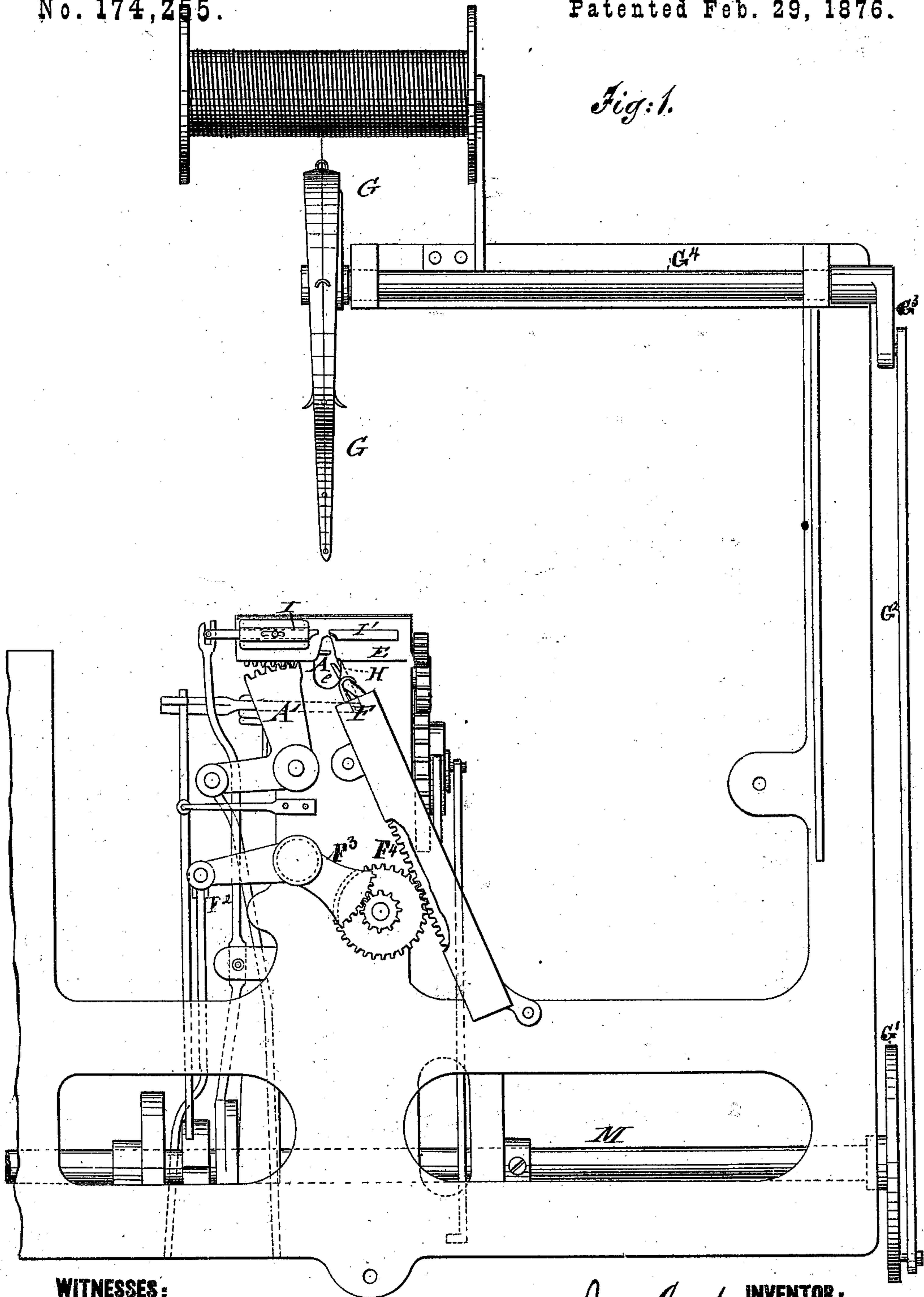


J. A. KAY.
GRAIN-BINDER.

No. 174,255.

Patented Feb. 29, 1876.

Fig: 1.



