(No Model.) 8 Sheets—Sheet 1.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

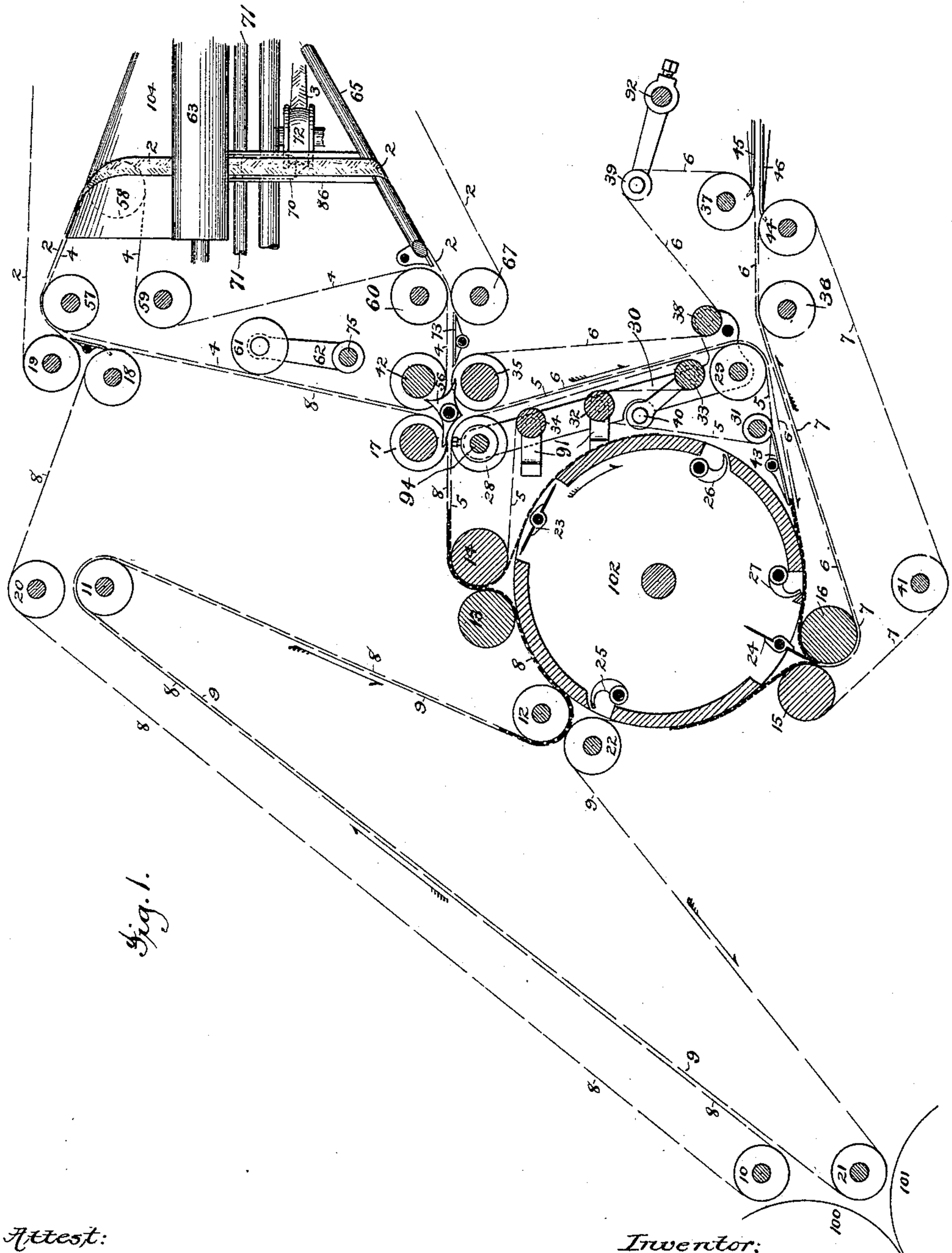

Fig. 1.

Attest:
Geo. H. Graham
J. A. Tracy

Inventor:
Luther C Crowell
by Munn & Philipp
Attys.

