

No. 671,993.

Patented Apr. 16, 1901.

J. L. FIRM.

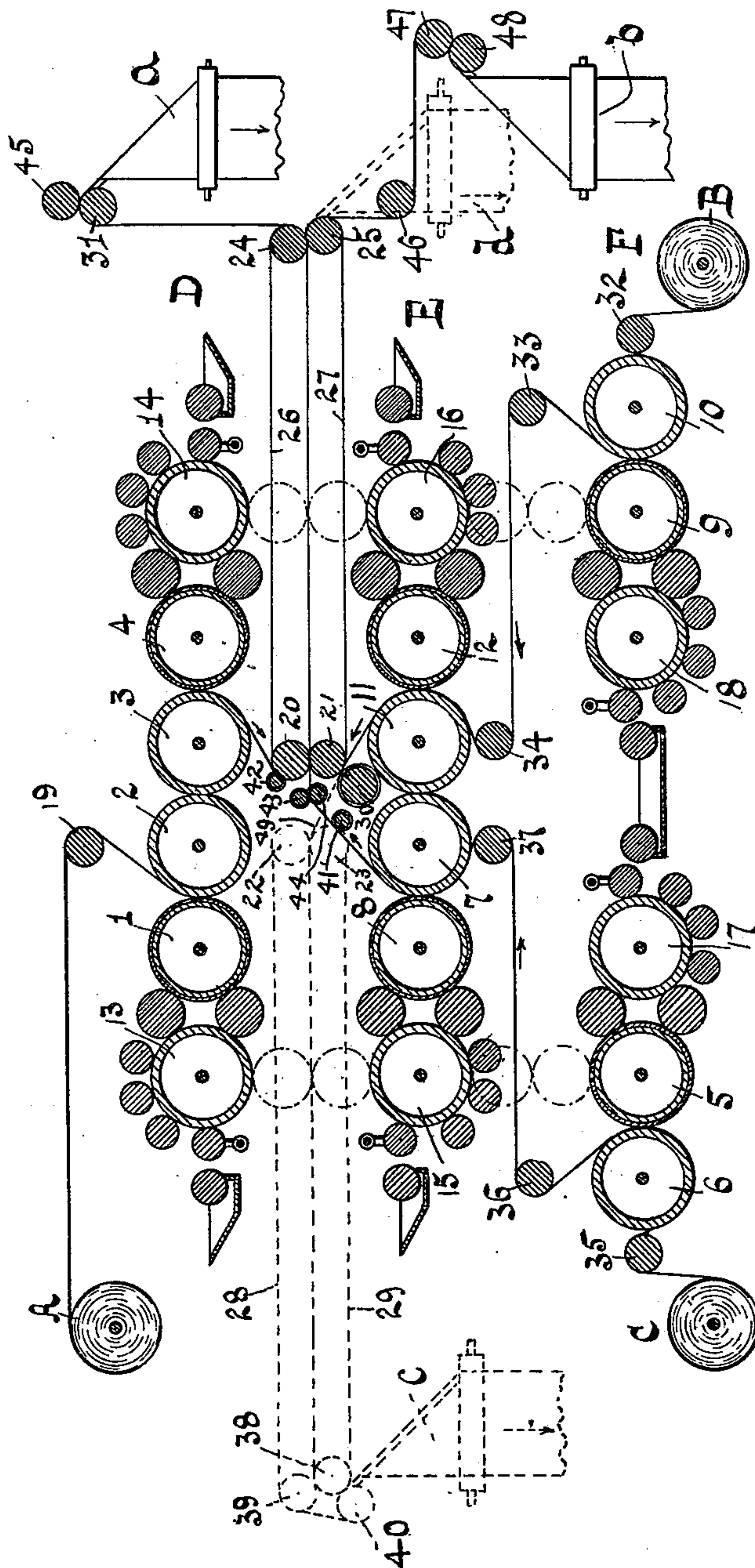
DELIVERY APPARATUS FOR WEB PRINTING MACHINES.

(Application filed Oct. 26, 1894.)

(No Model.)

6 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

Chas. W. Thomas
M. Wilson.

INVENTOR

Joseph L. Firm
BY *Gifford & Bull*
ATTORNEYS.

No. 671,993.

Patented Apr. 16, 1901.

J. L. FIRM.

DELIVERY APPARATUS FOR WEB PRINTING MACHINES.

(Application filed Oct. 28, 1894.)

(No Model.)

6 Sheets—Sheet 2.

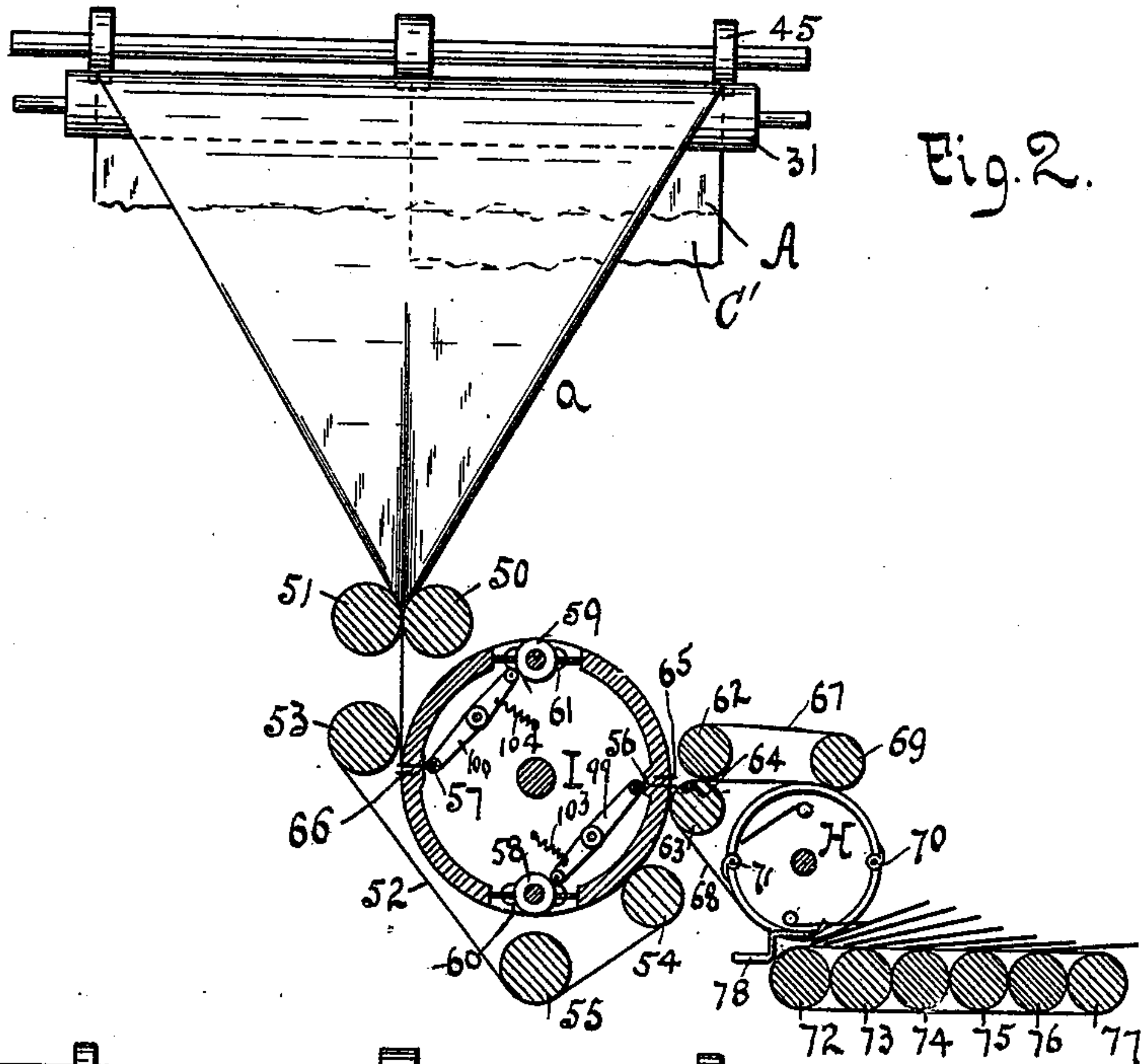


Fig. 2.