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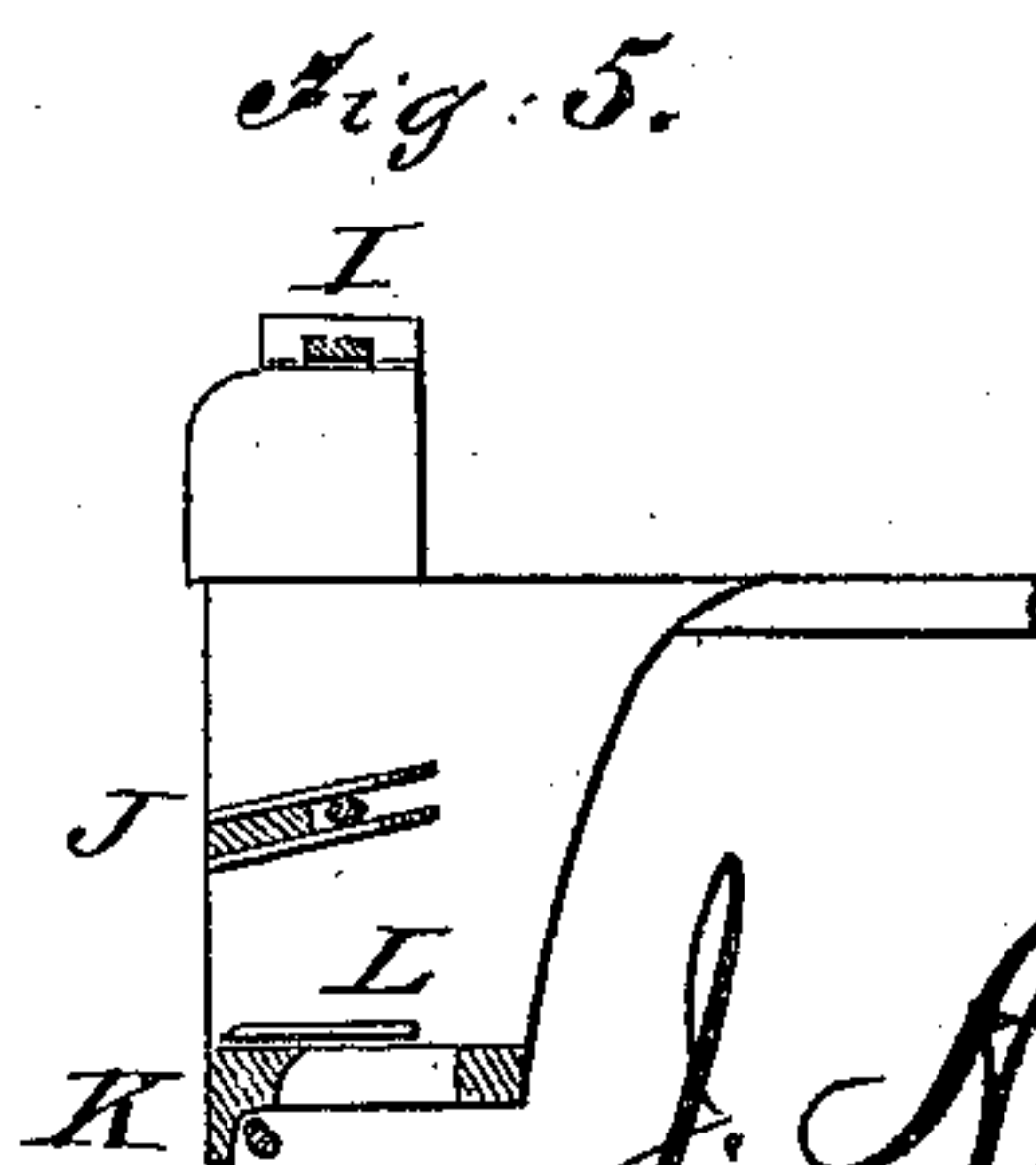
