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M. E. KNIGHT.

MACHINE FOR CUTTING SHOE SOLES.

No. 436,359. Patented Sept. 16, 1890.

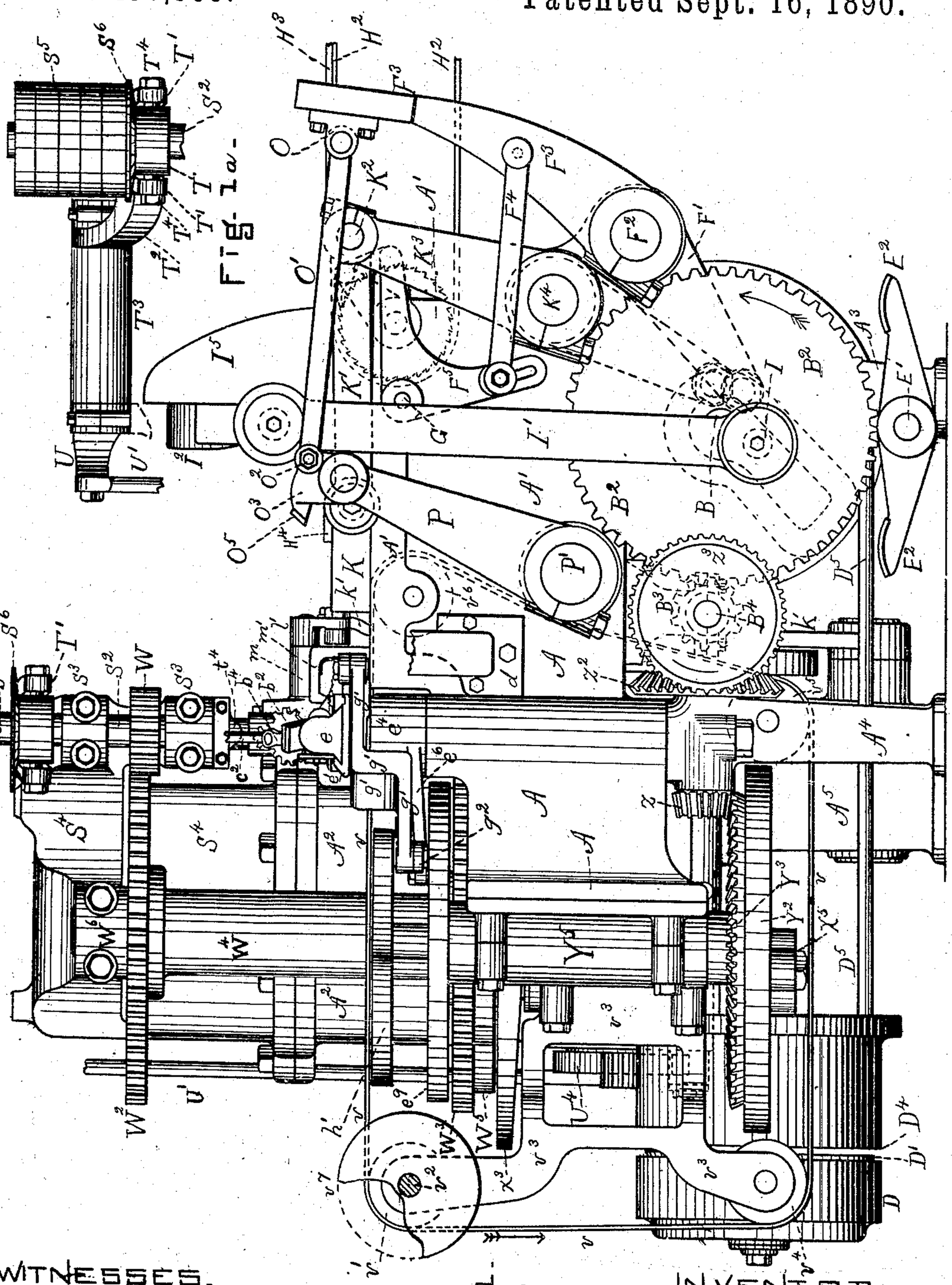

Fig. 1a.

Fig. 1.

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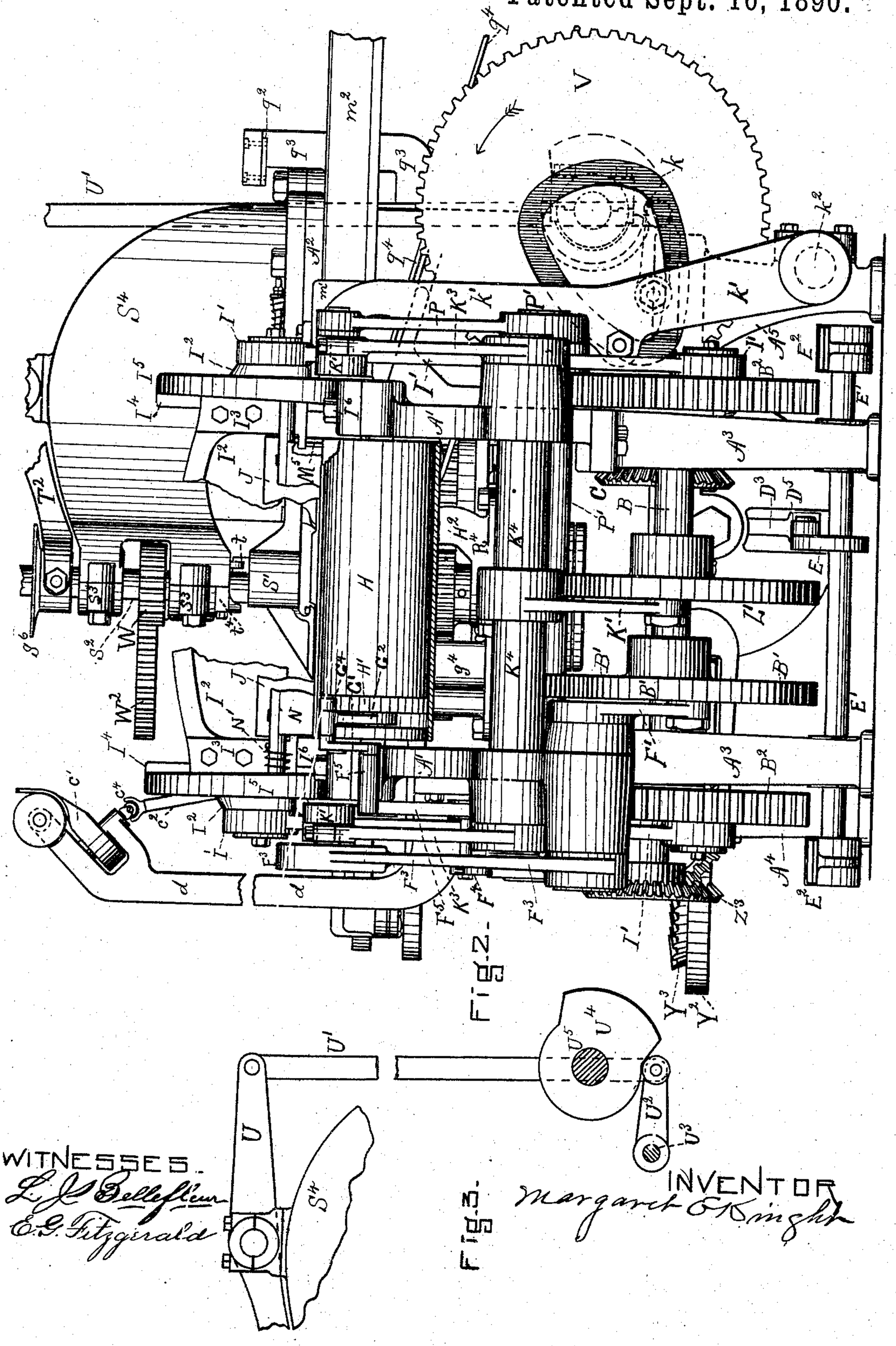

Fig. 2.

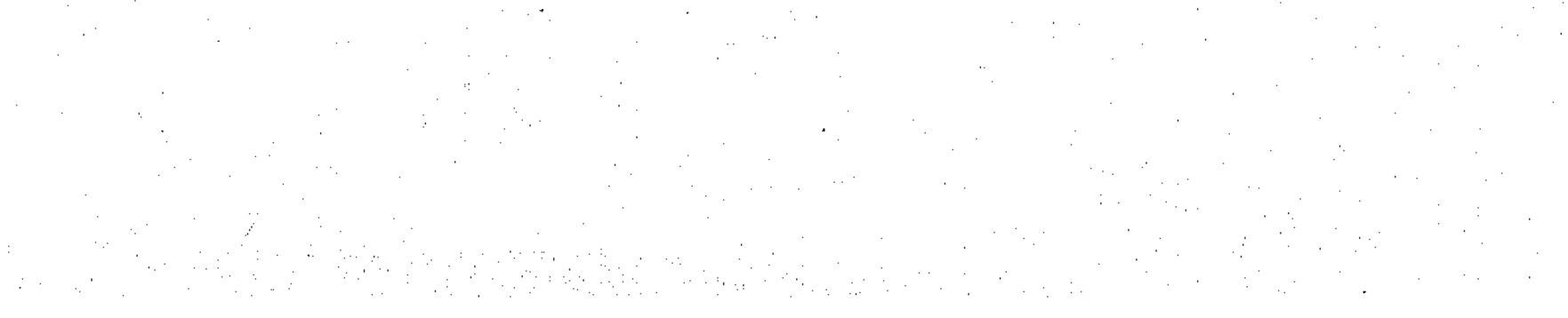

Fig. 3.

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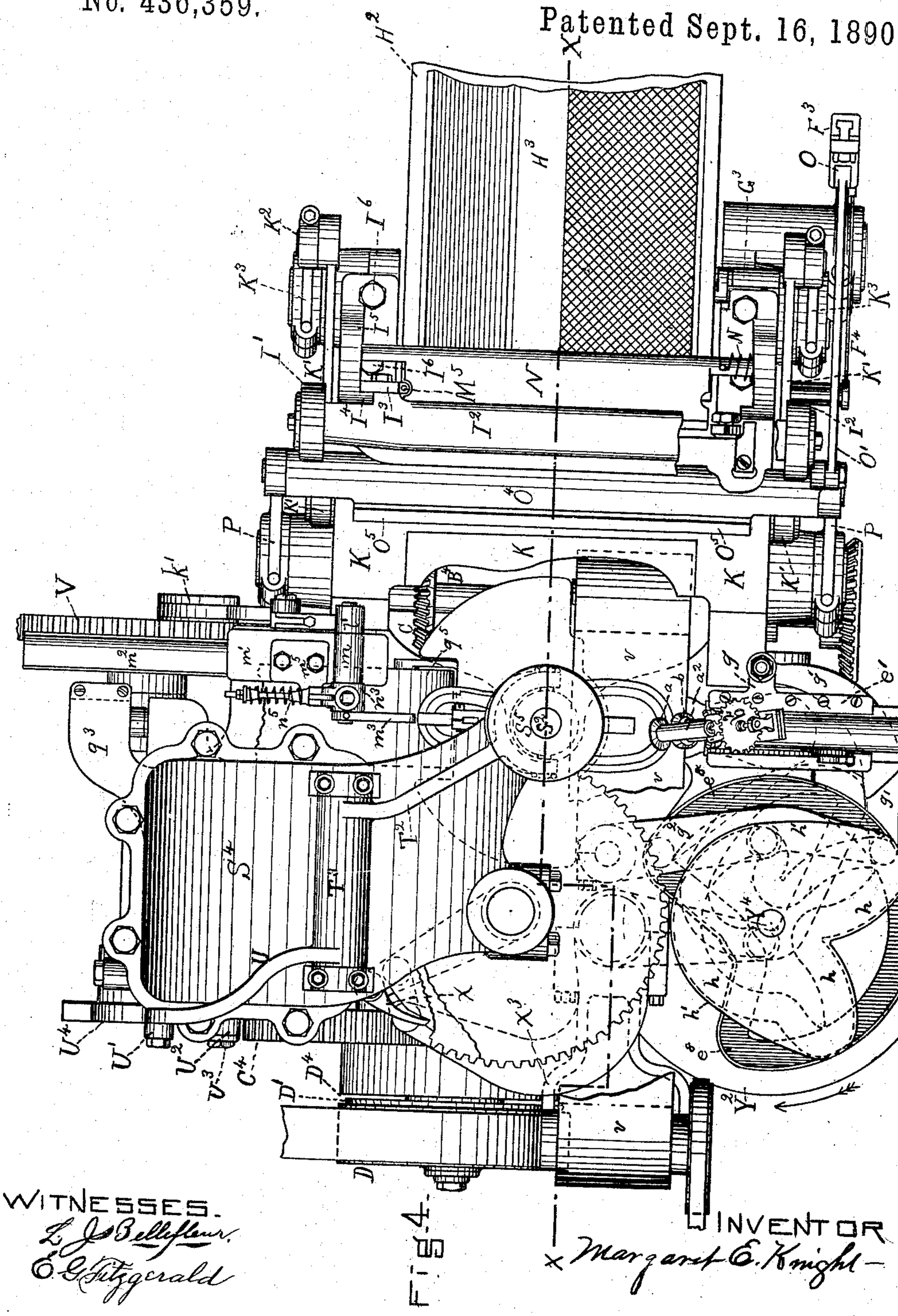

Fig. 4.

