

(No Model.)

5 Sheets—Sheet 1.

C. B. COTTRELL.
SHEET DELIVERY AND FOLDING APPARATUS.

No. 494,846.

Patented Apr. 4, 1893.

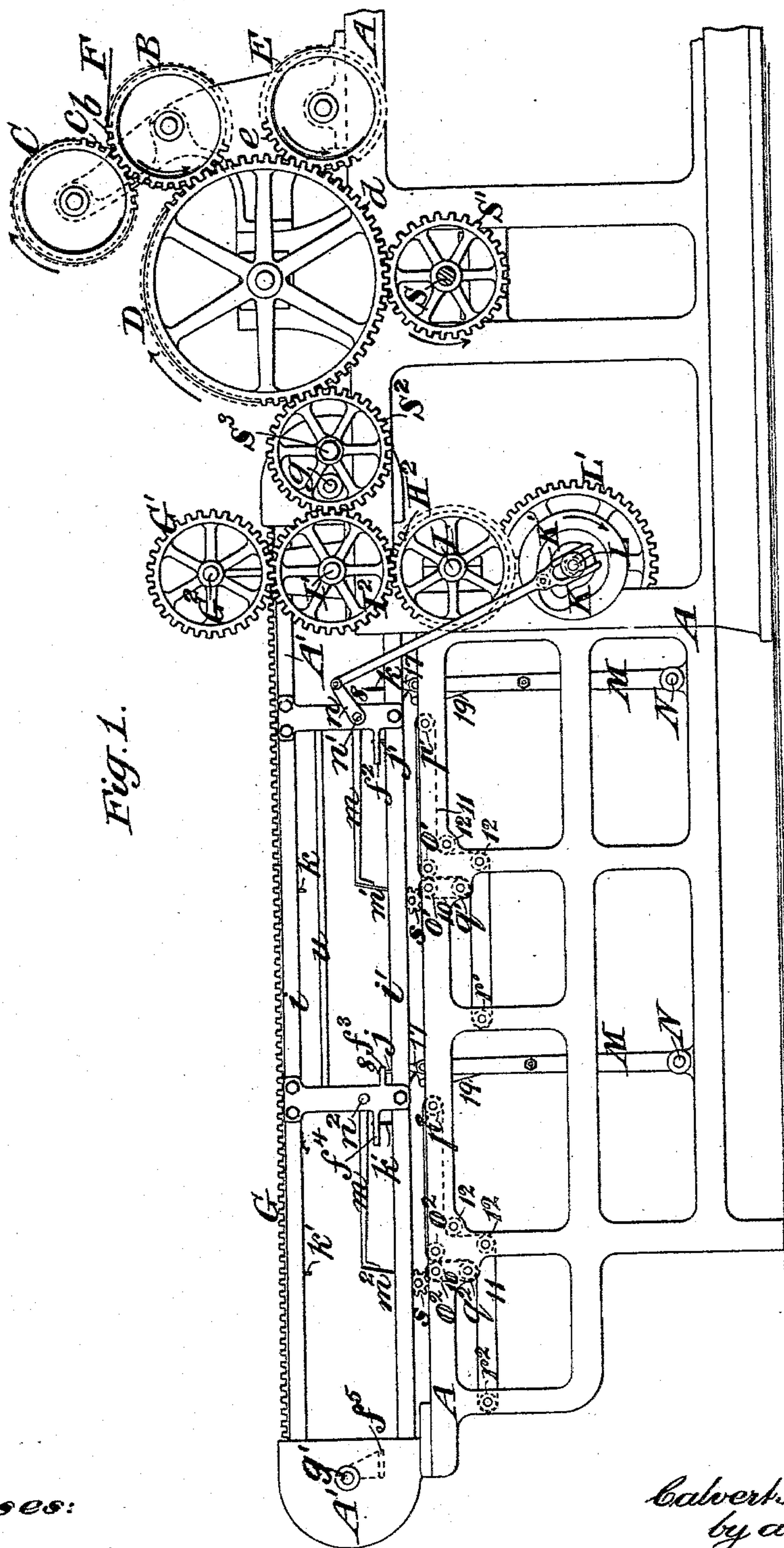


Fig. 1.

Witnesses:
C. Sundgren
George Barry.

Inventor:
Calvert Cottrell
by attorneys
Rown & Seward

(No Model.)

5 Sheets—Sheet 2.

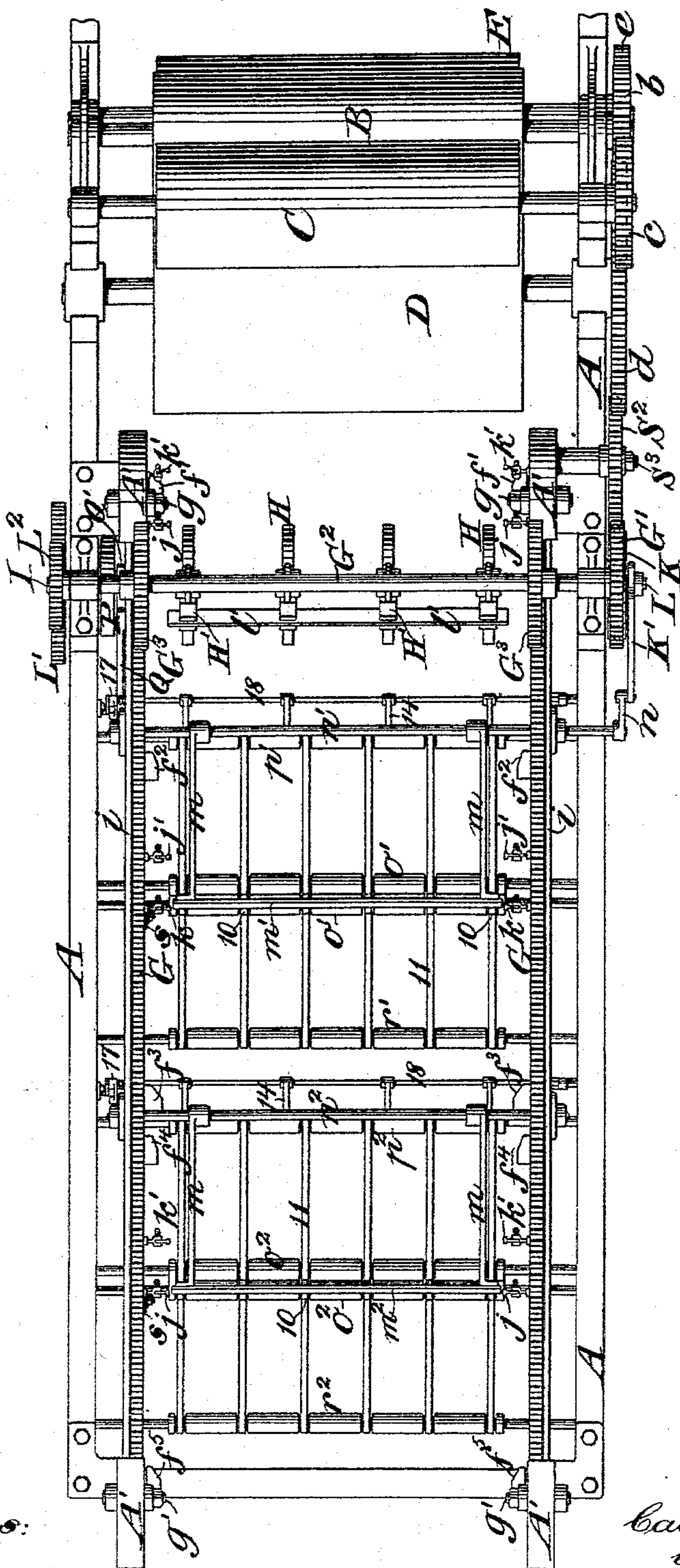
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Fig. 2.