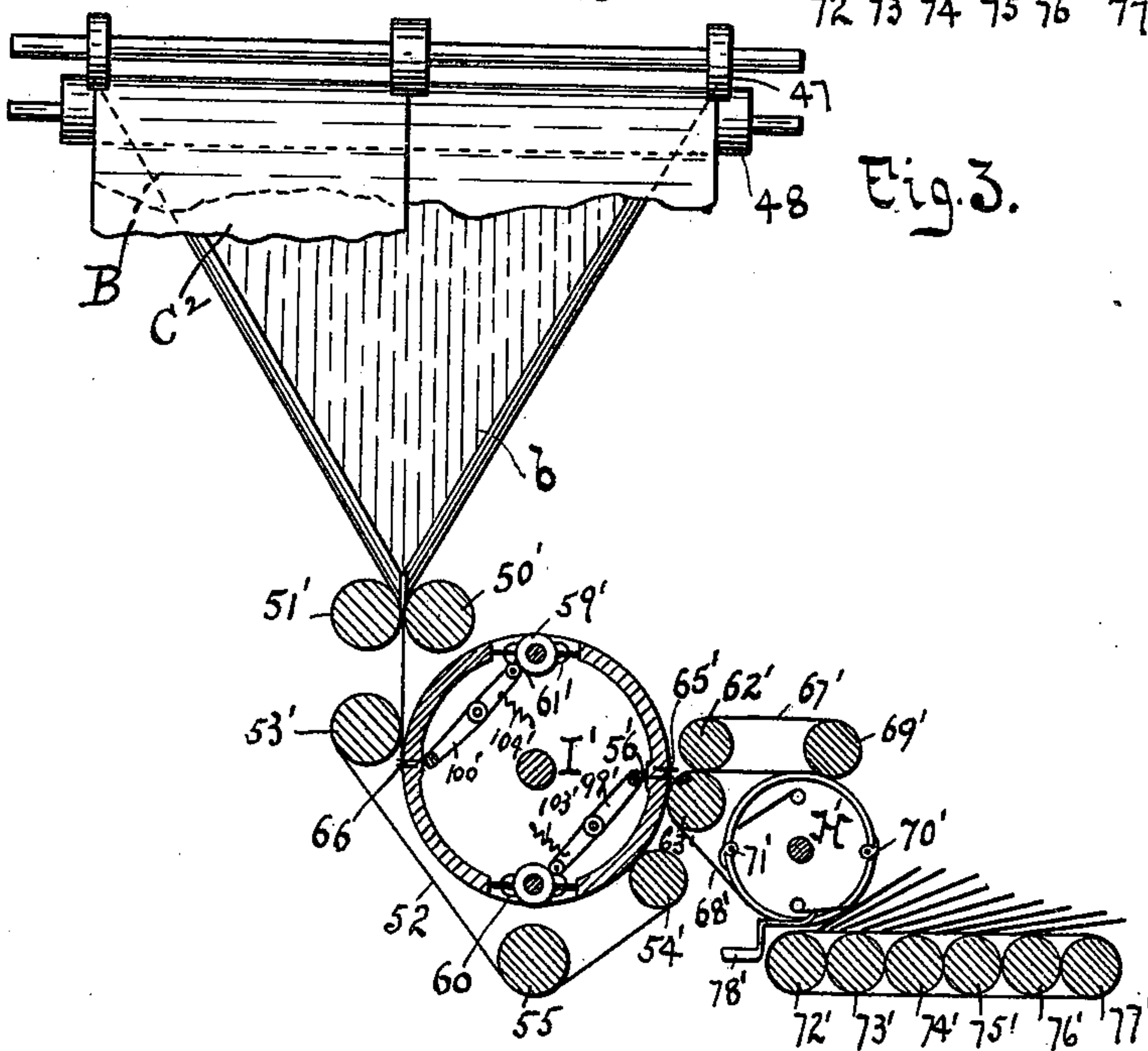


Fig. 3.

WITNESSES:

Chas. W. Thomas.
M. Wilson.

INVENTOR

Joseph L. Firm
BY Gifford & Bull

ATTORNEYS

No. 671,993.

Patented Apr. 16, 1901.

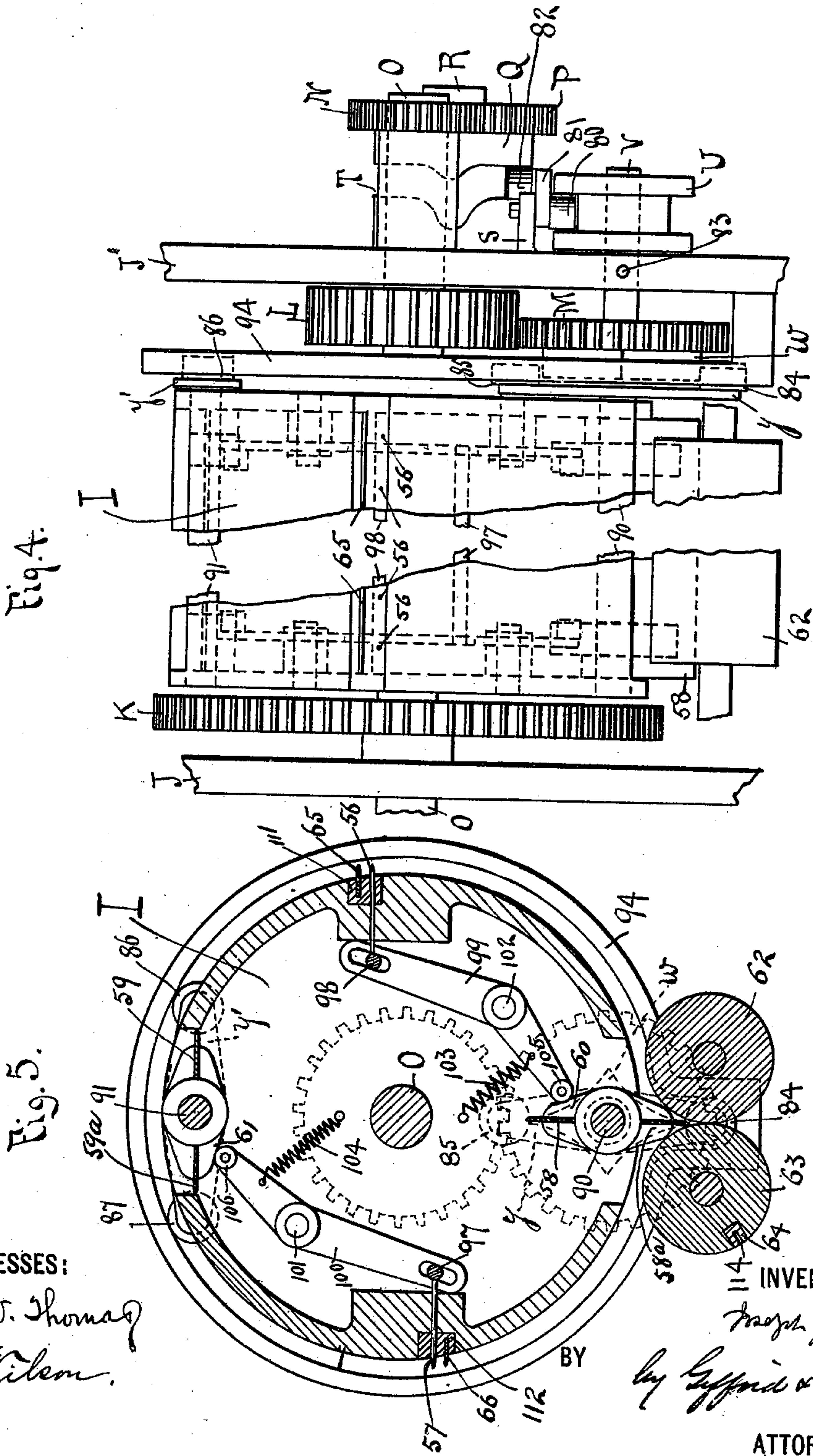
J. L. FIRM.