(No Model.) 8 Sheets—Sheet 2.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

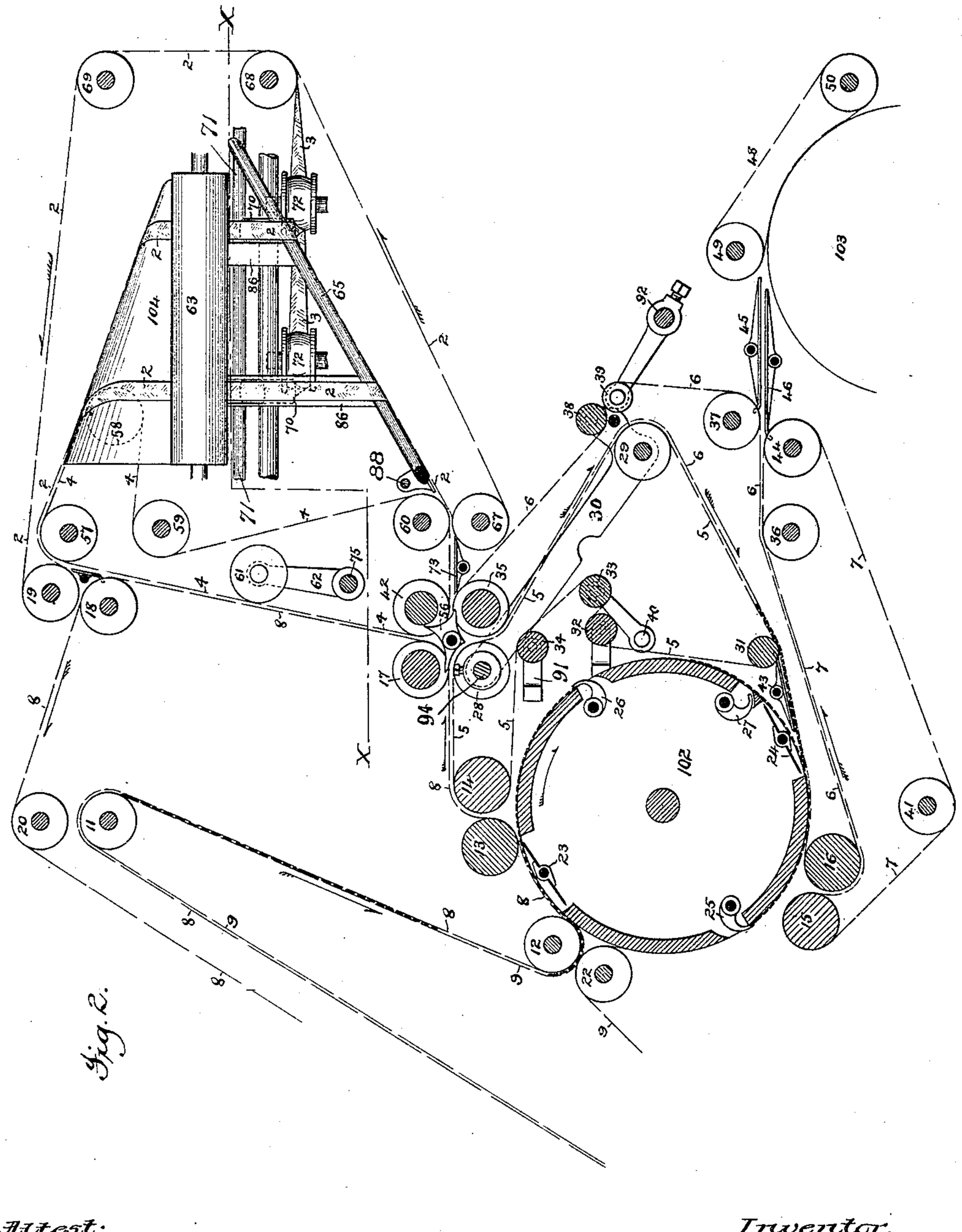

Fig. 2.

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(No Model.)