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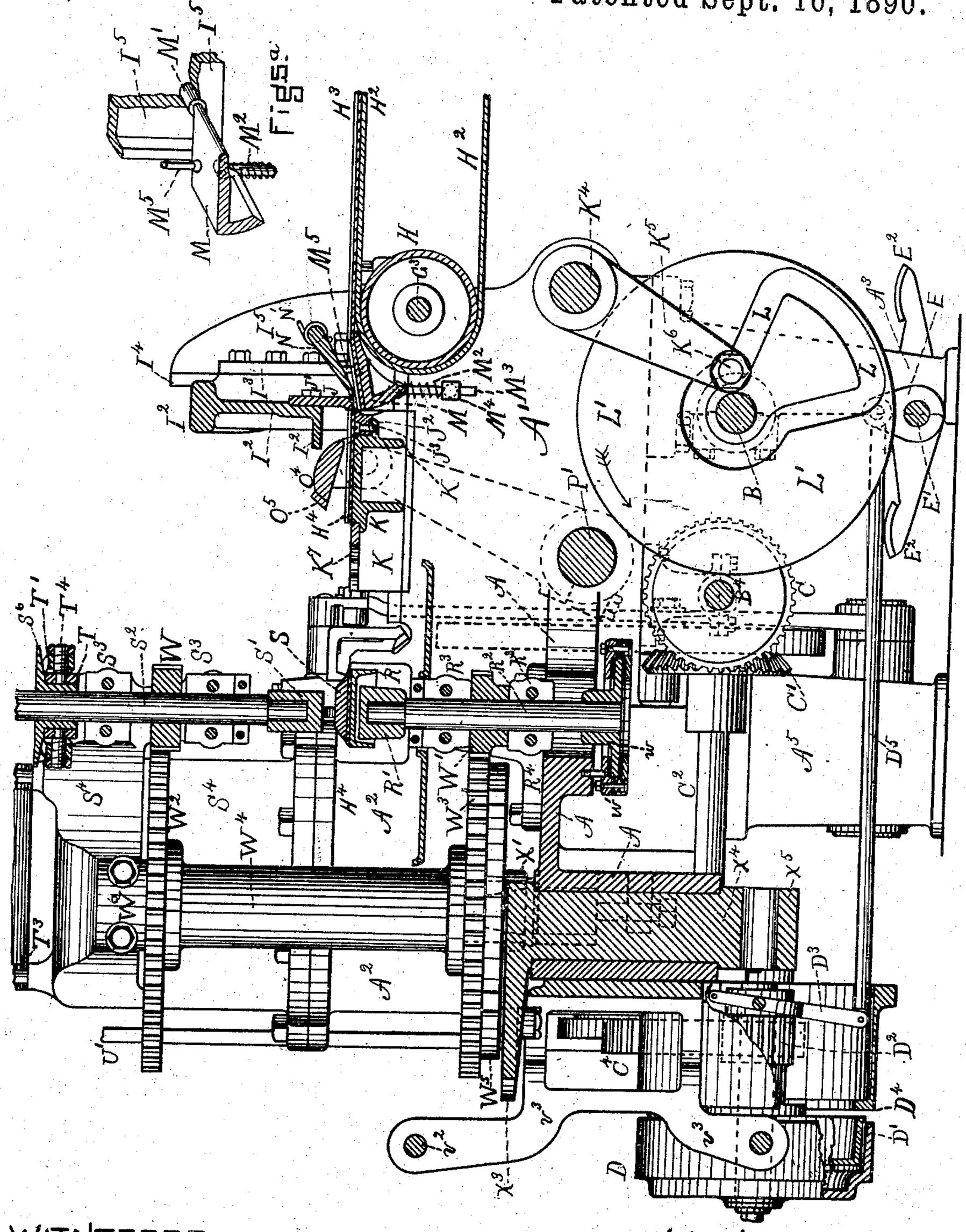

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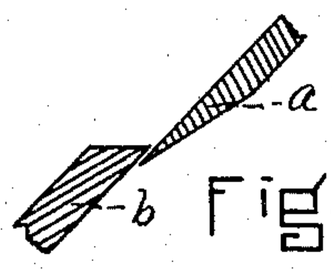

Fig. 6a

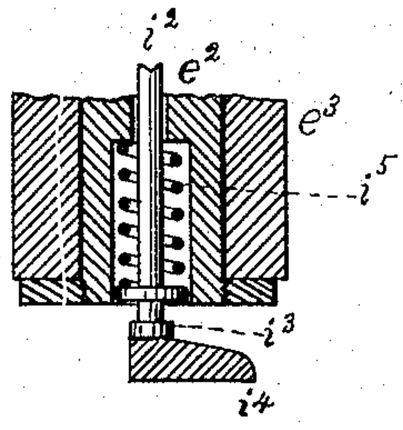

Fig. 6b

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Fig. 6

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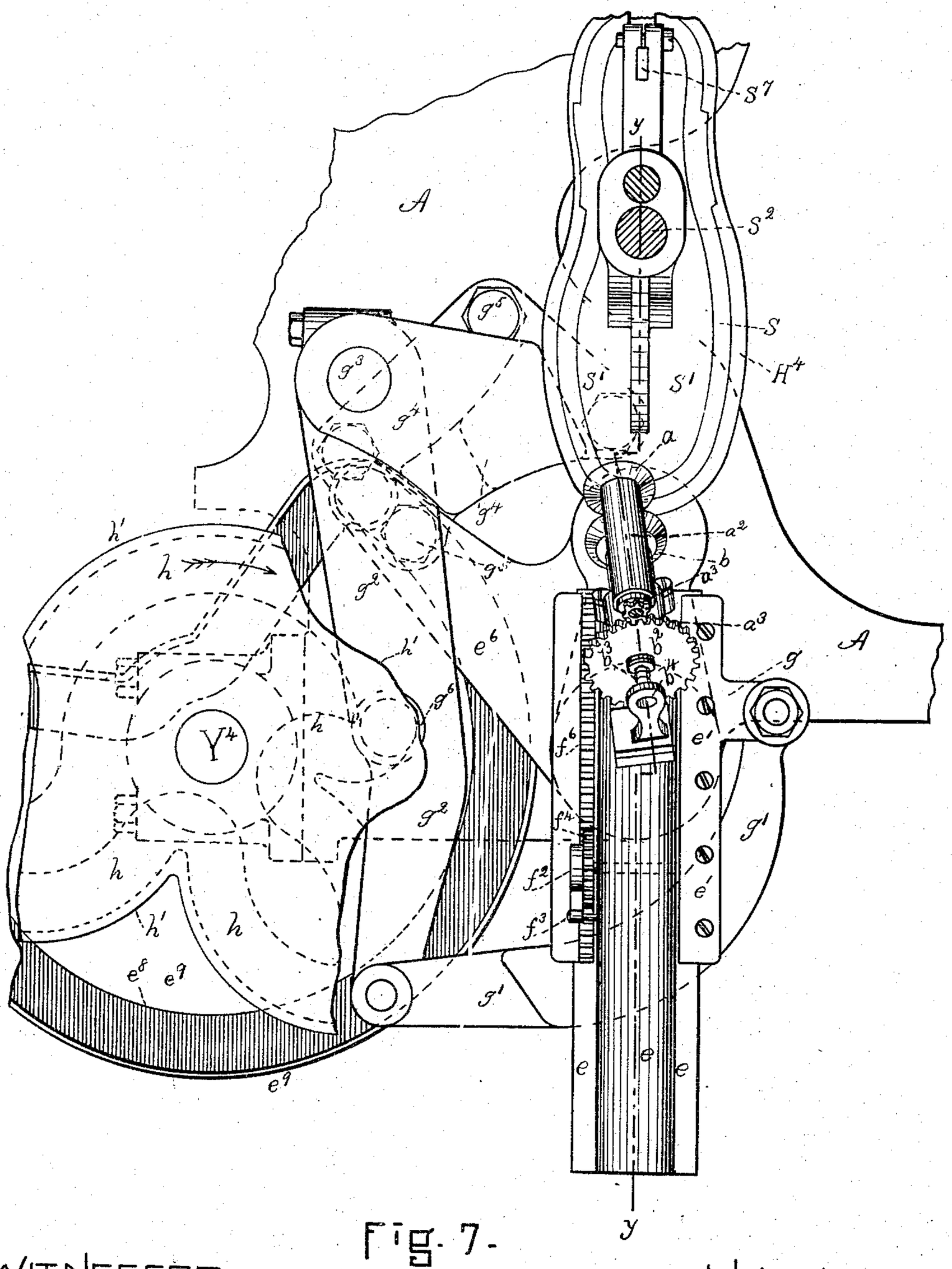

Fig. 7.