DELIVERY APPARATUS FOR WEB PRINTING MACHINES.

(Application filed Oct. 20, 1894.)

(No Model.)

6 Sheets—Sheet 3.



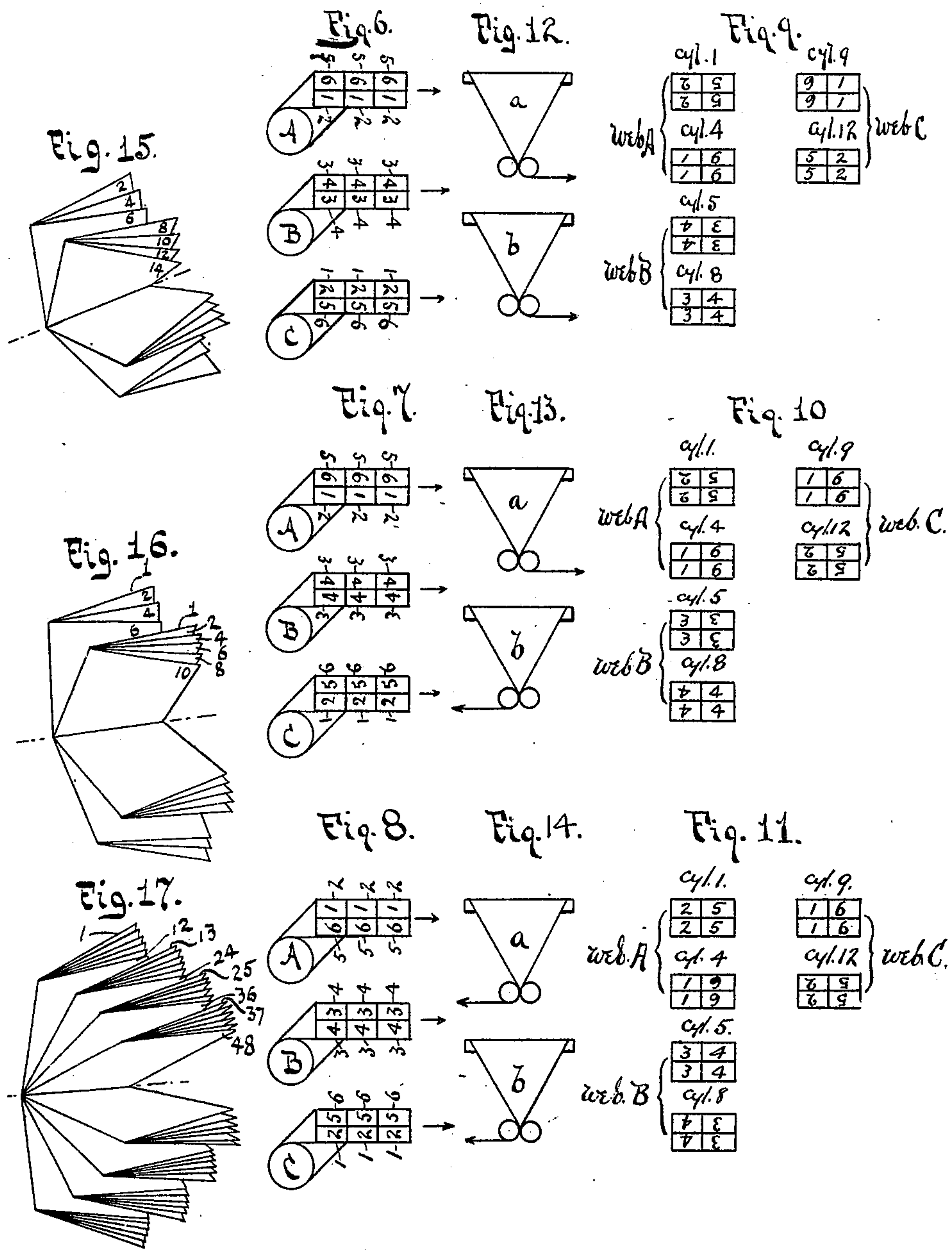
J. L. FIRM.

DELIVERY APPARATUS FOR WEB PRINTING MACHINES.

(Application filed Oct. 26, 1894.)

(No Model.)

6 Sheets—Sheet 4.



WITNESSES:

Chas. W. Thomas.

M. Wilson.

INVENTOR

Joseph L. Firm.

BY

Gifford & Bull

ATTORNEYS.

No. 671,993.

Patented Apr. 16, 1901.