Witnesses:

O. Sundgren
George Barry.

Inventor:
Calvert B. Cottrell
by attorneys
Brown & Seward

(No Model.)

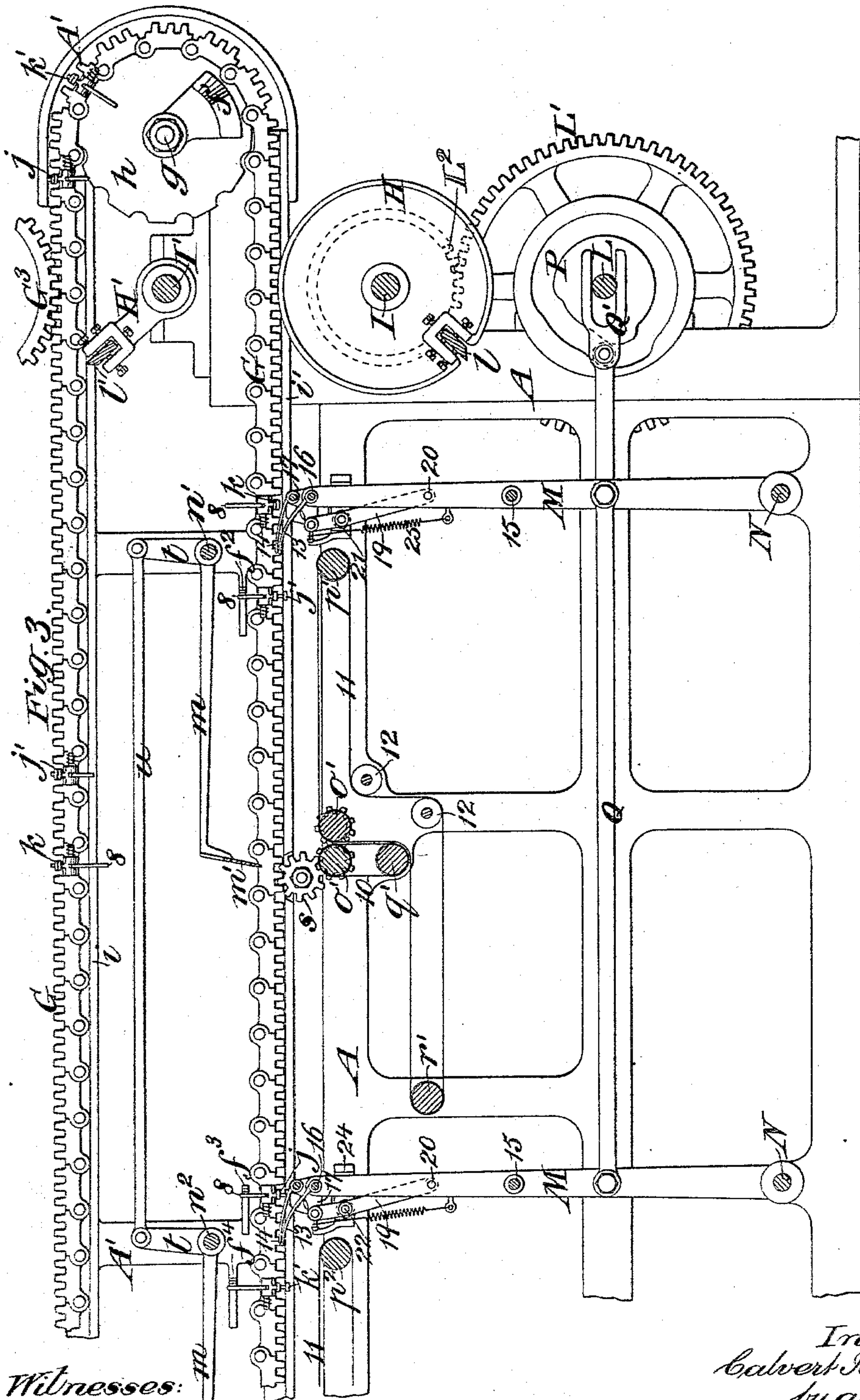
5 Sheets—Sheet 3.

