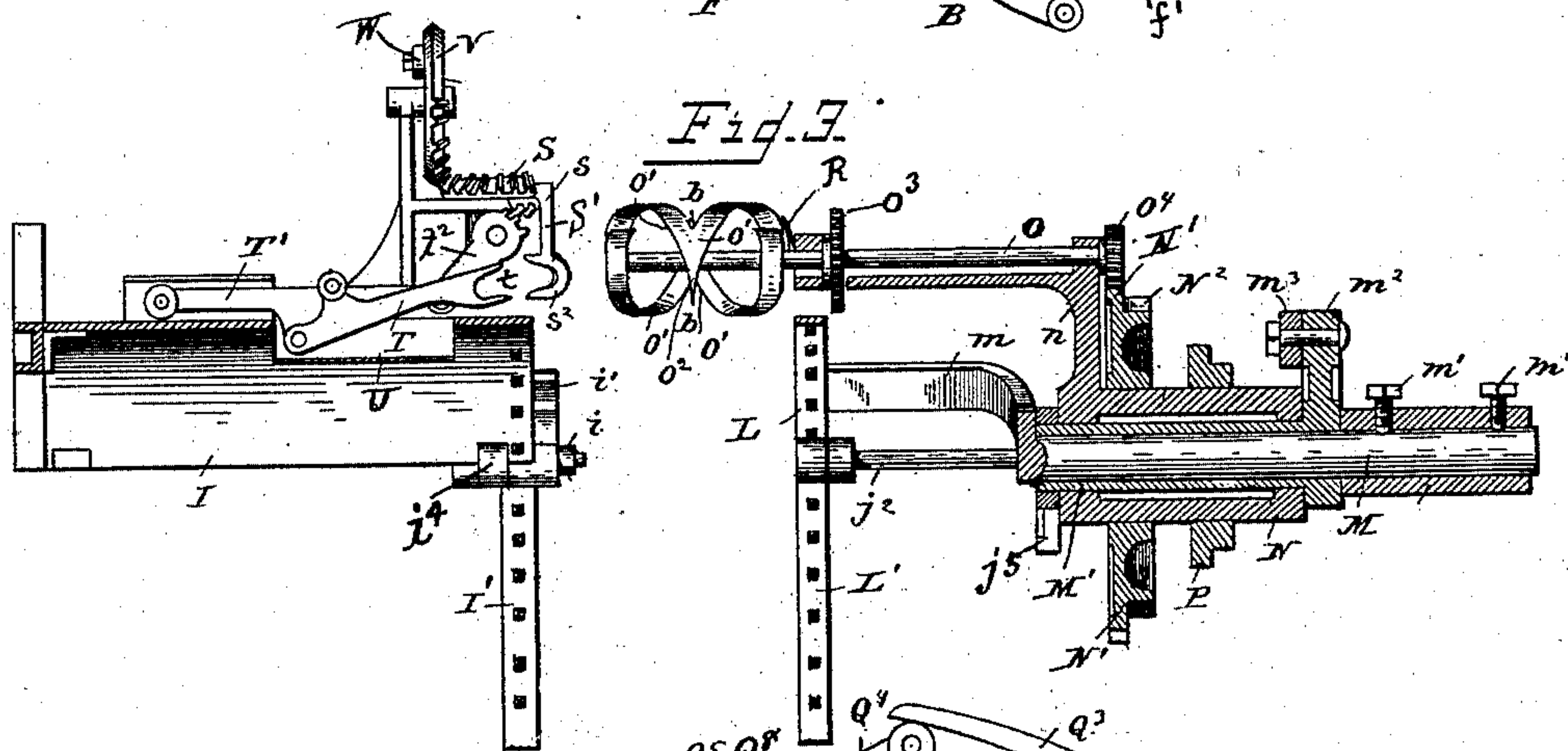
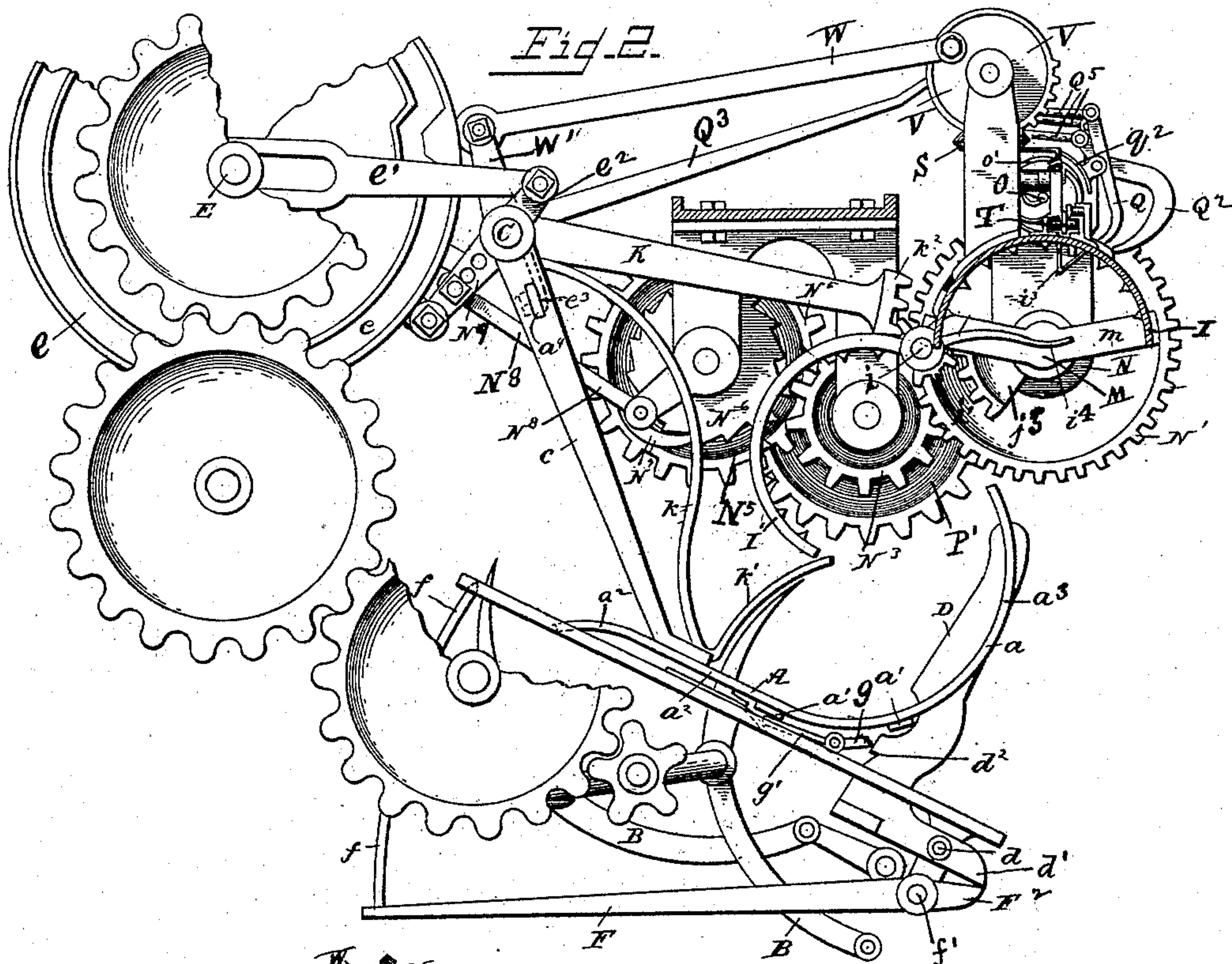
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