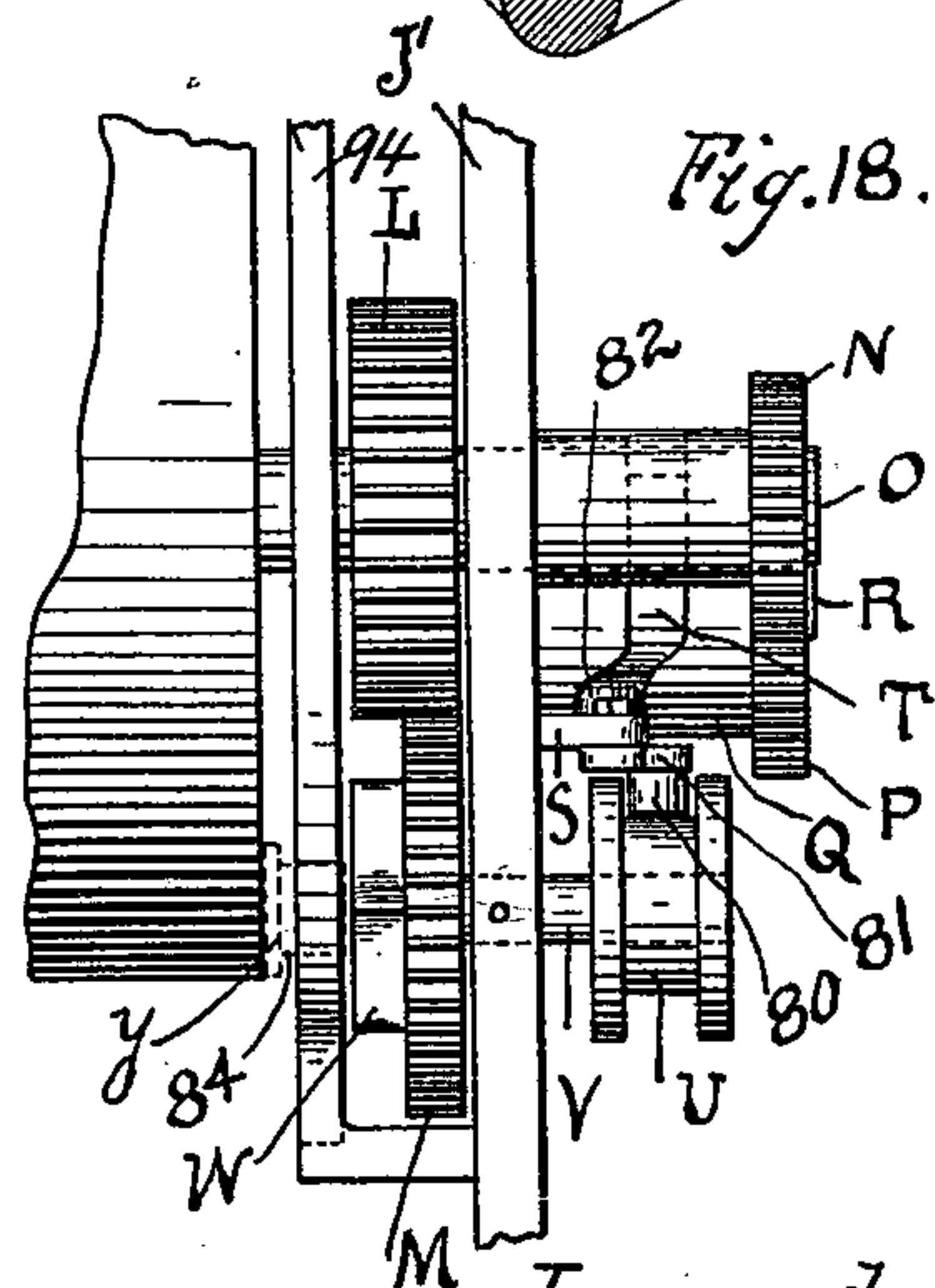
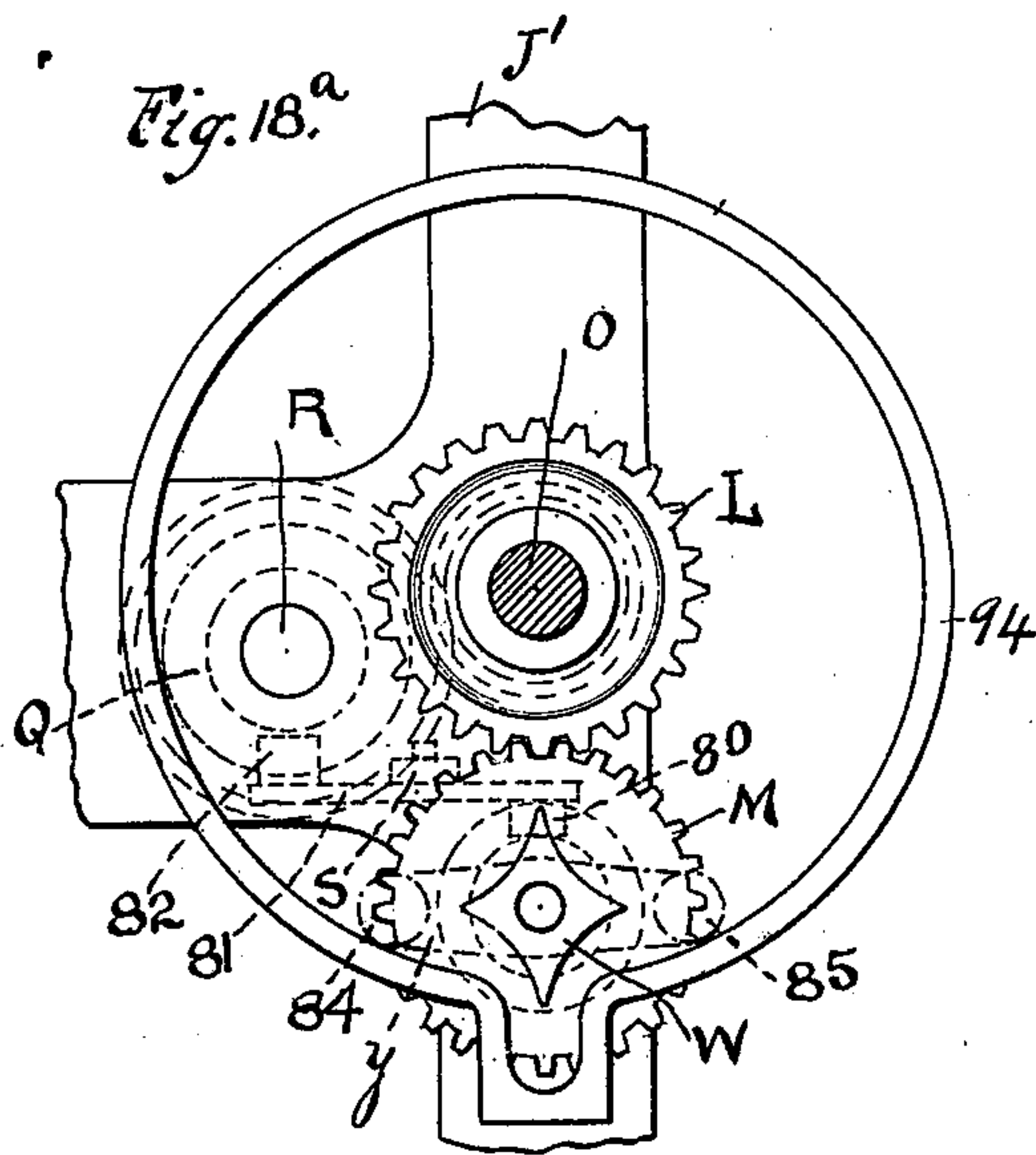
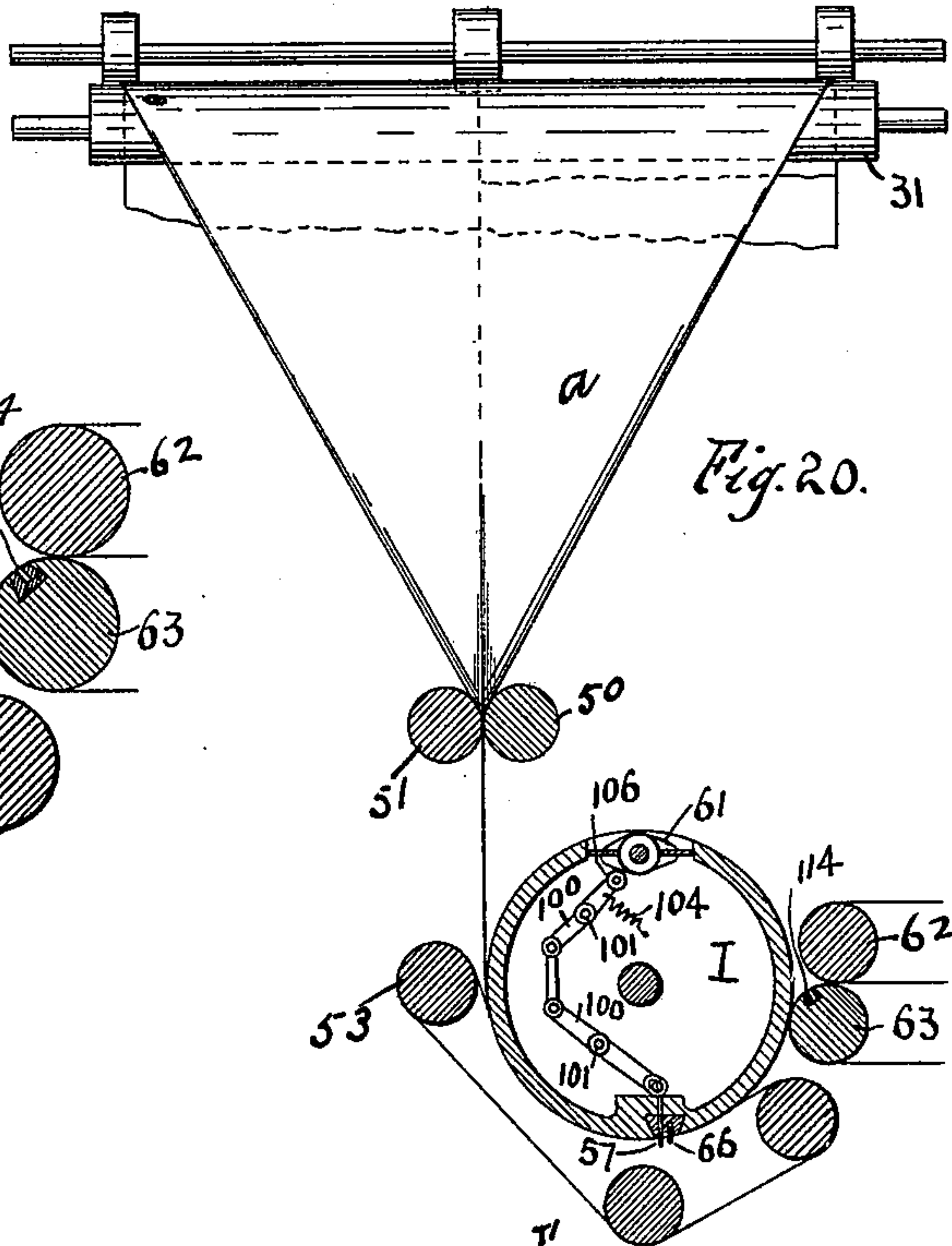
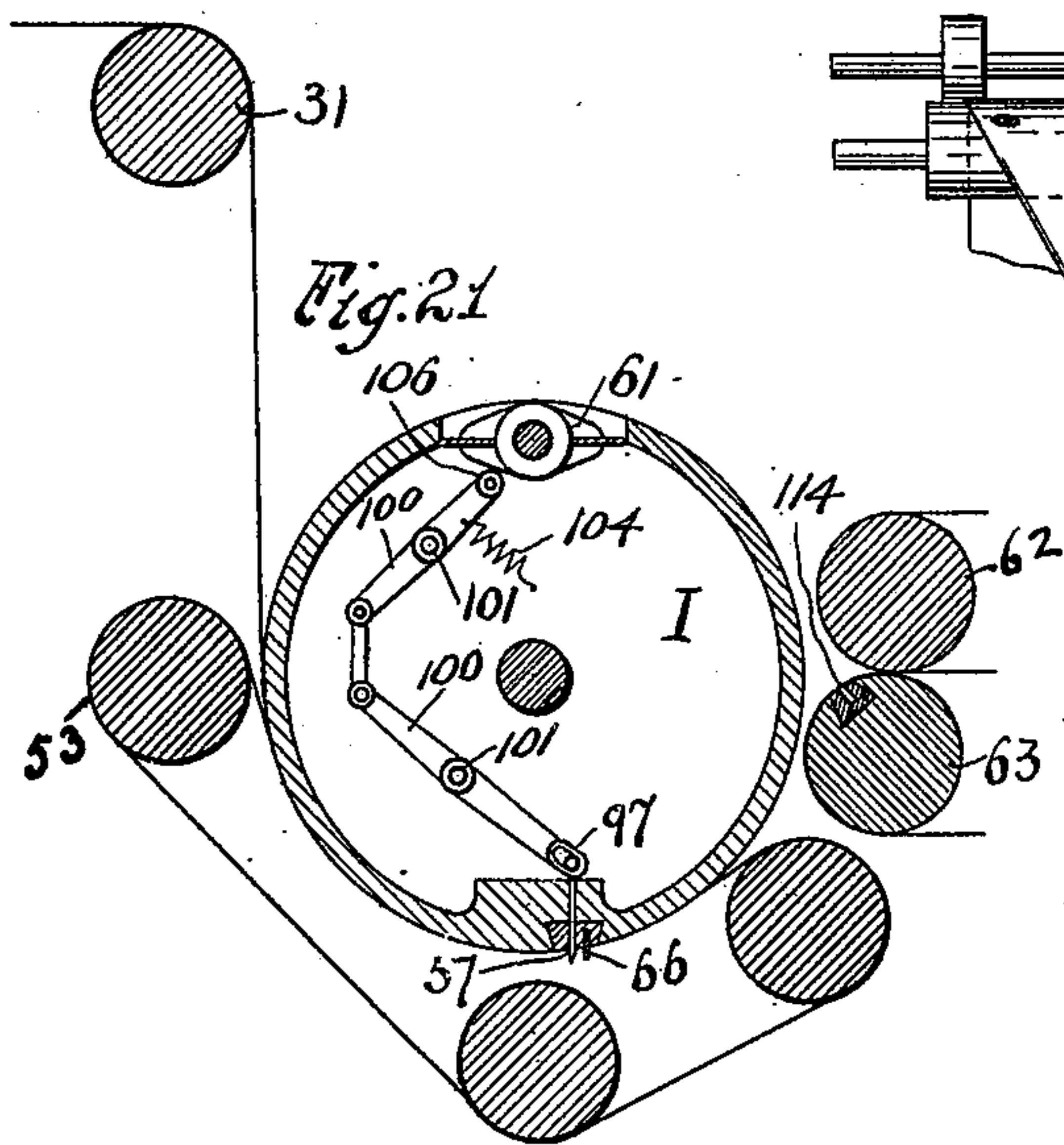
J. L. FIRM.