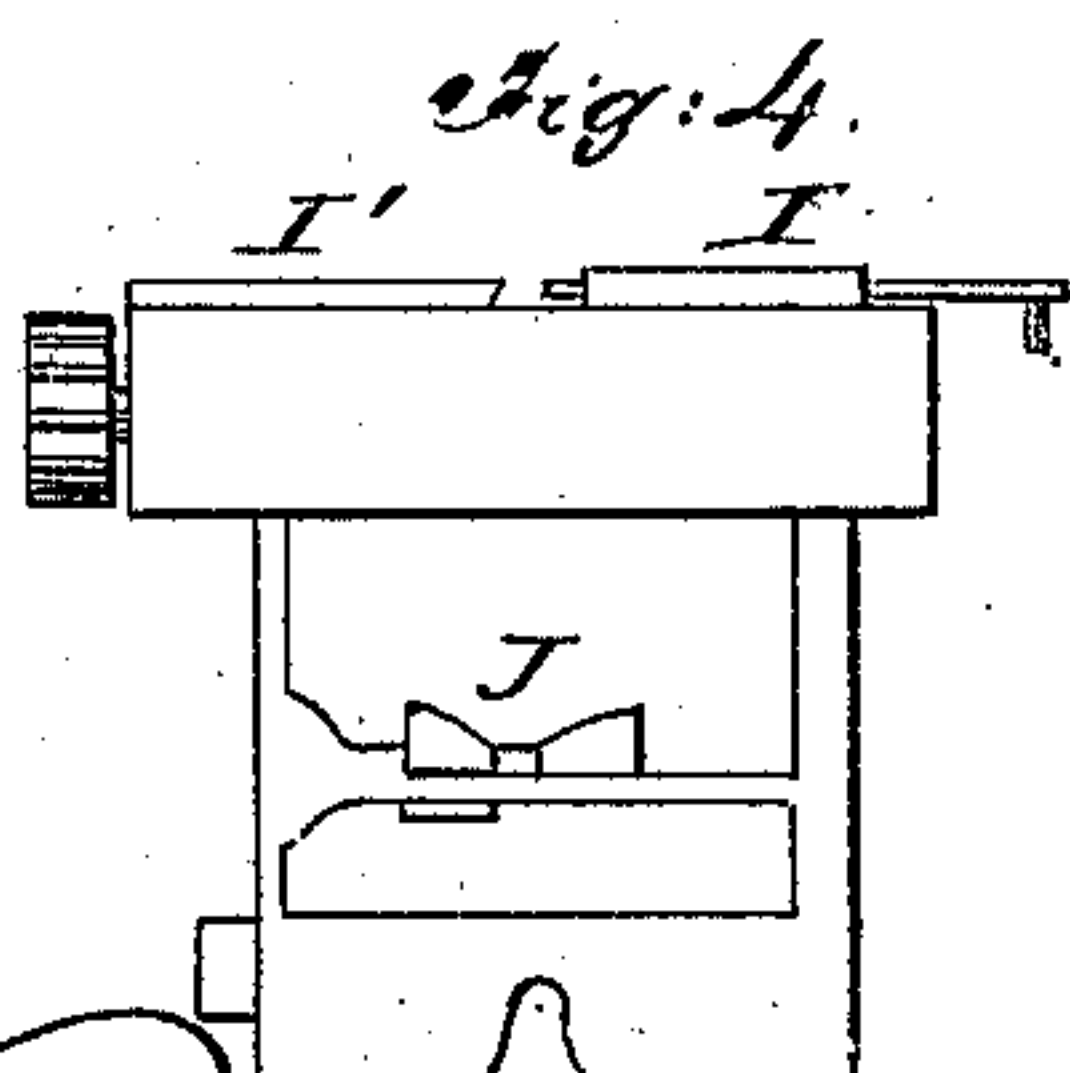
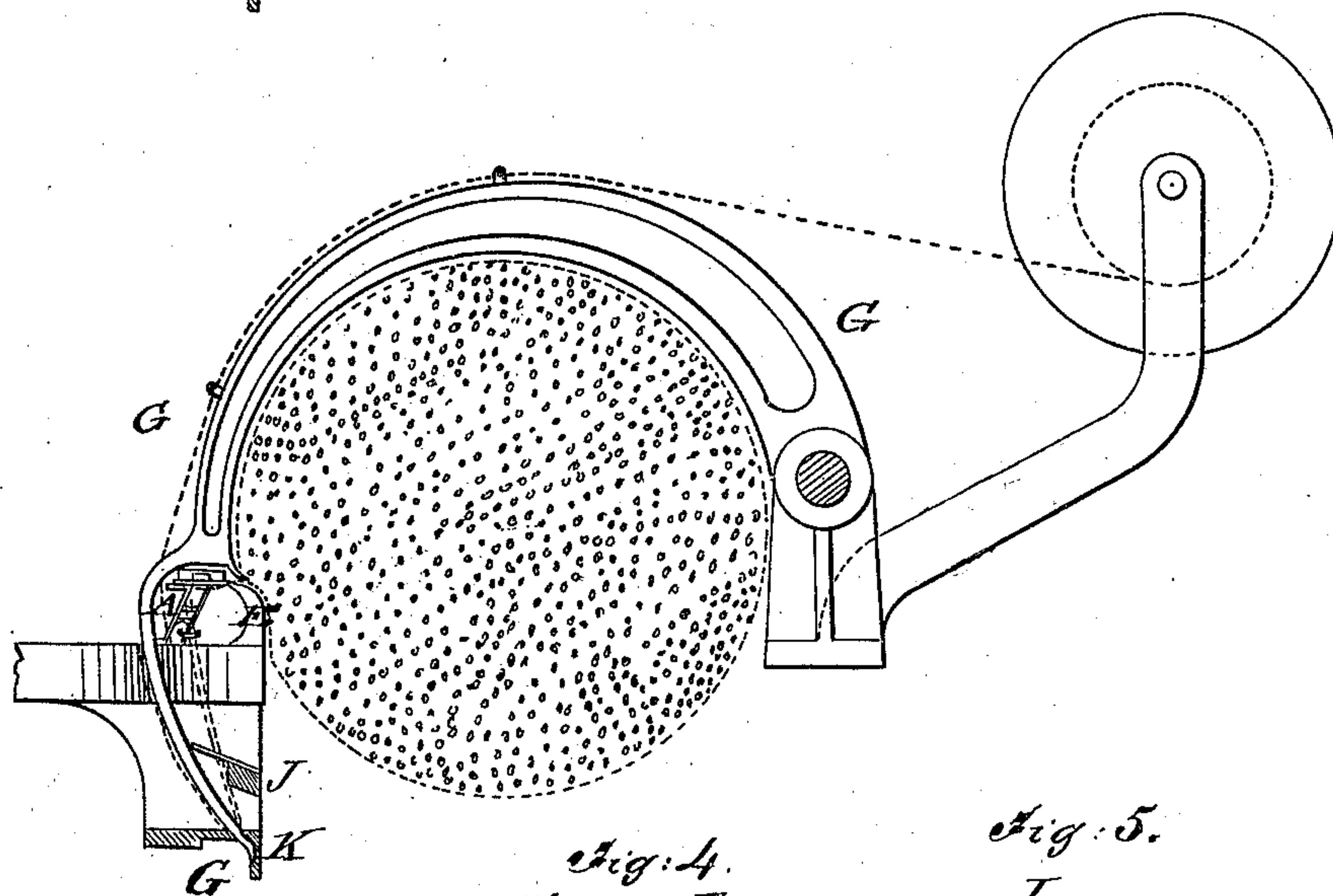
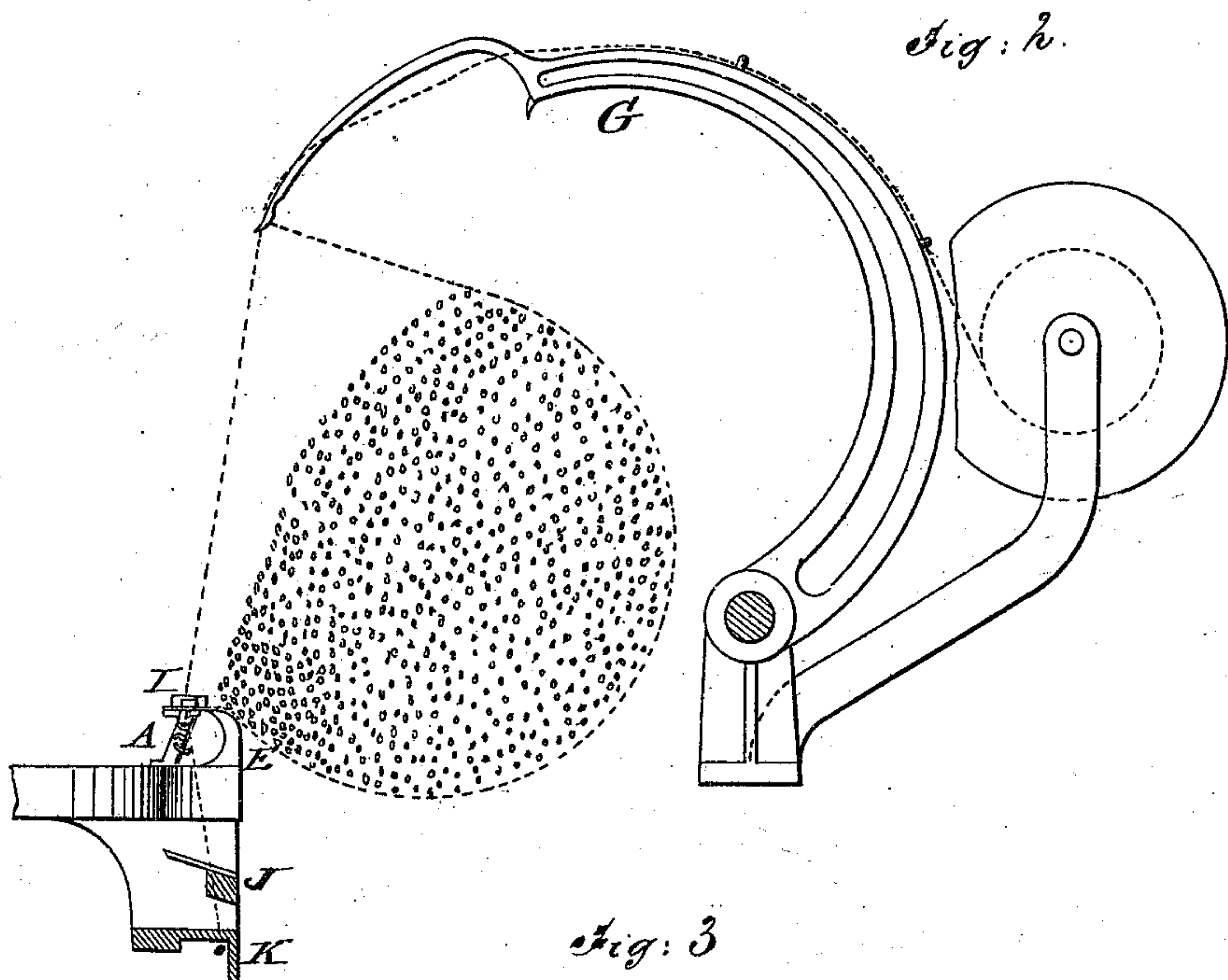