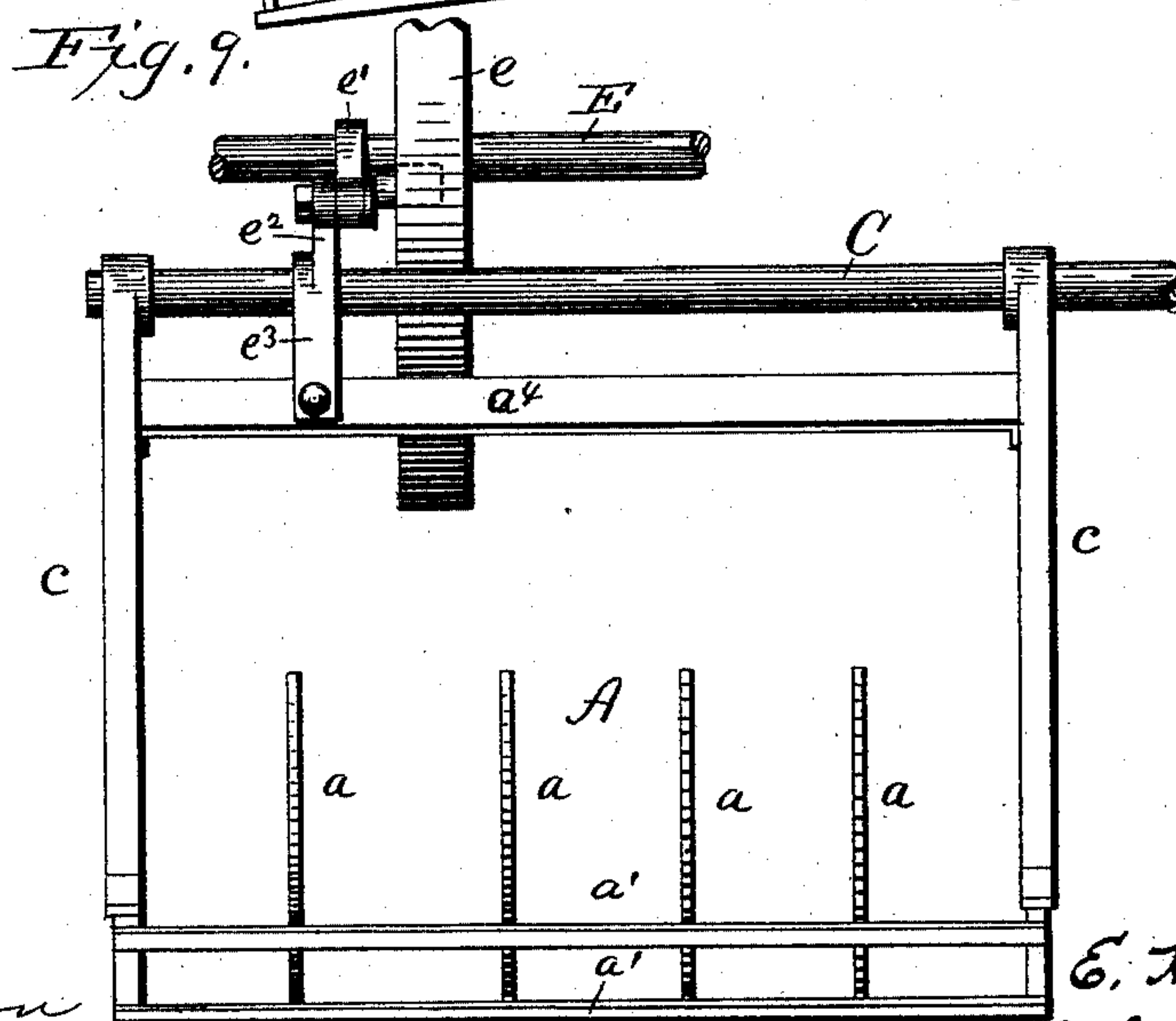
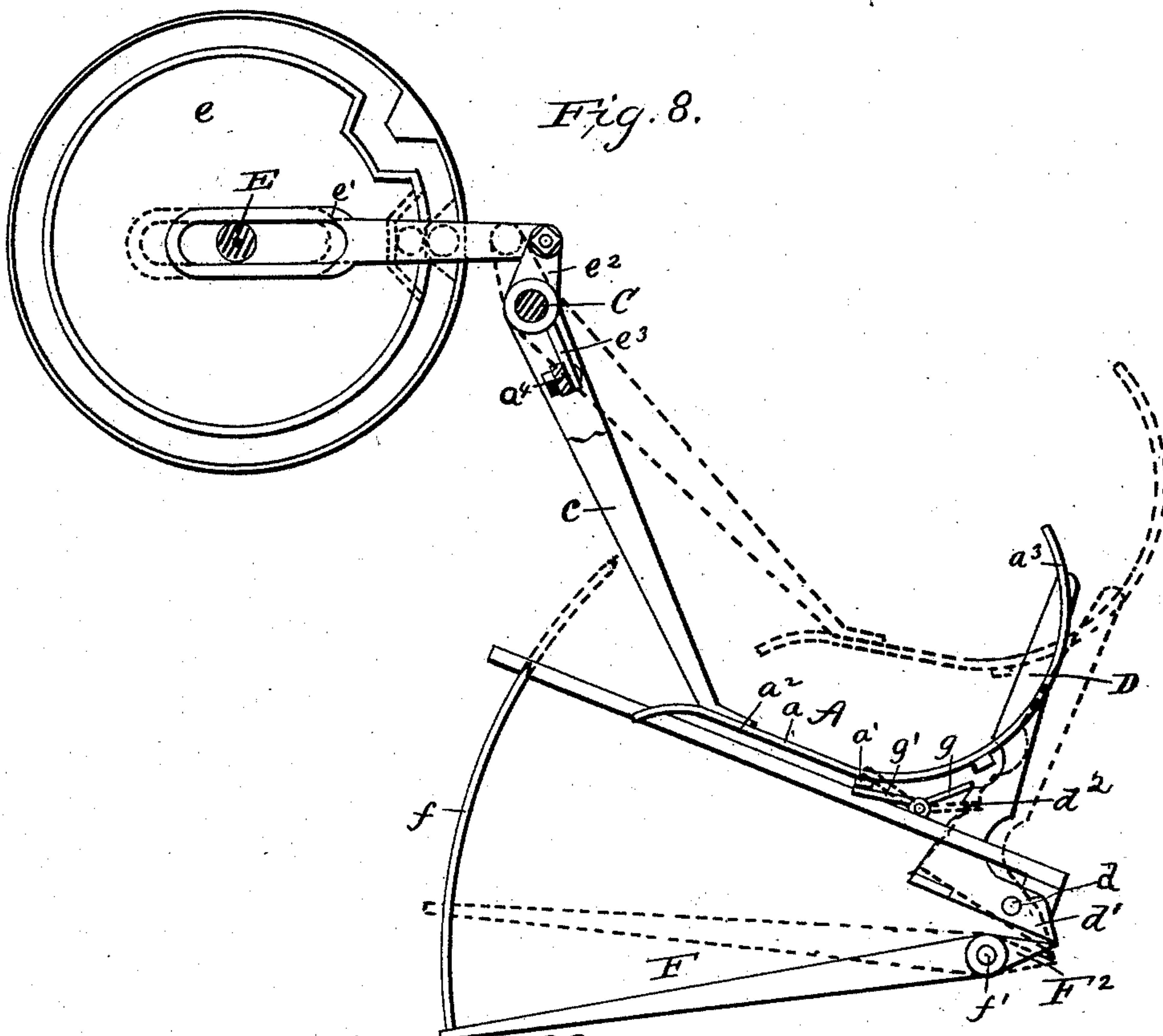
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