DELIVERY APPARATUS FOR WEB PRINTING MACHINES.

(Application filed Oct. 26, 1894.)

(No Model.)

6 Sheets—Sheet 5.



Witnesses:

Chas. W. Thomas.
James O. Smith

Inventor:

Joseph L. Firm.
By Lyffie & Bull.

Attorneys.

No. 671,993.

Patented Apr. 16, 1901.

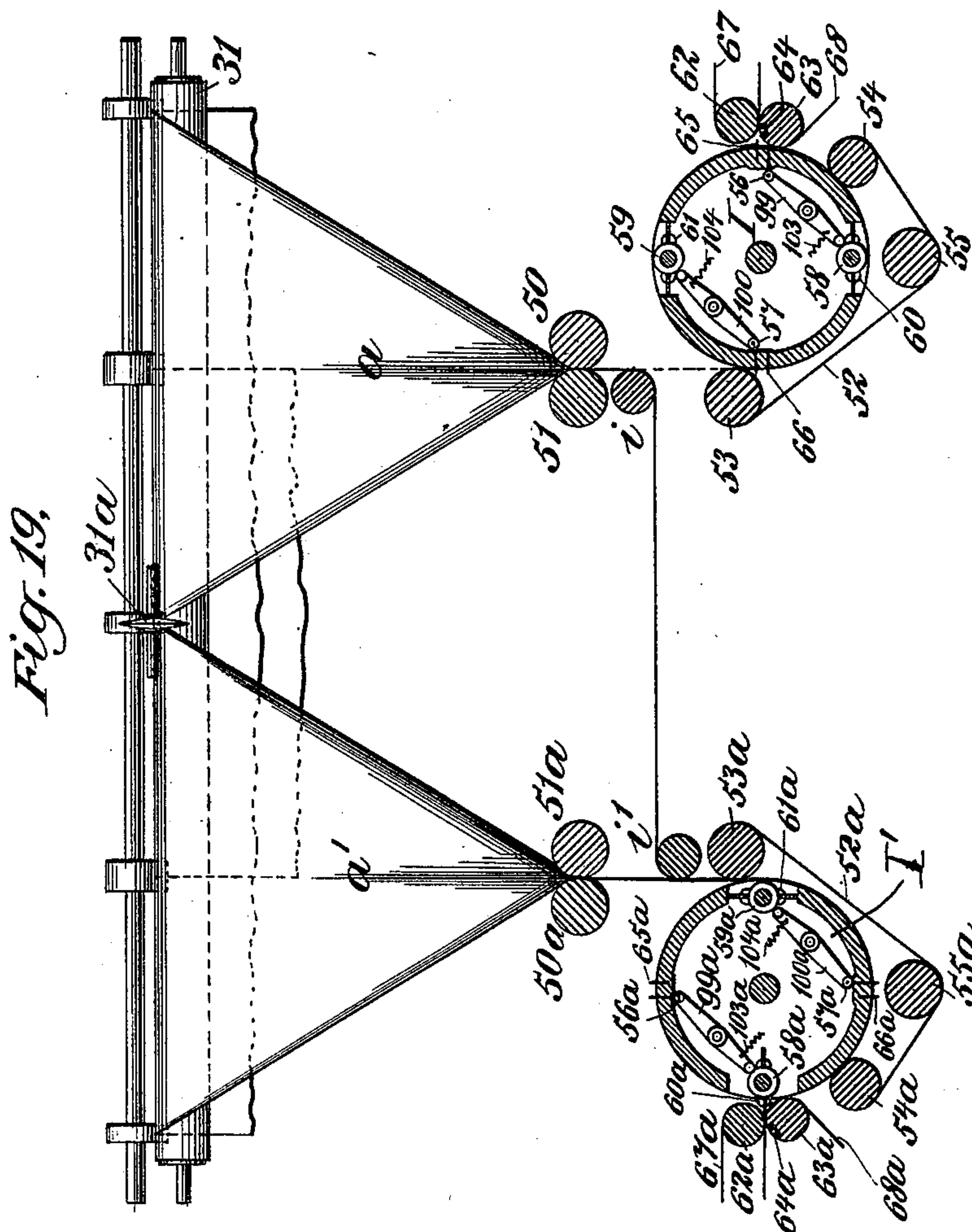
J. L. FIRM.