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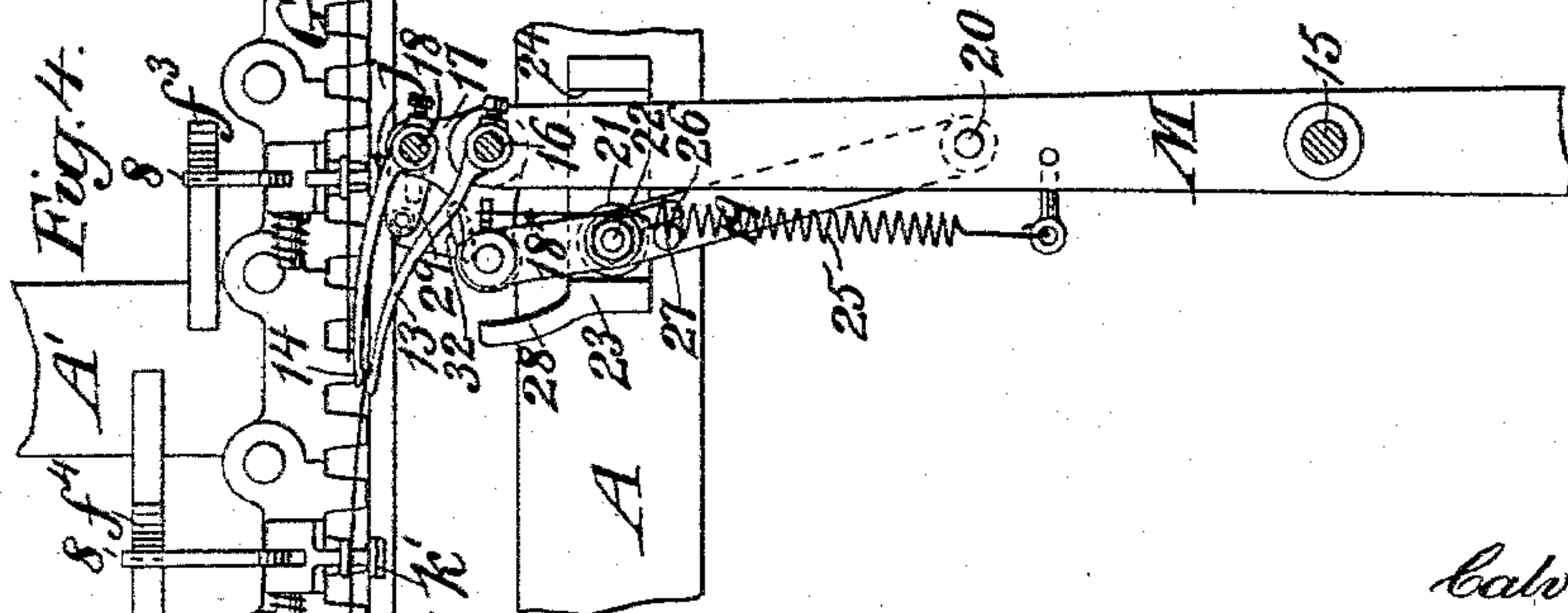
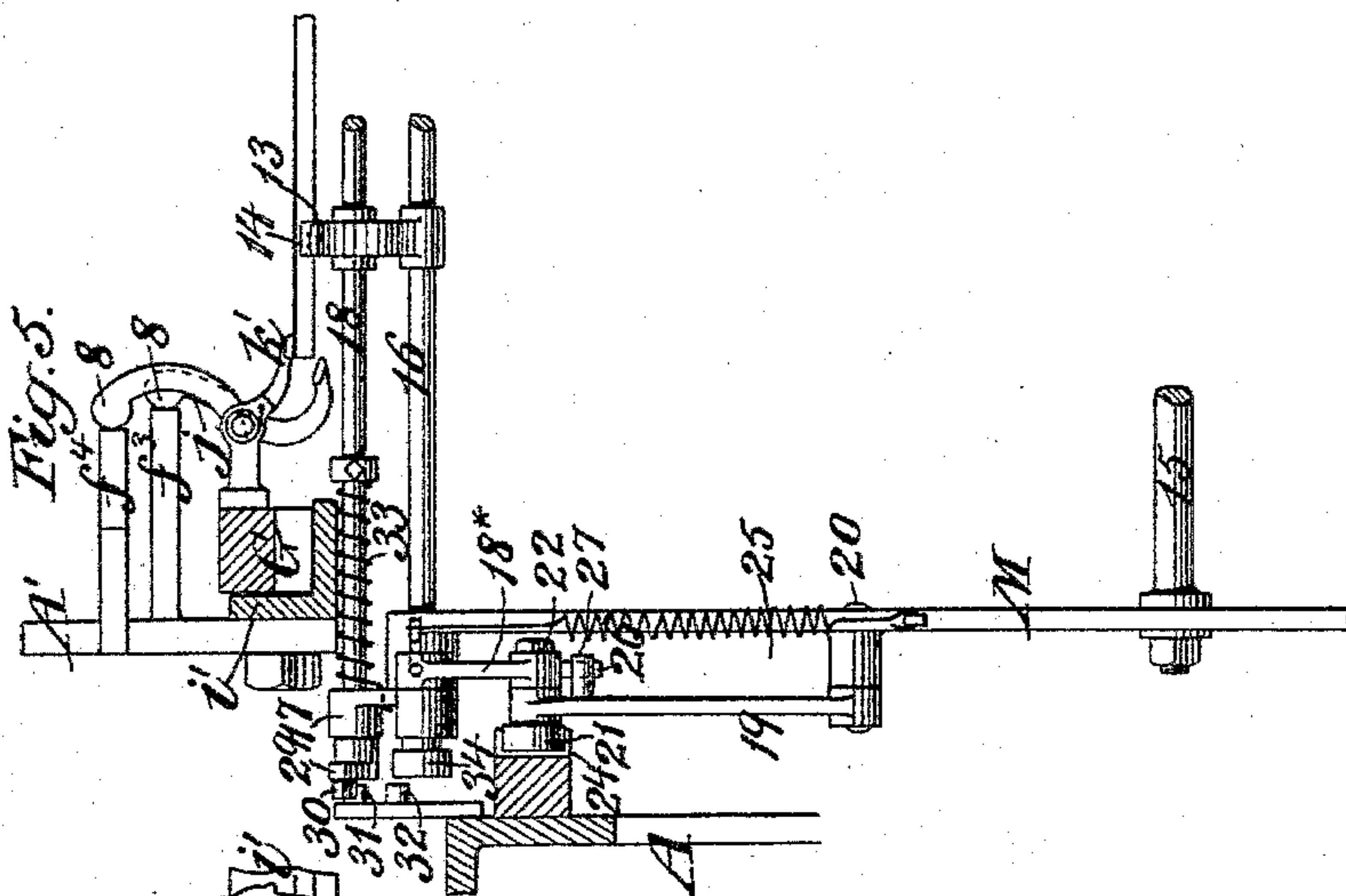
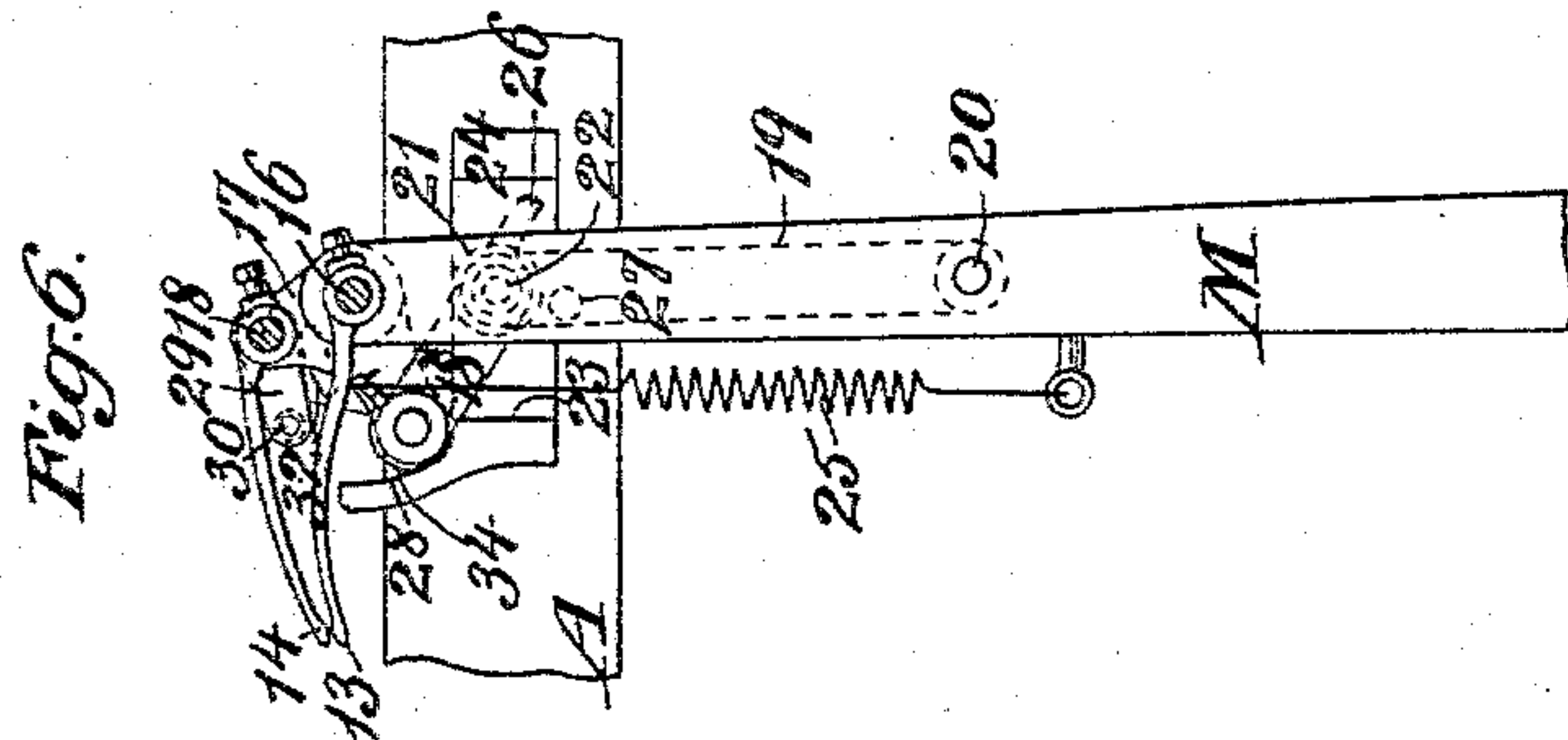
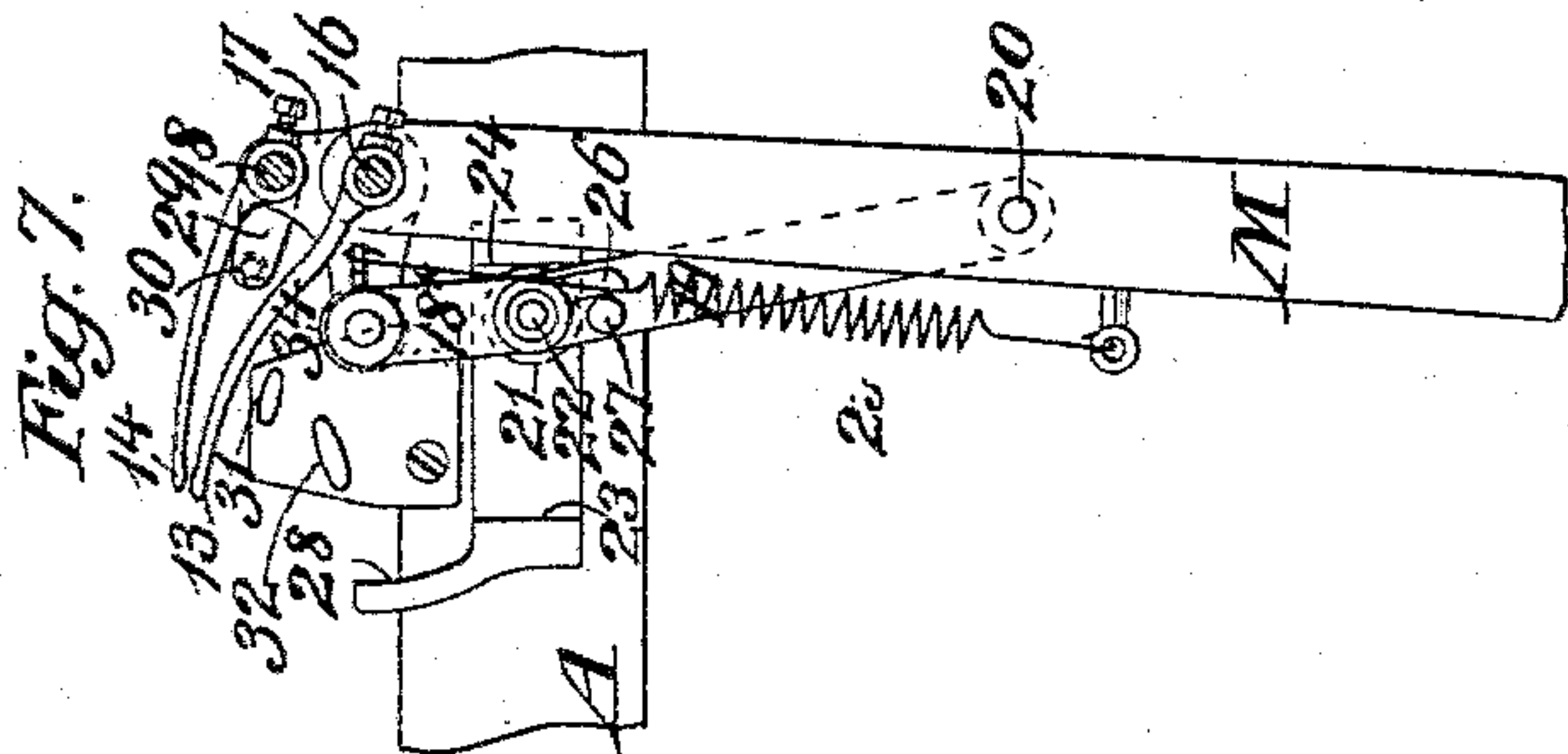
Inventor:
Calvert Cottrell
by attorneys
Frost & Sewall