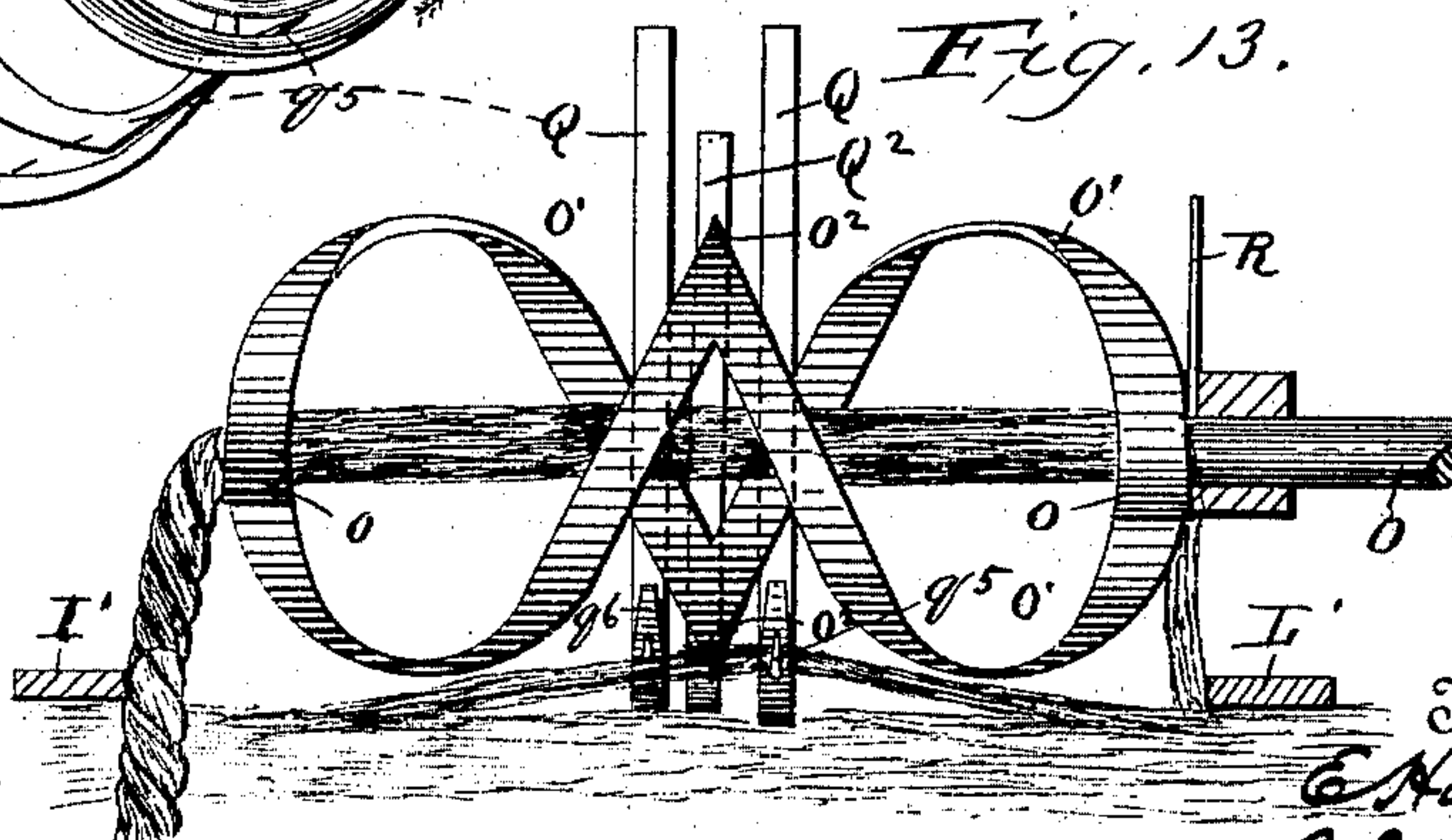
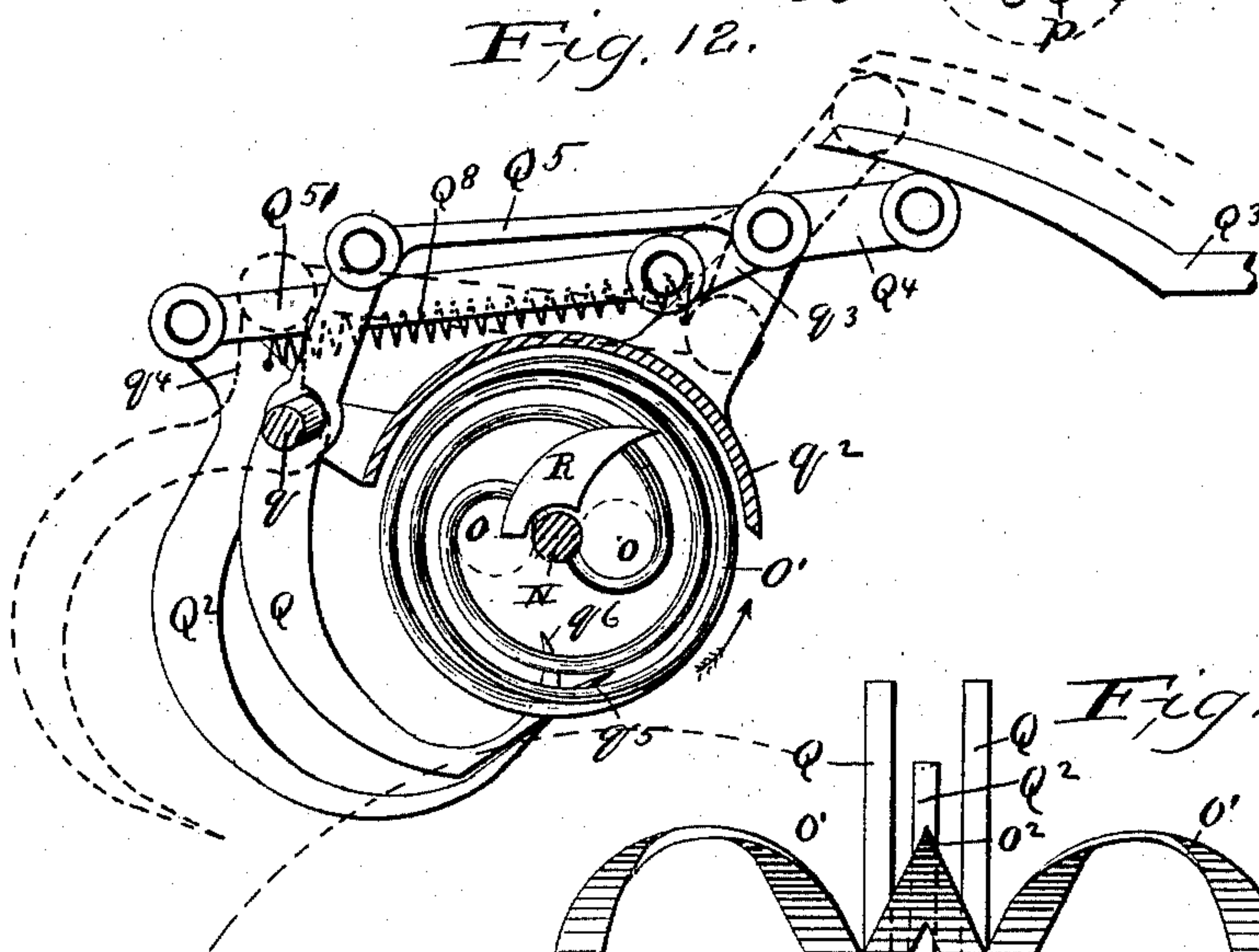