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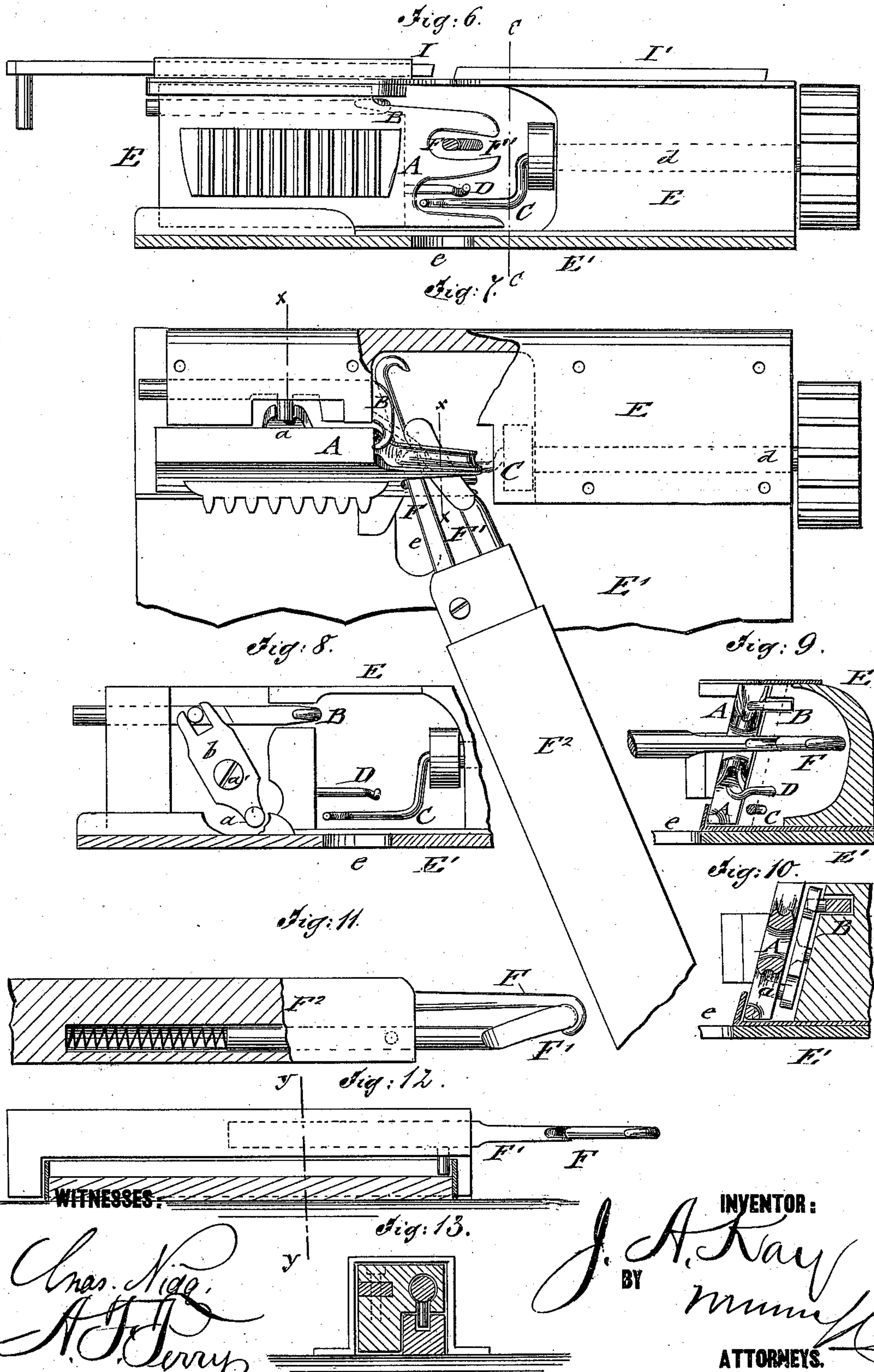
