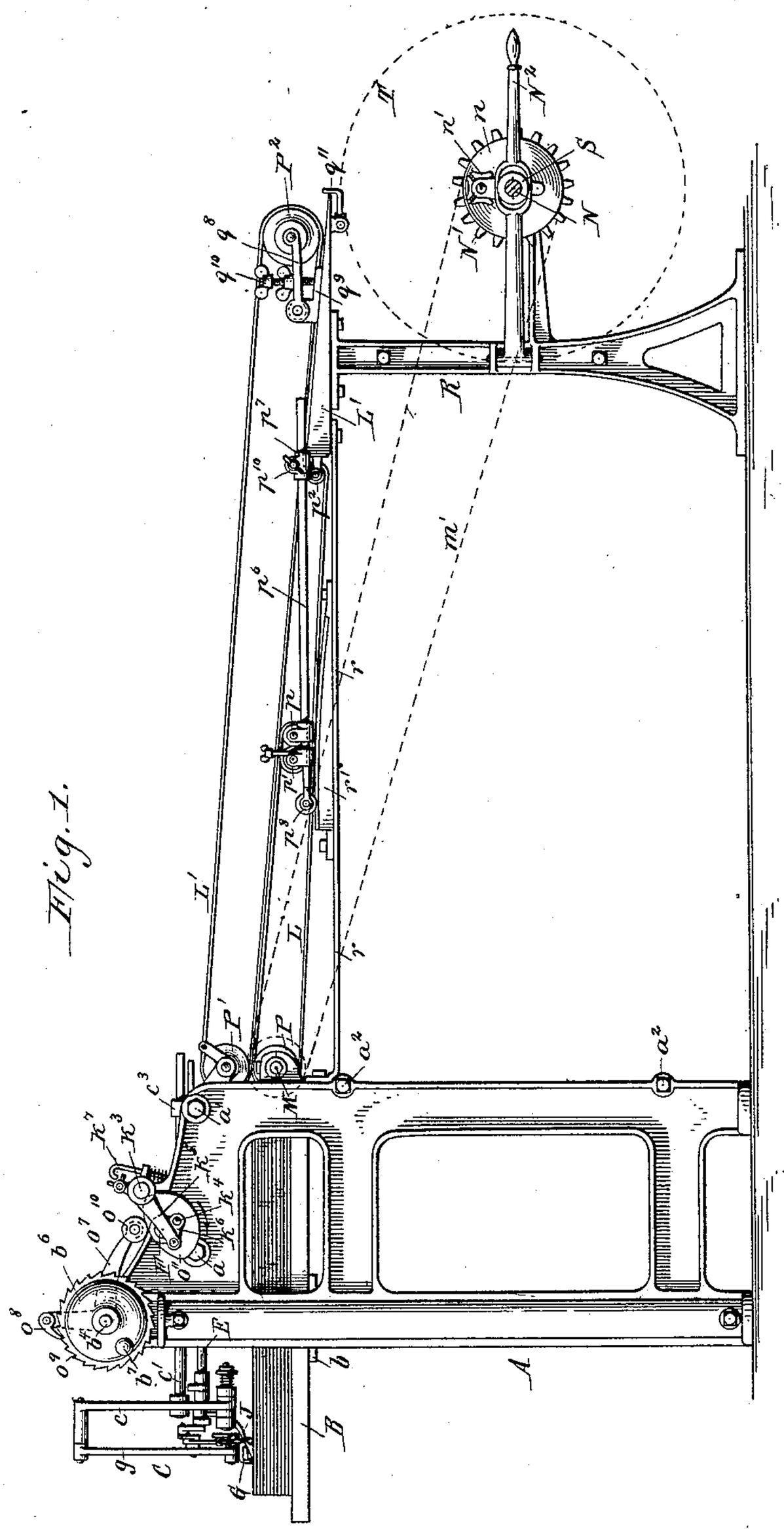
(No Model.)

11 Sheets—Sheet 1.

F. HART.

PAPER FEEDING MACHINE.

No. 434,629. Patented Aug. 19, 1890.



Witnesses:
Theo. L. Popp.
Carl F. Geyer.

Frederick Hart, Inventor.
By Edward Wilhelm
Attorney.

(No Model.) 11 Sheets—Sheet 2.

F. HART.

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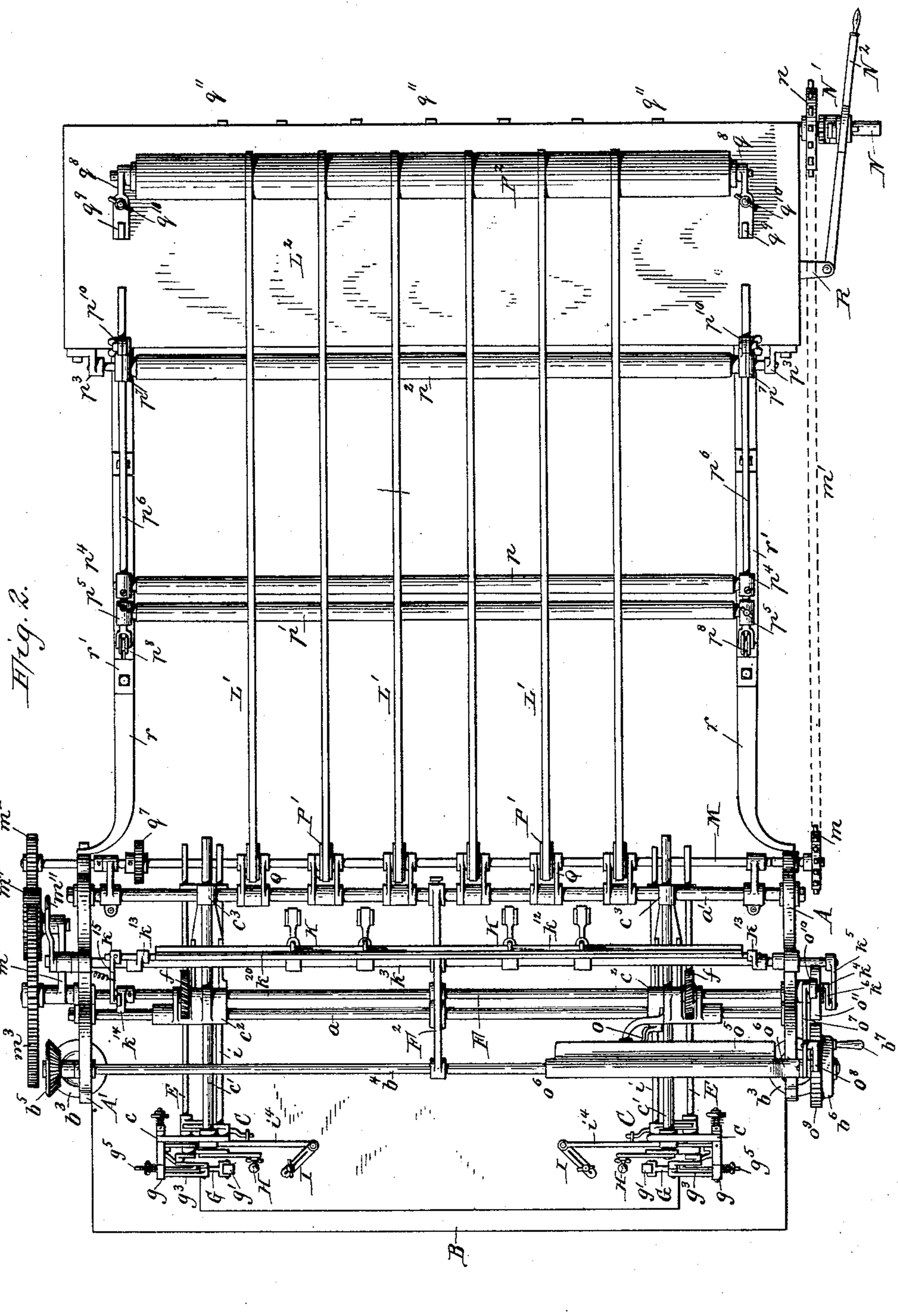

Fig. 2.

Witnesses:
Theo. L. Popp.
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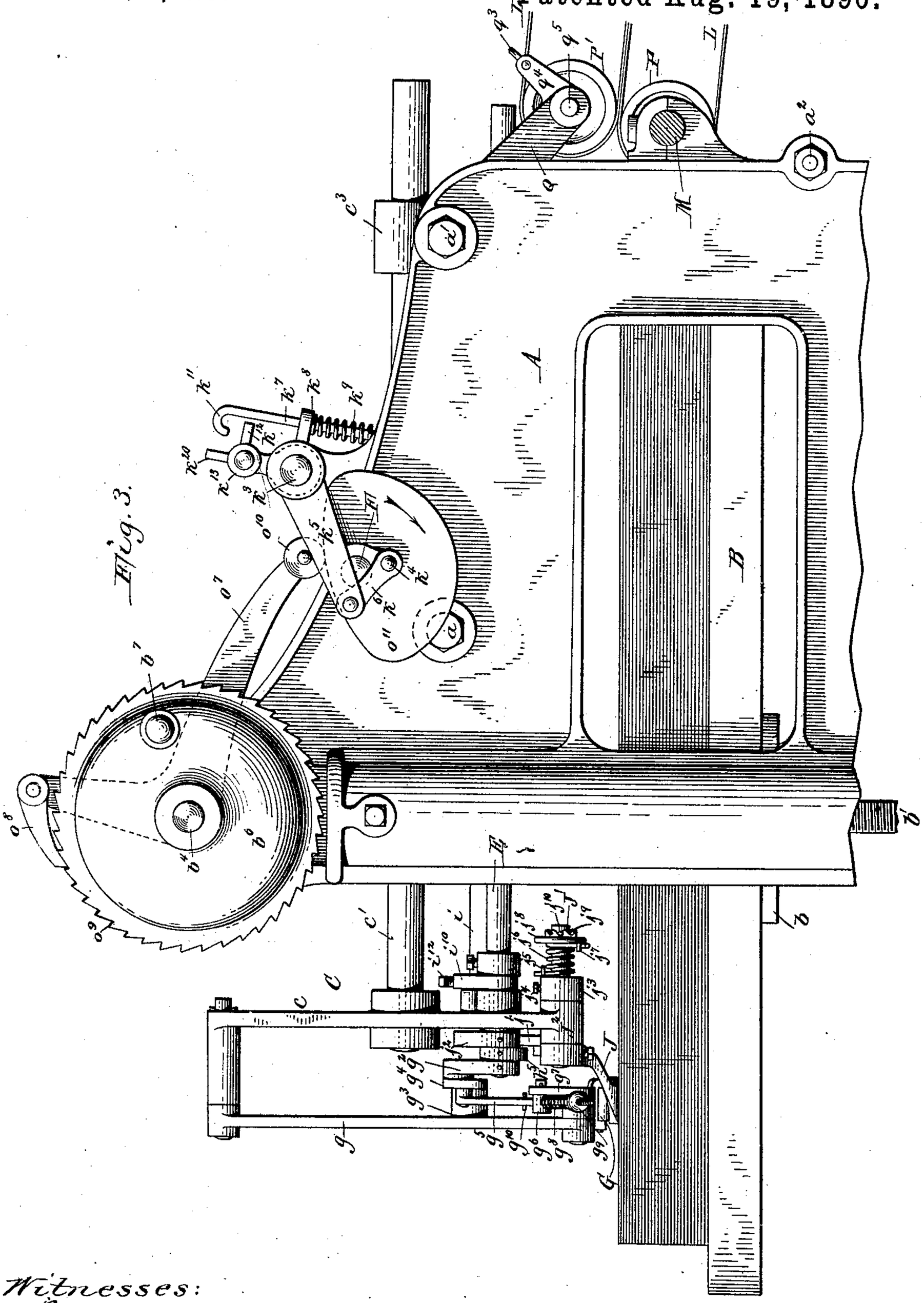