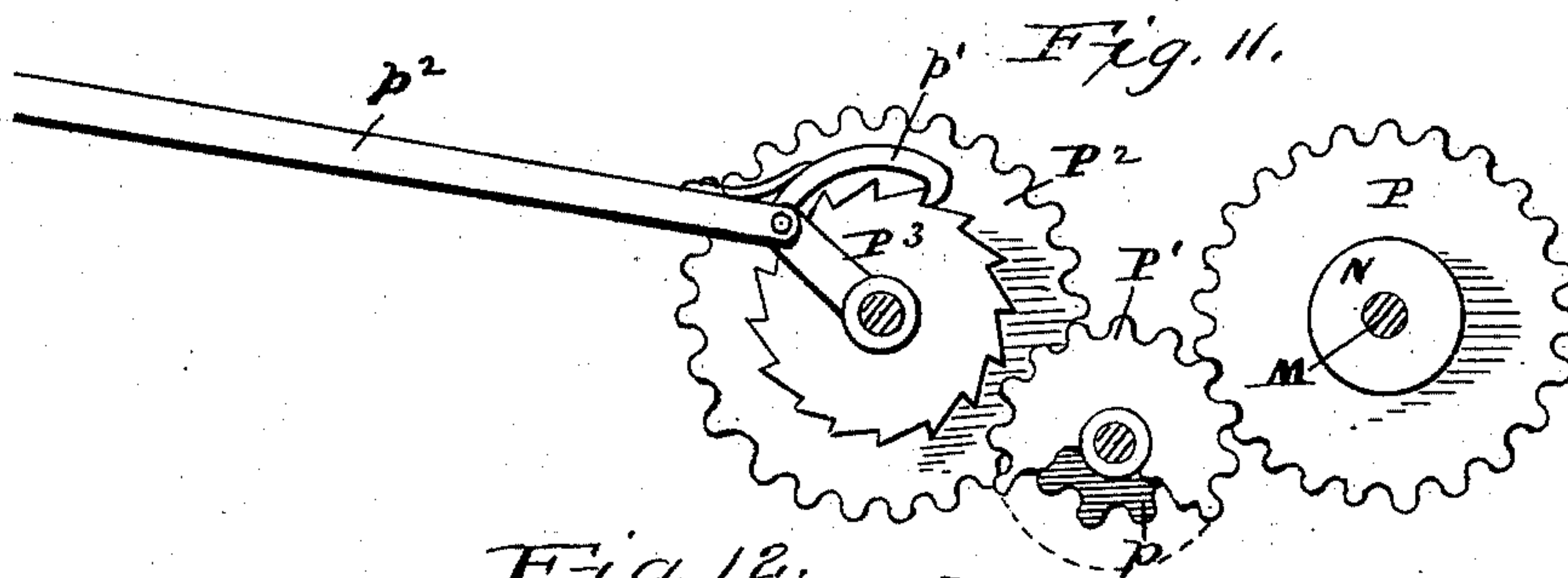
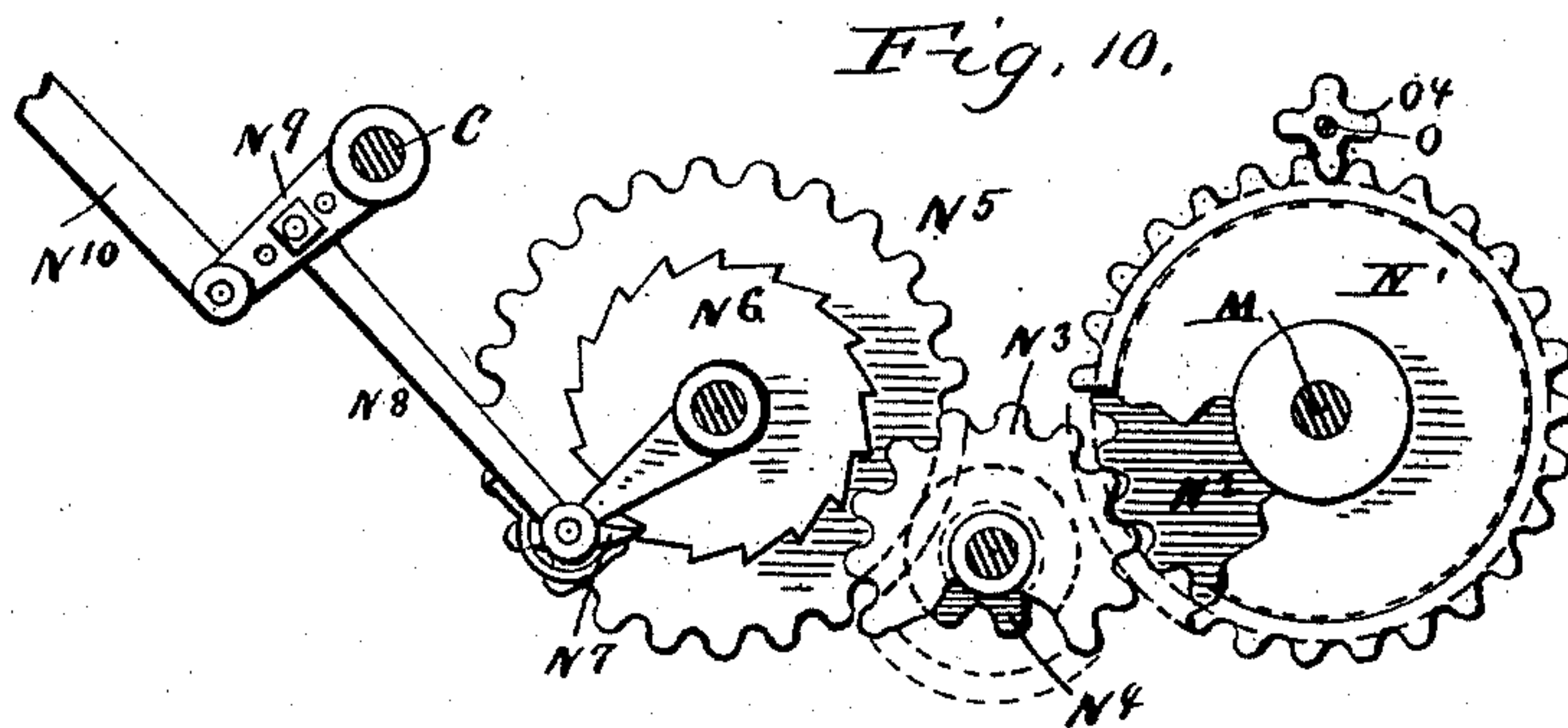
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