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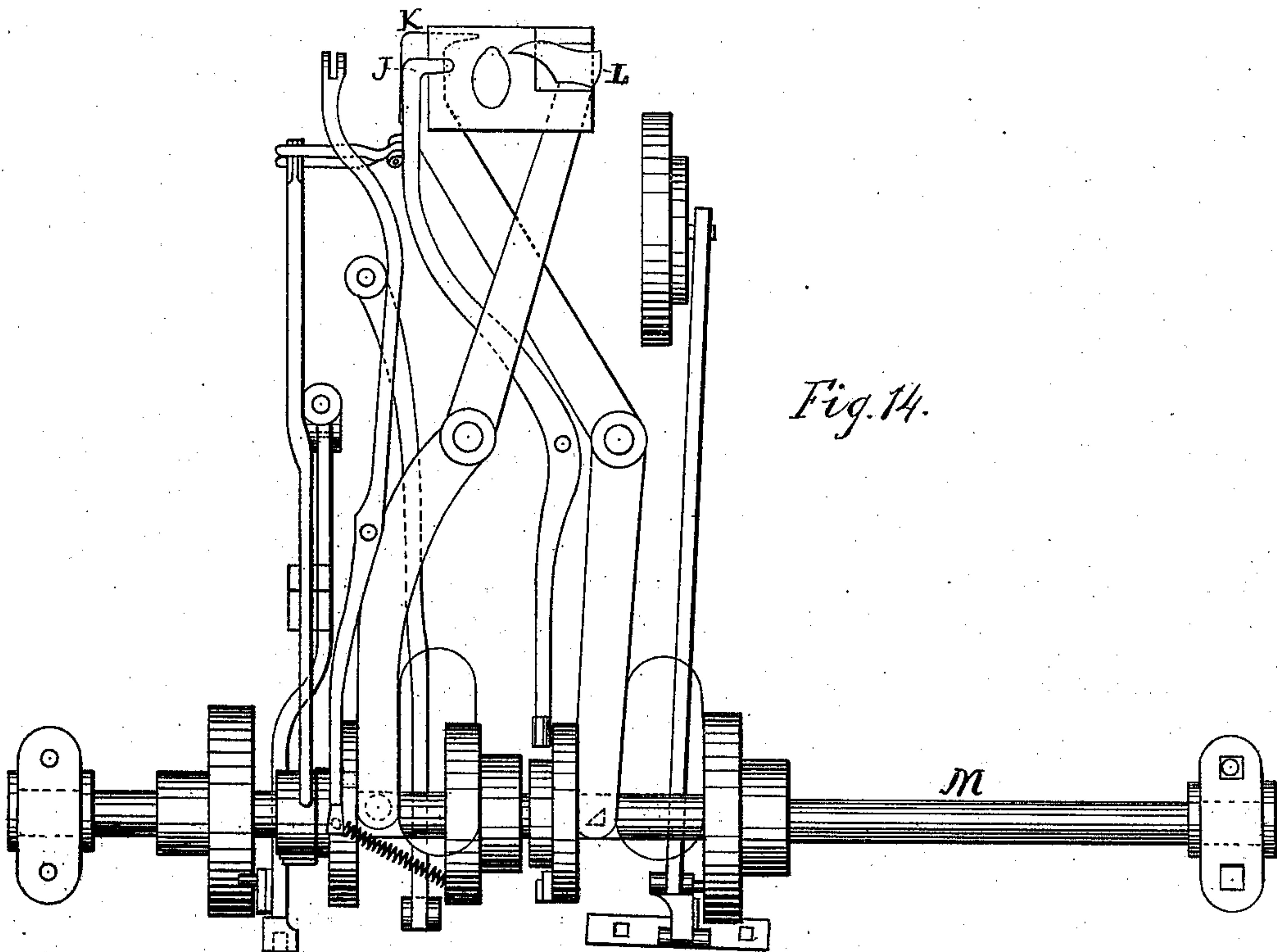