8 Sheets—Sheet 3.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

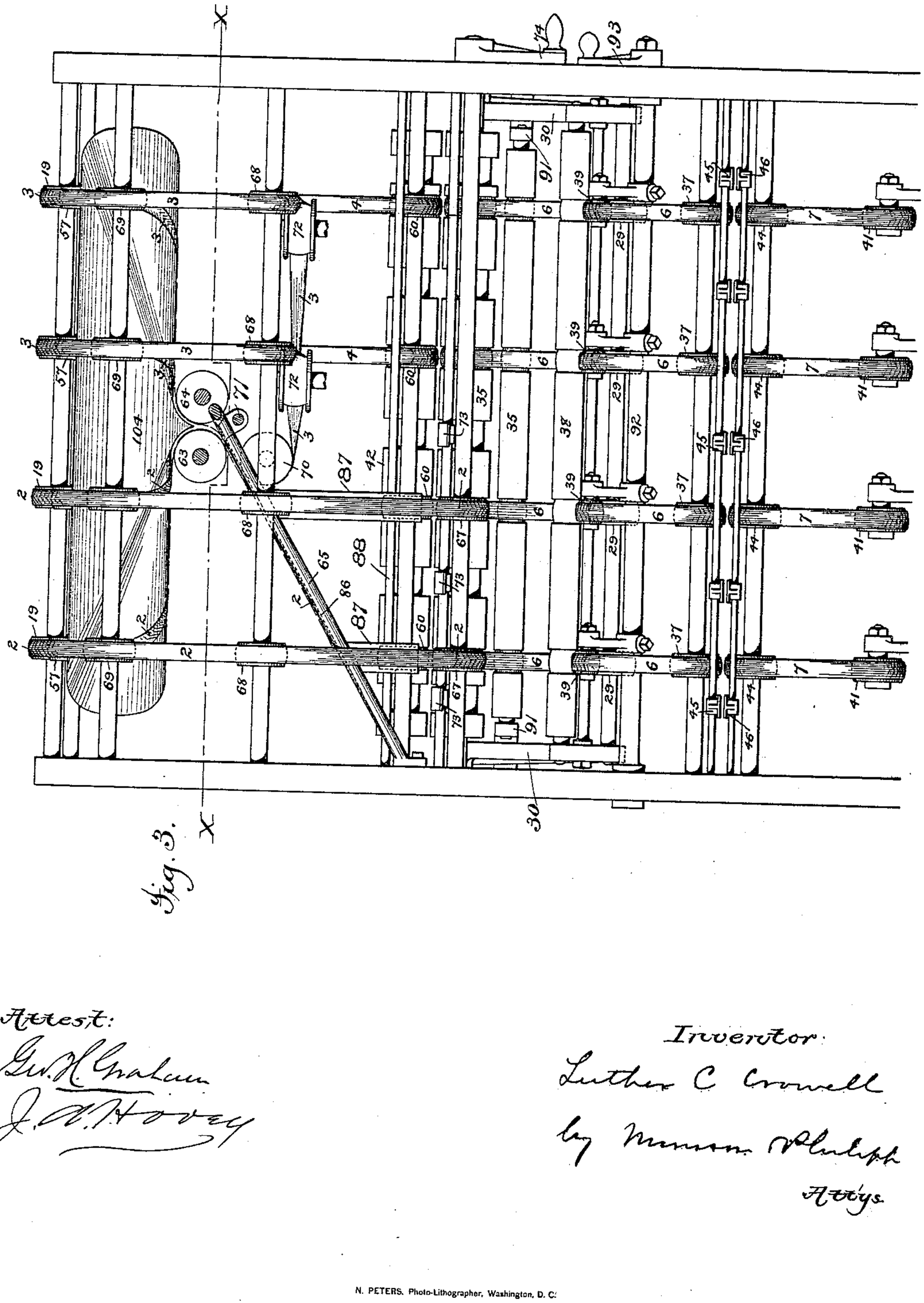

Fig. 3.

Attest:
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(No Model.)