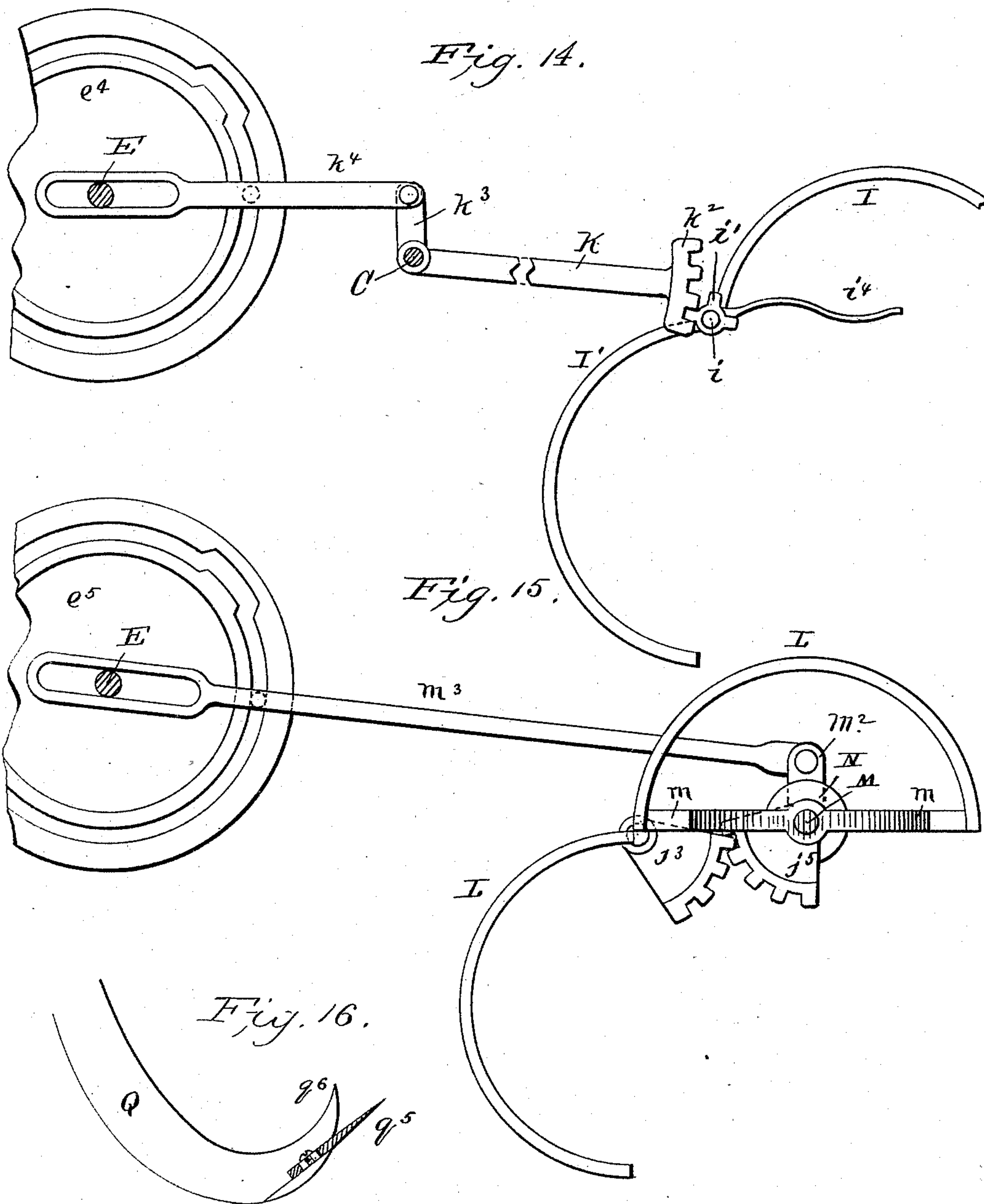
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UNITED STATES PATENT OFFICE.