Witnesses:
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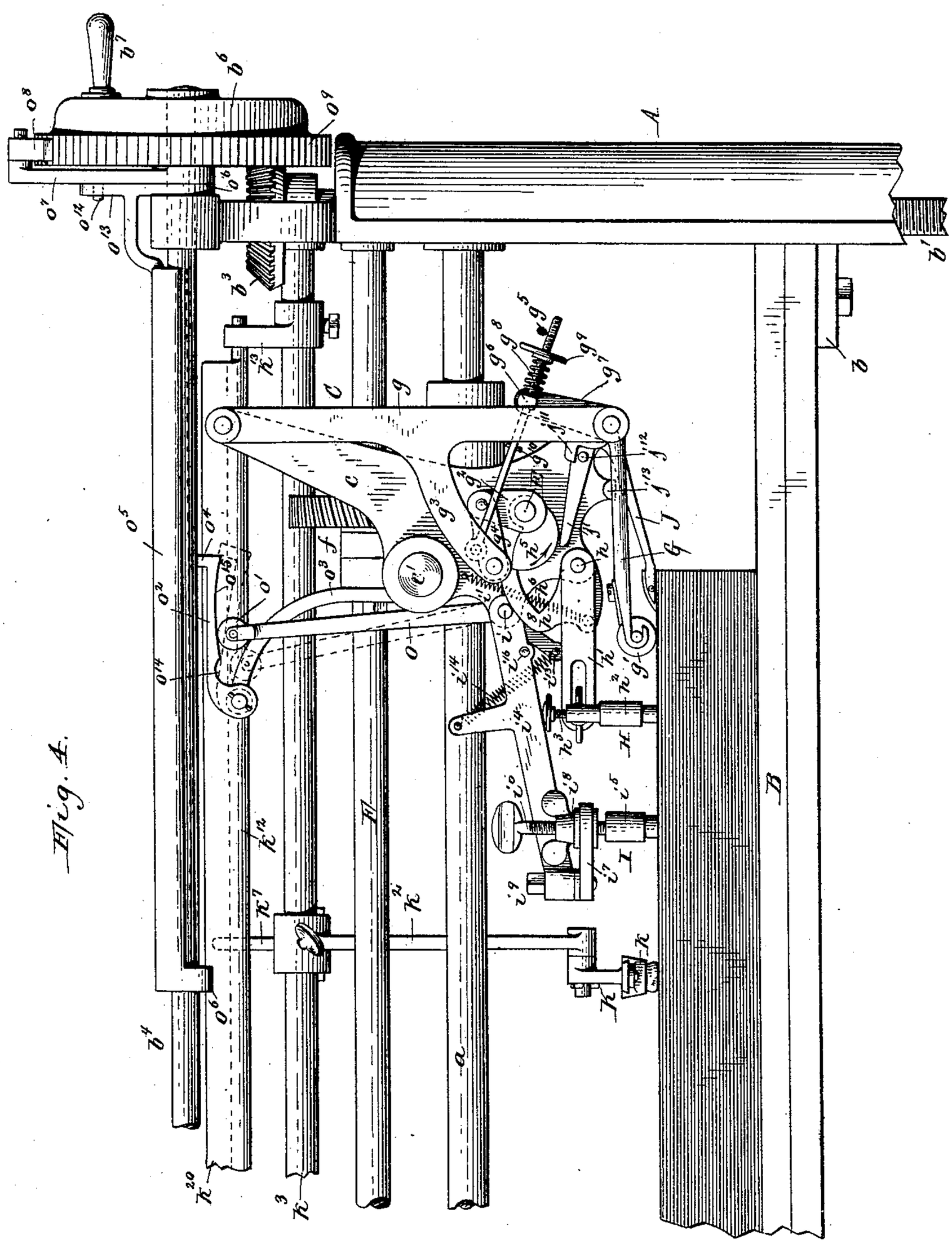

Fig. 4.

Witnesses:
Thos. L. Popp.
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Frederick Hart, Inventor:
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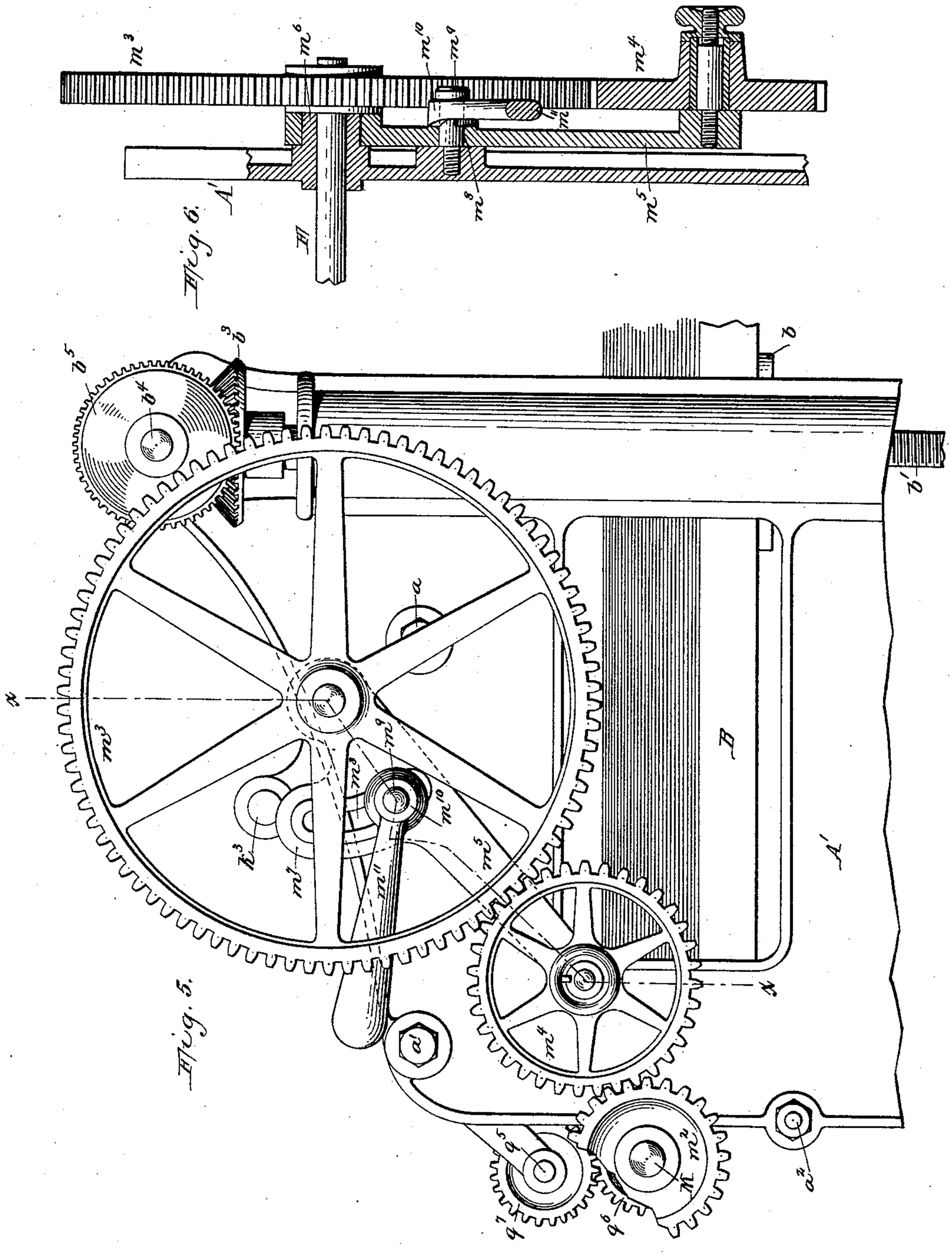

Fig. 5.

Witnesses:
Theo. L. Popp.
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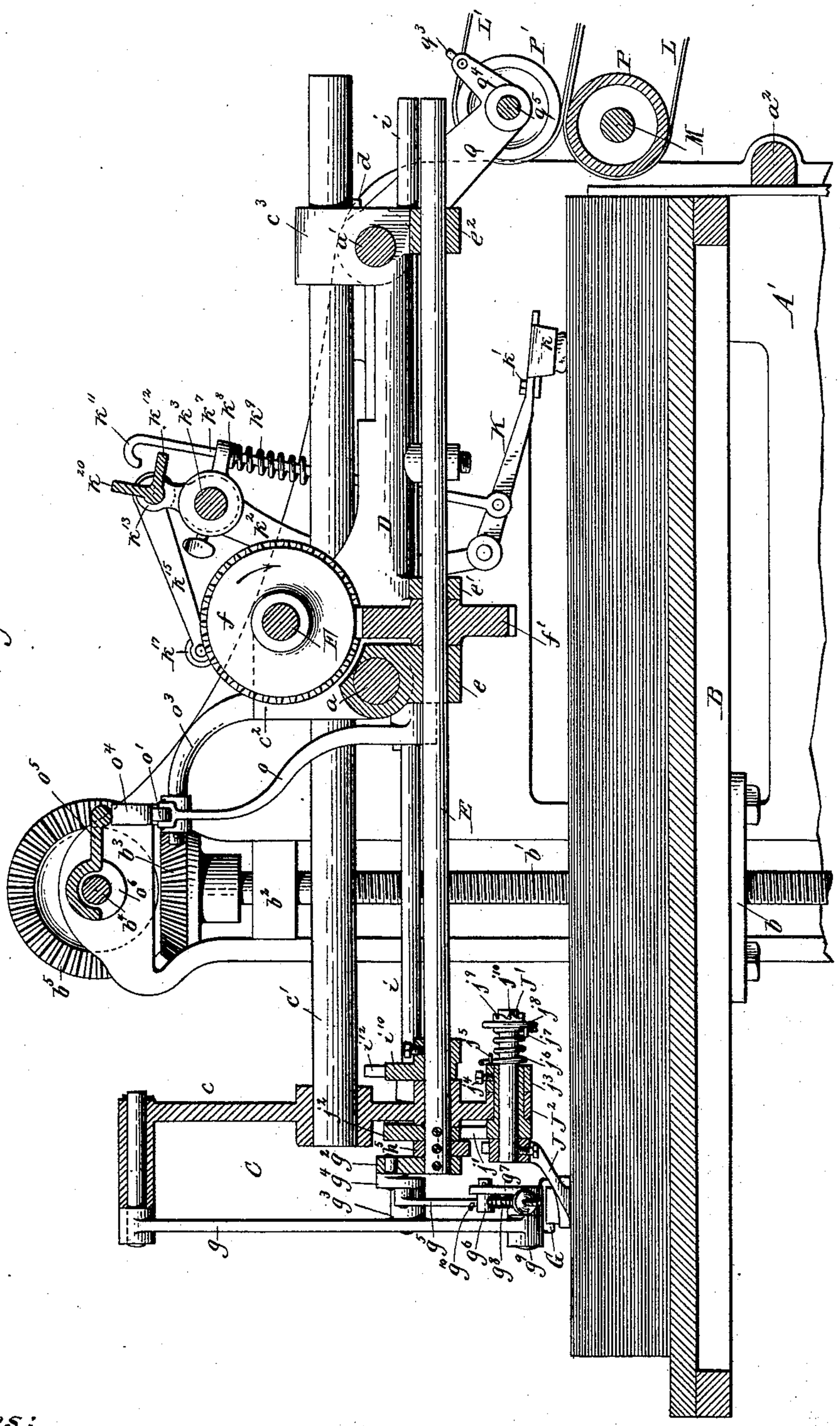
Fig. 2.