DELIVERY APPARATUS FOR WEB PRINTING MACHINES.

(Application filed Oct. 26, 1894.)

(No Model.)

6 Sheets—Sheet 6.



Witnesses:-

D. H. Raymond

M. Wilson.

Inventor:-

Joseph L. Firm
by Clifford & Bull
Attys.

UNITED STATES PATENT OFFICE.

JOSEPH L. FIRM, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO THE GOSS PRINTING PRESS COMPANY, OF CHICAGO, ILLINOIS.

DELIVERY APPARATUS FOR WEB-PRINTING MACHINES.

SPECIFICATION forming part of Letters Patent No. 671,993, dated April 16, 1901.

Application filed October 26, 1894. Serial No. 527,002. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH L. FIRM, a citizen of the United States, and a resident of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Web Printing and Delivery Apparatus for Web-Printing Machines, of which the following is a specification.

Figure 1 is a diagrammatic section, in side elevation, showing the manner of printing and associating the webs to the different delivery mechanisms. Fig. 2 is a front elevation of one of the formers for longitudinally folding the different webs and a diagrammatic side section of the improved delivery mechanism. The former hereshown is the former *a* of Fig. 1, viewed from the right of said Fig. 1. Fig. 3 is a view similar to Fig. 2, showing the web partly broken away. The former here shown is the former *b* of Fig. 1, viewed from the right of said Fig. 1. Fig. 4 is a side elevation, partly broken away, showing mechanism for transversely folding and associating the different webs to form the newspaper or pamphlet. Fig. 5 is a vertical section of the same. Figs. 6, 7, and 8, are diagrammatic views of the partly-unrolled webs with the position of the pages as they appear when six pages have been printed upon them by a press two pages wide. Figs. 9, 10, and 11, inclusive, are the form-surfaces of the various printing-cylinders developed to show the arrangement of forms on them for printing four copies of six-page papers on a two-page-wide press. Figs. 12, 13, and 14 are diagrammatic views of the formers, showing the longitudinally-folded webs passing to the right and left of the machine. Figs. 15, 16, and 17, inclusive, show associated and folded papers. Figs. 18 and 18^a are details of the mechanism for operating the folding-blades and pins. Fig. 19 shows the arrangement of the longitudinal splitting and folding and superposing and transverse folding apparatus as modified to accommodate the product of a press four pages wide. Fig. 20 shows the modified construction wherein the carrier *I* contains only one pair of folding-blades and one series of pins and one cutting-blade. Fig. 21 shows the same construction, but with the longi-

tudinal folder omitted and the web proceeding directly from the roller 31 to the carrier *I*.

In my Patent No. 415,321, dated November 19, 1889, filed January 17, 1888, I described a machine for printing, associating, cutting, and folding a plurality of webs pursuing a substantially direct pathway. In my Patent No. 410,271, dated September 3, 1889, filed October 27, 1888, I described another form of machine for producing a similar result. In my Patent No. 529,680, dated November 20, 1894, filed November 9, 1899, I described still another form of machine for accomplishing a similar result. In all of said machines the control of the paper and the speed of the machine and the perfection of the work was more or less impaired by the distances through which the papers ultimately to be folded together had to pass in going from one operation to another, especially when traveling through separate paths, and also by the conditions under which the paper was held while undergoing the various operations. In my present machine I have succeeded in so arranging and constructing the various parts as to obviate these difficulties, and it is the object of the present patent to secure jointly and severally the features of improvement which my present machine possesses over and above said patents, among which may be prominently mentioned the following. Others will be apparent from the specification, description, and claims: From the time that the several webs are separately printed until they come together they traverse a minimum distance, as shown in the drawings, hereinafter referred to, only the distance from the rolls 3, 7, and 11 to the intermediate collecting-rolls 20 and 21. From the time that the paper is again separated, as by the splitting-knife, until it is brought together again it is separated only so long as is necessary to pass over the longitudinal folders and get together again, and during that time it is still attached to the web, or, in other words, it remains separated only from the time that it is split by the knife 31^a until the two parts come together again at the roller *i'*. The longitudinal cutting and longitudinal folding are performed while the web is held by substantially the same parts, (the roll 31 and the formers adjacent thereto,) and

the transverse cutting and folding are performed while the paper is held by substantially the same part, (the carrier I,) so that each cut and the fold parallel with it are maintained in exact relationship. Until the paper is upon the carrier-roller I', from which it passes in receiving its final fold, it remains unsevered from the web.

The object of my invention is to provide new and improved means whereby the webs can be cut into sheets, folded, (or superposed and folded,) associated, folded again, and delivered in a more effective manner, one of the advantages derivable being the making of certain combinations possible on a two-page-wide press.

In the drawings, D E F indicate three sets of printing mechanisms adapted to print upon a plurality of webs A B C. Each form-cylinder, as here shown, is provided with two-page forms abreast on each semicircumference. The printing mechanism D consists of form-cylinders 1 4 and impression-cylinders 2 3, as shown in Fig. 1. The web A passes over the roller 19 to form and impression cylinders 1 2, thence to impression and form cylinders 3 4, thence to collecting-rollers 20 21, thence between the tapes 26 27, that pass over rollers 20 21 and 24 25, thence over the roller 31 to the former *a*, thence to the mechanism shown in Fig. 2. The web B passes over the roller 32 to form and impression cylinders 9 10, thence to the roller 33, thence under roller 34 to impression and form cylinders 11 12, thence to the rollers 20 21 to be associated with the webs A and C. The web C passes over the roller 35 to form and impression cylinders 5 6, thence over the roller 36 and under roller 37 to impression and form cylinders 7 8, thence between the slitting-rollers 43 44 to the collecting-rollers 20 21 to be associated with the webs A and B. The rollers 20 21 place the longitudinal strips of the web C underneath web A and on top of web B. One strip of the web C is pasted to the under side of the web A by paste supplied to the middle of web A from the past-roller 42. The other strip of the web C is pasted to the upper side of the web B by paste supplied to the under side of that strip of the web C from the paste-roller 41. The associated webs pass between the tapes 26 27. Then the web A and one strip of web C pass under the roller 24, over the roller 31, and under the roller 45 to the former *a*, thence to the mechanism shown in Fig. 2. The web B and the other strip of web C pass over the roller 25, under roller 46, between rollers 47 48, thence to the former *b* and to the mechanism shown in Fig. 3. Thus may be printed, associated, folded, and delivered four complete copies of six-page newspapers for each revolution of the four cylinders without turning or reversing the webs.