EDWARD HAWLEY AND CHARLES L. BARRETT, OF ALLEGAN, MICHIGAN.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 442,045, dated December 2, 1890.

Application filed April 9, 1890. Serial No. 347,215. (No model.)

To all whom it may concern:

Be it known that we, EDWARD HAWLEY and CHARLES L. BARRETT, citizens of the United States, residing at Allegan, in the county of Allegan and State of Michigan, have invented certain new and useful Improvements in Grain-Binders, of which the following is a specification, reference being had therein to the accompanying drawings.

In the accompanying drawings, Figure 1 shows a plan view of our improved binding-machine; Fig. 2, a side elevation of the same, parts being broken away and other parts shown in section for the purpose of better illustration. Fig. 3 is a longitudinal section of the compressing devices, said section being taken on a line passing through the axis thereof. Fig. 4 is a transverse section on the line $x x$, Fig. 1, showing the straw picking and twisting mechanism. Fig. 5 is an elevation of the mechanism shown in Fig. 4. Fig. 6 is a detail plan view of the band securing or tucking devices. Fig. 7 is a longitudinal section of the same; Fig. 8, a vertical transverse sectional view of a portion of the machine, showing the rack and the means for elevating it more clearly; Fig. 9, a front elevation of the same; Figs. 10 and 11, detail views of the gearing employed to rotate the twisting devices; Figs. 12 and 13, views of the band twisting and picking mechanism, which will be fully hereinafter described; Fig. 14, a detail view of the means employed to operate the head-compressor arm; Fig. 15, a similar view of the means for operating the butt-compressor arm; Fig. 16, a detail view of one of the picker-arms.

The object of our invention is to provide certain improvements in that class of grain-binding machines in which the binding-band employed consists of straw taken from the bundle being bound and applied thereto as it is formed; and more particularly our object has been to make improvements on the device covered in our Patent No. 419,945 and dated January 21, 1890; and to this end our invention consists in the grain-binding mechanism and the parts thereof constructed and combined as hereinafter specified.

Our apparatus consists, essentially, of mechanism for receiving the grain after it has been cut, and, when accumulated in a desired

quantity to form the bundle or gavel, transferring it to compressing devices; of mechanism to effect its compression; mechanism for forming the binding-band, passing it around the bundle as said band is formed, and securing it thereto when applied, and mechanism for ejecting the bound bundle, such mechanisms operating automatically and in order.

Our apparatus may be employed in conjunction with any suitable reaping or harvesting machine; but as such machine forms no part of our invention and as the construction and operation of our mechanisms can be readily understood without reference to any particular form thereof we have not shown in the drawings nor shall we describe any such.

Referring to the drawings, A represents a cradle or rack into which the grain after being cut is delivered, its transportation thereto from the sickles or knives being effected by any of the means usually employed for such purposes. Said cradle or rack is constructed of several bars $a a$, arranged parallel with each other and connected together by two or more straight parallel strips or bars $a' a'$, extending transversely at right angles to them. The bars $a a$, as clearly shown in Fig. 2, each consists of a straight or substantially straight portion a^2 , which when the parts occupy the position seen in said figure slants at an angle of about twenty-five degrees to a horizontal line, and a curved or hook-shaped portion a^3 . Into this latter portion the grain, after being delivered at the highest point of the straight portion a^2 , gravitates and is allowed to collect therein until a quantity sufficient to constitute a bundle has been accumulated, packers B B, of usual construction, being employed to facilitate its passage and effect the proper packing thereof. A bar or shaft C, located above and parallel with said cradle or rack A, serves to support the latter, the extreme outer bars $a a$ being connected to said bar or shaft by means of downwardly-extending arms or bars c . The latter, for a purpose hereinafter set forth, are connected to said shaft, so as to be capable of oscillation thereon.

When the desired quantity of grain has accumulated and been packed in the cradle or rack A, the pressure of such grain upon the

longitudinal arm of an L-shaped trip-lever D, pivoted at d , will, through the operation of suitable clutch mechanism of the usual construction, cause the rotation of the main driving-shaft E, which is journaled to one side of and parallel with the shaft C. Mounted on and rotating with said shaft E is a cam e , which engages with a stud on a reciprocable bar e' , that is connected to a short crank-arm e^2 , which in turn is connected by an arm e^3 , projecting from its hub, to a bar a^4 , extending between and connected to the cradle or rack supporting arms or bars c , as shown most clearly in Figs. 8 and 9. The movement of the cam e , being transmitted to the crank-arm e^2 , will, through a rocking of the latter, effect a raising of the cradle or rack A and the loose grain contained therein into position for the grain to be operated on by the compressing and binding mechanism, as shown in dotted lines in Fig. 8. During the elevation of said cradle or rack and until its return to its lower normal position the grain coming from the harvesting machinery, which would otherwise be delivered into the space occupied thereby when in such lower position, is held in check by means of several fingers or tines f , which are projected upward into its path the instant that the upward movement of said cradle commences, and which are withdrawn the instant it reaches its lower position again, thus permitting a resumption of the movement of the cut grain into said cradle. To produce this movement of the fingers or tines f , they are mounted upon the extremity of the long arm of a rocking lever F, pivoted at f' and having its short arm F^2 engaged by the heel d' of the trip-lever D, from which lever the arm of lever F, carrying the tines f , receives its upward movement, the reverse movement of said tines being caused by gravity. A spring-actuated pawl g , engaging with a notch d^2 in said trip-lever, serves to hold said lever in the position to which it is moved by the straw, and accordingly the fingers or tines in their raised positions, as shown in dotted lines in Fig. 8. Said pawl is disengaged and the tines permitted to drop by the tail g' of said pawl being struck by a portion of the cradle or rack when it has descended to its lower position. Curved spring-arms k suspended from bar or shaft C and extending downward over the path of the loose cut grain serve to retain it in place and direct it into the lower portion of the cradle or rack, while an upwardly-extending curved or overhanging portion k' operates to guide the grain to the compressing and binding mechanism when raised thereto by the cradle or rack, as above described. When raised to the proper height, the loose bundle of grain is encircled simultaneously at two points by two sets of compressing devices, the one which we term the "head-compressor" engaging the bundle approximately at its longitudinal center, and the other, which we term the "butt-

compressor," engaging it at a point intermediate the former and the butt, a space being left between them.