Witnesses:
Thos. L. Popp.
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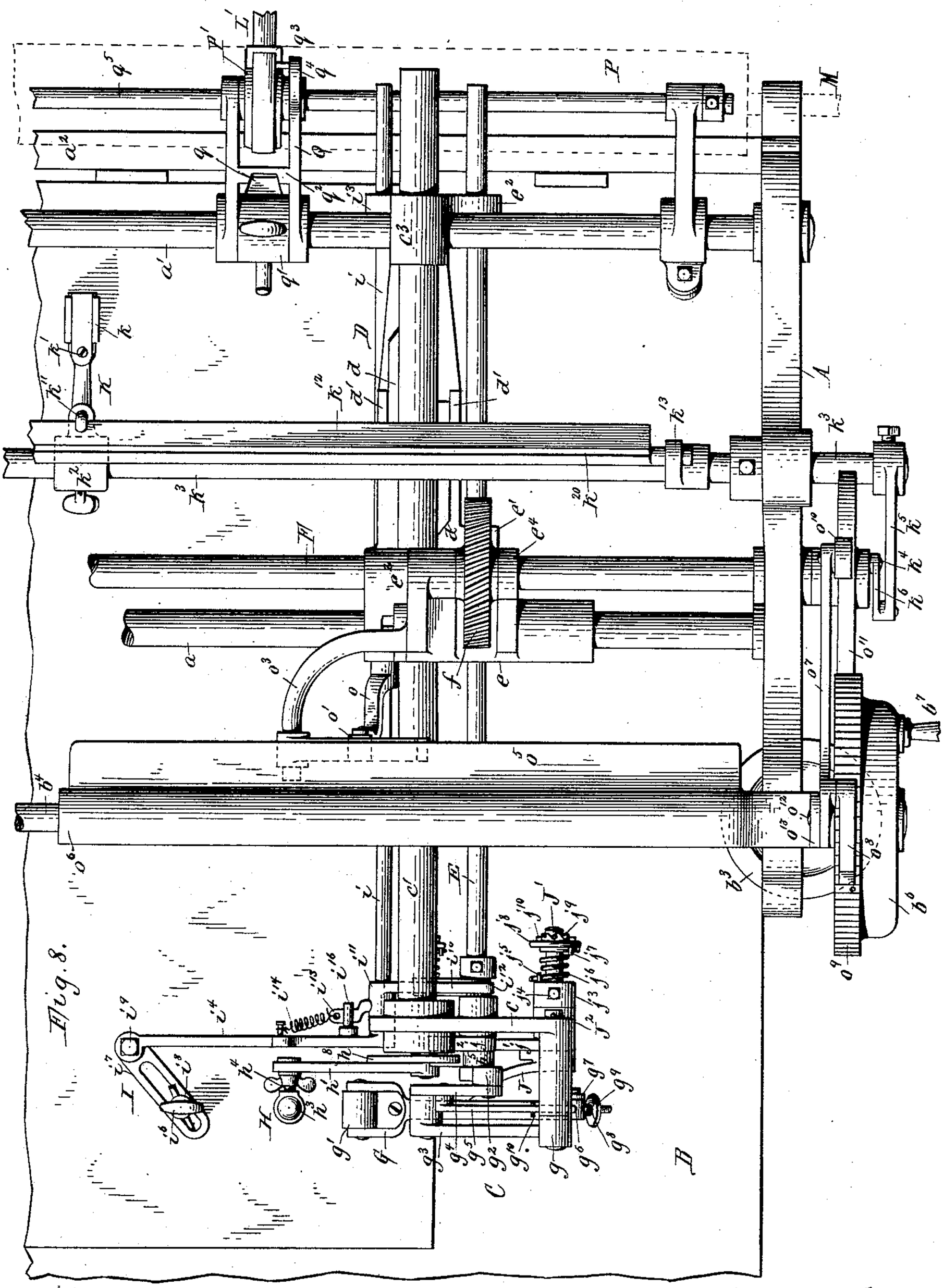

Fig. 8.

Witnesses:
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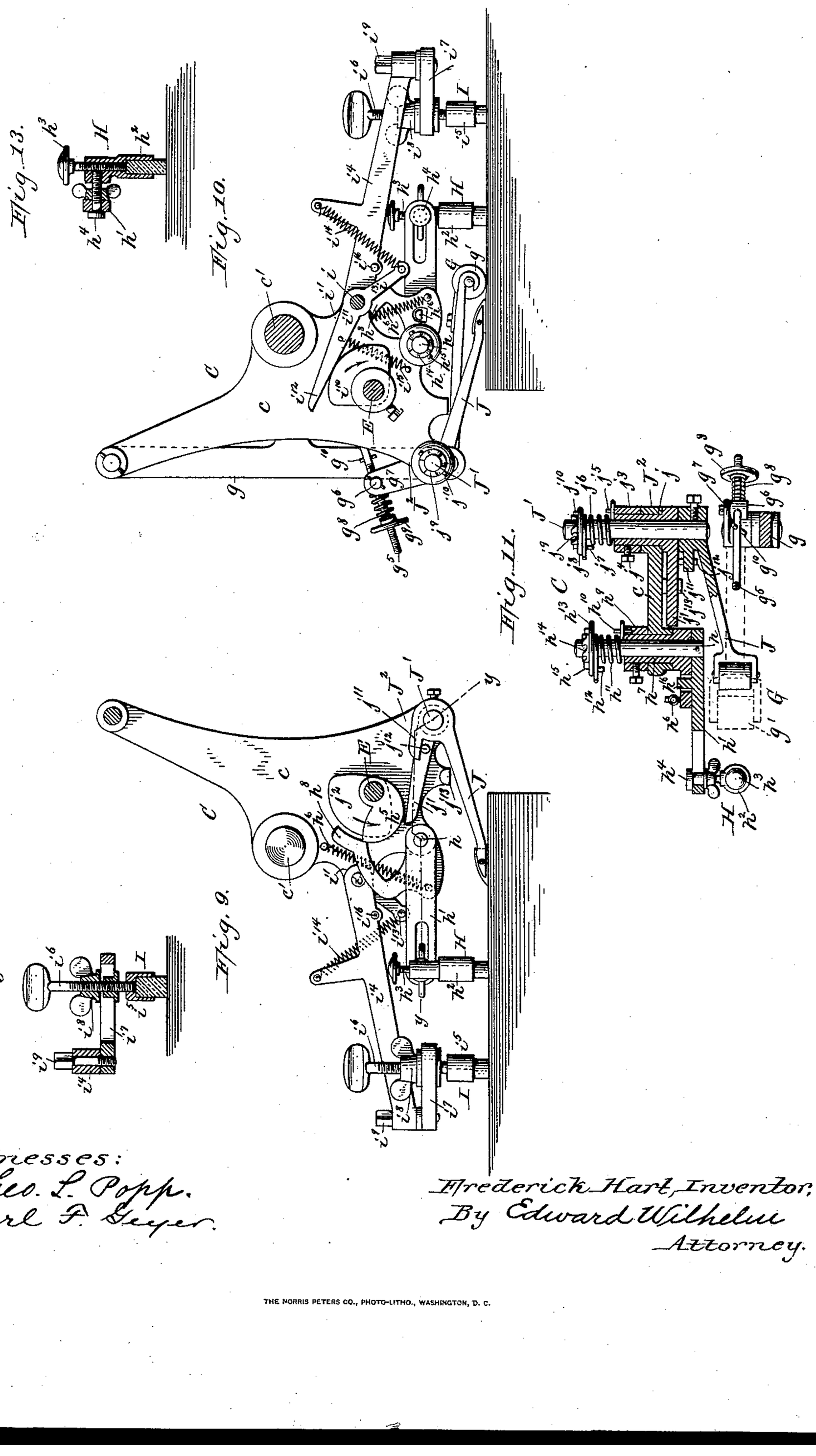

Witnesses:
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Fig. 15.

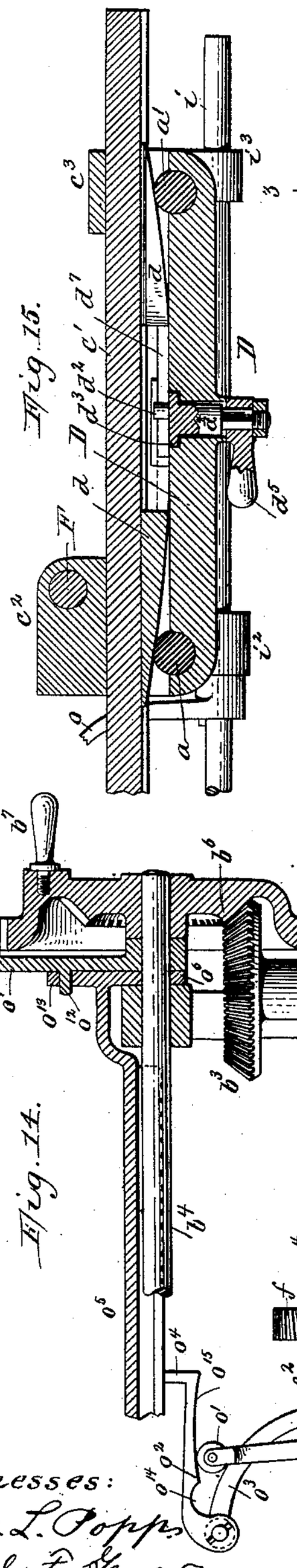

Fig. 16.