The form-cylinders 1 4 8 12 5 9 are each provided with inking devices 13 14 15 16 17 18, respectively, as shown in Fig. 1.

I prefer to use the pasting device described

in Patent No. 529,680, dated November 20, 1894, for applying paste to the webs A and C. The same result may be accomplished by splitting the web B longitudinally and associating one strip of it with the web A and the other strip with the web C, as shown in dotted lines in Fig. 1, as I will next describe. In this case the webs A and C travel in opposite directions (each carrying with it one strip of the web B) and the delivery takes place at both ends of the machine instead of all at one end, as in the example before described. The slitting-knife of the roller 30 is used to split web B longitudinally into two different strips. One of these strips will pass over the roller 21, where it will meet the web A and associate itself with it, and pass between the tapes 26 27, under the roller 24, over 31 to the former *a* and the mechanism shown in Fig. 1. The other strip of the split web B, as shown in dotted lines 49, passes between the rollers 22 23, where it meets the web C, (which in this instance is passing without being split from cylinder 7,) over the roller 23, and under roller 22. Tapes 28 29 pass around the rollers 22 23 38 39 40. The web C and the strip of web B pass together between these tapes to the former *c*, thence to the mechanism shown in dotted lines, which will be constructed similar to Fig. 3. By placing a former *d* (shown in dotted lines, Fig. 1) opposite the rollers 24 25 the formers *a b* can be dispensed with by sending web A with one half web B to former *d* and web C with the other half of web B to former *c*.

I will next describe the folding and delivery mechanism.

Fig. 2 illustrates the roller 31 and roller 45, where the associated web A and one-half of web C (which I have here lettered C') pass to the former *a*. From former *a* the webs pass between the rollers 50 51, where the web A is longitudinally folded around the half-web C'. Next the webs enter between carrier I and tapes 52, which pass over the rollers 53 54 55. If the carrier I is in the position shown in Fig. 2, when the leading end of the webs arrive the impaling-pins 57 will retain the leading ends of the webs on the carrier I until they reach the proper point to be acted upon by the folding-blades 59. Thereupon cam 61 will act upon the lever 100 and retract the pins 57 as the sheet is folded from the carrier I by the folding-blades 59 between the roller 62 and roller 63. The roller 63 has a grooved box 64 to coact with the knife 65 on carrier I, which knife will sever the webs transversely at the proper time, allowing the cuts or sheets to pass on disconnected between the tapes 67 68, which pass over the rollers 62 63 69 to the delivery-carrier H. Here the leading ends of the sheets are caught by grippers 70 or 71 and thence delivered to the rollers 72 73 74 75 76 77 by the stops 78, which rollers will deliver the product ready for distribution. The carrier I may be provided with two sets of retaining-pins, folders,

and cutters, each set being diametrically opposite the other, as shown in Figs. 2, 3, 5, and 19, or the carrier I may be provided with only a single set of retaining-pins, folders, and cutters, as shown in Figs. 20 and 21. Where the carrier I has only a single set of retaining-pins, folders, and cutters, it will be constructed of one-half the diameter that it will have when containing two sets. Whether it contains one set or two sets the folding-blades may be made to operate on each revolution of the carrier I or only on alternate revolutions. When operated on each revolution, the carrier I containing two sets will transversely fold two cuts from the webs on every revolution, but the carrier containing one set will transversely fold only one cut from the web on each revolution. When the folding-blades and pins are operated only on alternative revolutions of the carrier I, the web will be wound twice around the carrier; but the knife or knives operating on each revolution will cut each lap as it is applied, and upon the alternate revolutions the folding blade or blades will operate to fold the two laps together instead of folding each lap separately, as in the case where they operate on each revolution.

Fig. 3 is a duplicate of Fig. 2 in all its parts after the associated webs pass down the former *b* through the rollers 47 48, Fig. 1. In Fig. 3 the half of the web C which is associated with the web B is lettered C² to distinguish it from the half C' which is associated with web A, as shown in Fig. 2.

The formers I prefer to use are the same as those shown and described in Patent No. 529,680, dated November 20, 1894, and are made of metal.

Fig. 4 is a side elevation of Fig. 5, showing mechanism for folding (and superposing, if desired) the associated webs. 90 and 91 are shafts carried by the carrier I and upon which the pairs of folding-points 58 58^a and 59 59^a are fixed. When either of these points is swung into the radially-outward position of 58^a in Fig. 5 it will project into the opening between the rollers 62 and 63 and press the paper on the line of fold between those rollers. So long, however, as the points occupy the position shown at 59 59^a, Fig. 5, the sheets will continue to accumulate on the carriers I, because they will not be forced off of it between the rollers 62 63. Each time, however, that a sheet is placed upon the carrier it will be severed from the web by the knife 65 or 66; but it will still be held onto the carrier by the pins 56 or 57, because such pins are not retracted until the revolution occurs on which the folding blade or blades operate. Therefore by properly timing the intermittent movements of each of the pairs of points 58 58^a and 59 59^a so as to swing into radial position either during each revolution of the carrier I or only during each of a series of revolutions each cut from the associated webs may be folded separately or a series of cuts

may be superposed upon the carrier I and all folded together. I will now describe how this is accomplished. J J represent the frame for holding the shaft O of the carrier I, which is driven by the gear-wheel K. On the opposite end of the carrier-shaft O is a gear L, which engages with a gear M, which is fastened to a shaft V. The gear M is narrower than the gear L, and the bearings of the shaft V admit of the endwise movement of it and all parts carried by it without disengaging the teeth of the gears L and M. Fixed to the inner face of the gear M is a diamond-shaped cam W for working the folding-blades and impaling-pins. Upon the shaft O is fixed the gear N, which drives the gear P, turning on the stud R. Fixed to the gear P is a collar Q, provided with a circumferential cam-groove T. 82 is a pin moved by the cam-groove T and moving a rocker 81, upon one arm of which it is mounted. The rocker is pivoted to a stud S and carries upon its opposite arm a pin 80, extending into the peripheral groove of the wheel U, fixed on the shaft V. Now it will be seen that when the shaft V occupies its inward position, as shown in Fig. 4, the diamond cam W will engage the rollers 84 and 85 on the cross-head *y*, fixed to the shaft 90, and will hold the shaft 90 so as to bring one of the folding-points into folding position. It will do the same in passing the rollers 86 and 87 on cross-head *y'* of shaft 91. When, on the other hand, the cam-groove T slides the shaft V outward, as shown in Fig. 18, the cam W will not engage either the studs 84 85 or 86 87. 94 is a fixed ring concentric with the carrier I and surrounding the path of the studs 84, 85, 86, and 87, so as to hold them in the position shown at the top of Fig. 5, excepting at a point opposite the opening between rollers 62 and 63 a radial pocket is formed in the inside of the ring, which pocket in Fig. 5 is occupied by the stud 84. This ring therefore permits the folding-blades to be swung into the radial position (shown at bottom of Fig. 5) by the diamond-shaped cam W, but at all other points in the rotation of the carrier I holds the folding-blades in the inactive position. (Shown at the top of Fig. 5.) Thus by timing the speed of the collar Q relatively to the speed of the carrier I the cam W may be made to swing the folding-points into position on every revolution or on every series of revolutions of the carrier, as may be desired. The relative speed of the collar Q may be changed at any time by substituting for the gears N and P other gears of different diameters.