C. B. COTTRELL.

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Witnesses
O. Sundgren
George Barry

Inventor:
Calvert Cottrell
by attorneys
Brown & Howard

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5 Sheets—Sheet 5.

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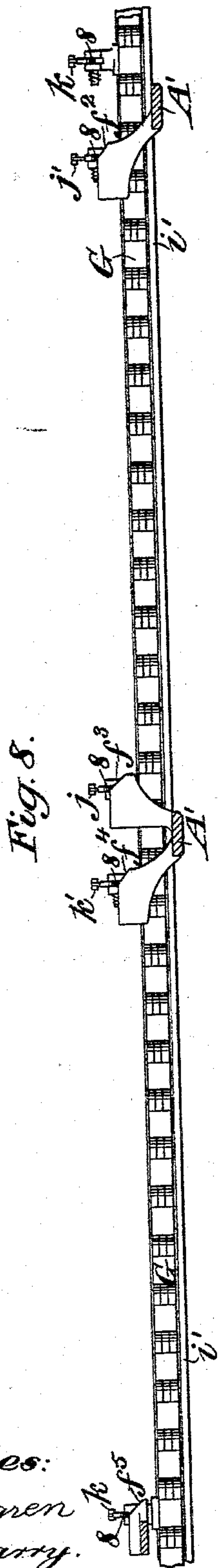


Fig. 9.