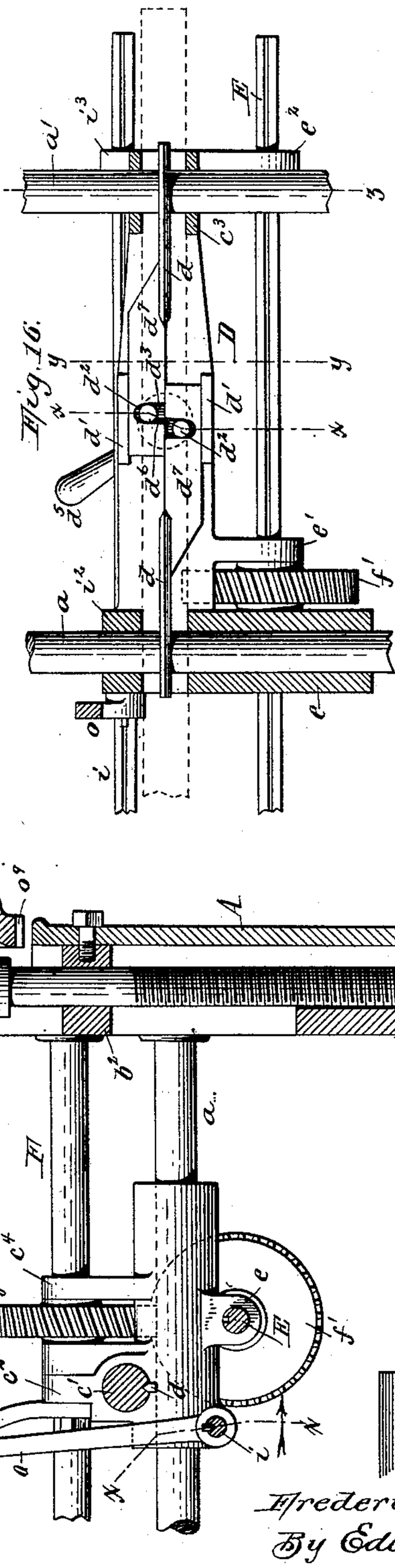

Fig. 19.

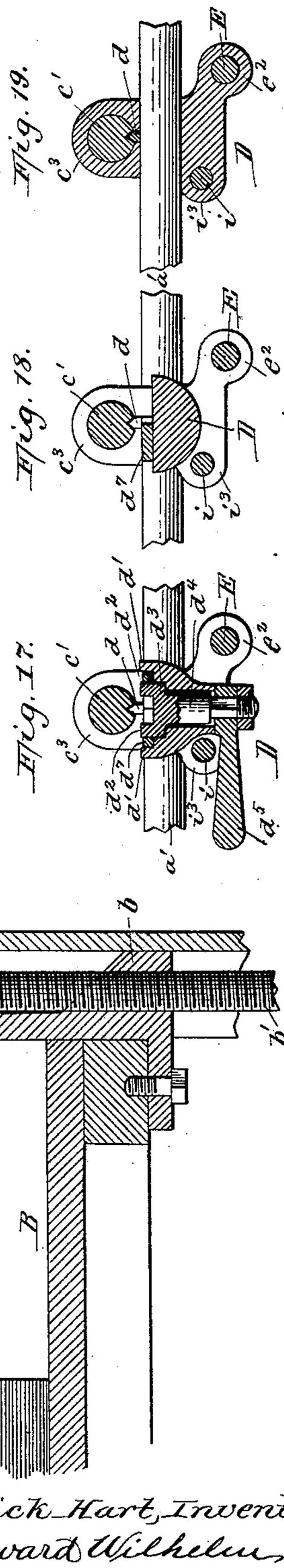

Fig. 18.

Fig. 17.

Fig. 14.

Witnesses:
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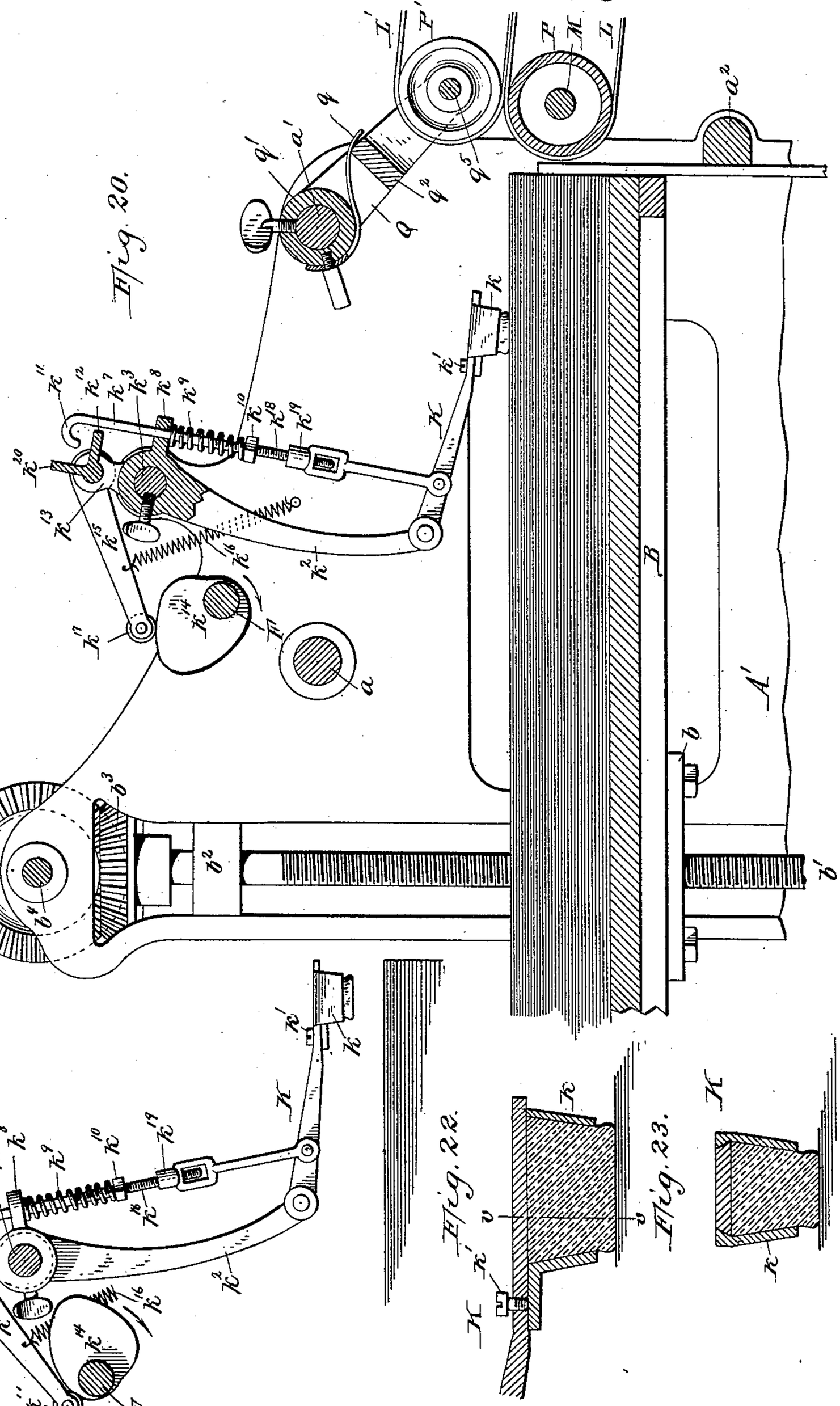

Fig. 20.

Fig. 21.

Fig. 22.

Fig. 23.

Witnesses:
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Carl F. Geyer.

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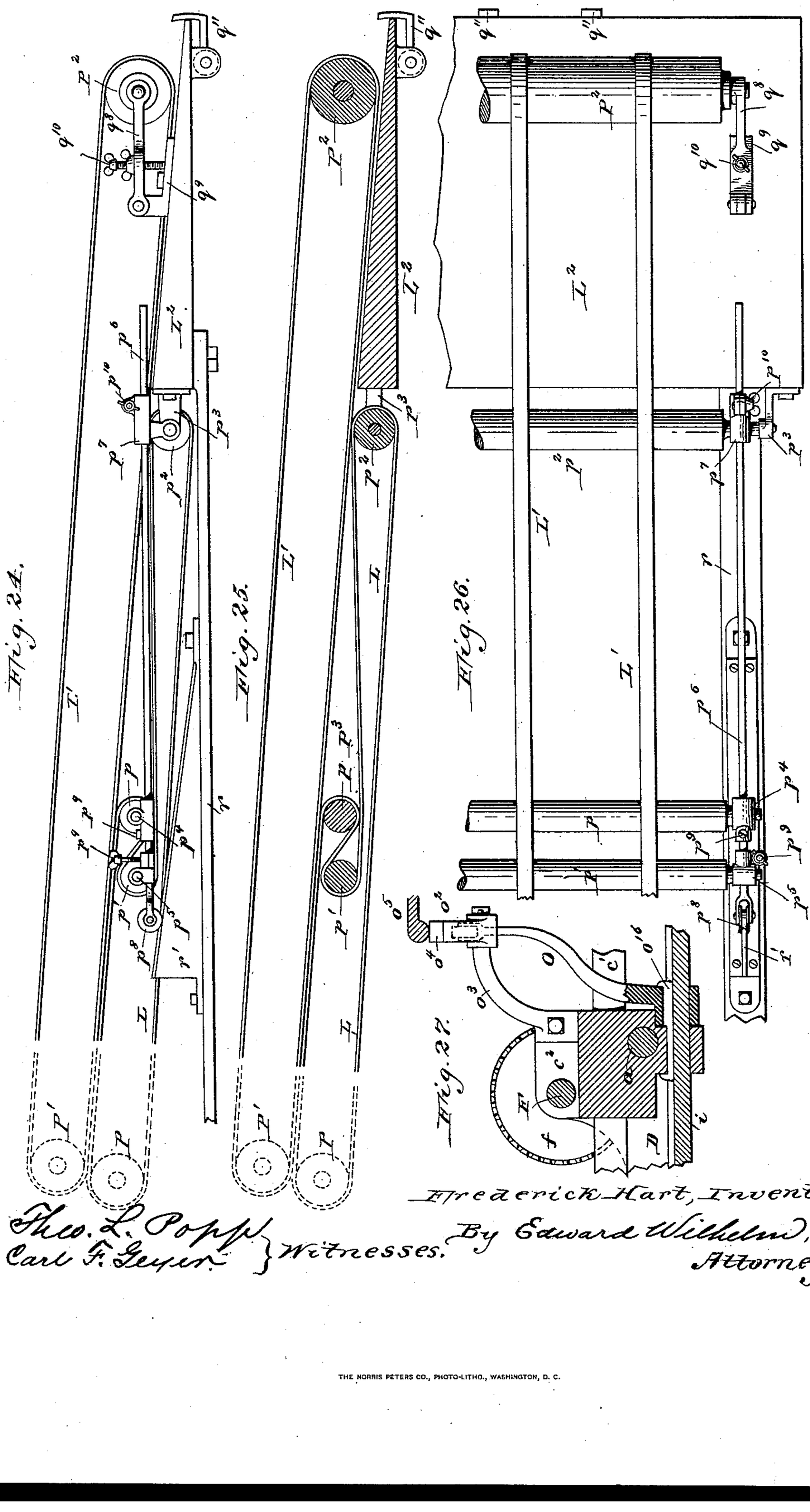

Witnesses:
Theo. L. Popp
Carl F. Geyer

Frederick Hart, Inventor.
By Edward Wilhelm,
Attorney.

UNITED STATES PATENT OFFICE.

FREDERICK HART, OF POUGHKEEPSIE, ASSIGNOR TO D. H. BURRELL & CO., OF LITTLE FALLS, NEW YORK.

PAPER-FEEDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 434,629, dated August 19, 1890.

Application filed September 16, 1889. Serial No. 324,127. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK HART, a subject of the Queen of Great Britain, residing in Poughkeepsie, in the county of Dutchess and State of New York, have invented a new and useful Improvement in Paper-Feeding Machines, of which the following is a specification.