Fig. 14.

Fig. 16

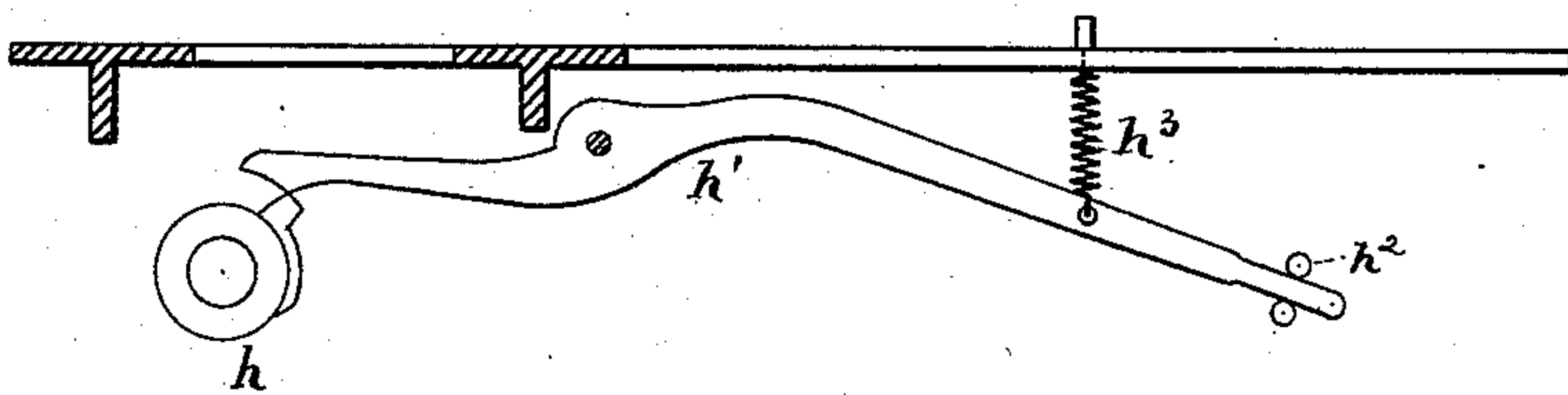
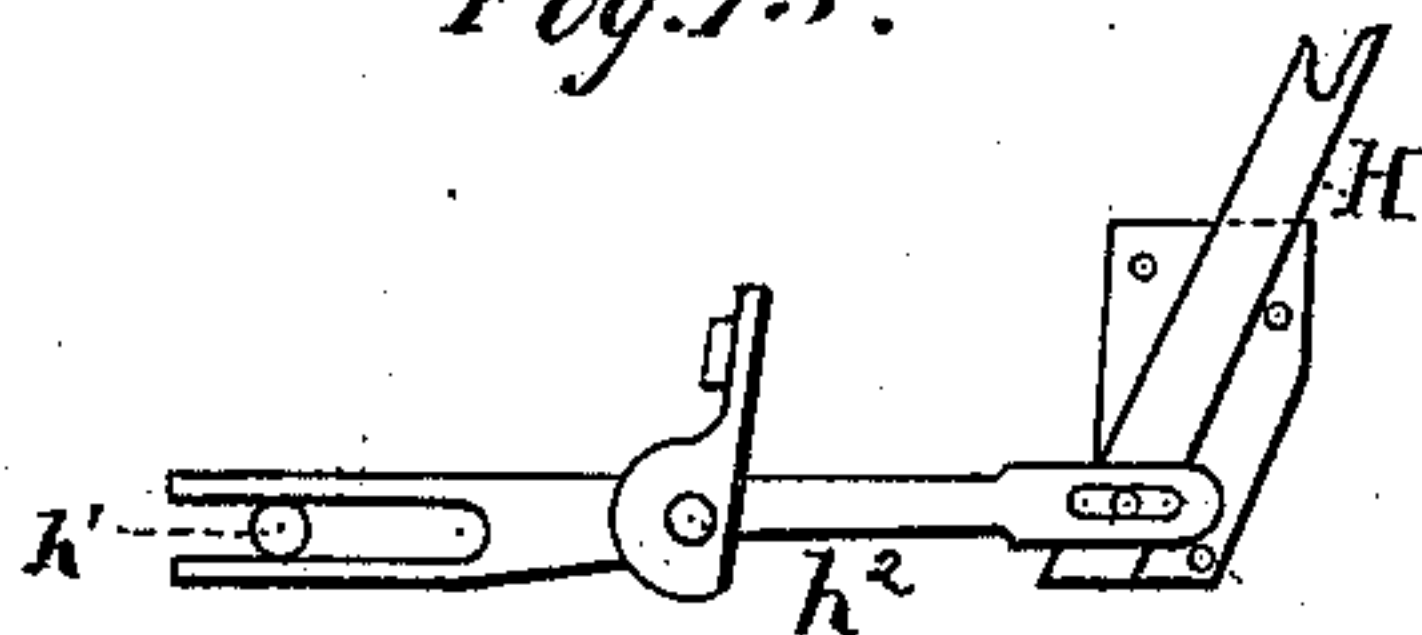


Fig. 15.



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UNITED STATES PATENT OFFICE.

JOSHUA A. KAY, OF MELBOURNE, COLONY OF VICTORIA.

IMPROVEMENT IN GRAIN-BINDERS.

Specification forming part of Letters Patent No. **174,255**, dated February 29, 1876; application filed July 24, 1875.

To all whom it may concern:

Be it known that I, JOSHUA ALEXANDER KAY, of Melbourne, in the Colony of Victoria, have invented a new and Improved Apparatus for Tying Knots, of which the following is a specification:

The object of my invention is to furnish an apparatus for tying knots in single or double string, being mainly intended to be used in grain-binders for tying knots in strings around sheaves of grain.