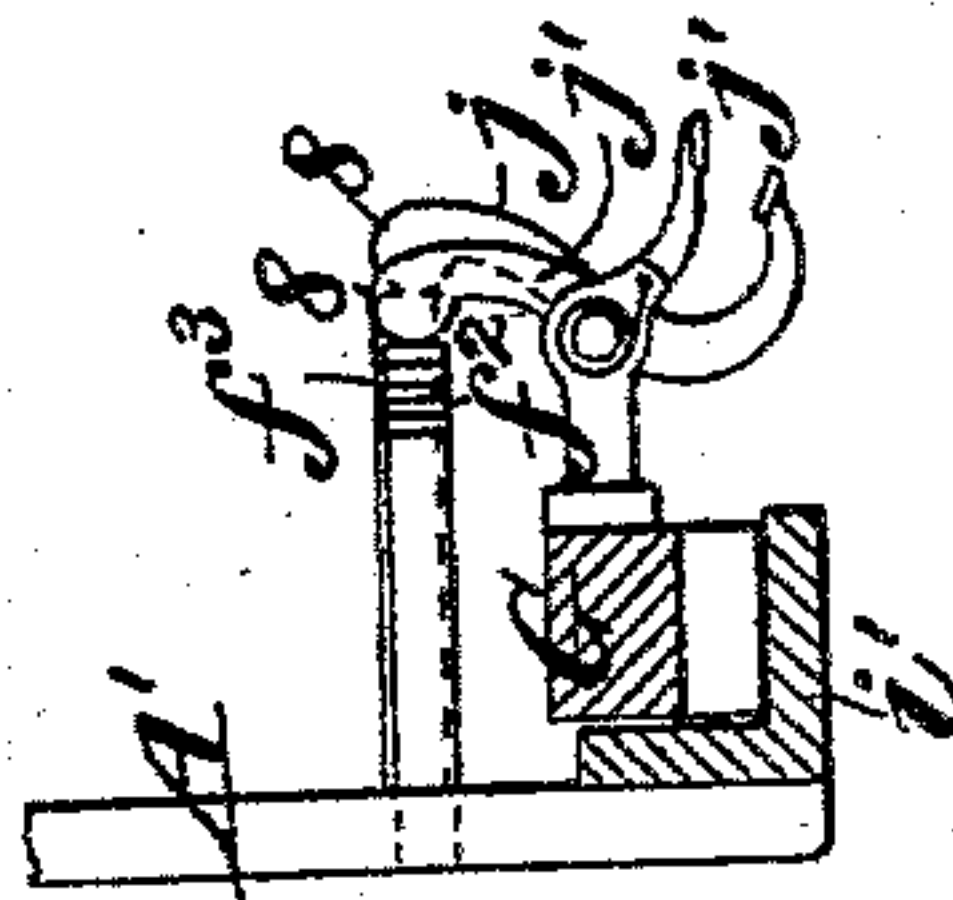
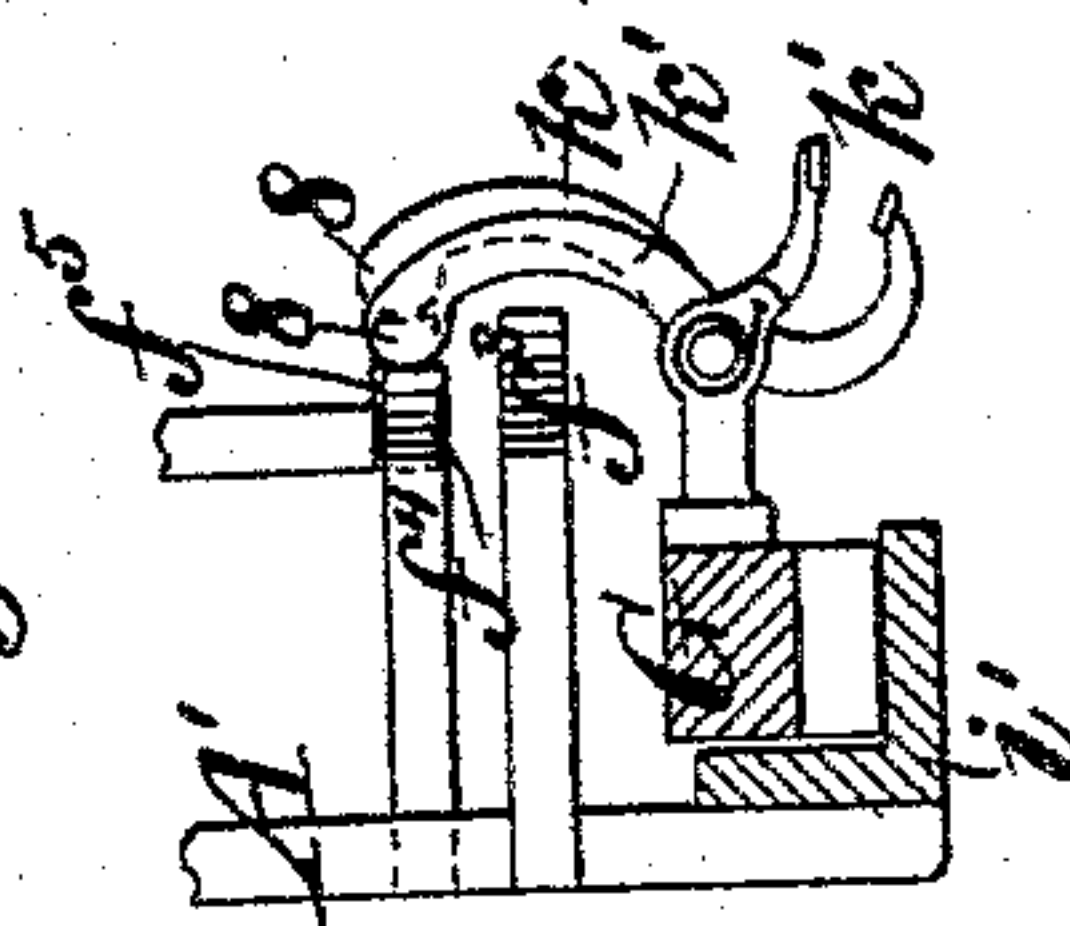


Fig. 10.



Witnesses:
C. Sundgren
George Barry.

Inventor:
Calvert Cottrell
by attorneys
Rowntree & Co.

UNITED STATES PATENT OFFICE.

CALVERT B. COTTRELL, OF WESTERLY, RHODE ISLAND.

SHEET DELIVERY AND FOLDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 494,846, dated April 4, 1893.

Application filed November 3, 1892. Serial No. 450,804. (No model.)

To all whom it may concern:

Be it known that I, CALVERT B. COTTRELL, of Westerly, in the county of Washington and State of Rhode Island, have invented a new and useful Improvement in Sheet Delivery and Folding Apparatus, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to rotary printing machines in which the paper to be printed is supplied to the cylinders from a roll or continuous web and after having been printed is cut into sheets which are delivered to a folding apparatus. In web printing machines heretofore provided with apparatus for cutting the web into sheets and folding the sheets the difficulty has been to fold the sheets with sufficient rapidity. The object of this invention is to overcome this difficulty.