This invention relates to paper-feeding machines which feed sheets of paper successively from a pile to a printing-press, ruling, folding, calendering, or other machine in which sheet-paper is used.

These machines consist, essentially, of a pile-supporting bed or table which is automatically raised as the sheets of paper are fed off, feed-fingers whereby the top sheet is removed, and carrying-tapes whereby the removed top sheet is delivered to the printing-press or other machine.

The object of my invention is to produce a simple machine of this character which is certain and reliable in its operation, and which can be readily adjusted to feed paper of different sizes.

In the accompanying drawings, consisting of eleven sheets, Figure 1 is a side elevation of my improved paper-feeder. Fig. 2 is a top plan view thereof. Fig. 3 is a fragmentary side elevation of the paper-feeder on an enlarged scale. Fig. 4 is a fragmentary front elevation thereof. Fig. 5 is a side elevation of the paper-feeder viewed from the side opposite to that shown in Fig. 3. Fig. 6 is a sectional elevation of the driving mechanism in line $x\ x$, Fig. 5. Fig. 7 is a fragmentary longitudinal sectional elevation of the paper-feeder. Fig. 8 is a fragmentary top plan view of the same. Fig. 9 is a sectional front elevation of the buckling mechanism with the buckling-finger removed. Fig. 10 is a sectional rear elevation of the buckling mechanism. Fig. 11 is a horizontal section of the buckling mechanism in line $y\ y$, Fig. 9. Fig. 12 is a setional elevation of the regulating-foot. Fig. 13 is a sectional elevation of the preliminary holding-down finger. Fig. 14 is a transverse sectional elevation of the mechanism for raising the feed-table. Fig. 15 is a longitudinal sectional elevation of the device for locking the buckling mechanism in place when adjusted. Fig. 16 is a top plan view of the same and connecting parts. Figs. 17, 18, and 19 are vertical transverse sections in lines $x\ x$, $y\ y$, and $z\ z$, Fig. 16, respectively. Fig. 20 is a longitudinal sectional elevation of the paper-feeder, showing the manner of operating the feed-fingers. Fig. 21 is a similar view showing the feed-fingers in a raised position. Fig. 22 is a fragmentary sectional elevation of one of the feed-fingers. Fig. 23 is a vertical cross-section of the same in line $v\ v$, Fig. 22. Fig. 24 is a fragmentary side elevation of the tape mechanism on an enlarged scale. Fig. 25 is a longitudinal sectional elevation of the same. Fig. 26 is a fragmentary top plan view of the same. Fig. 27 is a vertical section in line $x\ x$, Fig. 14.

Like letters of reference refer to like parts in the several figures.

A A′ represent the upright side frames of the machine, which are connected at their upper portions by rods $a\ a'$ and at their rear ends by cross-stays a^2 a^2.

B is the vertically-movable feed-table, upon which the pile of paper is placed, and which is provided with laterally-projecting screw-nuts $b\ b$, which are guided in upright ways formed on the side frames.

$b'\ b'$ represent the vertical feed-screws which work in the screw-nuts $b\ b$ of the feed-table. The feed-screws are provided at their upper ends with bevel-wheels b^3, which are connected by a horizontal transverse shaft b^4, journaled at the upper ends of the side frames and having bevel-wheels $b^5\ b^6$, which mesh with the wheels of the feed-screws, so as to actuate both feed-screws simultaneously. The bevel-wheel b^6 is provided with a handle b^7, so that it can be turned by hand in adjusting the machine.

C C represent two movable frames carrying the buckling mechanism, one of which is arranged in a large machine on each side of the pile of paper, so as to buckle the sheet simultaneously from opposite sides, while in a small machine a single buckling mechanism may be used. These two buckling devices are identical in construction, and each is arranged on a carrying-head c, supported on the front end of a longitudinally-adjustable rod c'. This rod is arranged in lugs $c^2\ c^3$, formed

on a clamping-frame D, which is capable of transverse adjustment on the cross-rods $a\ a'$.

E E represent the longitudinal cam-shafts which support the cams of each buckler, and which are journaled with their front ends in the heads c and with their rear ends in bearings $e\ e'\ e^2$, formed on the lower sides of the clamping-frames D, as clearly shown in Fig. 7.

$f\ f$ represent spiral gear-wheels, which are mounted on a transverse horizontal countershaft F, journaled in the side frames, and which mesh with corresponding spiral wheels $f'\ f'$, mounted on the cam-shafts E at right angles to the wheels $f\ f$. The angles of the teeth in the two sets of wheels are reversed, so as to actuate both buckling devices and simultaneously buckle the sheet inwardly from opposite sides of the sheet.

G, Figs. 4, 7, and 8, represents the buckling-finger pivoted to the lower end of a rock-arm g and provided at its free end with a buckling-roller g', which rests upon the pile of paper. A forward-and-backward movement is imparted to the buckling-finger, and its roller may be journaled in the bifurcated front end of the buckling-finger in such manner that it is held against turning during the forward movement of the buckling-finger, so as to buckle the sheet of paper, and allowed to revolve during the backward stroke of the buckling-finger, or the latter may be provided with a bearing-pad of any other suitable construction.

The rock-arm g, carrying the buckling-finger, is pivoted at its upper end on a lug projecting from the upper end of the head c, and a rocking motion is imparted to the arm by means of a crank g^2, secured to the end of the cam-shaft and connecting with an inwardly-extending arm g^3 of the rock-arm g by means of a link g^4. By employing this link-connection between the crank and the rock-arm a fast motion is imparted to the buckling-finger in its forward stroke and a slow motion during its backward stroke, while a pause is produced in the motion before beginning a new stroke in order to allow the pushing-out fingers to operate.

g^5 represents a tension-rod, which is pivoted with one end to the central portion of the link g^4 and passes with its free end through a swivel-post g^6, secured to the upper end of an upwardly-extending arm g^7, formed on the buckling-finger.

g^8 represents a spring surrounding the tension-rod between the post g^6 and a thumb-screw g^9, by means of which the tension on the buckling-finger can be regulated. The link g^4 in moving the rock-arm and buckling-finger inwardly also moves the tension-rod inwardly, which latter, being pivoted on the link, travels in advance of the rock-arm g and slides through the post g^6, thereby compressing the spring g^8 and creating a downward pressure on the buckling-finger. The tension-rod is provided with a pin g^{10}, which bears against the swivel-post g^6 during its outward movement and raises the buckling-finger from the paper during its backward stroke.

H represents the preliminary holding-down finger, arranged at a short distance in front of the buckling-finger and against which the top sheet is buckled by the initial portion of the forward stroke of the buckling-finger G. This preliminary holding-down finger has a vertical movement toward and from the surface of the pile of paper and is provided with actuating mechanism whereby it is held on the pile of paper and lifted therefrom just before the advancing buckling-finger reaches it, so as to allow the latter to pass underneath.

h represents a horizontal rock-shaft journaled in the inner lower portion of the carrying-head, and h' is a slotted rock-arm, which is mounted on said shaft and carries the preliminary holding-down finger. The latter preferably consists of a block of rubber or other elastic material seated in a socket h^2, having a thumb-screw h^3, whereby the rubber can be adjusted when worn. The socket is adjustably secured on the rock-arm h' by a clamping-bolt h^4, secured to the socket and passing through the longitudinal slot in the rock-arm and held therein by a thumb-screw. A rocking motion is imparted to the rock-shaft h in one direction by means of a cam h^5, mounted on the cam-shaft in front of the carrying-head, and in the opposite direction by a balancing-spring h^6.

h^7 represents a sleeve surrounding the rock-shaft h and provided at its front end with an arm h^8, against which the cam h^5 bears. The balancing-spring is secured with its ends to the arm h^8 and the carrying-head c, so that when the cam moves the arm the spring will be strained. The sleeve h^7, surrounding the rock-shaft h, is held in the carrying-head by a collar h^9 and a set-screw.

h^{10} represents a pin on the collar h^9, and h^{11} is a coil-spring surrounding the rock-shaft h and bearing with its ends against the pin h^{10} and a similar pin h^{12}, formed on a thumb-piece h^{13}, secured to the rock-shaft h, so that a connection and tension are maintained between the rock-shaft supporting the preliminary holding-down finger and the sleeve carrying the arm which bears against the cam h^5. This tension of the spring h^{11} can be regulated by means of the notches h^{14} on the thumb-piece, which engage over a pin h^{15}, secured to the rock-shaft h. When the cam h^5 bears against the arm h^8 and swings the upper end of the latter inwardly, the sleeve h^7, to which the arm is secured, is turned and creates a tension on the spring h^{11}, which tension is transmitted through the rock-shaft h to the preliminary holding-down finger secured thereto, and which causes this holding-down finger to bear heavily on the pile of paper. The balancing-spring h^6 is under tension continually; but when the cam forces the arm h^8 inwardly the tension of the balancing-spring is increased, so that when the cam releases the arm h^8, and thereby removes the

pressure from the tension-spring h^{11}, the contraction of the balancing-spring will raise the arm h^8 and also lift the arm carrying the preliminary holding-down finger from the paper by means of a stud h^{16}, which is secured to the rock-arm h' and engages in an opening in the arm h^8, as clearly shown in Figs. 10 and 11.

I represents the gage or foot, which rests upon the pile of paper and is arranged at a distance from the preliminary holding-down finger and beyond the range of movement of the buckling-finger. The foot I serves the double function of regulating the upward-feed motion of the table B and acting as a main holding-down finger, against which the top sheet is buckled when the latter has been released by the preliminary holding-down finger. The foot I has a vertical movement toward and from the pile of paper, so as to release the sheet and allow it to be fed off from the pile.

i is a longitudinal horizontal rock-shaft arranged above the rock-shaft h and journaled in a bearing i', formed on the carrying-head c, and in bearings i^2 i^3, formed on the carrying side of the clamping-frame D.

i^4 is a rock-arm, which is secured to the front end of the rock-shaft i, and carries the gage or foot I. The latter is preferably composed of a block of rubber or other elastic material seated in a socket i^5, provided with a screw-shank i^6, passing through a flat-sided nut adjustably secured in a slotted arm i^7 by means of a thumb-screw i^8. The slotted arm i^7 is secured to the outer end of the rock-arm i^4 by a clamping-bolt i^9.

i^{10} represents a cam mounted on the cam-shaft in rear of the head c, and i^{11} is an intermediate lever mounted loosely on the rock-shaft i and resting with its long arm i^{12} on the surface of said cam, while its short arm i^{13} is flexibly connected by a spring i^{14} to an upwardly-extending arm formed on the rock-arm i^4. When the cam bears upwardly against the long arm of the lever i^{11}, as shown in Figs. 9 and 10, it causes the short arm to draw downwardly on the spring i^{14}, and consequently causes the foot I to press firmly on the pile of paper.

i^{15} represents a balancing-spring secured with its ends to the head c and the long arm i^{12} of the intermediate lever i^{11} for raising the foot I when the sheet of paper is to be fed off from the pile. The balancing-spring i^{15} is continually under strain, and this strain is increased when the cam i^{10} moves the arm i^{12} of the lever i^{11} upwardly and strains the spring i^{14} so as to depress the foot I. When the cam releases the lever i^{11}, the strain on the spring i^{14} is removed and the foot I is relieved. The rock-arm i^4 is provided with a pin i^{16}, against which the lower arm i^{13} of the intermediate lever engages as it moves upwardly, when the upper arm is released by the cam i^{10}, and the balancing-spring i^{15} contracts, thereby causing the arm i^{13} to raise the foot I from the pile of paper and allowing the sheet to be removed.