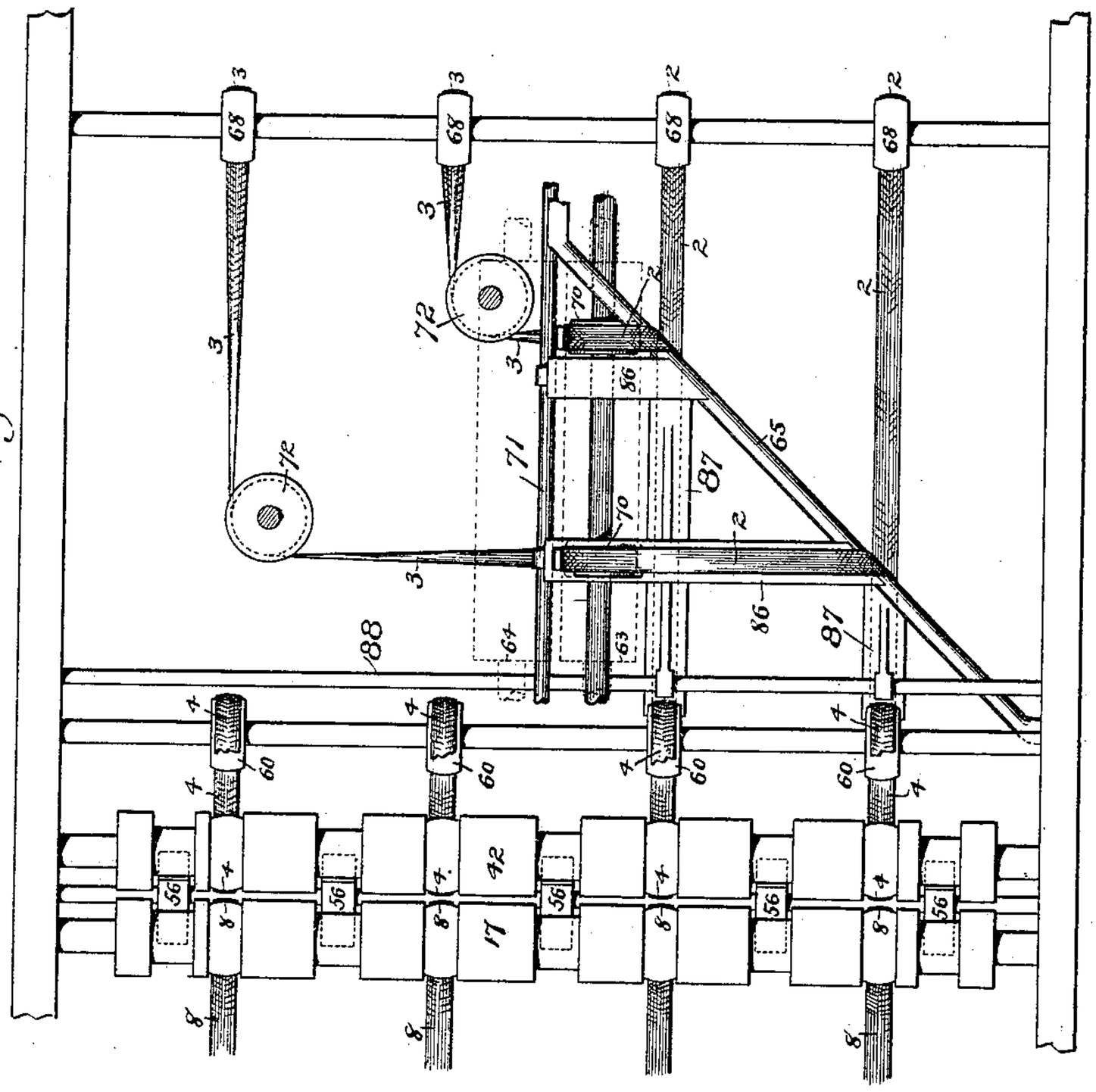
8 Sheets—Sheet 4.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

Fig. 4.

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Geo. H. Graham

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(No Model.)