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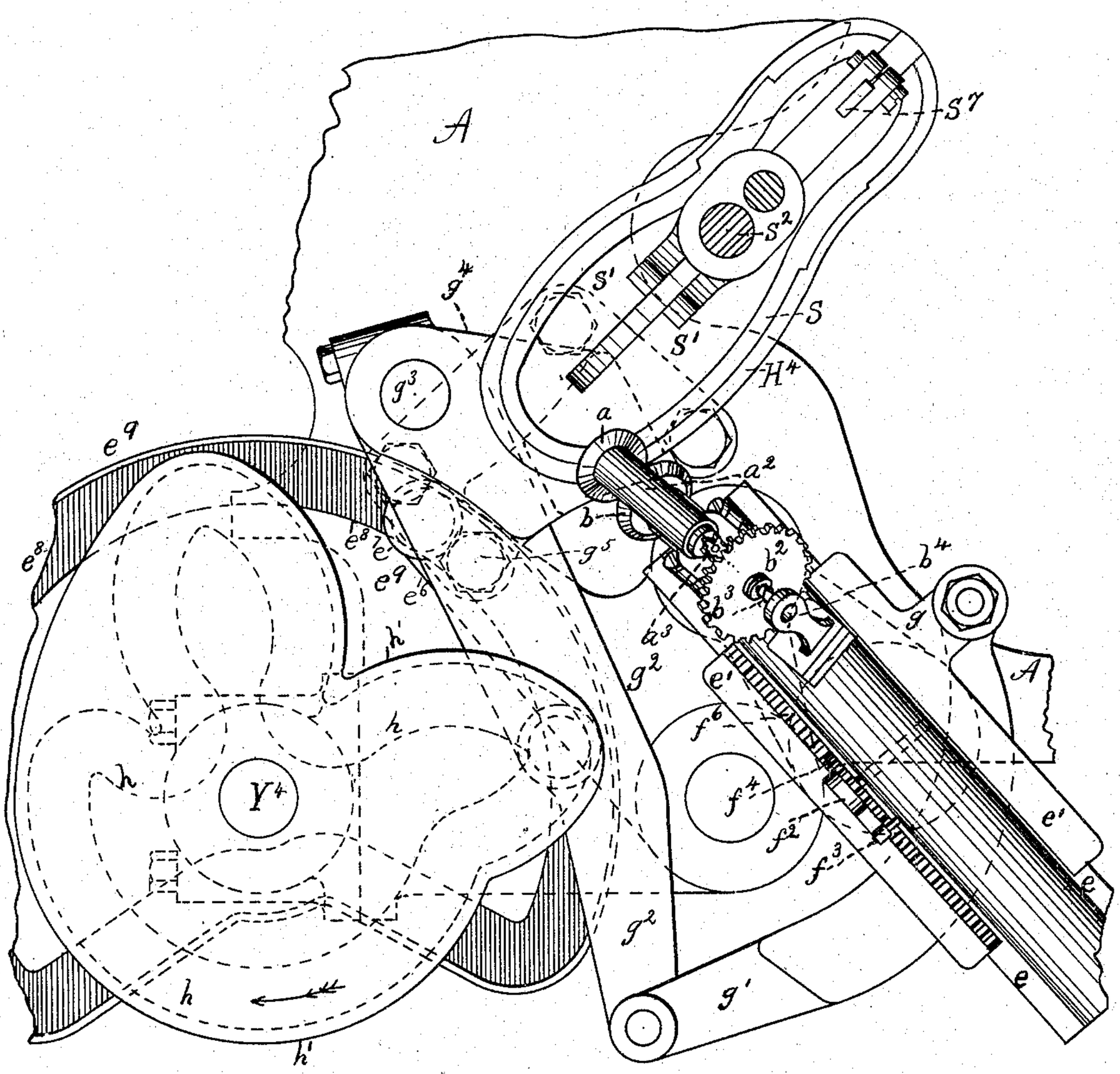

Fig. 8.

WITNESSES.
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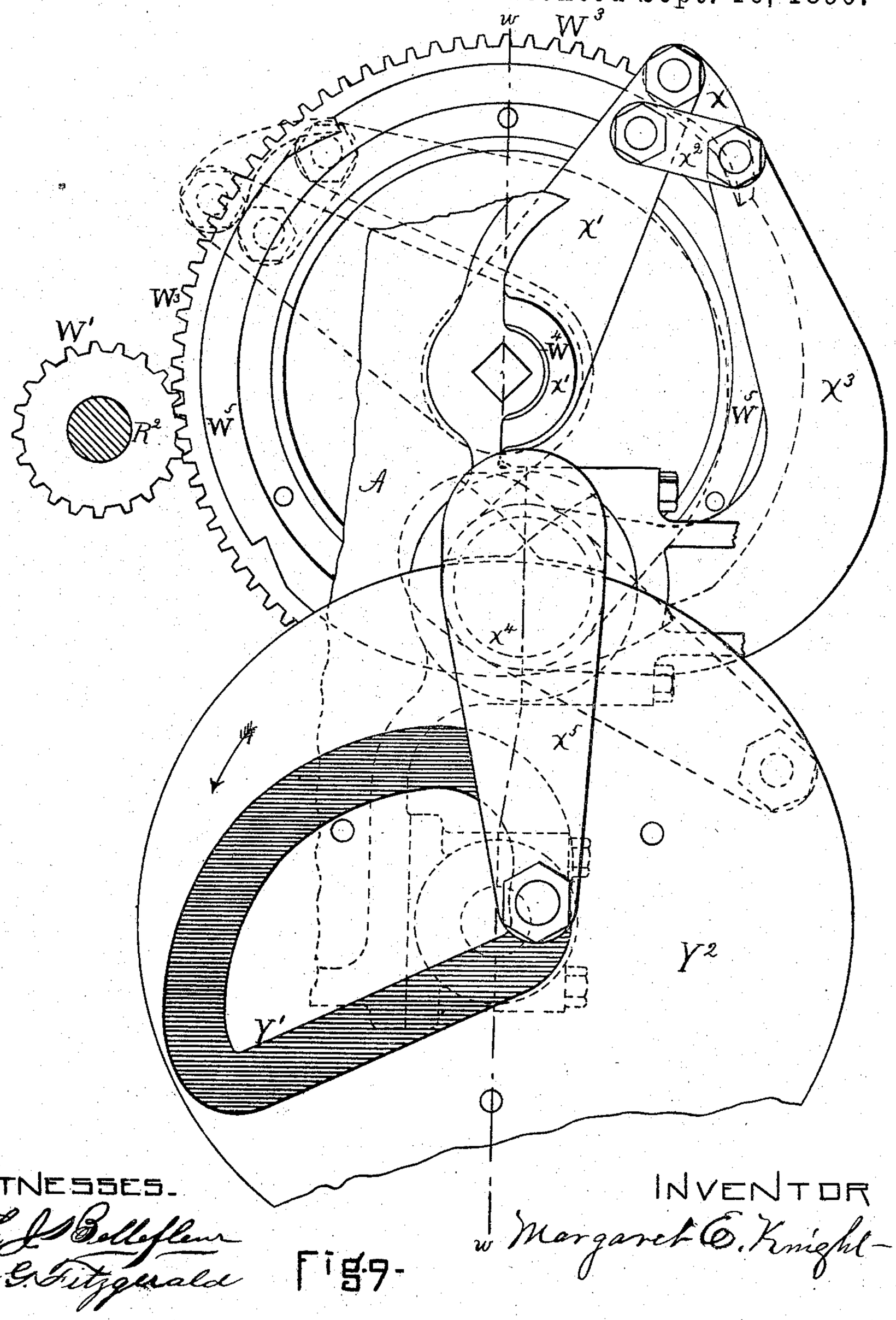

Fig. 9.

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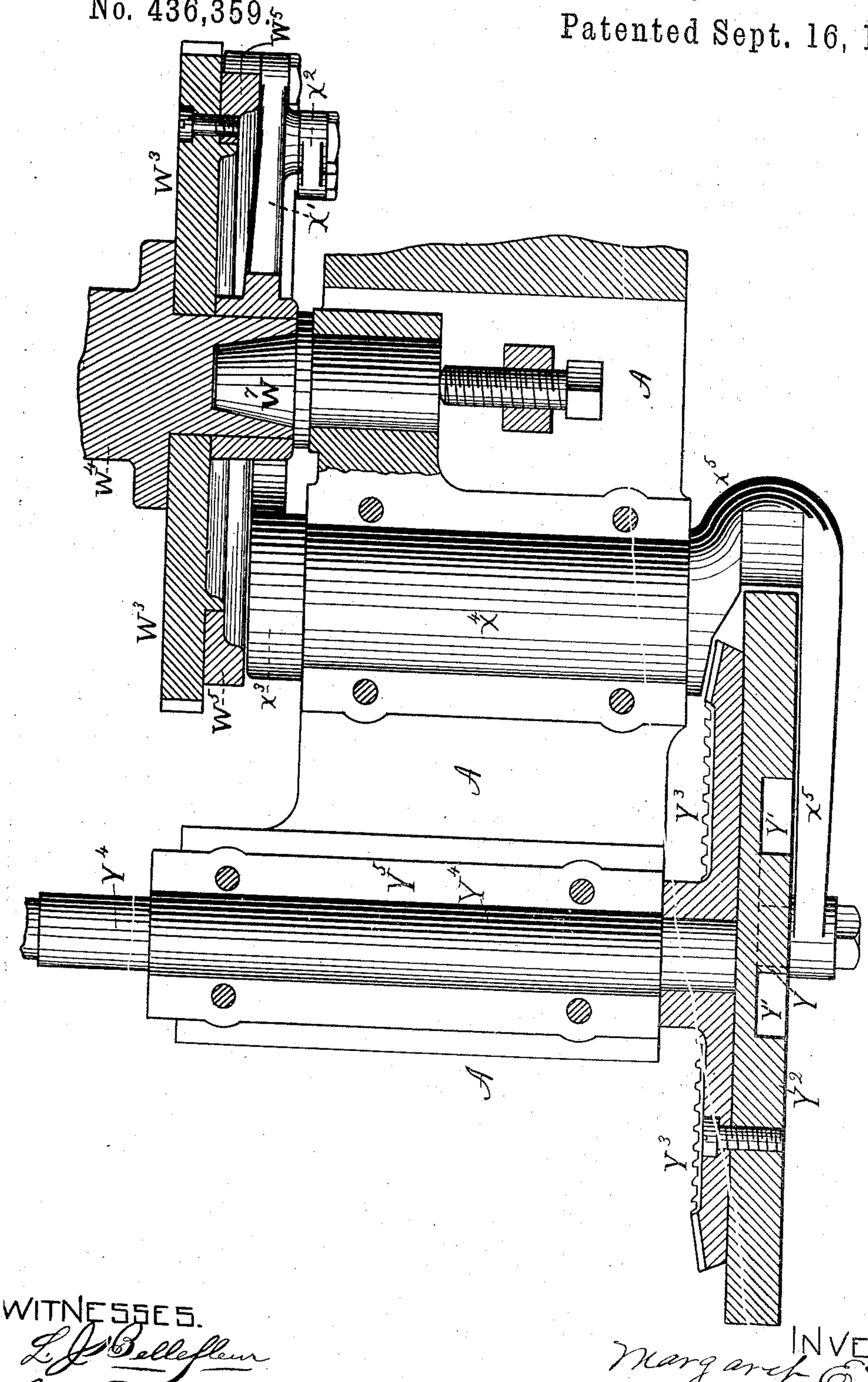

FIG. 10.

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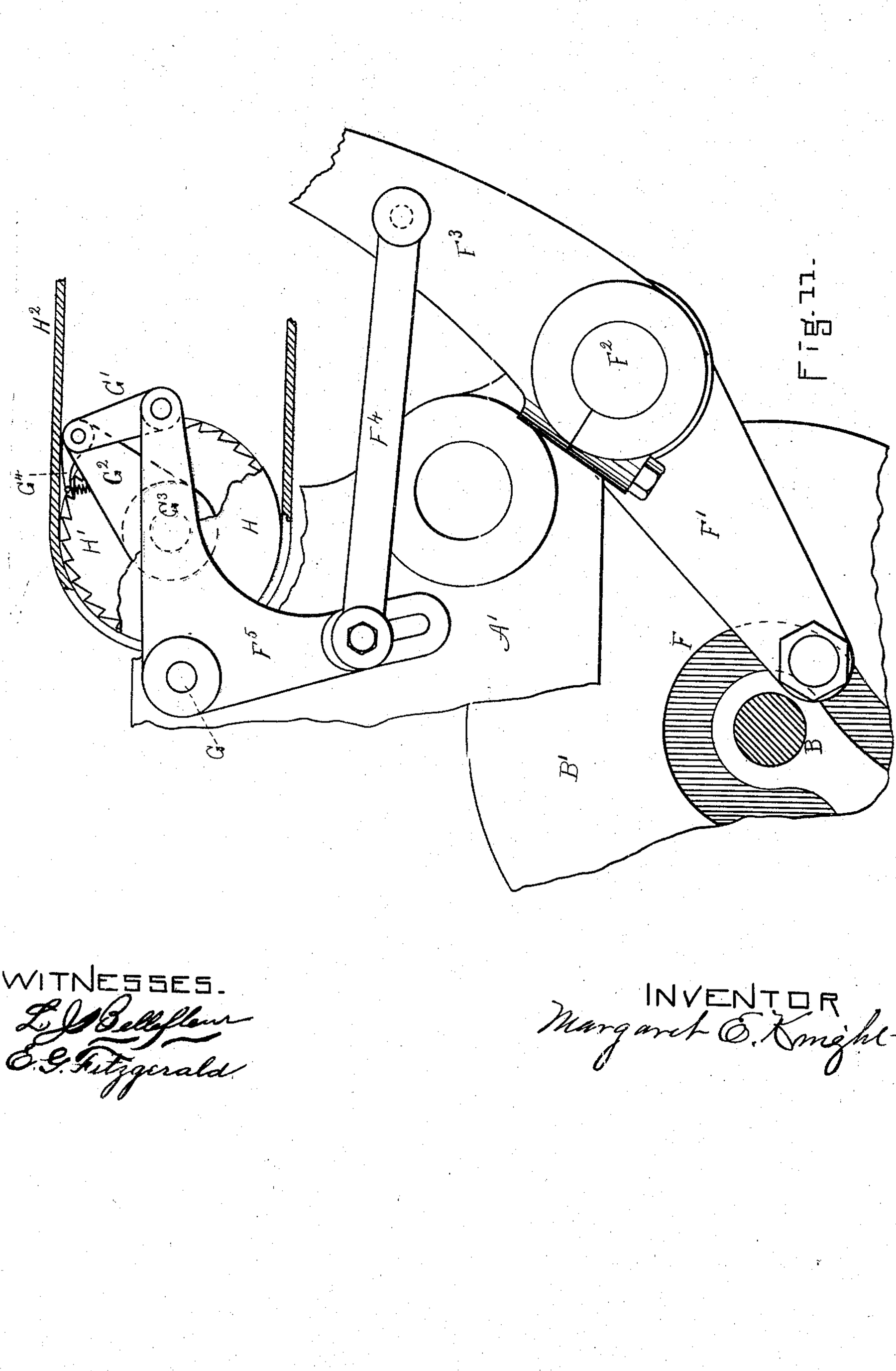