In carrying out my invention I take the printed web from the printing cylinder by an endless carrier and in this carrier by means of suitable cutters I cut the said web into sheets which the said carrier takes in close succession to the folding devices of which I use two, one arranged before the other, one operating to fold every other sheet and the other operating to fold the intervening alternate sheets, each of the said devices being thus required to make but one operation for every two printing and cutting operations.

I will first describe my invention with reference to the accompanying drawings and afterward point out its novelty in claims.

Figure 1 represents a side elevation of a perfecting printing machine embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is a longitudinal vertical section showing the endless carrier and cutters and the folding devices and their appurtenances on a larger scale than Figs. 1 and 2. Fig. 4 is a view parallel with Fig. 3 but on a still larger scale, of a part of the carrier and of the means employed to take the sheets out of the carrier preparatory to the folding. Fig. 5 is a view corresponding with Fig. 4, at right angles thereto. Figs. 6 and 7 are views corresponding with Fig. 4 showing some of the details of that figure in different positions. Fig. 8 is a plan view of a portion of the endless carrier corresponding with Fig. 3. Figs. 9 and 10 are diagrams of the grippers and their cams.

A designates the main side framing of the machine, which contains the bearings for the cylinders B C D E, of which B is the first impression-cylinder, C the first form-cylinder, D the second impression-cylinder, and E the second form-cylinder, and all of which are geared together by gears *b c d e* to rotate in the direction of the arrows, which are shown near them in Fig. 1, the whole deriving motion from the main shaft S of the machine through a gear S' on the said shaft gearing with the spur gear *d*, as shown in Figs. 1 and 2.

F is the web of paper supplied from a suitably-placed roll (not shown) and passing between the cylinders B and C downward between the cylinders D E and under the cylinder D to the delivery apparatus, which I will now proceed to describe.

A' A' are frames, erected one upon each of the side frames A of the main framing forward of the impression cylinder D, for the support of the endless carrier, which is represented as consisting of two parallel endless toothed racks or chains G G with attached grippers *j j'* and *k k'*. The said frames have secured in them studs *g g'*—one near each end of each frame—for the support of the wheels which carry the said endless racks, and have also provided in them parallel horizontal ways *i i'* for the support of those portions of the endless racks between the said carrying-wheels. The said endless racks are driven from the spur-gear S' of the main shaft S through gearing which will be presently described, so that their lower parts, which are nearly on a level with the bottom of the impression-cylinder D, run in a direction away from the said cylinder. The grippers *j j'* and *k k'* which are attached to the inner sides of the endless racks, are presented transversely to the length of the racks for the purpose of taking hold of the side edges of the printed web after the latter has passed the cylinder D, the grippers operating while on the lower runs of the endless racks.

H H' (see Figs. 2 and 3) are two sets of rotary cutter heads furnished with cutting blades *l l'*. These heads are mounted on shafts I I' (see Fig. 3) supported in journal boxes on the side frames A, a short distance forward of the rear rack carrying wheels *h* of the endless racks. The height at which these shafts

are supported in their bearings is such that the edges of the cutting blades of the two cutter-heads will meet in their rotation about on a level with the web of paper which is being
 5 carried away from the cylinder D by the grippers $j j'$ or $k k'$ in the lower runs of the racks, the shaft I' of the upper cutter head passing through the endless carrier and the shaft I of the lower cutter head being below it. The
 10 edges of the cutting blades meeting as above mentioned, will cut the web into sheets.

To drive the cutters and the endless carrier, the upper cutter shaft I' is furnished with a spur gear I² which is geared with and derives
 15 rotary motion from the spur gear d on the shaft of the cylinder D, through an intermediate gear S² which runs on a fixed stud S³ secured in one of the frames A' A', and the said gear I² communicates motion to the lower cutter shaft I through a spur gear H² on the latter
 20 shaft so that both cutter shafts and their heads rotate at the same velocity. The said gear I² on the upper cutter shaft I' gears with a spur gear G' (see Figs. 1 and 2) which is
 25 fast on a shaft G² which is arranged transversely above the endless carrier. This shaft G² carries two spur gears G³ (see Fig. 2) which gear with and drive the endless racks of the carrier.

30 The number of sets of grippers in the carrier will depend upon the length of the carrier and the length of the sheets to be cut, and the length of the carrier requires to be sufficient to include the length of two sets of folding devices $m m' n' o' p' q' r'$ 10, 11 and $m m^2 n^2 o^2 p^2 q^2 r^2$ 10, 11. In the example represented the carrier has six sets of grippers, each set consisting of a gripper j or k on each rack G to take a sheet near its forward end and a
 40 gripper j' or k' on each rack to take a sheet near its rear end. The grippers $j j'$ constituting every other set and forming a series of three sets are intended to deliver the sheets to the first set of folding devices $m m' n' o' p' q' r'$ 10, 11, and those $k k'$ which constitute the intervening sets and forming a second series of three sets are for delivering sheets to the second set of folding devices $m m^2 n^2 o^2 p^2 q^2 r^2$ 10, 11. The said grippers $j j'$ and $k k'$ which are furnished with springs for closing them automatically, are all substantially like those now employed in the endless carriers of sheet delivery apparatus and they are all alike except as to the heels 8 of their movable members which so differ as hereinafter explained in their respective lengths and in their being set normally more or less inward away from their respective racks G G that the heel 8 of each gripper may, by the movement
 60 of that gripper with the said racks, be brought into range with the proper one of the stationary cams $f' f^2 f^3 f^4 f^5$ provided for opening that gripper.

The cams f' and f^5 are respectively fast upon
 65 the fixed studs $g g'$ upon which the carrying wheels of the endless racks turn. The other cams $f^2 f^3 f^4$ are all arranged upon or secured

to the side frames A' of the carrier. All of the cams are duplicated for the grippers on the two sides of the carrier. The first pair of
 70 cams f' are for opening all the grippers $j j'$ and $k k'$ of every set of the two series for the purpose of taking the web as it passes between the cylinder D and the cutters. The second pair of cams f^2 is for opening the
 75 rear grippers j' of the series $j j'$ to deliver the sheets from that series to the first set of folding devices $m m' n' o' p' q' r'$ 10, 11. The third pair of cams f^3 is for opening the front grippers j of the same series for the same purpose.
 80 The fourth pair of cams f^4 is for opening the rear grippers k' of the series $k k'$ for the purpose of delivering the sheets from that series to the second set of folding devices $m m^2 n^2 o^2 p^2 q^2 r^2$ 10, 11 and the fifth pair of cams
 85 f^5 is for opening the front grippers k of the same series for the same purpose.