8 Sheets—Sheet 5.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

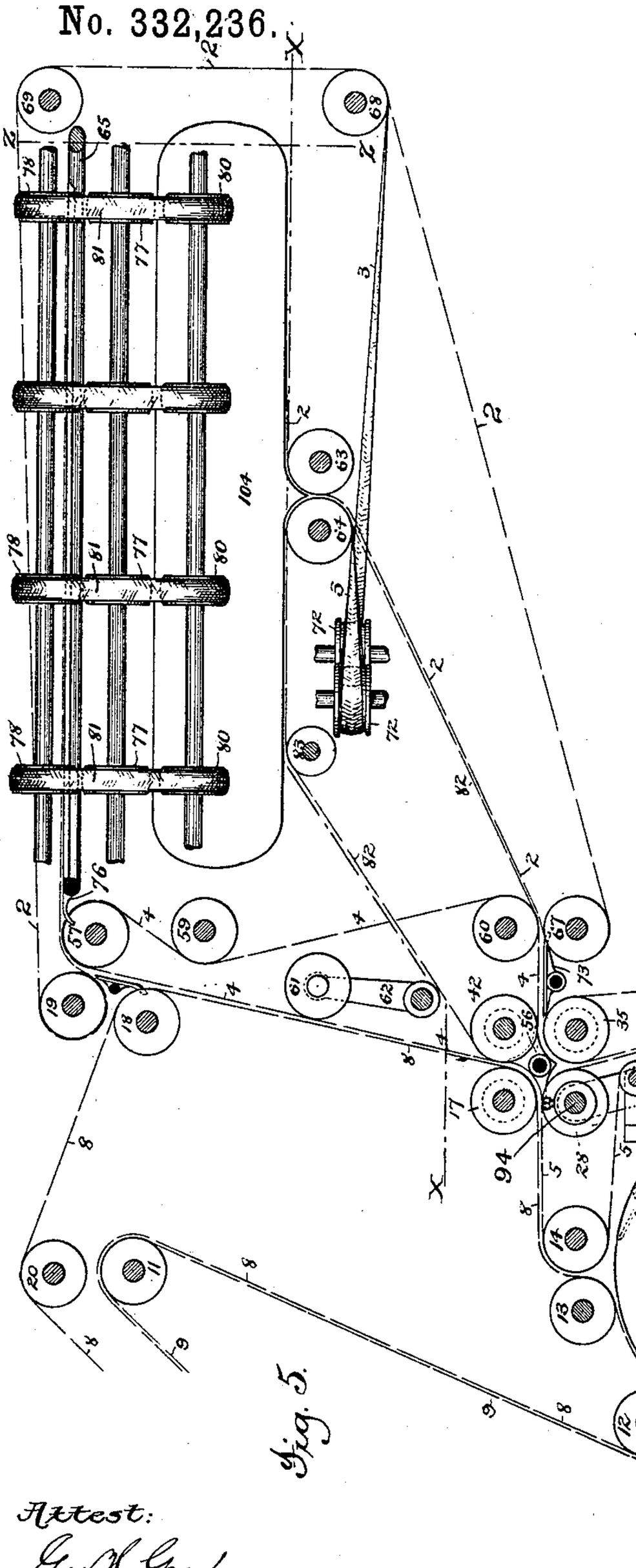

Fig. 5.

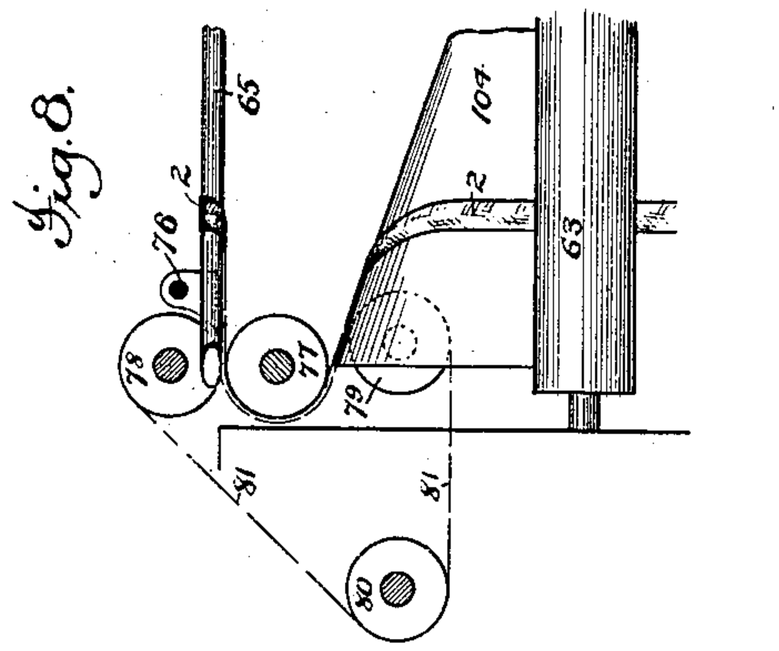

Fig. 8.