Fig. 11.

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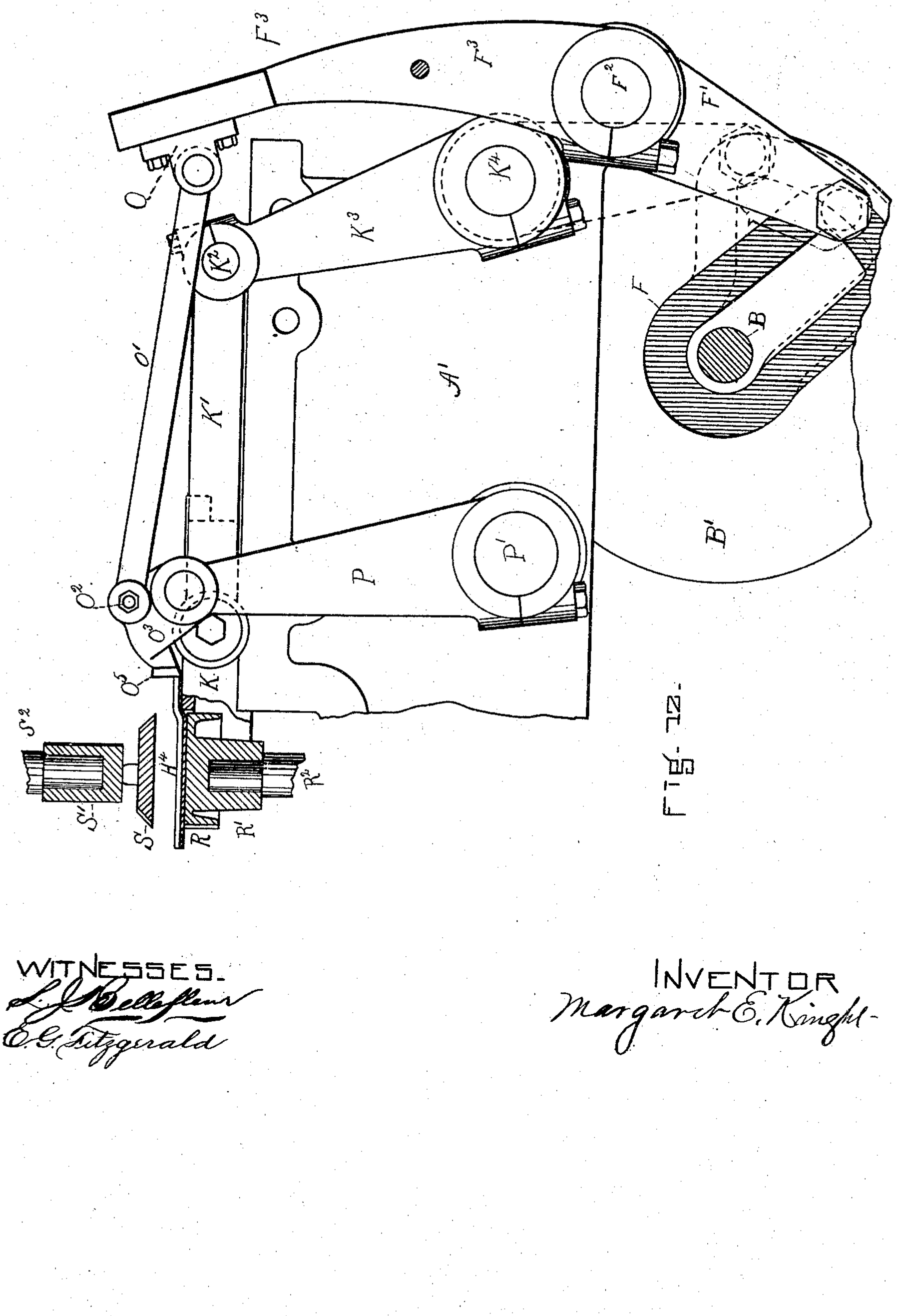

FIG. 12.

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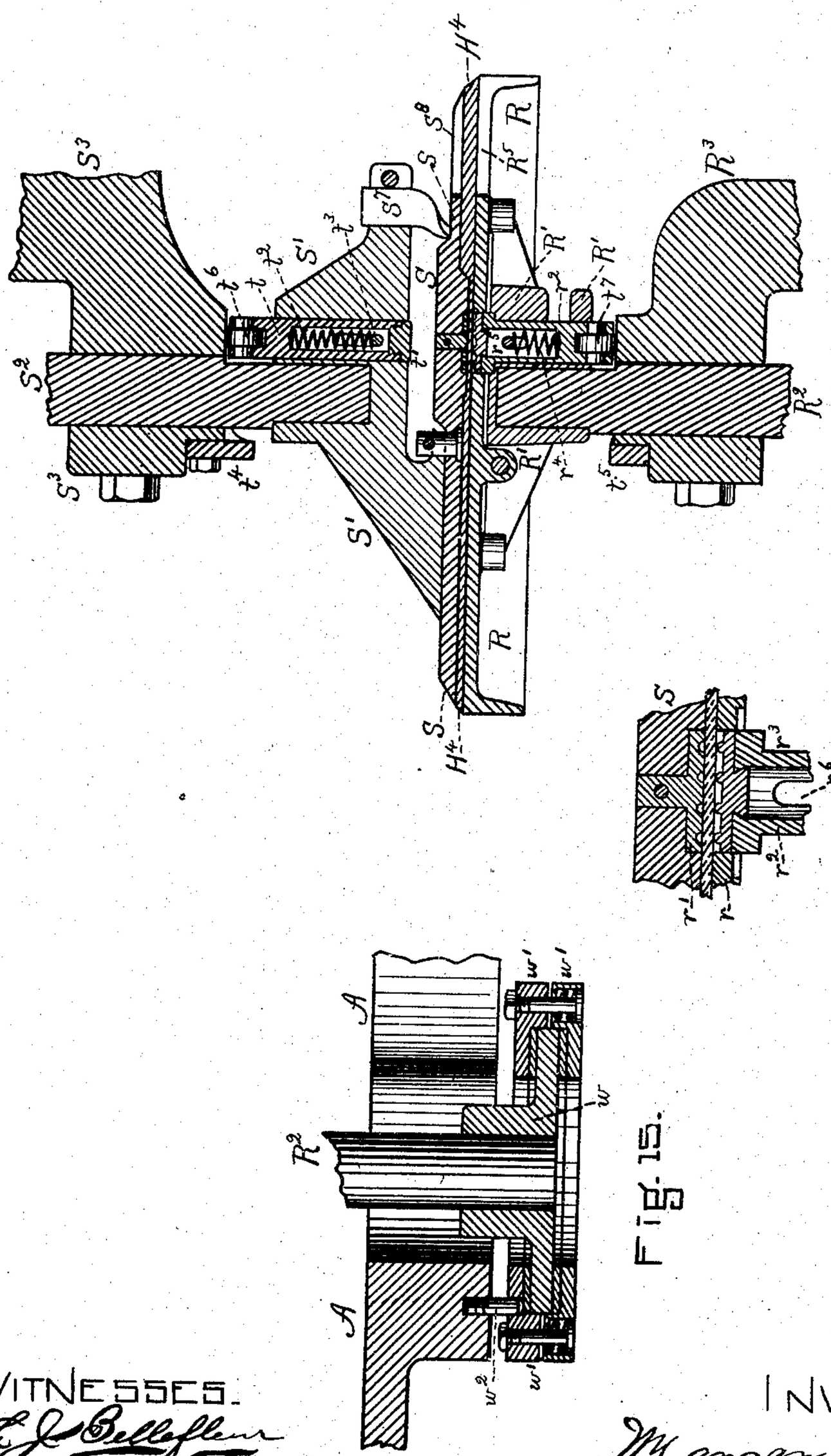

FIG-13.

FIG-14.

FIG. 15.

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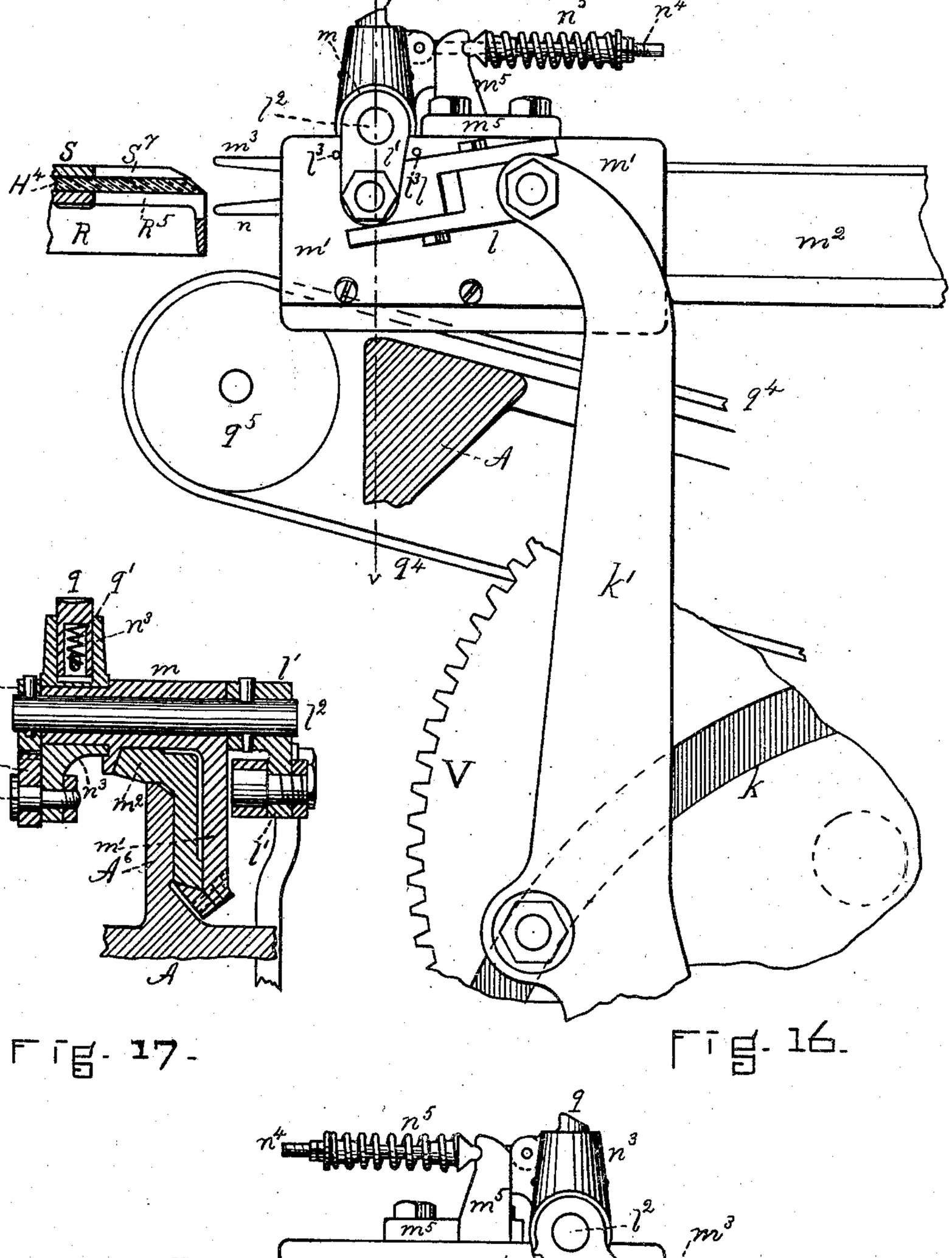

FIG. 17.