J represents the vertically-movable pile-retaining finger, which bears upon the corner of the pile of paper in rear of the buckling device and holds the pile in place while the top sheet is being removed. This pile-retaining finger is secured at its inner end to a horizontal rock-shaft J′, arranged below the rock-shafts E h i and mounted in a bearing J^2, formed on the lower side of the head c.

j represents a sleeve surrounding the rock-shaft J′, and provided at its front end with an arm j', against which the cam j^2 bears. The sleeve j', surrounding the rock-shaft J′, is held in the carrying-head c by means of a collar j^3 and set-screw j^4.

j^5 is a pin secured in the collar j^3, and j^6 is a coil-spring surrounding the rock-shaft J′ and bearing with its ends against the pin j^5 and a similar pin j^7, formed on a thumb-piece j^8, secured to the end of the rock-shaft, so that a connection and tension are maintained between the rock-shaft carrying the pile-retaining finger and the sleeve carrying the arm which bears against the cam j^2. The tension of the spring can be regulated by means of notches j^9, formed on the thumb-piece, which engage over a pin j^{10}, secured to the end of the rock-shaft J′. When the cam j^2 bears against the arm j' and turns the sleeve j, it creates a tension on the spring j^6, which tension is transmitted through the rock-shaft to the pile-retaining finger J and prevents the pile from being disturbed while the separated sheet is being removed. When the cam j^2 releases the arm j', the tension on the spring j^6 is removed and the pile-retaining finger rests loosely on the top of the pile, so as to allow the advancing buckling-finger to draw the sheet from underneath the retaining-finger.

j^{11} is a short arm formed on the pile-retaining finger and resting on a pin j^{12}, formed on the arm j', whereby the pile-retaining finger is supported when the tension on the latter has been removed.

j^{13} is a forwardly-projecting lug, upon which the arm j' rests when all of the paper has been removed, or when it is necessary to adjust the machine.

The buckling mechanism is adjusted to sheets of different sizes, as follows, and as most clearly shown in Figs. 7 and 14 to 19.

d d represent two wedges arranged longitudinally on the upper side of each clamping-frame D, one at the front end and the other at the rear end thereof. These wedges are interposed between the lower side of the longitudinal rod c' and the upper sides of the transverse rods a a', for the purpose of locking the clamping-frame on the transverse rods against transverse movement in the machine, and at the same time locking the longitudinal rod c' against longitudinal movement in the clamping-frame. Each wedge is composed

of a vertical outer portion d, which is beveled on its under side, and a horizontal inner portion d^7, which lies flat on the top of the clamping-frame and is guided thereon longitudinally by a rib d', formed on the clamping-frame and bearing against the outer side of the horizontal portion of the wedge, while the inner side thereof bears against the contiguous inner side of the other wedge, as represented in Fig. 16, in which the longitudinal rod c' is omitted and indicated by dotted lines. The two wedges on each frame are moved simultaneously in opposite directions for clamping or releasing the parts by crank-pins d^2, secured to the upper side of a disk d^3 and entering notches d^6 in the horizontal portion d^7 of the wedges. The disk is provided with a vertical shank d^4, journaled in the clamping-frame and provided below the same with a handle, by which it is turned. The shank d^4 is fitted rather loosely in the bearing in the clamping-frame, so that it is capable of a limited movement in the longitudinal direction of the wedges, whereby the shank can shift its position or yield when one wedge tightens before the other, and thus enable the other wedge to tighten also, which would not be possible if the shank were fitted snugly in its bearing. Upon releasing the wedges the buckling mechanism can be adjusted longitudinally in the machine by sliding the rod c' and the rock-shafts i E in the clamping-frame, and the buckling mechanism can also be adjusted transversely in the machine by sliding the clamping-frame on the transverse rods a a', so that by these two adjustments, which are effected at right angles to each other, the entire buckling mechanism can be adjusted to the position of the corner of the pile on the table without in any manner disturbing the relative adjustment of the different parts of the buckling mechanism. The buckling mechanism is in this manner released or secured in position by simply manipulating the handle d^5, so that the operation of adjusting the buckling mechanism is extremely simple. The upper sides of the wedges are preferably tapered and engage in a correspondingly-tapered feather-way in the lower side of the rod c', which prevents the latter from rocking, while allowing it to be adjusted longitudinally.

Each of the movable frames C C, carrying the buckling mechanism, is composed of longitudinal supporting-rods C′ and longitudinal rock-shafts i and E, all of which are supported in suitable bearings on the clamping-frame D, so as to permit of longitudinal adjustment of the buckling mechanism by sliding the rod and shafts in their bearings in the clamping-frame. The latter is supported on the transverse rods a a' and counter-shaft F, so as to permit of transverse adjustment of the clamping-frame, together with the longitudinal rod c', shafts i and E, and the buckling devices attached thereto. The lower spiral wheels f' f' are each provided with a key engaging with a feather in the longitudinal cam-shaft E, so as to turn with the latter. The bearings e e', formed on the lower side of the clamping-frame on opposite sides of the spiral wheels f' f', confine these wheels and prevent longitudinal movement of the spiral wheels f' f' when the shafts E are adjusted. The upper spiral wheels f f are each provided with a key which engages with a feather-way formed in the transverse counter-shaft F, so as to revolve with the same. The bearings c^2 c^4, formed on the clamping-frame and supporting the counter-shaft F on opposite sides of each spiral wheel f, confine the latter and compel it to move with the buckling mechanism and the clamping-frame when the latter is adjusted transversely. The main supporting-rod c' of the movable buckling-frame is supported in lugs c^2 c^3, formed on each end of the clamping-frame directly above the transverse rods a a'.

The mechanism whereby the feed-table is raised automatically is constructed as follows, and as most clearly shown in Figs. 3, 4, 7, 8, and 14:

O represents a rock-arm, which is mounted on the rock-shaft i, to which the main holding-down finger is attached. This rock-arm is attached at the front end of the clamping-frame D and partakes of a rocking motion as the main holding-down finger moves toward and from the pile and serves to regulate the upward-feed motion of the table B. The upper end of the rock-arm O is provided with a roller o', which engages against the lower side of a trip-lever o^2. The latter is pivoted at one end to a bracket o^3, secured to the clamping-frame and provided at its free end with an upwardly-extending lug o^4, which bears against the lower side of a transverse horizontal rocking plate o^5, pivoted on the horizontal shaft b^4 by means of perforated lugs o^6.

o^7 represents a rocking elbow-lever pivoted on the shaft b^4 between the rocking plate o^5 and the bevel-wheel b^6. The elbow-lever is provided at its upper end with a pawl o^8, engaging with a ratchet-rim o^9, formed on the periphery of the bevel-wheel b^6, and its lower arm is provided with a roller o^{10}, which is adapted to bear against a cam o^{11}, secured to the end of the counter-shaft F in order to actuate the ratchet-wheel. The elbow-lever is provided with a pin o^{12}, which engages with an upwardly-extending arm o^{13}, formed on the rocking plate o^5, which compels the rocking plate and rocking elbow to rock in unison. The trip-lever is provided on its lower side with a notch o^{14} and a curved path or face o^{15}, formed concentric with the rock-shaft i, carrying the rock-arm o and foot I. As the foot I moves up and down on the pile of paper when the latter is at a normal height, the roller o' at the upper end of the rock-arm O oscillates in the concentric path on the lower side of the trip-lever. The latter remains stationary and holds the rocking plate and elbow-lever in an elevated position, so

that the roller o^{10} at the end of the elbow-lever will be raised and held out of engagement with the cam o^{11}. When a sufficient number of sheets have been fed off from the pile of paper to necessitate raising the table, the foot I in bearing on the paper descends to a greater distance, owing to the removal of the sheets, and the end of the arm carrying the roller o' oscillates through a correspondingly-larger arc, which causes it to pass beyond the concentric path o^{15} and underneath the notch o^{14}, thereby allowing the trip-lever to drop down, as shown in dotted lines in Fig. 4. The descent of the trip-lever permits the front end of the rocking plate to drop, and the latter carries the elbow-lever with it, which causes the roller o^{10} to bear on the upper side of the cam o^{11}. The latter in revolving raises the roller and the elbow-lever and causes the pawl o^8 at the other end to move the ratchet-wheel, whereby the shaft b^4 is turned and the bevel-wheels b^5 b^6 on the shaft b^4 are caused to turn the feed-screws b b and raise the feed-table. This action continues until the table has been raised to a position in which the foot I resting on the pile confines the oscillations of the rock-arm to the concentric face of the trip-lever, when the roller o^{10} is again held out of engagement with the cam o^{11}.

The rock-arm O, which actuates the feed-table mechanism, is mounted only on one of the rock-shafts i, and the rocking plate o^5 is of sufficient length, so that the buckling mechanism can be freely adjusted transversely without disengaging the trip-lever from the rocking plate.

The rock-arm O is provided with a key o^{16}, as represented in Fig. 27, which attaches the rock-arm to the clamping-frame, and which engages in a groove in the rock-shaft, so that the arm is compelled to rock with the latter, but is prevented from moving lengthwise with the shaft when the latter is adjusted in the clamping-frame.

K represents the feeding-fingers whereby the top sheet is removed from the pile to the tapes L L′, which deliver it to the printing-press or other machine. The free end of each feeding-finger is provided with a roller similar to that on the buckling-finger, or a pad of rubber or other elastic composition seated in a socket k, which tapers downwardly, so as to retain the pad. The socket is attached to the finger by a dovetail, which engages over a dovetail shank on the finger and is held thereon by a set-screw k', as represented in Figs. 22 and 23. The feeding-fingers are pivoted to the lower ends of depending rock-arms k^2, which are adjustably secured at their upper ends to a transverse horizontal rock-shaft k^3, journaled in bearings formed at the upper ends of the side frames. A rocking motion is imparted to this shaft from the transverse shaft F by a crank k^4, secured to the end of the transverse shaft F and connected with the rock-arm k^5 of the rock-shaft k^3 by a link k^6, as clearly shown in Fig. 3. Each finger is provided with a pressure-rod k^7, pivoted with its lower end to the finger and passing loosely with its upper end through a rearwardly-projecting lug k^8, formed on the rock-arm k^2.

k^9 is a coil-spring surrounding the rod k^7 below the lug k^8 and bearing with its ends against the latter and a screw-nut k^{10} on the pressure-rod, by means of which the pressure of the spring on the feed-finger can be regulated. The upper ends of the pressure-rods terminate in hooks k^{11}, which project over a transverse horizontal rocking plate k^{12}, pivoted at its ends in bearings k^{13}, secured to the rock-shaft k^3.