In order that the grippers of the series $j j'$ may be opened by the cams $f^2 f^3$ when in proper position to deliver sheets to the first set of
 90 folding devices and that the grippers of the series $k k'$ may escape or pass by the said cams $f^2 f^3$ and not be opened until they reach the cams $f^4 f^5$ to be opened for delivering sheets to the second set of folding devices $m m^2 n^2 o^2 p^2 q^2 r^2$ 10, 11, the heel 8 of the grippers $j j'$ are made shorter than those of the grippers $k k'$, the cams $f^2 f^3$ for operating the grippers $j j'$ are arranged all in one horizontal line lower than a horizontal line in which the
 100 cams $f^4 f^5$ for operating $k k'$ are all arranged and the heels 8 of the grippers $k k'$ are curved to pass by the lower cams $f^2 f^3$. This is illustrated in Figs. 3, 4 and 5, but will be best understood by reference to Fig. 5 in which are
 105 shown the cams $f^3 f^4$ and in which a gripper k' is shown in full outline while operated upon by the cam f^4 and a gripper j is partly shown while operated upon by the cam f^3 . All of the gripper j however, that is actually visible
 110 in this figure is its heel 8, the remainder of it being exactly behind and concealed by the gripper k' so that the lines which show the gripper k' indicate the concealed portions of the gripper j . In order that the front grippers j and k may escape or pass by the cams
 115 f^2 and f^4 provided for the opening of their respective rear grippers j' and k' , the said cams f^3 and f^5 are made to project more than the corresponding cams f^2 and f^4 for opening
 120 the front grippers. This will be understood by reference to Fig. 2 and also by reference to Figs. 9 and 10 which represent front views of the cams and grippers. The heels 8 of the grippers j and k are for the same purpose set,
 125 as shown in Figs. 9 and 10, farther inward over the jaws of their respective grippers as will be understood by reference to Figs. 9 and 10 in which the cams f^2 and f^4 and the grippers j' and k' are shown in front of the cams
 130 f^3 and f^5 and grippers j and k .

The folding apparatus employed in carrying out my invention may be of any known or suitable kind but will generally com-

prise a folding blade arranged to operate between the endless racks of the carrier and a series of rollers and tapes or bands arranged below the carrier. In the example represented the said blades, m' for the first folding apparatus and m^2 for the second, arranged transversely to the carrier, are attached to the arms m of one of two rock-shafts n' n^2 which have their bearings in the side frames A' , the said shafts, arms and blades being so located, proportioned and organized that the blade m' may strike exactly across the middle of a sheet in a set of grippers $j j'$ and the blade m^2 may strike exactly across the middle of a sheet in a set of grippers $k k'$. The rollers $o' o' p' q'$ and r' for the first folding apparatus which have bearings provided for them in or on the side frames A of the machine, consist of a pair $o' o'$ arranged side by side so that the blade m' may strike between them and three other rollers $p' q' r'$ of which q' is under the forward roller o' to receive tapes 10 which run on the latter, while p' is arranged on a level with and behind $o' o'$, and r' is lower down than and in front of q' to receive tapes 11 which run over the rear roller o' and over idler pulleys 12, 12. The rollers $o' o'$ are geared together as shown in Fig. 3 and one of them is also geared through an intermediate gear s with one of the endless racks for the purpose of driving both of said rollers $o' o'$ and the tapes 10, 11.

The second folding apparatus $m m^2 n^2 o^2 p^2 q^2 r^2$ 10, 11, is precisely similar to the first one just described and it is so arranged relatively to the first one and to the endless carrier that while a sheet in one of the sets of grippers $j j'$ of one series is presented for folding between the blade m' and rollers $o' o'$ of the first folding apparatus, a sheet in one of the sets of grippers $k k'$ of the other series is similarly presented between the blade m^2 and rollers $o^2 o^2$ of the second folding apparatus. The rock-shafts $n' n^2$ of the folding blades m' m^2 of the two sets of folding devices are so connected by arms $t t$ on the said rock-shafts and a connecting rod u between these arms that both blades are operated together.

The folding devices so far as they have been and may be further herein described are only what are employed for giving the first folds to the sheets, those being the only parts of the folding apparatus involved in my invention. The addition of the devices necessary for further folding will be within the ordinary province of persons skilled in paper folding machinery and therefore it is not necessary to explain them. The folding by the devices illustrated and described produce the folding in a well known manner by the blades $m' m^2$ both together striking down the sheets between their respective rollers $o' o'$ and $o^2 o^2$ and tapes 10, 11, and the tapes deliver them so folded over the rollers r' and r^2 . This double folding operation takes place after every two complete printing and cutting operations and the operation is not repeated

until after two more complete printing operations have been performed and two more sheets have been cut and presented one within range of one and the other within range of the other of the two folding apparatuses. The operations of the folding blades is effected and the blades are raised again above the level of the sheets in the endless carrier by means of a cam K (Fig. 1) on a shaft L which works in bearings on the framing A and is furnished with a spur gear L' which derives motion from a gear L^2 on the lower cutter shaft I , the yoke K' of said cam being connected with an arm n on the rock-shaft n' of the first folding blade. The said gears L' L^2 are so proportioned that the cam K makes one revolution and produces one operation of the folding blades for every two cutting operations.

In order to provide for depositing the cut sheets on the tapes or bands 11 of the folding apparatus preparatory to the operations of the folding blades, I employ in connection with each series of grippers $j j'$ and $k k'$ on the endless carrier and with each folding apparatus a set of grippers 13, 14 carried by the upper ends of the arms $M M$ of two rock-shafts $N N$ supported in bearings in the lower part of the framing A , the said rock-shafts, arms and grippers 13, 14 being so arranged in rear of their respective folding apparatus and so operated that as two sheets are brought by the endless carrier to the proper position to be released by the grippers $j j'$ and $k k'$ and delivered to the folding apparatus, the said grippers 13, 14, may take the rear ends of the said two sheets and pull down the said sheets to the desired position. As the said rock-shafts, arms and grippers 13, 14 for the two folding apparatuses are alike it will be sufficient to particularly describe that for the first folding apparatus.

The arms M , of which there are two on each rock-shaft connected by a brace 15, have pivoted in their upper ends the shaft 16, to which are firmly secured the lower gripper members 13, and the said shaft 16 has firmly secured to it two bell-crank-like tumblers 17 in which are pivoted the shaft 18 of the corresponding upper gripper members 14. Of the depositing grippers 13, 14, there may be any suitable number arranged to work clear of the carrier grippers. The arms M have a backward and forward swinging movement and the points of the grippers 13, 14 have an upward and downward movement about the center of the shaft 16 besides their opening and closing movement. The backward and forward swinging movement of the arms M is produced by a cam P on the shaft L before described, the said cam acting upon a yoke Q' at the end of a rod Q which is connected with and operates the arms M of both rock-shafts N . The upward and downward movement of the points of the grippers 13, 14 are produced by the bending and unbending of a toggle 18*, 19 which connects one of the tumblers 17 with a

pin 20 on one of the arms M. The bending of the toggle to depress the points of the grippers as shown in Fig. 6, is produced by the striking of a roller 21 on its joint pin 22, against a fixed stop 23, (see Figs. 4, 5, 6, 7) on the framing A, as the arms M move forward, and the unbending or straightening of the toggle to raise the points of the grippers is produced by the striking of the said roller 21 against a fixed stop 24 on the framing A as the arms M move backward, as shown in Fig. 7. The bending and unbending of the toggle are both assisted by a spring 25 which connects the joint of the toggle with a lower part of the arm M. When the toggle is unbent and the grippers are raised, the said spring holds a downwardly projecting toe 26 on the upper toggle member 18* against a stop pin 27 on the lower member 19 as shown in Fig. 7, and so holds the grippers up. When the toggle is bent and the grippers are depressed, the spring 25 holds the roller 34 on the tumbler 17, upon the top of the stop 23 as shown in Fig. 6.