FIG. 16.

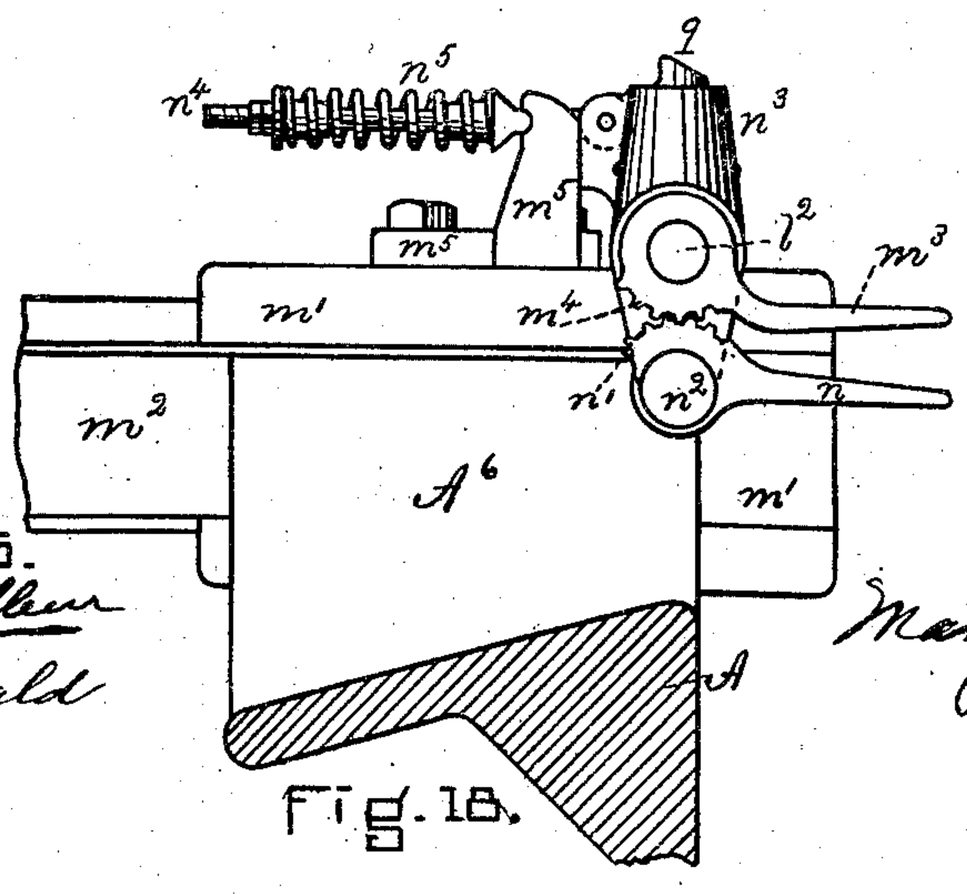

FIG. 18.

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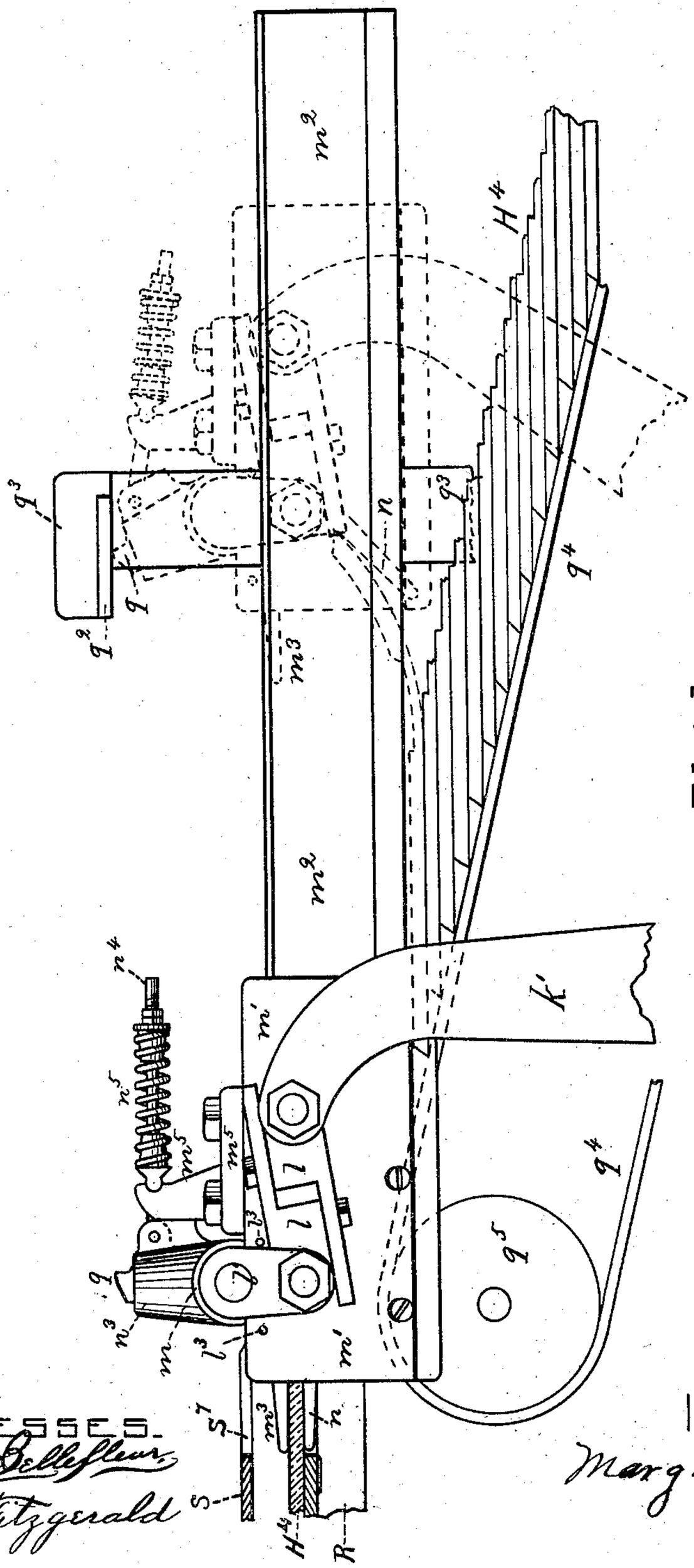
FIG. 19.



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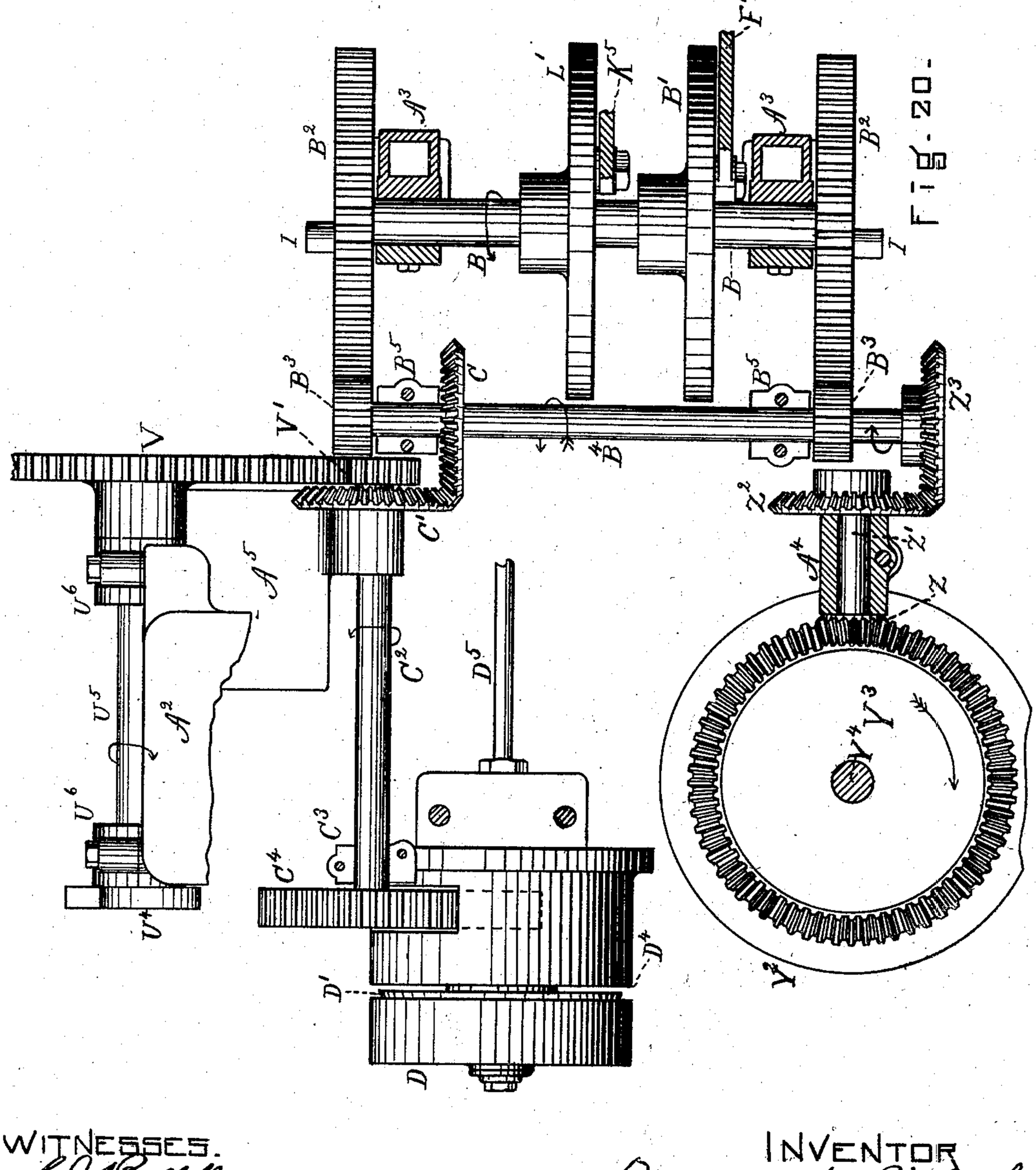

FIG. 20.

WITNESSES.
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E. G. Fitzgerald

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UNITED STATES PATENT OFFICE.

MARGARET E. KNIGHT, OF SOUTH FRAMINGHAM, MASSACHUSETTS.

MACHINE FOR CUTTING SHOE-SOLES.

SPECIFICATION forming part of Letters Patent No. 436,359, dated September 16, 1890.