A rocking motion is imparted to the rocking plate in one direction by means of a cam k^{14}, which engages against a rock-arm k^{15}, secured to the end of the rocking plate, and in the opposite direction by a spring k^{16}, secured with its ends, respectively, to the rock-arm k^{15} and the adjacent side frame, as represented in Figs. 2 and 20. At the beginning of the forward stroke of the feed-fingers the pressure of the spring k^9 on the latter is greatest, which insures a positive separation of the top sheet from the pile. At the same time the roller k^{17} on the front end of the rock-arm k^{15} bears on the abrupt rise of the cam k^{14}, which lowers the rocking plate below the hooks on the upper ends of the pressure-rods, as shown in Fig. 20. As the feed-fingers move forward, the angle between the feed-fingers and the depending rock-arms supporting the same becomes more obtuse, which causes the pressure of the springs k^9 upon the feed-fingers to be gradually reduced as the feed-fingers continue to move forward and allow the pressure-rods to slide through lugs k^8. When the feed-fingers have nearly finished their forward stroke, the hooked ends of the pressure-rods bear upon the rocking plate. In the meantime the cam k^{14} has revolved, and now presents the beginning of the descent to the rock-arm k^{15}, as shown in Fig. 21, which allows the spring k^{16} to suddenly draw down the rock-arm k^{15} and raise the rocking plate, with the pressure-rods resting by their hooks on the plate. This causes the rods to lift the feed-fingers from the paper the moment the feed-fingers reach the limit of their forward stroke. By connecting the rock-shaft of the feed-fingers with the counter-shaft F in the manner described a slow motion is given to the feed-fingers at the beginning of the stroke, which enables them to separate and start the sheet of paper moving, and then the speed of the fingers is gradually increased, so that at the end of the stroke the feed-fingers and the sheet travel at the same speed as the tape-wheels. The feed-fingers are then raised from the paper, whereby the former are prevented from retarding the sheet as it is carried away by the tapes. The pressure-rods k^7 are preferably jointed by means of a screw-threaded portion

k^{18} and screw-nut k^{19}, so that the height to which the feed-fingers are lifted on the return-stroke can be regulated. The rocking plate extends transversely underneath all of the hooks on the pressure-rods, so that the feed-fingers can be adjusted to any position laterally and be raised simultaneously from the paper. The rocking plate is preferably provided with a stiffening-rib k^{20}, arranged at right angles thereto.

F^2 represents a longitudinal brace which connects the shafts F, b^4, and k^3 and rods a a' and prevents them from vibrating owing to their length.

M represents the main driving-shaft journaled in bearings formed on the rear ends of the side frames, and m is a sprocket-wheel mounted on the shaft M, to which motion is transmitted from the printing-press shaft N by means of a sprocket-wheel n, mounted on the latter and connecting with the wheel m by a sprocket-chain m'.

m^2 represents a gear-wheel mounted on the opposite end of the driving-shaft, which transmits motion to the gear-wheel m^3 on the end of the counter-shaft F by means of an intermediate gear-wheel m^4. The latter is mounted on the end of an arm m^5, pivoted with its upper end on a boss m^6, formed on the side frame and surrounding the counter shaft F, so that the gear-wheel m^4 can be adjusted concentrically with reference to the wheel m^3 and allow the gear-wheel m^2 to be changed for a larger or smaller wheel in order to increase or diminish the speed of the buckling mechanism. The arm m^5 is provided with an arm m^7, having a slot m^8, and m^9 is a pin secured to the side frame and passing through the slot m^8 of the arm m^5.

m^{10} is a cam pivoted to the outer end of the pin m^9 and bearing against the arm m^5. The cam is provided with a handle m^{11}, by means of which the cam can be loosened and tightened when it is desired to shift the arm m^5 to change gears on the driving-shaft, as shown in Figs. 5 and 6.

The drive mechanism of the machine is preferably arranged adjacent to the side frame A', and the mechanism for operating the feed-table is arranged adjacent to the side frame A, so as to balance the working parts of the machine.

P, Figs. 24, 25, and 26, represents the lower delivery-roller mounted on the driving-shaft M.

L represents the lower carrying-tapes running around the roller P, thence forwardly and around a roller p, thence rearwardly and around a roller p', thence forwardly underneath the roller p and around a roller p^2, and thence rearwardly to the roller P.

L' represents the upper carrying-tapes, which are arranged above the lower tapes and run with their lower portions in contact with the lower tapes and over the feed-board L^2. The upper tapes L run around wheels P', which are arranged over the lower delivery-roller P, and thence forwardly to the roller P^2, which is arranged near the delivery end of the feed-board L^2. The latter is supported on the printing-press or any other suitable frame R, and is connected with the paper-feeder by means of horizontal bars r r. Each of the wheels P' is journaled in an arm Q, which is hung loosely upon the rear transverse rod a' and pressed downwardly by a spring q, which is secured to a collar q' and bears upon a cross-bar q^2 of the arm Q, as represented in Figs. 8 and 20. The collar q' is secured to the rod a' between the upper jaws of the arm Q by a set-screw. Each wheel is provided with a tape-guide q^3, which is secured to an arm q^4 projecting upwardly from the arm Q.

The wheels T' are mounted upon a shaft q^5, which is journaled in the arms Q, and preferably made so thin that it will bend and yield, so as to permit each wheel to adjust itself to any inequalities that may exist in the paper. The shaft q^5 is rotated from the driving-shaft M by gear-wheels q^6 q^7.

The roller P^2, around which the delivery portions of the upper carrying-tapes run, is journaled in bearings q^8, which are hinged at their front ends to base-plates q^2, which are secured to the feed-board L^2. The bearings are provided with set-screws q^{10}, by which the roller can be raised or lowered so as to adjust the upper tapes with reference to the lower tapes. The roller p^2, around which the delivery portions of the lower tapes run, is journaled in bearings p^3, secured to the receiving end of the feed-board, and the intermediate rollers p p' are journaled in bearings p^4 p^5, supported upon longitudinally-adjustable rods p^6, arranged on each side of the tape mechanism. The rods p^6 are supported near the feed-board in swiveling bearings p^7, pivoted concentric with the shaft of the roller p^2, and at their front ends by rollers p^8, which rest on curved guides r', secured to the horizontal bars r. The bearings p^4 p^5 of the intermediate tape-rollers p p' are capable of longitudinal adjustment on the rods p^6 by means of set-screws p^9, so that a proper tension can be put upon the lower tapes. The uppermost surfaces of the rollers P p p^2 of the lower tapes and the incline of the feed-board are arranged in line so as to maintain the upper portion of the lower tapes parallel with the lower portion of the upper tapes running in contact therewith. The rods p^6 are secured in the swiveling bearings p^7 by means of set-screws p^{10}, which enables the intermediate rollers p p' to be adjusted longitudinally, so that the distance from the roller p to the rear end of the feed-board can be adjusted to correspond to the length of the sheet of paper which is fed to the press. When the sheet has been carried forward between the carrying-tapes until it strikes the front guides q^{11}, the rear portion of the sheet should clear the intermediate roller p and drop into the depressed space P^3, formed above the depressed

portion of the lower tapes. The sheet after dropping into the space P^3 is carried forward by the slight friction between the lower tapes and the sheet and between the sheet and the upper tapes above the roller p^2 until it strikes squarely against all of the front guides q^{11}. The lower points of the intermediate rollers $p\ p'$ and the uppermost point of the end roller p^2 are in line, so that those portions of the lower tapes which run from the roller p' to the roller p^2 will bear lightly against the bottom of the roller p, and thereby prevent the sheet which has been dropped into the depressed space from being carried backward and under the roller p.

In adjusting the intermediate rollers $p\ p'$ back and forth in accordance with the size of the sheet the supporting-rods p^6 of these rollers are moved longitudinally in the swiveled bearings p^7, and the ends of these rods ascend or descend on the inclines r'. As the intermediate rollers approach the end roller p^2, the swivel-bearings p^7 turn backwardly on the shaft of this roller, whereby the intermediate roller p is raised with reference to the roller p', so that in all positions of the intermediate rollers the upper surfaces of the rollers P, p, and p^2 are kept in line with each other and with the upper inclined surface of the feed-board by reason of this peculiar mounting of the roller and the shape and angle of the inclines r'. By thus keeping these rollers in line a uniform contact between the upper and lower tapes is maintained in all positions of the rollers. The lower surfaces of the intermediate rollers are kept in line with the upper surface of the end roller p^2 by reason of the supporting of the intermediate rollers upon the rods p^6 and the attachment of these rods to the bearings p^7, hung upon the shaft of the end rollers, so as to swing concentric therewith.

N represents the printing-press shaft, and N′ is the clutch mounted thereon, by means of which the paper-feeder is set in motion when the press and feeder are in register, so that the sheet of paper will be fed to the press at the proper time.

n represents a sprocket-wheel mounted loosely on the shaft N, and n' is a star-wheel pivoted to the front side of the same.

S represents a sleeve mounted upon the shaft N and engaging with its periphery in one of a series of concentric notches formed in the periphery of the star-wheel. In the position of the parts shown in Figs. 1 and 2 the sleeve S is withdrawn by the hand-lever N^2 and the clutch is thrown out of engagement. The object of this clutch is to enable the paper-feeder to be disconnected from the press without disturbing the register of the driving mechanism between them when the press is being "made ready," during which operation the press is usually revolved a few times for trial prints.

The operation of my improved machine is as follows: The pile of paper being placed upon the feed-table and the latter being raised to the proper height, the pile-retaining finger J, buckling-finger G, preliminary holding down finger H, main holding-down finger or foot I, and feed-fingers K, all rest upon the top sheet. The buckling-finger G in its forward movement draws the corner of the top sheet from under the pile-retaining finger J and buckles the corner of the sheet against the preliminary holding-down finger H, thereby forming a short buckle in the paper. Just before the buckling-finger in its forward movement reaches the preliminary finger the latter is quickly raised from the top sheet, thereby releasing the top sheet between the buckling-finger and the regulating-foot I, and allowing the former to pass beyond the preliminary holding-down finger. The buckling-finger continuing its advancing movement buckles the partly-separated sheet against the foot and separates the sheet the entire distance from the buckling-finger to the foot I. During the last portion of the forward stroke of the buckling-finger the pile-retaining finger is caused to press on the corner of the pile and hold the same in place. The pressure of the buckling-finger on the paper is greatest at the beginning of the stroke, which insures a thorough separation of the top sheet. When the sheet has been separated and set moving by the buckling-finger, the pressure on the latter is gradually diminished so as to avoid disturbing the paper underneath, and the pressure is least at the end of the stroke. The buckling-finger is moved forward at a comparatively quick speed and returned at a slower speed. The object of this is to buckle the sheet as quickly as possible and allow as much time as possible during the return-stroke of the buckling-finger for the feed-fingers and the tapes to remove the sheet from the pile to the printing-press. The capacity of the paper-feeder is dependent largely upon the forward speed of the buckling-finger, and all the parts of the machine are regulated in accordance with the speed of the latter. When the buckling-finger has reached the limit of its forward stroke, it is raised from the paper and returned in its elevated position to the starting-point, where it is again lowered on the paper and full pressure applied by the tension-spring preparatory to buckling another sheet. The preliminary holding-down finger and the regulating-foot are pressed upon the top sheet by springs which are strained by cams, thereby giving the finger and foot a yielding pressure upon the paper, and they are raised therefrom by balancing-springs. These springs provide elastic supports for the finger and foot in both directions. The buckling-finger is given a yielding pressure upon the paper by the spring g^8, and a positive upward motion away from the paper by the pin g^{10}, formed on the rod g^5. Pressure is applied to the pile-retaining finger by the cam j^2 when the top sheet is being removed from the pile, which pressure is removed when the buck-