The invention consists of certain tools, implements, or devices for tying knots together, with the mechanisms for imparting the necessary motion thereto. These devices consist, primarily, of a pronged looper, a horizontally-sliding hook, a rotating hook, and a hooked finger and thumb, and, secondarily, of a needle, a knot-slipper, a fixed hook, a top, bottom, and middle cord-catcher, a holder, and a cutting-knife, by the joint working of all of which inside of an oblong casing or knotting-box the knots are produced.

In the accompanying drawings, Figure 1 represents a top view of my apparatus for tying knots. Figs. 2 and 3, respectively, show side elevations of the needle mechanism for supplying the cord around the sheaf, and to the looping and knotting devices. Figs. 4 and 5 are, respectively, end view and section of the top, middle, and bottom cord catchers; Figs. 6 and 7, respectively, sectional side elevation and top view of the knotting-box, with the looper, the horizontally-sliding, stationary, and rotating hooks, and the hooked finger and thumb. Fig. 8 is a detail view of knotting-box, with looper removed to show the horizontally-sliding, stationary, and rotating hooks. Fig. 9 is a vertical transverse section of knotting-box and its different parts, taken on line *c c*, Fig. 6. Fig. 10 is also a vertical transverse section of knotting-box on line *x x*, Fig. 7, showing looper and horizontally-sliding hook in section; and Figs. 11, 12, and 13 are, respectively, top view, side view, and vertical transverse section on line *y y*, Fig. 12, of the hooked finger and thumb and their guide-box. Fig. 14 is a top view of the machine, the top plate being removed to show the bottom and middle catch, the cutting-knife, and the mechanism for operating the

same. Fig. 15 is a detail view of the knot slipped, and Fig. 16 also represents in detail the mechanism for operating the same.

Similar letters of reference indicate corresponding parts.

I will first proceed to describe the different parts composing my apparatus for tying knots, and then their actuating mechanism, and, lastly, the consecutive working of the devices to produce the knots.

The looper A consists of an oblong slab, having three prongs at one end and some rack-teeth on its face. The upper prong is grooved lengthwise on its upper side and the middle one on its lower side. A slot is made in the back to receive a pin or stud, *a*, for working the horizontally-sliding hook B. This hook is at the end of a sliding metal rod, which is connected to a lever, *b*, fulcrumed to a central stud or pivot, *a'*, in the knotting-box, and pivoted to the pin or stud *a* of the looper.

The rotating hook C is a piece of cranked or bent steel, which is fitted into the socket end of a horizontal shaft, *d*, running through the center of one end of the knotting-box, and provided with a hook at the outer end. The fixed hook D is applied back of the looper, projecting horizontally from the interior of the knotting-box in longitudinal direction to the center of the same, on such a level as to be just below the middle prong of the looper. The knotting-box E incases the devices so far described, and is attached to the base-plate E', which is provided in front of the looper and hooks with an oval recess or throat, *e*, above which the sliding hooked finger F and thumb F¹ pass into the inside of the knotting-box. The hooked finger F and thumb F¹ slide in a guide-casing, F², placed at suitable angle to the knotting-box, and are so connected that they will move simultaneously until they reach a given point, when the hooked finger will proceed alone and the thumb wait until it returns. The thumb will then resume its position and motion with the finger, as before.

The needle G consists of a curved arm, bent into very nearly the shape of a semi-circle, with guide-holes at intervals, to permit the string or cord to pass through from back

to front, and back again, and having an eye near the extremity, as is usually the case with needles. The front end of needle-arm G is made with a forward-projecting curve, forming a shoulder, that rests on the knotting-box at the end of its motion, while the curved end reaches down through the throat of the base-plate to deliver the cords to the cord-catching devices below. The knot-slipper H is arranged beneath the base-plate E', in proper relation to the throat e, and is made of a narrow piece of flat metal, forked at its end. The cord-catchers are arranged above and below the base-plate E', for holding the cord or string more or less tightly against certain fixed parts of the framing. The top cord-catcher I slides on the top of the knotting-box E, against a fixed piece, I'. The middle and bottom cord-catcher J and K take hold of the cord below the throat.

The cutting-knife L is used to cut off the cord or string at the precise moment when the needle is at its extreme downward position, and ready to return.

The different parts just described are all actuated from one main shaft, M, to which they are connected by a suitable motion transmitting mechanism, so as to perform their proper functions at the required time. As the contrivances for imparting such motion may be altered or varied without departing from the nature or essence of my invention, I do not lay special claim to them, but describe only in general manner how the devices may be operated from the common shaft.

The looper A is moved by a segmental rack, A', of elbow shape, connected by intermediate lever and roller with a grooved disk of main shaft M. The rotating hook C is revolved by an eccentric groove of a disk of main shaft, and by the intervention of a circular ratchet, jointed crank-levers, and cog-wheels with the spindle of the rotating hook. The hooked finger and thumb F F¹ are operated by an eccentrically-grooved disk or cam-roller, and lever F², and an elbow-shaped segmental rack, F³, gearing indirectly with a rack, F⁴, on the tool itself. Rotary reciprocating motion is imparted to the needle-arm by a disk, G¹, with eccentric pin on the main shaft, actuating by a lever-rod, G², the crank G³ of the needle-shaft G⁴. The knot-slipper H is operated by a disk, h, with projecting part, an intermediate lever, h¹, and a forked lever, h², with spring h³, to retain the intermediate lever in position between the motions of the tool. The top cord-catcher I, as well as the bottom and middle cord-catcher J and K, is worked by similar lever and retaining-spring devices from crank-disks of the main shaft, also the cutting-knife, the exact time of the action being regulated by the relative eccentricity or projection of the cam-disks, so that the devices work accurately in the required order.