Attest:
Geo. K. Graham
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(No Model.)

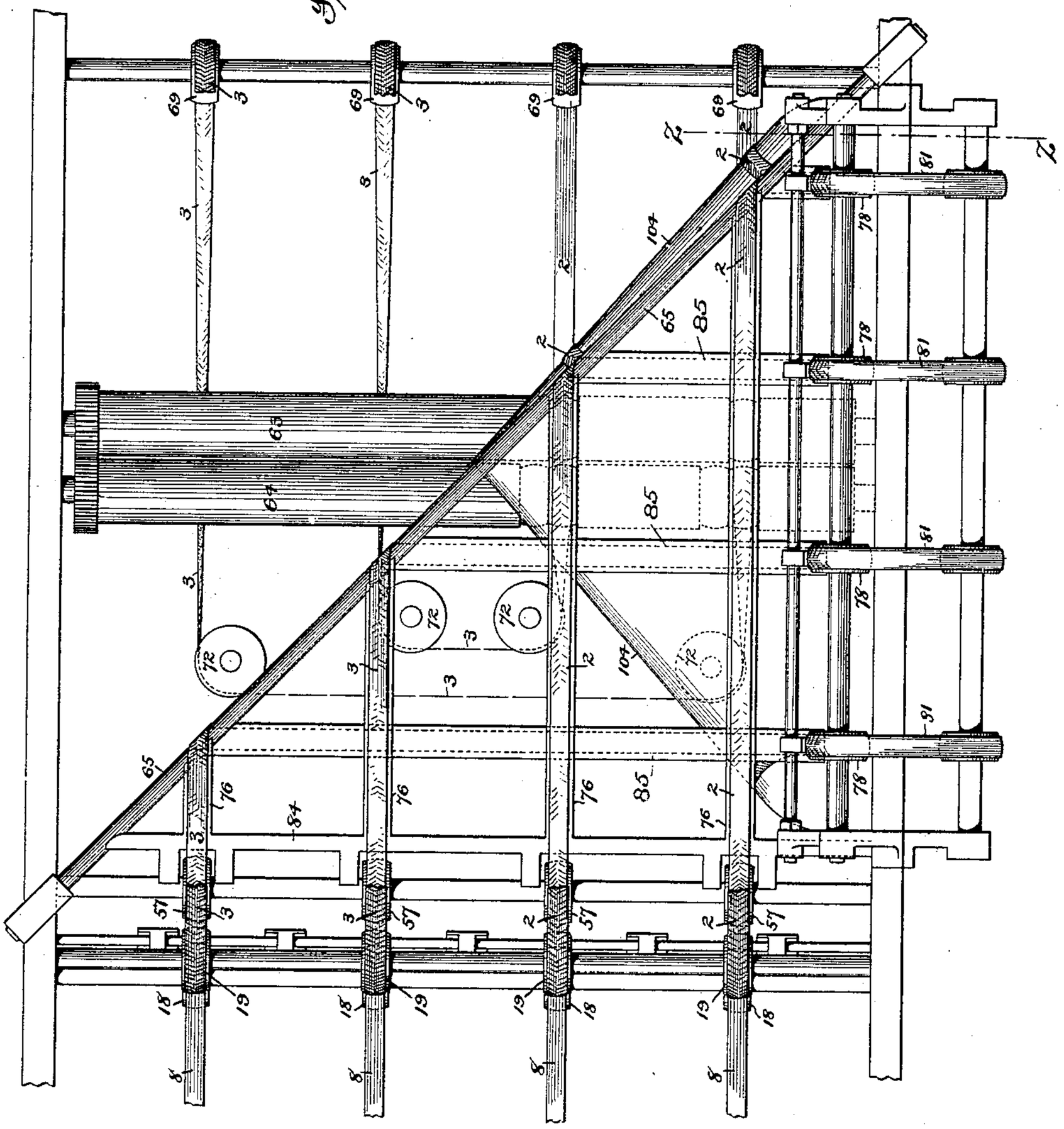
8 Sheets—Sheet 6.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

Fig. 6.

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(No Model.)