ling-finger draws the sheet from under the pile-retaining finger and allows the latter to rest loosely on the sheet. After the sheet has been buckled and separated the regulating-foot I is lifted from the top sheet and the feed-fingers K begin their forward movement seize the sheet and present it to the rollers L L′ and carrying-tapes P P′. The pressure of the feed-fingers on the paper is greatest at the beginning of the stroke, which insures a positive separation of the top sheet from the pile. When the sheet has been separated by the feed-fingers, the pressure on the latter is gradually relieved and is least at the end of the stroke. A slow motion is given to the feed-fingers at the beginning of the stroke, so as to enable them to start the sheet of paper moving, and then the forward speed of the fingers is gradually increased, so that at the end of the stroke the feed-fingers and sheet travel at the same speed as the tape-wheels. By raising the fingers from the paper they are prevented from retarding the sheet as it is carried away by the tapes. The feed-fingers are returned in an elevated position to the starting-point, where they are again lowered upon the paper and full pressure is applied to the fingers. The sheet of paper is carried forward by the carrying-tapes and delivered into the depression P^3 of the lower tapes, in which the sheet rests momentarily until it is aligned and registered by suitable mechanism. While the sheet is so resting and being aligned the next succeeding sheet is carried forward by the tapes and partly overlaps the sheet in the depression before the resting sheet is carried away by the nippers of the printing-press T. By allowing one sheet of paper to overlap the resting preceding sheet the tape mechanism of the feeder is considerably shortened.

The object of employing two buckling devices arranged on opposite sides of the machine is to enable sheets of larger dimensions to be fed than has been possible heretofore by a machine employing a single buckling device.

I am aware that prior to my invention the buckling mechanism has been mounted in a movable frame arranged above the table of the machine and made adjustable lengthwise of the machine, and I do not claim this construction broadly.

I claim as my invention—

1. The combination, with the buckling-finger, of an arm to which the finger is pivoted, a crank and link whereby said arm is oscillated, an actuating-rod connecting said link with the buckling-finger, and a spring interposed between the actuating-rod and the buckling-finger, whereby a gradually-decreasing pressure is applied to the buckling-finger during its forward stroke, substantially as set forth.

2. The combination, with the buckling-finger, of a rock-arm to which it is pivoted, a rotating shaft provided with a crank, and a link connecting the crank with the rock-arm, whereby a quick forward movement and a slow backward movement are imparted to the finger, substantially as set forth.

3. The combination, with the buckling-finger, of a rock-arm to which the finger is pivoted, a rotating shaft provided with a crank, a link connecting the crank with the rock-arm, and a rod connecting the link with the finger, whereby the finger is depressed during its forward movement and elevated during its backward movement, substantially as set forth.

4. The combination, with the holding-down finger, of a tension-spring connected with the finger, and depressing mechanism connected with the spring, whereby the spring is strained and the finger is depressed by the spring with increasing pressure, substantially as set forth.

5. The combination, with the holding-down finger, of a balancing-spring by which the finger is raised, a tension-spring by which the finger is depressed, and depressing mechanism connected with the tension-spring, whereby the spring is strained and the finger depressed, substantially as set forth.

6. The combination, with the preliminary holding-down finger, of a tension-spring h^{11}, a rotary sleeve h^7, provided with an arm h^8, and the rotary cam h^5, bearing against said arm, whereby the tension-spring is strained and the finger is depressed, substantially as set forth.

7. The combination, with the preliminary holding-down finger provided with a pin h^{16}, of a tension-spring h^{11}, a rotary sleeve h^7, provided with an arm h^8, and having an opening in which the pin h^{16} engages, a rotary cam h^5, bearing against the arm h^8, a head c, and a balancing-spring h^6, connecting the arm h^8 with said head, substantially as set forth.

8. The combination, with the holding-down finger provided with a pivot to which it is secured and the bearing to which said pivot is secured, of a tension-spring coiled around said pivot and secured with one end to said bearing, a notched washer to which the opposite end of the tension-spring is secured and which is capable of turning on said pivot, and a stop secured to the pivot, on which the washer can be locked for regulating the tension of the spring, substantially as set forth.

9. The combination, with the holding-down finger and a rotating cam i^{10}, of an intermediate lever i^{11}, against which the cam bears, a balancing-spring i^{15}, connected with the intermediate lever, and a tension-spring i^{14}, connecting the intermediate lever with the main holding-down finger, substantially as set forth.

10. The combination, with the holding-down finger and a rotating cam i^{10}, of an intermediate lever i^{11}, against which the cam bears, a balancing-spring i^{15}, connected with the intermediate lever, a tension-spring i^{14}, connecting the intermediate lever with the main holding-down finger, and a stop on the main

holding-down finger against which the intermediate lever engages for raising said finger, substantially as set forth.

11. The combination, with the pile-retaining finger J, provided with an arm j^{11}, of the rock-arm j', provided with a stop j^{12}, against which the arm j^{11} engages, and whereby the downward movement of the pile-retaining finger is limited, substantially as set forth.

12. The combination, with the pile-retaining finger provided with an arm j^{11}, of the rock-arm j', provided with a stop j^{12}, against which the arm j^{11} engages, and the head c, provided with a stop j^{13}, on which the rock-arm j' is supported, substantially as set forth.

13. The combination, with the main holding-down finger and the rock-shaft on which it is mounted, of a rock-arm mounted on said shaft, a trip-lever which is normally held by said rock-arm when the main holding-down finger is in its normal position, and which is allowed to move out of its normal position when the main holding-down finger descends below its normal position, and a feed mechanism which is set in motion by the trip-lever moving out of its normal position, substantially as set forth.

14. The combination, with the main holding-down finger and its rock-shaft, of a rock-arm O, secured to said shaft, a trip-lever o^2, provided on its under side with a concentric face o^{15} and a notch o^{14}, and a ratchet-feed which is controlled by said trip-lever, substantially as set forth.

15. The combination, with the main holding-down finger and its rock-shaft, of a rock-arm O, secured to said shaft, a trip-lever o^2, provided on its under side with a concentric face o^{15} and a notch o^{14}, a rocking plate o^5, resting on said trip-lever, a pawl-lever connected with said rocking plate, and a ratchet-wheel and feed-screws, substantially as set forth.

16. The combination, with the stationary frame having transverse guides or rods, of a clamping-frame adjustably mounted on said rods, a buckling-frame made longitudinally movable in the clamping-frame, and buckling mechanism mounted in said buckling-frame, whereby the buckling mechanism can be adjusted longitudinally in the machine by adjusting it in the clamping-frame and transversely by adjusting the clamping-frame on the transverse guides or rods, substantially as set forth.

17. The combination, with the stationary frame having transverse rods, of a clamping-frame adjustably mounted on said rods, a buckling-frame provided with a longitudinal rod which passes loosely through the clamping-frame, and clamping-wedges interposed between the transverse rods and the longitudinal rod, substantially as set forth.

18. The combination, with the stationary frame having transverse rods, of a clamping-frame adjustably mounted on said rods, a buckling-frame provided with a longitudinal rod which passes loosely through the clamping-frame, clamping-wedges interposed between the transverse rods and the longitudinal rod, and a crank-disk and pins, whereby the wedges are simultaneously operated, substantially as set forth.

19. The combination, with the clamping-frame and the buckling mechanism, of a longitudinal shaft actuating the buckling mechanism and passing loosely through the frame, a gear-wheel mounted on said shaft and held against longitudinal movement between bearings formed on the clamping-frame, and a transverse driving-shaft journaled in the clamping-frame and provided with a gear-wheel meshing with the wheel on the longitudinal shaft, substantially as set forth.

20. The combination, with the clamping-frame and the buckling mechanism, of a transverse driving-shaft passing loosely through the frame, a gear-wheel mounted on said shaft and held against transverse movement between bearings formed on the clamping-frame, and a longitudinal shaft actuating the buckling mechanism and journaled in the clamping-frame and provided with a gear-wheel meshing with the gear-wheel on the transverse shaft, substantially as set forth.

21. The combination, with the stationary frame provided with transverse rods, of a clamping-frame adjustably mounted on said rods, a transverse driving-shaft passing through the clamping-frame, a gear-wheel mounted on said shaft between bearings on the clamping-frame, a longitudinal shaft made adjustable in the clamping-frame, a gear-wheel mounted on said shaft and held against longitudinal movement between bearings on said frame, and a buckling mechanism actuated by said longitudinal shaft, substantially as set forth.

22. The combination, with the stationary frame provided with transverse rods, of a clamping-frame adjustably mounted on said rods, a longitudinal rock-shaft passing loosely through the clamping-frame, a rock-arm O, attached to the clamping-frame and provided with a key which engages in a groove in the rock-shaft, a trip-lever resting on the rock-arm, and a table-feed mechanism connected with the trip-lever, substantially as set forth.

23. The combination, with the transverse rock-shaft, the depending arms secured thereto, and the feed-fingers attached to said arms, of a rotating crank, a link connected with said crank, and a rock-arm secured to said shaft and connected to said link, whereby a forward movement of gradually-increasing speed is imparted to said fingers, substantially as set forth.

24. The combination, with the transverse rock-shaft provided with depending arms and the feed-fingers pivoted to said arms, of the tension-rods attached to the feed-fingers, and springs applied to said rods and bearing against the rock-arms, substantially as set forth.

25. The combination, with the transverse rock-shaft provided with depending arms and the feed-fingers pivoted to said arms, of the tension-rods attached to the feed-fingers, springs applied to the tension-rods, and a lifting-plate supported on the rock-shaft and engaging with said tension-rods, substantially as set forth.

26. The combination, with the transverse rock-shaft provided with depending arms and the feed-fingers pivoted to said arms, of the tension-rods attached to the feed-fingers, springs applied to the tension-rods, a lifting-plate pivoted on the rock-shaft, a rock-arm secured to said plate, and a cam and spring whereby said plate is actuated, substantially as set forth.

27. The combination, with the feed-finger, of a detachable socket open at the top and contracted at the bottom and secured to the lower side of the finger, and a removable pad or block seated in said socket, substantially as set forth.

28. The combination, with the feed-finger provided at its end with a dovetailed shank, of a socket open at the top and contracted at the bottom and provided with dovetailed ways fitting upon said shank, a fastening-screw, whereby the socket is held in position on the finger, and a pad or block seated in said socket, substantially as set forth.

29. The combination, with the lower feed-tapes, of a roller arranged at the delivery end thereof, supporting-bars pivoted concentric with said roller, bearings attached to said bars, and intermediate rollers journaled in said bearings, substantially as set forth.

30. The combination, with the lower feed-tapes, of a roller arranged at the delivery end thereof, bearings pivoted concentric with said roller, supporting-bars made longitudinally adjustable in said bearings, intermediate rollers attached to said bars, and guides supporting the free ends of said bars, substantially as set forth.

Witness my hand this 3d day of August, 1889.

FREDERICK HART.

Witnesses:
GEO. H. SHERMAN,
J. W. RUST.