The operation of the apparatus is as follows: The needle is first threaded with the string or cord to be used, and pulled sufficient-

ly far through the eye to allow of its being passed down through the throat in front of the knotting-box, and turned round the lower holder K, as shown in Fig. 2. The material around which the string is to pass is then placed in the position shown in the same figure, and the needle-arm commences its motion, descending in front of the knotting-box, and passing between two guides in front just above the middle holder, which then press forward and keep it in position, but without holding it. By descending still farther the needle reaches the lower holder K, which releases the gripe of the first cord at the same time that the middle holder presses fully forward and gripes both it and the cord last supplied, while immediately afterward the knife L cuts the string just above the lower holder in front of the needle. The motion of the knife follows that of the lower holder so quickly as to be almost simultaneous therewith. The top holder also presses itself dead up at the same time as the lower one. The needle then commences to retrace its motion, simultaneously with which the looper begins to move forward in the knotting-box, and the hook B, which passes immediately over the top of the upper prongs, to move backward, the two hooks B and D preserving the top and bottom portion of the loop in the required positions. When the looper has reached the extremity of its stroke, as in Fig. 6, the rotating hook C catches the lower end of the loop, and winds it around the two upper prongs of the looper until it has made very nearly three-fourths of a rotation, when the hooked finger F and thumb F¹ pass between the prongs of the looper, the thumb waiting just inside, while the hooked finger presses onward to the back of the casing. When the rotating hook, in continuing its rotation, carries the string in front of the hooked finger F, the same retires immediately with it to the thumb, which closes upon it and holds it fast, both together retiring backward into their case simultaneously with the backward movement of the looper A, and the forward movement of the sliding hook B.

Prior to these movements, and immediately after the finger and thumb are outside the knotting-box, the knot-slipper H rises and catches the string in its fork just in front of the knot. As the thumb and finger retire, the slipper slips along the string, the knot which has been previously formed being quite close to the top catch I, which then releases its hold, and the weight of the material contained in the band draws the string from the finger and thumb, so as to allow it to fall clear of the machine.

It will be noticed that each time the needle descends it carries two lengths of cord or string with it, one on each side of its eye, and each having a slight tension on it. In one case the tension is produced by the weight of the material; in the other, by the resistance of the reel on which the cord is wound. It

will also be noticed that, in starting the machine, the cord or string is first passed down to and held by the lower holder, then passed around the bundle to be tied, and then through the eye of the needle, so that when it descends it takes two lengths of cord or string, making, altogether, three lengths in the machine at one time. Two of these are released as each knot is tied, leaving a third one with which to commence the next band. This third string is, by the upward movement of the needle, kept quite clear of the other two until they have been knotted and released from the machine.

The several motions of the parts take place in the following order: The needle first descends, and when its point is on a level with the knife the lower holder K commences to move, the knife L entering almost simultaneously between the cord and the needle. Just before the completion of the downward stroke of the needle the top catch I commences to press in, and is dead up immediately before the knife cuts. The bottom catch K presses up at the same time as the top one, and passes between the cord and the needle just above the needle's eye. The looper gradually begins to move, and, when the needle has risen about three eighths of an inch above the knife, the finger and thumb begin to move, the lower catch and knife acting at the same time. The middle catch acts as a tension to the needle during the latter part of its stroke. The rotating hook then commences to rise and rotate, so that, when at sufficient height, the finger and thumb may pass underneath and enter the front of the knotting-box, the speed of the finger increasing as it enters. The thumb stops just inside, and the finger proceeds onward to the back of the box, waiting until the rotating hook passes inside it, when it immediately withdraws to and joins the thumb, retiring with the same to the outside of the box.

The knot-slipper now rises, catching the string in the fork just between the knot and

the finger and thumb. The looper now retires, and the finger and thumb recede into their case, thus tightening the knot, while the slipper slips it along close to the material being bound, the top catch releasing finally the cord, and completing thus the operation of the machine.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A machine for tying knots, being composed of a knotting-box, with a forked sliding looper; a horizontally-sliding, rotating, and fixed hook arranged therein; a top, middle, and bottom cord-catcher, with cord-cutting knife; a sliding hooked finger and thumb; a cord-slipper, and a rotary reciprocating needle, the whole arranged and operated to work in the consecutive order described, substantially as and for the purpose set forth.

2. The sliding looper provided with three prongs, of which the upper is grooved at the top and the middle prong at the under side, for accurate contact with horizontally-sliding and stationary hooks, substantially as specified.

3. The sliding hooked finger and thumb, in combination with the inclosing casing and stop device, so that the finger is allowed to enter the knotting-box, while the thumb is retained for passage of rotating hook, substantially as set forth.

4. The combination of the looper and the horizontally-sliding, rotating, and stationary hooks with the sliding hooked finger and thumb, for forming the knots in the knotting-box, substantially in the manner described.

5. The combination of the sliding hooked finger and thumb with the forked knot-slipper, for tightening the cord to the material to be bound, substantially as set forth.

JOSHUA ALEXR. KAY.

Witnesses:

EDWARD WATERS,

WALKER SMYTHE BAYSTON.