When it is desired to deliver the paper folded at every one-half revolution of the carrier I, the gear N may be removed from the shaft O and the shaft V pinned at the point 83, whereby the cam W will engage with the rollers 84 85 and 86 87 on the cross-heads *y y'* of the folding-blades every one-half revolution of the carrier I, or the carrier I may be constructed in the first place with

only a single set of folding, cutting, and pinning mechanism, as shown in Figs. 20 and 21. The leading end of the web or sheets, in case they are required to be superposed, is retained on the carrier I by means of pins 57, which are carried by rod 97, carried by the carrier I, parallel with its axis. The pins 57 pass through suitable bearings, in which they are free to reciprocate, and project in their outward position beyond the surface of the carrier I. The rod 97 is connected to the rockers 100, pivoted to the studs 101, which are also mounted on the carrier I. The rockers hold the pins outward under the influence of the springs 104. On the ends of the rockers 100 are rollers 106, which engage with cams 61, fast to the cross-heads y' . When the shaft 91 is turned by the cam W to fold the web or sheets from the carrier I, it rocks the rockers 100, retracting pins 57 and releasing the web or sheets. As soon as the cam W passes by the pins return to their former position by the action of the springs 104 until withdrawn again. The webs are severed or perforated transversely into sheets by the projecting knife 66, mounted in box 112 on the carrier I, which works against the folding-roller 63, which has a box 64, with a recess 114 to receive the edge of knife 66. This is very essential, for if the web were continuously wrapped around the carrier I while superposing the collected webs the knife would not cut the collected webs on account of their thickness. In this construction the webs are cut or severed at every rotation of the carrier I on every other transverse margin, as required, before superposing, leaving the cut or cuts to be folded on the intermediate transverse margins.

By placing the carrier I parallel to the printing mechanism the webs can pass directly from the roller 31 to the carrier I, as shown in Fig. 21, when they will be cut and folded or superposed, the cuts being on every other transverse margin. The forms on the printing-cylinders in this case will be placed with their column-rules parallel with the axes of the different form-cylinders, the former and folding-rollers 50 51 being omitted. This product of the superposed and associated pages may be increased in multiples of fours indefinitely until the number of thicknesses of sheets become too great to be handled by the carrier I, thereby saving space for a machine running at a high rate of speed and saving an extra cutting-cylinder and an extra superposing-cylinder.

Figs. 6, 7, and 8 indicate partly-unrolled webs A B C with different possible positions of pages as they appear for six-page papers on a two-page-wide press.

Figs. 9, 10, and 11 indicate the surfaces of the different form-cylinders, showing the corresponding arrangements of the forms for a six-page paper.

Figs. 12, 13, and 14 indicate the leading of the webs after the longitudinal fold is made

to the different folding mechanism required by the imposition of the forms arranged on the printing mechanism. (Shown in Figs 9, 10, and 11.)

When the product is greater than six, eight, ten, or twelve pages from the printing mechanism of a two-page-wide press, the association will be accomplished by superposing the different cuts or sections, the forms in this instance being placed behind each other, similar as shown and described in United States Patent to me, No. 399,659.

Fig. 17 shows an association of the different webs—viz., for a forty-eight-page paper four sections of twelve. When a printing mechanism consists of four pages wide, the longitudinal former and folders and the folding-carriers require to be duplicated, the formers being placed side by side. In this case all the webs or any two of them or the whole of some and the half of others may be brought together to one folding-carrier and associated after the primary fold is made, there to be superposed, if desired, and thence delivered as one product. Such an arrangement of the folding and superposing devices is shown in Fig. 19. The four-page-wide web is split by the knife 31 with the halves a a' , which are folded longitudinally by the rollers 50 51 and 50^a and 51^a. Then they may be combined by running both over the roller i' onto the carrier I', or they may be combined by running both over the roller i onto the carrier I. By running several full webs or full-width and half or quarter width webs on top of each other over roll 31 a great number of combinations can be effected at roll i' . Thus if the strip a of Fig. 19 contains a half-web and a quarter-web and strip a' contains two half-webs there will be six pages coming simultaneously on strip a and eight pages coming simultaneously on strip a' , making, after being folded by carrier I', the fourteen-page combination. (Shown in Fig. 15.) For a sixteen-page paper six pages may come from a and ten from a' , or vice versa; for eighteen pages, six and twelve or twelve and six; for twenty pages, eight and twelve or twelve and eight; for twenty-four pages, twelve and twelve. If after the pages are combined on roller i' it is required to superpose successive cuts or sections on each other to be associated the second time, this may be done by the operation of the carrier I', so as to superpose.

In the construction shown in Fig. 19 it will be observed that after the simultaneous printing on the web of a plurality of pages and after the longitudinal splitting and longitudinal folding of the two strips the two strips are caused to travel in the same direction with and are associated with each other, and as soon as they are associated they are received by the carrier I', which they do not leave until they receive their final transverse fold and final transverse cut. By thus postponing the transverse cut until after the two strips have been associated and placed upon

the carrier from which they are to be folded I substantially prevent any difficulty arising from irregularity of tension produced by conducting the strips to intermediate severing mechanism on their way to the folding-carrier, such as is shown in my Patent No. 529,680, dated November 20, 1894.

I do not limit myself to the form of mechanism described, since I am aware that it may be varied in construction and number of parts to a great extent without departing from the principle of my invention.

I claim—

1. In combination, a rotary carrier, the inverse folding-blades 59 and 59^a pivoted thereto and carried thereby, a device 57 for retaining the leading end of the sheet or web, a lever connected with said device, and a cam connected with said blades whereby said device is moved as either of said blades is thrown into folding position, substantially as described.

2. In a rotary press containing a plurality of web-printing mechanisms and folding mechanisms, in combination, the impression-cylinders 2, 3, 7 and 11 arranged at the corners of a quadrilateral, a slit located within said quadrilateral whereby one of said webs is split as it passes through said quadrilateral and guides whereby the two halves of said split web are conducted out of said quadrilateral at opposite sides thereof, substantially as described.

3. In a rotary press containing a plurality of web-printing mechanisms and two folding mechanisms arranged on opposite sides of the machine in combination the impression-cylinders 2, 3, 7 and 11 arranged at the corners of a quadrilateral, guides 20, 21 and 22, 23, whereby one of the webs is conducted through said quadrilateral and a slit located within said quadrilateral whereby said web is split as it passes through said quadrilateral, substantially as described.

4. In a rotary press containing a plurality of web-printing mechanisms and folding and

severing mechanisms, the folding mechanisms being located at opposite sides of the machine in combination, the final impression-cylinders, as 3, 7, and 11 arranged at the corners of a polygon, a longitudinal slit, as 30, for one of said webs, as B, in its path from the impression-cylinder 11, guiding mechanism whereby one half of said slit web is conducted through said polygon and associated with one of the other webs, as C, and guiding mechanism whereby the other half of said slit web is associated with the other of said webs, as A; each printing mechanism being constructed to deliver its printed web into the space within said polygon, substantially as described.

5. In a rotary press containing a plurality of web-printing mechanisms and folding and severing mechanisms in combination, the entrance-guides, as 19, 32 and 35 for the respective webs located at the corners of a polygon, the collecting-guides, as 20, 21, within said polygon, the printing mechanism of each web being grouped between its entrance-guide and said collecting-guide and each printing mechanism being constructed to deliver its printed web into the space between said groups, substantially as described.

6. In combination, the rotary carrier I, a folding-blade pivotally connected therewith, the folding-rollers presenting an opening substantially radial to said carrier, a cam W, a cam member 94 presenting a substantially circular bearing-surface extending in a circle concentric with said carrier excepting at a point adjacent to the opening between said rollers, substantially as described; whereby the said folding-blade is held by said circular member normally in inactive position during the rotation of said carrier but is swung into radial position by said cam to cooperate with said folding-rollers.

JOSEPH L. FIRM.

Witnesses:

Mrs. R. S. JOHNSON,
A. H. BLAIR.