The head-compressor consists of a semi-cylindrical inverted shell I, immovably attached to some part of the frame-work of the machine, and semicircular arm I' , pivotally connected to one of the lower edges of the part I. Said arm I' is caused to encircle the bundle of straw by means of a segment i' , attached to it, a rocking arm K, mounted on the bar or shaft C and having gear-teeth k^2 at one end meshing with said segment i' , a crank-arm k^3 , supported on the shaft C and attached to said arm K, and a reciprocable bar k^4 , having a stud in engagement with a cam e^4 , mounted on the shaft E, as shown particularly in Fig. 14. The butt-compressor likewise consists of the semicircular parts—the one stationary the other movable, and both arranged axially in line with the corresponding parts of the head-compressor. The stationary part consists of a narrow semicircular piece L, mounted on two forked arms m , that branch out from a suitably-supported bar or shaft M, which is held in a non-rotative position by set-screws m' . The movable parts consist of the semicircular arm L' , secured on one end of a short shaft j^2 , mounted on the part L at a point corresponding to the pivotal point of the head-compressor. The other end of said shaft j^2 is provided with a segmental pinion j^3 , which meshes with a segmental gear j^5 , mounted on one end of a hollow shaft M' , encircling the fixed shaft M, and on the other end of said shaft M' is mounted a crank-arm m^2 , that is connected by an arm or bar m^3 with a cam e^5 , mounted on the shaft E, as shown most clearly in Fig. 15, said parts operating to cause a movement of said compressor-arm L' simultaneously with a movement of the compressor-arm I' , the result being the entire removal of the loose bundle from the cradle or rack A and the requisite degree of compression of such bundle for binding.

The binding operation is performed by the following-described mechanism: Mounted on the hollow shaft M' , between the crank-arm and the segment j^5 , so as to revolve on but independently of it, is a cylindrical sleeve or casting N. Projecting from the end of the latter, adjoining the segment, is an arm n , which extends radially to a point beyond the periphery of the compressor I, where it furnishes gearing for a shaft O, that is arranged parallel with the axis of the compressors, or of a bundle of grain when contained therein. Said shaft O has such length that one of its ends reaches to a point about in a line with the longitudinal center of a bundle of grain when in the compressors, and its other end to a point somewhat beyond the butt-end thereof. On the former end said shaft carries our twister device. This consists of two oppositely-extending spirally-disposed members $O' O'$, that commence and terminate at points diametrically opposite each other. As

shown, each of said members has several coils terminating where they are secured to the shaft N in semicircular bends *o o*. Each of these members *O' O'* consists of two blades *o' o'*, secured to the shaft O at some distance apart and gradually converging until they unite in a sharp point, as *o²*, which constitutes the outer termination of the spiral, and preferably is sharpened to enable it readily to engage with the straw.

Instead of having the twister device remain stationary with reference to the bundle and causing the bundle to rotate in the operation of forming and applying the band, as in our before-mentioned patent, we now have the bundle remain stationary and cause the twisting device to revolve around it, for this purpose employing the gear-wheel P, mounted and secured on the casting or sleeve N, the gear-wheel P', meshing with the latter, the pinion *p*, keyed to the same shaft with the gear P' and meshing with the gear-wheel P², the ratchet-wheel P³, for rotating the latter, the pawl *p'*, engaging with said ratchet-wheel, a pitman *p²*, and the cam *e⁶*, for imparting motion to the latter, as shown in Fig. 11. Said mechanism is designed to be so timed as to cause either one or two revolutions of the twister, as may be desired, around the bundle, so as to form and pass around it either a single or double band.

The straw for forming the band is first "picked" from the surface of the bundle by two reciprocating pickers Q, mounted on a crank-shaft *q*, which has bearings on a semicircular-shaped hood or shield *q²*, inclosing the upper half of the twister, and receives its motion from a gear *q³*, keyed to its end and meshing with a gear *o³*, mounted on and rotating with the twister-shaft O. The motion of said pickers in the desired direction is effected by pivotally connecting portions which extend above the crank-shaft *q* to rods Q⁵, that in turn are pivotally connected to lugs which project upward from the twister shield or hood *q²*. At their lower ends said pickers carry needles *q⁵*, which, in conjunction with upwardly-extending portions *q⁶*, provided on the former, operate to engage with and separate the straw intended for use in the band from the body of the bundle, as shown in Fig. 13, and preferably said needles are made adjustable, so as to permit of variation in the amount of straw picked up. When the desired amount of straw has been picked up, the pickers are prevented from taking more by means of a hook-shaped arm Q², (of a shape resembling that of the former,) that is placed between said pickers, and by means of a lever Q³, engaging one end of a rocking arm Q⁴, and a rod Q^{5'} is at the proper time forced into contact with the straw of the bundle, thereby preventing its removal by said pickers. This lever Q³ when pressed into contact with the bundle at a point between the pickers presses or crowds the straw back into the bundle a sufficient

distance to take it out of reach of the pickers, as shown in full lines in Figs. 4 and 12. A cam *e⁷* on the drive-shaft E, engaging a stud or pin on a reciprocable bar Q⁶, pivotally connected to a crank-arm Q⁷, supported on a shaft C, effects such movements through the medium of lever Q³ of the arm Q², while a spiral spring Q⁸ causes a reverse movement thereof and holds said arm Q² normally away from the bundle to prevent interference with the pickers, as shown in dotted lines in Fig. 12. The straw after being by the picker devices thus preliminarily raised or picked from the surface of the bundle is engaged by the points *o²* of the twister, as shown in Fig. 13. Each member *O'* engages a portion so as to form a strand, and by reason of its divergent shape draws the straw from the butt-end of the bundle (the butt-compressor for this purpose being made larger in diameter than the head-compressor, so as to encircle the bundle less tightly than the latter) until the length requisite has been obtained, and, before the strand reaches the semicircular bends *o o* and the twisting of the two strands commences, carries it into contact with a relatively-stationary cutter or knife R, secured to the shaft-bearing adjacent to the end of the twister nearest the gear O³, which operates with the edges of the members *O' O'* as shears to sever said strands, after which, being carried into the bends *o o*, they are twisted together, as shown in Fig. 13.

The advantage accruing from drawing the straw from the butt to form the strand is that a strand longer than the space between the compressors is obtained, and therefore there is less waste of straw.

The edges of the members *O' O'* are preferably made sharp, so as to cut their way through twisted straw, thus insuring a clean strand for the band, and also preventing straw from winding upon the twister.

If desired, the straw-picking device may be omitted and the twister arranged to take the straw directly from the bundle, in which event of course it would be disposed closer to the bundle than when used with the pickers; but we prefer to use the latter, as a more even and uniform band can be made than without them, and instead of forming a double band around the bundle, by passing the twister twice around it two twister devices may be simultaneously employed, so as to form two bands by one revolution around the bundle.

Rotation of the twister on its axis may be effected either by meshing a pinion *o⁴* on the end of twister-shaft O with a gear-wheel N' and maintaining the latter in a stationary position during the revolution of the twister around the bundle, so as to constitute a sun-and-planet gear, or, if an increased rotation of the twister is desired, by rotating the gear-wheel N' through the agency of a gear-wheel N², arranged to revolve therewith, a pinion N³, a second pinion N⁴, keyed to the same shaft with pinion N³ and meshing with a gear-

wheel N⁵, a ratchet-wheel N⁶, arranged to rotate with the latter, a pawl N⁷, engaging with said ratchet-wheel to effect its rotation, a pitman N⁸, connecting the latter to a crank N⁹, mounted on the shaft or bar C, a reciprocable bar N¹⁰, attached to said crank, and a cam e⁸, rotating with the shaft E, as shown in Fig. 10. As shown, the crank N⁹ is provided with a number of perforations, so as to permit of a change in the throw of the pawl N⁷ when desired.