To prevent any shock in the bending of the toggle and depression of the grippers there is provided above the stop 23, a fixed curved guide 28 for the roller 34 to run upon as it approaches the stop 23. The two stops 23, 24, and the guide 28 are represented in Figs. 4, 5, 6, 7 as made in one piece.

For the opening of the depositing grippers 13, 14, the shaft 18 of the upper members is furnished with an arm 29 on which is a roller 30. This roller is caused during the forward movement of the arms M, while the grippers are raised as shown in Figs. 4 and 7, to run over the top of a fixed cam 31 and so to open the grippers to receive the rear edge of the sheet, and the said roller is caused by the return movement of the arms M, while the grippers are depressed, as shown in Fig. 6, to run over the top of a lower fixed cam 32, represented in Figs. 5 and 7 as on the same plate with the cam 31, and so to open the grippers to liberate the sheet. At all times but when required to be opened, the grippers are kept closed by a spring 33 (see Fig. 5) applied in a well known manner to the shaft 18 of their upper members 14.

As in the forward movement of the carrier one cut sheet in a set of grippers $j j'$ of one series and another cut sheet in a set of grippers $k k'$ of the other series arrive nearly in proper range with the folding apparatus, the arms M carrying the two sets of grippers 13, 14 begin to move forward just in rear of the rear edges of said sheets at a velocity a little greater than that of the carrier and sheets and just before the points of the said grippers arrive at the said edges the grippers are opened by the roller arms 29 of the upper gripper shafts 18 passing the cam 31 and as the grippers continue to move forward their upper members 14 raise or hold up the front edge of the sheet and the front edge of the web immediately behind the said rear edges

and so make room between the said front and rear edges for the points of said members to enter between the said front and rear edges as shown in Fig. 4, while the points of the lower members 13 pass under said rear edges. The grippers then immediately close and take hold of the rear edges of the two sheets at the same time that the carrier grippers $j j' k k'$ are opened by their cams $f^2 f^3 f^4 f^5$ to liberate the sheets from the carrier. As soon as the grippers 13, 14 are thus closed their points are caused by the action of their toggles aided by their springs 25, as hereinbefore described, to be depressed as shown in Fig. 6, to a position to deposit their sheets on the tapes 11 of the folding apparatus; but before or by the time this depression has been completed, the arms M will have commenced the return movement by which the said grippers will be caused first to straighten the sheet in case of any buckling to which it may have been subjected in taking hold of its rear edge and afterward to release the sheet by the passage of the roller arms 29 of the gripper shaft 18 over the fixed cam 32. As soon as the two sheets have been liberated from the grippers 13, 14, the folding blades $m' m^2$ descend quickly and produce the first fold of the two sheets simultaneously as hereinbefore described, and then quickly rise to permit the next two sheets to pass on to the two folding apparatuses. The return movement of the arms M brings the toggle into contact with the stop 24 and so raises the grippers 13, 14 to a position to come forward to take the rear edges of the next two sheets.

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

1. The combination of an endless carrier, two folding apparatuses arranged one before the other in the direction of the movement of the said carrier, and two sets of depositing grippers for taking two sheets simultaneously from the carrier and depositing them on the folding apparatus; substantially as herein set forth.

2. The combination of two folding apparatuses arranged one before the other, an endless sheet carrier running past both of said apparatuses and provided with two series of grippers of which those of one series alternate with those of the other series lengthwise of the carrier, a set of cams for operating the grippers of each series to take in sheets, cams for operating the grippers of one series to liberate sheets for delivery to one of said folding apparatuses, and cams for operating the grippers of the other series to liberate sheets for delivery to the other of said folding apparatuses, substantially as herein set forth.

3. The combination of an endless carrier having grippers in alternate series, cutters for cutting a web into sheets in said carrier, two folding apparatuses arranged one before the other in the direction of the movement of the said carrier, cams for operating the grippers of the two series for taking two of the cut

5 sheets simultaneously one from each of said series of grippers, and cams for operating the said grippers for liberating the said two sheets simultaneously for delivery to the two folding apparatuses; substantially as herein set forth.

10 4. The combination of an endless carrier having several sets of sheet holding grippers, two folding apparatuses arranged one before the other in the direction of the movement of said carrier and each comprising a folding blade and rollers between which said blades operate, cams for opening simultaneously two sets of the said grippers, a cam for operating the said folding blades and a connection between said blades whereby both are operated simultaneously by the one cam; substantially as herein set forth.

20 5. The combination of an endless carrier having several sets of sheet holding grippers, two folding apparatuses arranged one before the other in the direction of the movement of said carrier, two sets of gripper arms carrying depositing grippers for taking sheets from two sets of the grippers of the carrier, a cam for operating the said gripper-carrying arms, and connections between said arms whereby both are operated simultaneously by the one cam; substantially as herein set forth.

30 6. The combination of the swinging arms M for carrying the depositing grippers, the shaft 16 fitted to bearings in said arms and carrying one set of gripper members 13, the tumblers 17 carried by said shaft, the shaft 35 18 fitted to bearings in said tumblers and carrying the other set of gripper members 14, the toggle 18*, 19 connecting the said tumblers with the said arms, and the stops 23, 24 for producing the bending and straightening of the toggle and consequent depression and elevation of the grippers by the swinging

movement of the said arms; substantially as herein set forth.

7. The combination of the swinging arms M for carrying the depositing grippers, the 45 shaft 16 fitted to bearings in said arms and carrying one set of gripper members 13, the tumblers 17 carried by said shaft, the shaft 18 fitted to bearings in said tumblers and carrying the other set of gripper members 14, 50 the arm 29 on said shaft 18, the toggle 18*, 19 connecting said tumblers with said arms M, the stops 23, 24 for producing the bending and straightening of the toggle to depress and elevate the grippers, and the cams 31, 32 55 for opening the grippers; substantially as herein set forth.

8. The combination of the endless carrier having two alternating series of sets of grippers of which those of the two series have 60 heels of different length, and two sets of stationary cams arranged in different lines for operating simultaneously the grippers of a set in each series, one set of said cams for opening the grippers of one series and the 65 other for opening those of the other series, substantially as herein set forth.

9. The combination of an endless carrier having front and rear grippers for taking the side edges of sheets near their front and rear 70 ends the front grippers having heels set farther inward laterally to the sides of the carrier than heels of corresponding length on the rear grippers and stationary cams of different projection all on the same line for operating respectively on the heels of the front 75 and rear grippers, substantially as and for the purpose herein set forth.

CALVERT B. COTTRELL.

Witnesses:

A. R. STILLMAN,
B. FRANK LAKE.