Application filed December 12, 1889. Serial No. 333,394. (No model.)

To all whom it may concern:

Be it known that I, MARGARET E. KNIGHT, of South Framingham, in the county of Middlesex and State of Massachusetts, have invented certain new and useful improvements in machines for cutting shoe-soles and other articles of curvilinear form from sheet material and imprinting a design thereon before removal from the machine and automatically removing the completed article, of which the following is a specification.

The machine is intended to automatically produce an article of the desired shape, cut from sheet material in accordance with the pattern employed. The sheet of india-rubber, leather, or other material is placed upon an endless belt or apron, which intermittently feeds it forward under a knife and onto a table or blank-carrier a distance equal to the desired width of a blank for the article to be made. The knife cuts off the blank, which is carried forward by the blank-carrier having a reciprocating movement and fed upon a form or pattern in the machine by a reciprocating feed-bar. An upper pattern then descends and clamps the blank upon the lower one, and the two revolve together upon supporting-spindles, thus presenting the entire circumference of the edge of the blank to the action of a knife, which by reason of its capability of swinging bodily in the arc of a circle upon a pivot and of moving in straight lines radial to such pivot, its cutting-edge will always be presented to the periphery of the pattern in the proper position to cut or trim the blank into the shape corresponding to the outline of the pattern. The position of the knife in relation to the pattern which I have found most satisfactory is with the cutting part of its edge substantially in contact with the periphery of the pattern and the plane of the blade of the knife as near as may be at right angles to the normal of the curve of the pattern at the point of contact of the knife therewith. After the article is cut the upper pattern rises and the completed article is removed by automatically-operating fingers, which grasp it, withdraw it from between the forms, and deposit it, for convenience, upon an endless apron, which carries it away from the machine. While the blank is clamped between the two patterns and during the operation of cutting it to the desired shape, a pair of dies are arranged to operate in conjunction through the patterns and stamp or emboss upon the surface of the article any design which may be cut upon the dies.

The construction and operation of the machine, as I have found it convenient to make the several parts, will be understood from the description hereinafter contained, and illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of the machine, a portion of the top being broken off, such portion being shown in similar elevation in Fig. 1ª. The bracket for carrying the actuating mechanism of the cutters is also broken out from this figure, and is shown in Fig. 2 and in an enlarged section in Fig. 6. Fig. 2 is an end elevation of the machine, certain parts shown in Figs. 1ª and 3 being broken off and the cross-head knife and scraper being broken out the better to illustrate other parts of the machine. Fig. 3 shows in end elevation the portion broken off from Fig. 2 and a detail of the actuating mechanism for such portion. Fig. 4 is a plan of the machine, the portion broken out from Fig. 1 being also broken out from this figure. Fig. 5 is a longitudinal vertical section on line X *x*, Fig. 4, the same portion that is broken off from Fig. 1 being broken off from this figure. Fig. 5ª is a sectional detail of the pivoted shelf M, below described. Fig. 6 is a transverse vertical section taken on line *y y*, Fig. 7, and particularly illustrates the action of the cutters. Fig. 6ª is an enlarged detail showing the relation of the cutters at their cutting-edges. Fig. 6ᵇ is a longitudinal section or detail of a portion of the mechanism for actuating the device for locking the sliding cutter-frame. Fig. 7 is a plan view on line *z z*, Fig. 6. Fig. 8 is a view similar to Fig. 7 with the parts in the act of trimming the side of the sole. Fig. 9 is a view of the under side of the mechanism for rotating the patterns. Fig. 10 is a vertical section taken on line *w w*, Fig. 9. Fig. 11 is a detail of the mechanism for actuating the feeding-apron. Fig. 12 is a detail of the feed-bar mechanism in the act of delivering the blank into position upon the lower pattern. Fig. 13 is a central vertical

section taken longitudinally through the forms or patterns. Fig. 14 is a sectional detail of the embossing-dies. Fig. 15 is a detail of the friction mechanism on the lower end of the form-spindle. Fig. 16 is a detail of the mechanism for withdrawing the articles from the machine. Fig. 17 is a vertical section on line *v v*, Fig. 16. Fig. 18 is a detail of a portion of the reverse side of the mechanism shown in Fig. 16, illustrating the gripping-fingers. Fig. 19 is a detail of a portion of the mechanism shown in Fig. 16, the full lines in said figure showing the mechanism gripping the article and started back, and the broken lines showing it in the act of dropping the finished article. Fig. 20 is a diagram illustrating the shafting and gearing on the under side of the machine.

Similar letters of reference indicate like parts.

With the exception of Figs. 12 and 19 the position of the machine in the drawings is that assumed at the instant of the completion of the trimming or final cutting of the sole or other article.

A represents that portion of the frame of the machine which I term the "bed," provided with two parallel wings A′, rising upward therefrom, (see Figs. 1, 2, and 5,) and the stump A^2, (see Figs. 1, 2, and 5,) which are supported by the legs A^3 A^3 A^4 A^5.

B′ (see Figs. 2, 12, and 20) is a cam-wheel fast on the shaft B, which is supported by the legs A^3 A^3. B^2 B^2 are gear-wheels fast on said shaft B and engaged by the pinions B^3, which are fast on the shaft B^4, having its bearing in boxes B^5, supported by the wings A′ of the frame.

C is a bevel-gear fixed to the shaft B^4 and engaged by the bevel-gear C′, keyed on the shaft C^2, which is supported by the leg A^5 and a box C^3, attached to the bed A. On the opposite end of the shaft C^2 is fixed the gear-wheel C^4, all as shown in Fig. 20.

Power is applied to the machine by means of the pulley D, which is loose on a suitable stud. (Shown in broken lines in Fig. 5.) The cone D′, also loose on said stud, is rigidly secured to the gear-wheel D^2 by a loose sleeve on said stud and engages with the gear-wheel C^4. This gear D^2 is adapted by means of a shipper D^3 (see Fig. 5) to throw the cone into engagement with the pulley D, thereby communicating motion to the machine.

D^4 is a brake against which the cone D′ may be moved by the same shipper to stop the machine.

The shipper D^3 is operated by the connecting-rod D^5, the opposite ends of which are pivotally secured to said shipper and to a suitable crank E, fast on the rock-shaft E′, supported by the legs A^3, and provided with treadles E^2 E^2 for the purpose of starting and stopping the machine.

F is a cam-groove on the face of the wheel B′, in which plays a roller carried by the cam-lever F′. (See Fig. 11.) This lever F′ is integral with the shaft F^2, which is supported by one of the wings A′.

Fast on the shaft F^2 is the lever F^3, connected by means of the rod F^4 with the bell-crank F^5, said rod being pivotally secured at its opposite ends to said bell-crank and lever, the connection with the bell-crank being adjustable by means of a slot in said crank. This bell-crank is loose upon a stud G, supported by the portion A′ of the frame. The opposite end of the bell-crank F^5 is connected by means of the link G′ with the radius-lever G^2, which is loose on the stationary shaft G^3, supported by the frame. The radius-lever G^2 carries a pawl G^4, which engages in its reciprocations with the ratchet H′, which is integral with the roll H, the office of which is to give motion to the endless feeding-apron or stock-support H^2, upon which the sheets of material H^3, Fig. 4, are fed to the knife J to be cut into blanks. (See Figs. 1, 2, and 11.)

I I are crank-pins projecting from the outer sides of the gear-wheels B^2. (See broken lines in Fig. 1 and full lines in Fig. 20.)

I′ I′ are rods the lower ends of which work on the crank-pins I and the upper ends connect by means of suitable trunnions with the cross-head I^2, of which said trunnions are a part, and is the mechanism by which vertical reciprocating motion is imparted to the cross-head. The cross-head is guided in its vertical movement by means of the gibs I^3, Figs. 2 and 4, bolted to said cross-head, which slide on the vertical face of the ribs I^4, projecting inwardly from the uprights I^5, which are bolted at I^6 to the wings A′ of the frame.

J is a blank-cutting knife bolted at J′ to the cross-head. (See Fig. 5.)

J^2 is a lower blade bolted at J^3 to the table or blank-carrier K, supported by the two wings A′ and sliding thereupon, as below described. This table is given its horizontal reciprocating motion by means of links K′, the inner ends of which work in suitable trunnions on the table and the outer ends are pivotally secured at K^2 to the outer ends of the lever K^3, clamped to the rock-shaft K^4, which is operated by the lever K^5, fast on said rock-shaft, such lever K^5 being, by means of the pin K^6, operated by the cam-groove L in the disk L′.

M (see Figs. 2, 4, 5, and 5ª) is a swinging shelf pivotally secured at M′ to the uprights I^5. This shelf supports the end of the stock after a blank is cut off, and it is held normally in a horizontal position and on a line with the apron H^2 and the surface of the table K by means of springs M^2, surrounding the guiding-rods M^3, which slide on the blocks M^4, which are pivotally secured to the wings A′ of the frame. The shelf is depressed into the position shown in Fig. 5 from its normal horizontal position when the cross-head descends by means of tappers M^5, projecting downward from the under side of said cross-head.

N is a scraper or knife-clearer, the object

of which is below described, and has its opposite ends journaled in the uprights I^5. The normal position of this scraper is raised. Its edge, however, which is slightly bent, as shown, extends under the bevel of the cutting-edge of the knife J, and hence is forced down by said knife as it descends against the power of the spring N'.

The operation of the machine up to the point described is as follows: Power being applied at the pulley D, the cam-wheel B' is rotated by means of the shaft B, gear-wheels B^2, pinions B^3, shaft B^4, bevel-gears C C', shaft C^2, and gear-wheel C^4. The rotation of the cam-wheel B' causes the shaft F^2 to oscillate by means of the lever F', integral therewith. Said shaft communicates motion to the lever F^3, which, by means of the link F^4, operates the bell-crank F^5, which, by means of the link G', radius-lever G^2, and pawl G^4, gives intermittent rotary movement to the roll H, and hence corresponding movement to the belt H^2, thus feeding the strip of rubber or other material intermittently under the knife J and onto the table K sufficiently to produce a blank, as shown in Fig. 5. When the strip of material has reached this point, the knife J descends, being moved by the cross-head, which is operated, as above described, through the rods I' and crank-pins I, projecting from the gears B^2, fast on the shaft B. This knife in its descent cuts off a blank or rectangular piece H^4, Fig. 5, the size of which should be about the size of the article desired. The shelf M is forced down into the position shown in Fig. 5 by the tappet M^5 at substantially the instant of the cutting, so that the incoming edge of the sheet H^3 will be prevented from being injured by the heel of the knife. Immediately after the knife has done its work and cut off the blank it rises and is followed by the edge of the scraper N, which prevents the edge of the strip H^3 from adhering to the knife and following it in its upward movement. As soon as this blank has been cut off, the table K carries it forward to a point (see Fig. 12) from which it can be moved by suitable mechanism, below described, to the patterns which correspond to the shape desired for the finished article. The table then moves back horizontally into its former position, as shown in Fig. 5. This reciprocation of the table is produced by the mechanism above described—viz., by means of the links K', levers K^3, rock-shaft K^4, lever K^5, and cam L in the disk L', which is fast on the shaft B.

The lever F^3, which, as above mentioned, is fast on the shaft F^2, extends upward, as shown in Figs. 1 and 12, and at its upper end is provided with a vertically-adjustable saddle O, to which one end of the connecting-rod O' is pivotally secured, the other end being pivotally secured at O^2 to the ears O^3, which are rigid with the rocking bar O^4, Fig. 4, and upon either end thereof.