To prevent any rotation or tendency to rotation of the bundle of straw within the compressors during the operation of forming and applying the band, the internal peripheries of said compressors are corrugated or roughened by means of pointed projections, as shown.

To secure the band in place after its formation and application to the bundle, we use the following mechanism: Mounted on the top of a vertical shaft supported in bearings located on the upper side of the shell I of the head-compressor is a mutilated bevel gear-wheel S, that has formed on or attached to it a radial arm s. Extending downward from the latter is an arm S', whose lower end is formed into a U-shaped hook s². Said hook is adapted at the proper time, by the rotation of the bevel-gear S, to engage with the end of the binding-band, remove the same from the twisting device, and pass it across that portion of the band encircling the bundle, as shown in Fig. 7, into position to be engaged by the hooked end t of a reciprocating arm T, moving in suitable guides U, provided on the upper side of the shell I, which arm T engages with the band end and, through the agency of a stud t' and a camway U', carries said end down below the lower surface of the band, the bundle having been depressed at such point for the purpose by an offset i³, (see Fig. 2,) formed on the compressor-section I, and then tucks it under the band and into the straw. To effect such movements of the tucker-bar T, it is connected to a reciprocating bar T', which in turn is connected to a crank t², mounted on a short shaft or gudgeon t⁴ and having teeth adapted to mesh with bevel gear-teeth t³ on the under side of the radial arm s. As will be observed, the end of the band is removed from the end of the twister by the hook s² and carried across the laid band into the jaw t, which automatically forces it under the laid band from the side nearer the head of the bundle. Motion is imparted to the gear S from a mutilated gear V, driven from the cam e, mounted on the shaft E, and a reciprocating bar W, this bar W being held in engagement with cam e by a pivotally-connected supporting-arm W', mounted loosely on the shaft C. After the end of the band is secured as above explained the compressor-arms I' and L' are automatically opened by the mechanism hereinbefore described, and the bound bundle ejected from the machine by means of a radial arm i⁴, at-

tached to and moving with said compressor I'. The bundle on being thus ejected falls upon the convex sides of the hook-shaped portions of the cradle or rack A, which thus serve as guides to direct it in its exit from the machine, such portions, as shown by the drawings, having a situation relative to the bundle holding and compressing devices for this purpose. It is to be observed that, as in our formerly-patented device, the straw for the band is removed from the butt-end of the sheaf or bundle, the heads thereof not being affected at all, and, further, that the peculiar construction of the twister and the picker devices effectually comb out or separate the straw used in forming the strands of the binding-band, in this being aided by the corrugations or projections provided on the compressor-section I.

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

1. The combination of a binding mechanism, a straw-receiving rack located below the same and consisting of curved tines connected together, mechanism for elevating said rack to the binding mechanism, consisting of a bar or shaft C, located above the rack, depending arms c c, pivoted on the shaft C and attached at their lower ends to the rack and connected by a cross-bar a⁴, an arm e², pivoted on said shaft C and connected to said cross-bar a⁴, a shaft E, carrying a cam e, a link e', provided with a stud engaging said cam e and connected to arm e², and a pair of stationary compressor-sections I and L, pivoted compressor-arms I' L', provided with toothed segments, and means for operating these arms, substantially as and for the purpose described.

2. In a grain-binder, in combination with a straw-receiving and elevating mechanism, straw-checking fingers or tines, a lever interposed between the latter and said mechanism to raise said fingers or tines, and a locking-pawl engaging said lever, substantially as shown.

3. The combination, with a bundle holding and compressing device, two separated immovable semicircular sections and two similarly-shaped movable sections hinged to the former, and mechanism for operating the movable section, of a twister device supported between the said immovable sections, pivoted pickers carried by the twister and a crank-shaft and gears for operating these pickers, and mechanism for rotating the twister on its own axis and around the bundle-holding devices simultaneously, as and for the purpose described.

4. The combination of two separated bundle-compressors L and I, two depending pivoted compressing-sections I' L', gearing for operating these hinged sections, a shaft M for supporting the section L, a sleeve on this shaft and provided with a radial arm n, gearing for rotating this sleeve and arm, a shaft

o, journaled upon the arm *n* and carrying twisting devices, and gearing for rotating this latter shaft, substantially as described.

5 5. The combination, with a rotating twisting device, of a device for picking the straw from the bundle, consisting of a pair of curved arms pivoted on a crank-shaft and provided with hooks at their ends to engage and carry the straw to the twisting device, and means
10 for rotating the said crank-shaft, substantially as and for the purpose described.

6. The combination, with a pair of pickers *Q Q* and means for operating them, of an arm *Q²*, pivoted between the pickers, and mechanism for automatically operating this arm,
15 whereby the straw in under the pickers is depressed and kept out of engagement therewith, substantially as described.

7. The combination, with a twister-shaft, 20 of a twisting device carried by the shaft, said twisting device consisting of two oppositely-disposed spiral members coiled one or more times around the shaft, each of said members being constructed of two blades converging
25 to a point and connected at their outer ends and secured to the shaft at their inner ends, substantially as and for the purpose described.

8. The combination, with a band-twister constructed of two oppositely-arranged spiral
30 members secured to a shaft, of a cutter situated relatively stationary to the said shaft and adapted to co-operate with the edges of the said spiral members to sever the strands of the band, substantially as and for the purpose described.
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9. In a grain-binder, in combination with

the band forming and applying mechanism, the tucking mechanism consisting of a bevel-gear carrying a radial arm, a band-engaging hook carried by the latter, a reciprocating
40 hook, a reciprocating bar connected thereto, a crank connected to the latter, and means for rocking said crank, substantially as set forth.

10. The combination of a curved stationary 45 compressor-section and a curved compressor-arm pivoted thereto and provided with an extension or arm *i⁴*, projecting into the said stationary compressor-section and adapted to eject the bundle when the pivoted arm is
50 opened, substantially as described.

11. The combination of a straw receiving and elevating rack constructed of curved tines or bars, an upright lever *D*, arranged in the curved part of the rack and pivoted be- 55 low the same, this lever being provided with a toe *d'*, and a lever *F*, pivoted below the lever *D* and provided with an extension *F²*, adapted to engage the said toe *d'*, this lever *F* being provided with upwardly-extending
60 tines adapted to be projected up in the path of the loose grain while the elevating-rack is raised, substantially as and for the purpose described.

In testimony whereof we affix our signatures 65 in presence of two witnesses.

EDWARD HAWLEY.
CHAS. L. BARRETT.

Witnesses:

WILL C. WALTER,
J. G. STEIN.