P P are levers pivoted at their upper ends to the ears O^3 and at their lower ends are fast on the rock-shaft P', which is supported by the wings A' of the frame. After the blank H^4 has been cut off and the table has moved forward into the position shown in Fig. 12 the blank is pushed into position between the forms below described by means of the mechanism last described. The shaft F^2, rocking to feed the apron, at the same time moves the lever F^3, so that its upper end pushes the connecting-rod O' forward and tips the rocking feed-bar O^4 from the position shown in Fig. 1 into the position shown in Fig. 12, so that as the bar moves forward its edge O^5 pushes the blank H^4 between the patterns, as shown in Fig. 12. The adjustable connection between the bell-crank F^5 and the link F^4, which is for the purpose of enabling the operator to vary the width of the blank, renders the adjustable connection between the lever F^3 and the connecting-rod O' necessary.

R, Figs. 5, 6, 12, and 13, is the lower form or pattern on which the blank rests while it is being cut into its final shape, said pattern being rigidly secured to a foot R', supported by and rigidly secured to the spindle R^2, which has its bearings in boxes R^3, supported by the bracket R^4, which is secured to the frame. This spindle is stationary vertically, but has a rotative motion which will be described below. S is the upper form or pattern secured to the foot S' by readily-detachable connections, in order that patterns of different size may be interchanged, (see Figs. 5, 6, 7, 8, and 13,) said foot being rigidly secured to a vertical shaft S^2, having bearings in the boxes S^3, which are supported by a column S^4, (see Figs. 1 and 5,) which is supported by and bolted to the stump A^2, as shown. This shaft S^2 has a vertical motion in order that the form S may be pressed down upon the blank H^4 to hold it while it is being trimmed and raised to release it. This vertical motion is produced by the following mechanism:

The shaft or spindle S^2 is provided with weights S^5 at its upper end, (see Fig. 1^a,) said weights resting upon the flange S^6. The upper end of this spindle is provided with a ring T, which is embraced by the perforated bifurcated ends T' of the lever T^2, said lever being integral with the rock-shaft T^3. Screws or bolts T^4 pass through the perforations in the fork T' and extend into the ring T. Integral with this rock-shaft T^3 is a horizontal curved lever U, having its outer end pivoted to the vertical rod U', (see Figs. 1, 2, and 3,) extending down and being pivotally secured to the cam-lever U^2, which is loose upon a stud U^3, supported by the frame.

U^4 is a cam on the shaft U^5, supported by the boxes U^6, secured to the back of the frame or stump A^2.

The gear-wheel V is fast on the shaft U^5 and is engaged by the pinion V', fast on the shaft C^2. Motion being imparted to the shaft

U^5 and cam U^4 by the gear last above mentioned, said cam causes the rod U′ to rise and drop rapidly, carrying with it the end of the lever U and rocking the shaft T, which, by means of its bifurcated arm T^2, lifts and lowers the spindle S^2, and hence the upper form S. The effect of the cam U^4 is to make the stroke of the spindle S^2 quick, but to allow the upper form to remain for an appreciable length of time at its highest and lowest points, thereby giving the cutters time to trim the blank and also affording time to remove a finished article and put on a fresh blank. The pressure of the upper form upon the blank is regulated by the weights S^5.

The different parts of the mechanism described connected with the forms are shown in Figs. 1, 2, 3, 4, 5, 6, 7, 12, 13, 15, and 20.

In order that rotary motion may be applied to the spindles S^2 R^2, and hence to the patterns S R, whereby the blank, which is held between them, may be rotated and thus present its edges throughout the entire circumference of the pattern to the action of the cutters below described, said spindles are provided, respectively, with the pinions W W′, Fig. 5, the former W being made of extra thickness to allow for the vertical motion of the spindle on which it is fast. The pinions W and W′ are engaged, respectively, by the gear-wheels W^2 and W^3, fast on the vertical shaft W^4, which is supported in bearings at W^6 and W^7, respectively, in the column S^4 and the bed of the machine. The gear-wheel W^3 has bolted to its under side a ratchet W^5. (See Figs. 5, 9, and 10.) This ratchet is engaged by the pawl X, which is carried by the radius-lever X′, which is loose on the shaft W^4.

X^2 is a link pivotally connecting the lever X′ with the curved lever X^3, which is integral with the shaft X^4, which has also integral with it a lever X^5. The outer end of this lever X^5 is provided with a cam-roll Y, (shown in broken lines in Fig. 10,) which runs in the cam-groove Y′ on the under side of the cam-wheel Y^2, which is bolted to the under side of the gear-wheel Y^3, Fig. 10, fast to the shaft Y^4, supported by the box Y^5 on the end of the bed or frame A.

Motion is imparted to the gear-wheel Y^3 by the pinion Z, the shaft Z′ of which is supported by the leg A^4, (see Figs. 1 and 20,) and is driven by the bevel-gear Z^2, which is engaged by the bevel-gear Z^3, fast on the shaft B^4. Thus it will be seen that the gear-wheel Y^3 by rotating the cam-wheel Y^2, which is provided with the peculiarly-shaped groove Y′ on its under side, produces by means of the intermediate mechanism—viz., the levers X^5 X^3, shaft X^4, link X^2, radius-lever X′, shaft W^4, and gears W^3 W^2 W′ W—the irregular rotation of the forms necessary to the suitable treatment of the blank by the cutters.

In Fig. 9 the above mechanism is shown in full lines at one end of the stroke and in broken lines at the opposite end of the stroke.

The mechanism for trimming or cutting the sole to its final shape is as follows: a is a rotary cutter rigidly secured to the shaft a', supported in the frame a^2. (See Figs. 6, 7, and 8.) b is a lower cutter provided with a beveled edge, as shown, and rigidly secured to the shaft b', also supported in the frame a^2. This shaft b' is provided with a gear-wheel b^2, which is engaged by a pinion a^3 on the shaft a', whereby the motion of the upper cutter a is made, say, five times greater than that of the lower cutter b. The gear b^2 may be dispensed with and the lower cutter allowed to turn by friction. The cutters are placed, preferably, at about an angle of forty-five degrees when it is desired to produce an article with beveled edges. It will be observed that the cutters are so placed in the frame that the under or beveled cutter b overlaps the upper or principal cutter a, (see Fig. 6^a,) so as to produce a shear cut. The principal office of the cutter b is to hold the material up to the cutter a, which operates chiefly as the cutting-tool, the bevel of said cutter b being such as to bring the plane of its bevel substantially in the same plane with the upper surface of the lower pattern. The lower cutter b may be made stationary and still hold the material up to the action of the cutter a, and in connection with it produce a shear cut. In that event the lower disk b would slide along beneath the material instead of turning in its bearings by friction against the material and the upper disk a would act as a single cutter against a stationary blade. In practice, however, it will be found preferable to allow the lower disk to revolve in its bearings, especially when cutting sheets of india-rubber. The faces of the cutters b and a where they overlap are held together by means of the spring b^3, which lies between a suitable shoulder on the shaft b' and the bracket b^4. Both the frame a^2 and the bracket b^4 are supported by an extension-piece e, fully described below.

The cutters a and b are given their motion of rotation by mechanism, as follows: Power is applied through a belt c^7 to the pulley c^6 upon the shaft c^5, which is supported by a bracket d, extending from the frame of the machine. To this shaft c^5 the tubular shaft c^2 is attached by a universal joint c^4. Projecting up into the shaft c^2 is a shaft c', which can slide therein, limited, however, by a slot and a key c^3. The shaft c' is connected by a universal joint c with the shaft a', upon the lower end of which is the cutter a. By means of the gear a^3 upon the shaft a' engaging with the gear b^2 upon the shaft b' the cutter b is caused to rotate. (See Figs. 1, 2, and 6.) If, however, it is desired to have the cutter b rotate by friction only, the gears a^3 and b^2 may be dispensed with.

It is requisite in a cutting-machine of this character that the edge of the cutter should be substantially in contact with the periphery of the pattern at all times and be pre-

sented to the material as nearly as may be with the plane of its blade at right angles to the normal of the curve of the periphery of the pattern at the point of contact therewith, and the mechanism which I employ to accomplish this is illustrated in the drawings in Fig. 6.

e is an extension on which the cutter-frame $a^2\ b^4$ is supported. This extension slides horizontally in straight lines upon the swiveling guide e', pivoted at e^2 in the boss e^3, which is integral with the yoke e^4, made fast on the spindle e^5, supported by and turning in the frame A.

f is a bracket rigidly secured to the inner end of the sliding support e, for the purpose of limiting the movement of the cutter-frame toward the pattern, and is provided with a roll f', which bears against the edge of the lower form R for the purpose of reducing the friction at that point. This is accomplished by means of a spring f^2, the outer end of which is secured by a pin f^3 (see Figs. 7 and 8) to the slide e and the inner end to a gear f^4, supported by the spindle f^5, carried by said slide, the gear f^4 engaging the rack f^6 on the guide e'.

The guide e' is provided with a projection g, to which is pivotally secured a link g', bent horizontally and vertically, as shown, (see Figs. 1, 6, 7, and 8,) said link being pivotally secured at its opposite ends to the cam-lever g^2, pivoted at g^3 to a bracket g^4, bolted at g^5 to the bed A. This cam-lever g^2 carries on its upper surface the roll g^6, which is engaged by the cam-groove h (see broken lines in Fig. 5) on the under side of the cam-wheel h', keyed to the shaft Y^4, which is carried by the box Y^5, Fig. 1, as above described. This motion is for the purpose of swinging the support e, and hence the cutter-frame with its cutters $a\ b$, in the arc of a circle in order that the product of the two motions—viz., that last mentioned and the sliding in straight lines of the support e produced by the spring, gear, and rack $f^2\ f^4\ f^6$—may be such as to keep the plane of the cutter-blades perpendicular to the normal of the curve of the periphery of the rotating pattern at the point where the cutter is in contact with it, as above mentioned.

Integral with the yoke e^4 is a cam-lever e^6, Figs. 7 and 8, having at its outer end a roll e^7, which engages with the cam-groove e^8 in the cam-wheel e^9, made fast on the shaft Y^4. By this means at the time that the blank is being fed in the yoke is swung to one side, thus carrying the guide e', cutter-frame, and cutters to one side in order that they may not interfere with the blank before the upper form has descended and clamped said blank.

i, Fig. 6, is a bell-crank lever pivoted at i' to the guide e'. The lower or horizontal arm of this lever i is pivotally secured to the upper end of the rod i^2, which extends through the pivot of the guide e' and is provided with a foot i^3 resting on the inclined surface of the bracket i^4, secured to the frame. (See Figs. 6 and 6^b.)

i^5 is a spring upon the rod i^2, which when the yoke e^4 is swung to one side so that the foot i^3 slips off the surface of the bracket forces the rod i^2 down, and hence the lower arm of the bell-crank i, so that the upper arm is carried forward and caused to bind against the under side of the support e and prevent it from sliding toward the pattern until released by the foot i^3, being re-established in its position upon the bracket i^4 when the several parts return to the position shown in Fig. 6.

The upper end of the bell-crank may be serrated or provided with teeth, if desired, in order to assist its hold on the under side of the support e.

It now remains for the machine to remove the finished sole or other article from the form and also the scraps—*i. e.*, the parts cut from the blank in making the finished article. The mechanism for this purpose is illustrated in Figs. 2 and 4 and in detail in Figs. 16 to 19, inclusive.

The gear-wheel V is provided on its outer face with the cam-groove k, which engages a suitable roller on the vertical cam-lever k', the lower end of which is pivoted at k^2, Fig. 2, to the foot A^5. The upper end of this cam-lever is pivotally secured to the lengthwise-adjustable link l, having its opposite end pivotally secured to the crank l', which is fast on the shaft l^2. This shaft is supported in a boss m upon the upper face of the slide m', provided with two pins l^3. This slide moves on the guide-bar m^2, which is supported by the portion A^6 of the frame A. The throw of the crank l' is limited by the two pins l^3. As the cam-lever k' is actuated by the cam-wheel, its upper end, by means of the adjustable link l, moves the crank l' until it strikes the proper pin l^3, and then by means of said crank and pin moves the slide m' on the guiding-bar m^2.

Rigidly secured to the opposite end of the shaft l^2 is the finger m^3, the hub of which is provided with teeth m^4. These teeth engage similar teeth n' on the hub of the finger n, which is pivoted at n^2 on the lower end of the yoke n^3. Thus it will be seen that as the shaft l^2 oscillates by means of the above-described movement of the crank l' the fingers m^3 and n close at the end of the forward throw of the slide m' and open at the end of its backward throw. The yoke n^3 is pivoted on the slide m' concentrically with the shaft l^2, (see Fig. 17,) and is held normally in a vertical position by means of an eye-rod n^4, provided with a spring n^5 and secured at one end to said yoke, said eye-rod and spring holding said yoke normally against the bracket m^5 on the slide m'. Furthermore, the yoke is provided with the spring-latch q, having the ordinary spring q'.

q^2 is a trip-piece supported by the bracket or standard q^3, which is rigidly secured to the

rear side of the stump A^2. (See Figs. 2, 4, and 19.) As the slide and yoke move toward the right (in Fig. 19) when said yoke reaches the trip-piece q^2, the latch q, coming in contact with said trip-piece, causes a partial rotation of the yoke, with the effect of partially revolving the pivot n^2 around the pivot of the upper finger, and hence revolving the gear n' around the gear m^4, thus depressing the end of the lower finger n into the position shown in broken lines in Fig. 19. After the latch has passed from under the trip-piece q^2 the yoke is returned to its vertical position by the spring n^5. When the yoke and slide after having reached the end of the backward throw return, the beveled edge of the latch strikes the trip-piece q^2 and is depressed, so that the vertical position of the yoke is not affected. The mechanism being in the position shown in Fig. 16 and in the act of approaching the forms the fingers, as they come forward to grip the article, are enabled to reach the upper and lower surfaces thereof by means of openings S^7 and R^5 in the forms. At the instant of the reversal of this forward motion the fingers grip the finished article and move back, as above described, and are opened near the end of the backward throw while under the trip-piece, thus freeing the article. It will be remembered that in Figs. 16 and 18 the mechanism is in a position corresponding with most of the preceding figures—that is, with the fingers approaching the pattern—while in Fig. 19 the full lines show the fingers gripping the article at the instant of their starting back on their reverse motion, and the broken lines show the fingers wide open and passing under the trip-piece. As the completed soles or other articles are released, they drop upon an endless apron q^4, Fig. 19, passing over a roll q^5, supported by the frame, and a similar roll at a suitable distance from the machine, (not shown in the drawings,) to which power is applied in any desired manner.

When cutting soles, the under side at the instep (which is uppermost in the machine) may be embossed during the operation of the trimming by means of male and female dies $r\ r'$. (See Figs. 13 and 14.) The female die r' is embedded, as shown, in the upper form S, and the die r is held adjustably by means of its dovetailed shank r^2 in the tubular slotted die-carrier r^3, which is supported by and moves in the foot R′ of the under form. The die-carrier r^2 is held normally down by means of the spring r^4, the upper end of which is secured to a pin r^5, projecting from the foot R′ through the slot r^6.

t is a hollow plunger provided at its lower end with a plug t', adapted to slide vertically in the foot S′, which supports the upper form. This plunger is held normally up by means of a spring t^2, the lower end of which is secured to a pin t^3, projecting from the foot S′ through a vertical slot in the said plunger.

Rigidly secured to the brackets R^3 and S^3, respectively, are the stationary cams t^4 and t^5.

The plunger t is provided at its upper end with a roller t^6, and the die-carrier r^2 is provided at its lower end with a similar roller t^7. As the spindles R^2 and S^2 rotate for the purpose of rotating the forms, the die-carrier r^2 and the plunger t revolve, being carried by the feet R′ and S′, and their rollers t^7 and t^6 come in contact, respectively, with the cams t^5 and t^4, with the effect of forcing the male die r up into the sole at the point named and forcing the plunger t^2 down upon the upper surface of the upper form S, thereby holding said form firmly and rigidly as the die r does its work. The scrap or trimmings—that is, the waste removed by the cutters during the operations above described—fall on the endless apron v, (see Figs. 1, 4, and 6,) carried by the fast pulley v' on the shaft v^2, which is supported by the bracket v^3, bolted to the frame. This apron passes over the loose pulley v^4, supported in said bracket, the pulley v^5, supported by the leg A^4, and the pulley v^6, supported by the wing A′ of the frame. (See broken lines in Fig. 1.) Motion is given to this apron by applying a belt to the pulley v^7, such belt communicating with any suitable power.

It being desirable to apply a slight resistance to the spindle R^2, a suitable mechanism for so doing is shown in Fig. 15, such mechanism consisting of a flanged hub w, having friction produced upon its flange by means of the annular clamps w', secured to the frame by a suitable stud w^2. The foot S′, it will be noticed, especially in Fig. 13, while being solid vertically at the toe portion is chambered out from the heel to a point beyond the instep. This is for the purpose of allowing the cutters greater access toward the center at the instep portion. In the same figure it will be noticed that near the heel of the foot is a removable extension S^7, extending through a slot in said foot down upon the upper surface of the sole. The table K (see Figs. 4 and 5) is provided with an extension K^7, of shape to fit the side of the form, and should be made of such size and shape as to fit the particular form being used.

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

1. In a machine for cutting articles of specified form from sheet material, the combination of a pivoted pattern to support the stock to be cut, a pivoted clamp to hold it thereon, a rotary knife, and a co-operating blade held in a sliding frame supported upon a swiveling carriage, whereby the knife is adapted to be held in juxtaposition to the periphery of the pattern with the operating portion of its cutting-edge substantially in the line of the axis of movement of the carriage and to move in straight lines radial to the curves of the pattern, substantially as described.

2. In a machine for cutting articles of curvilinear outline from sheet material, the combination of a pattern upon which the stock

to be cut is securely held, sustained, and rotated by a pivot beneath, a rotary knife, and co-operating blade held in a frame which rests upon and slides in guides attached to a pivoted support, whereby in operation said frame will move in straight lines radial to the pivot of its support, substantially as described.

3. In a machine for cutting articles of curvilinear outline from sheet material, the combination of a rotary stock-supporting pattern sustained and operated by a spindle beneath, a rotary vertically-reciprocating clamping-pattern sustained and operated by a spindle above a rotary knife and co-operating blade, a frame in which the knife is journaled, a pivoted support for the frame, and a cam and lever to automatically operate said support, substantially as described.

4. In an organized machine for cutting specified forms from sheet material, a pair of stock-clamping patterns rotated by their respective supporting-spindles, a pair of co-operating rotary cutters held in a frame with the operating portion of their cutting-edges in a plane substantially the same as the upper surface of the lower pattern, and gears or pulleys to give said cutters different speeds of rotation, substantially as described.

5. In a machine for cutting articles by pattern and with beveled edges, a rotary cutting-tool journaled in a supporting-frame with the plane of the cutter-blade inclined to the plane of the surface of the stock-supporting pattern at an angle corresponding to the desired bevel of the edge of the article to be cut, a blade to co-operate with the rotary cutter, and mechanism, substantially such as described, to move the said frame and present the cutting-edge of the knife in operative relation to the periphery of the pattern, in the manner specified.

6. In a machine for cutting articles by pattern from sheet material, the combination of a pair of stock-holding patterns and a pair of co-operating knives the overlapping cutting-edges of which are formed with different bevels, respectively, and which are automatically held in juxtaposition with the periphery of the pattern during the cutting operation, whereby the knife-edge having the most acute angle of bevel will operate chiefly as the cutting-tool, substantially as described.

7. In a machine for cutting articles by pattern from sheet material, the combination of a pattern to which the stock to be cut is secured, and two co-operating cutters which are maintained in operative relation to the periphery of the pattern, one of which cutters is formed with a knife-edge and the other with a bevel, the plane of which is coincident with the plane of the face of the pattern during the cutting operation, substantially as described.

8. The combination of a pair of rotary stock-clamping patterns, a rotary cutting-tool automatically operated to accommodate its position to the varying shape of the edges of the patterns and maintain its cutting-edge in operative relation thereto during their revolution, and universally-adjustable mechanism through which rotary motion is communicated to the cutter, substantially as described.

9. In a machine for cutting boot or shoe soles, the combination of an intermittently-moving carrier which feeds the material forward, a knife which cuts it into blanks, a reciprocating arm which feeds the blanks to a pattern, and a cutting-tool which trims the blank to the shape of the pattern, substantially as described.

10. In a machine for cutting sheet material into curvilinear forms, the combination of a reciprocating blank-feeding bar, a pair of rotating forms or patterns to hold the blank and determine the shape to which it shall be cut, and a rotary knife adapted to follow the contour of the pattern and cut the material in accordance therewith, substantially as described.

11. In a machine for cutting curvilinear forms from sheet material, the combination of an intermittently-moving feed-apron, a reciprocating blank-cutting knife, and a hinged stock-supporting shelf at the front of the knife which is adapted to be depressed during the operation of the knife and to return to its normal position when the cutting is completed, substantially as described.

12. In combination with a machine for cutting sheet material by pattern, an endless intermittently-moving stock-supporting apron, a reciprocating blank-cutting knife, a reciprocating carrier to move the blank from the knife to the pattern, and a reciprocating feed-bar to transfer the blank from the said carrier onto the pattern, substantially as described.

13. In a machine for cutting articles from sheet material, the combination of a blank-cutting knife and a reciprocating feed-bar which rocks upon supporting-pivots and is connected with its actuating-lever by a rod which is pivoted thereto in a bearing vertically adjustable thereon, whereby the forward movement of the feed-bar may be regulated to the varying sizes of the blanks which are cut, substantially as described.

14. The combination of an intermittently-moving stock-feeding apron, a blank-cutting knife, and a knife-clearer N for the purpose of preparing blanks to be fed to a cutting-machine, substantially as described.

15. In a machine for cutting curvilinear forms from sheet material, having a rotary pattern upon which the stock to be cut is secured, a rotary cutter journaled in a frame which slides upon a pivoted support in lines radial to such pivot, and a spring which constantly acts to force the cutter-frame toward the pattern, substantially as described.

16. In a cutting-machine having a pair of rotating patterns to hold the stock, the combination of a rotary cutter journaled in a slid-

ing frame upon a pivoted support, a spring which forces the frame toward the pattern, and an arm upon the end of the frame which bears upon the periphery of the pattern, whereby the cutter maintains a constant position with relation to the edge of the pattern and follows its varying contour throughout the revolution of the pattern, substantially as described.

17. In a cutting-machine, the combination of a rotary stock-supporting pattern and a cutting-tool held in a frame pivoted eccentrically upon a swiveling support, whereby the cutter may be withdrawn from its operative relation to the pattern while a blank is being placed thereon, substantially as described.

18. In a cutting-machine having a rotary stock-supporting pattern, the combination of a cutter and frame which slides upon its support in lines radial to the curve of the pattern at the point where the cutter is operating, a spring which constantly acts to hold the said frame in contact with the pattern, and a locking-lever to hold the frame against the action of the spring when the cutter is moved from operative relation to the pattern, substantially as described.

19. In a machine for cutting sheet material into specified forms, having a pair of stock-holding patterns, a pair of co-operating dies which are respectively combined with one of said patterns and operated through the same to emboss or stamp the surface of the article which is being cut while held between the patterns, substantially as described.

20. In combination with a machine for cutting articles of sheet material, a pair of reciprocating fingers or nippers which advance and grip the article when cut and withdraw it from the machine, and a tripping-bar to open the fingers during their backward motion and thereby release the article, substantially as described.

21. In a machine for cutting articles from sheet material, a pair of reciprocating fingers for withdrawing the completed article therefrom, provided with an adjustable link *l*, whereby the forward movement of the fingers may be regulated to the size of the article cut, substantially as described.

22. In a machine for cutting articles of curvilinear form, the combination of a stock-supporting pattern and a stock-clamping pattern having openings R^5 S^8, and a chambered foot S′, for supporting the clamping-pattern, substantially as described, and for the purpose specified.

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