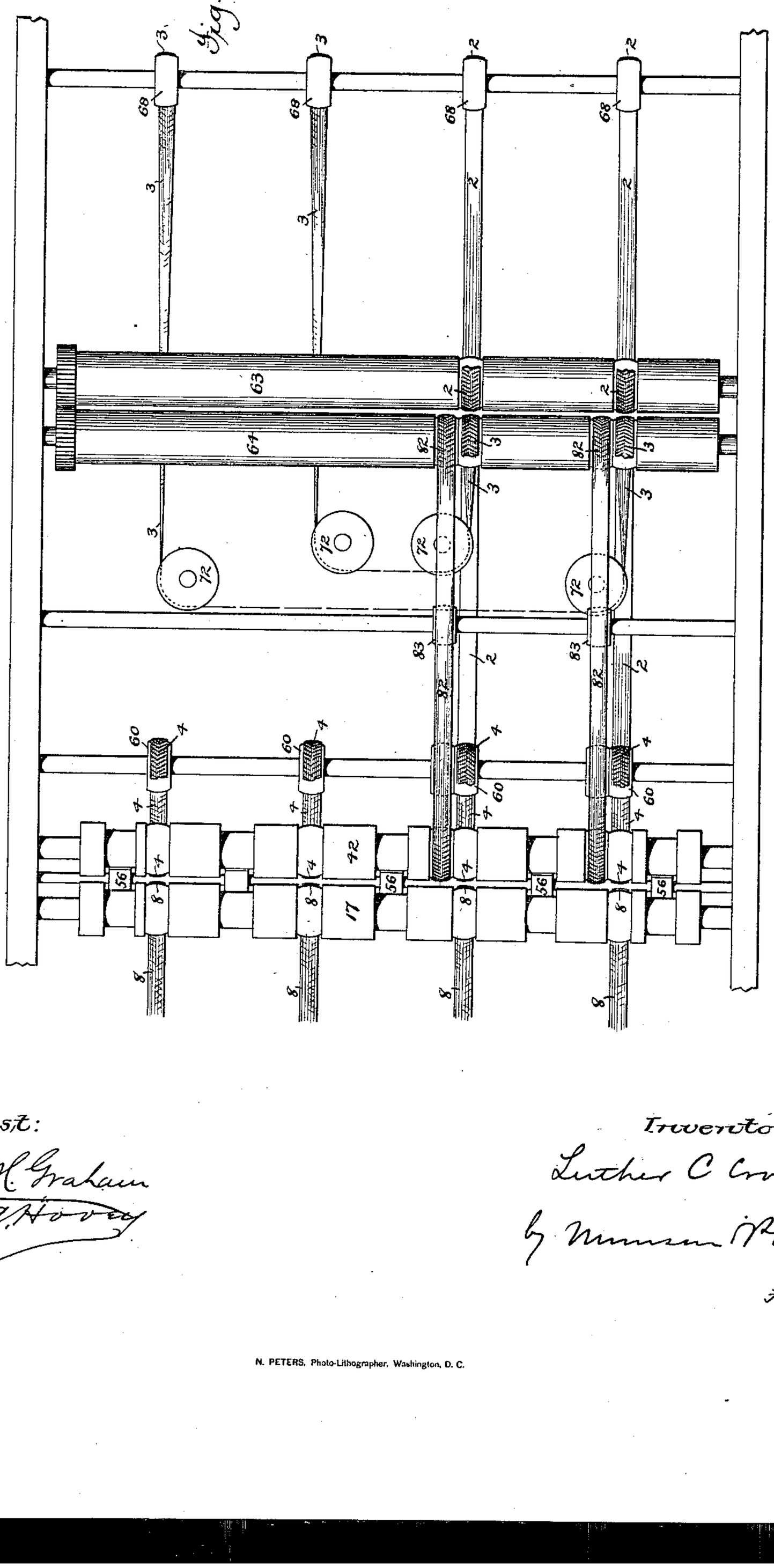
8 Sheets—Sheet 7.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

Fig. 3.




Attest:

Geo. H. Graham

J. A. Hovey

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Luther C Crowell

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Attys.

(No Model.) 8 Sheets—Sheet 8.

# L. C. CROWELL.

## SHEET DELIVERY APPARATUS.

No. 332,236. Patented Dec. 15, 1885.

Fig. 10.

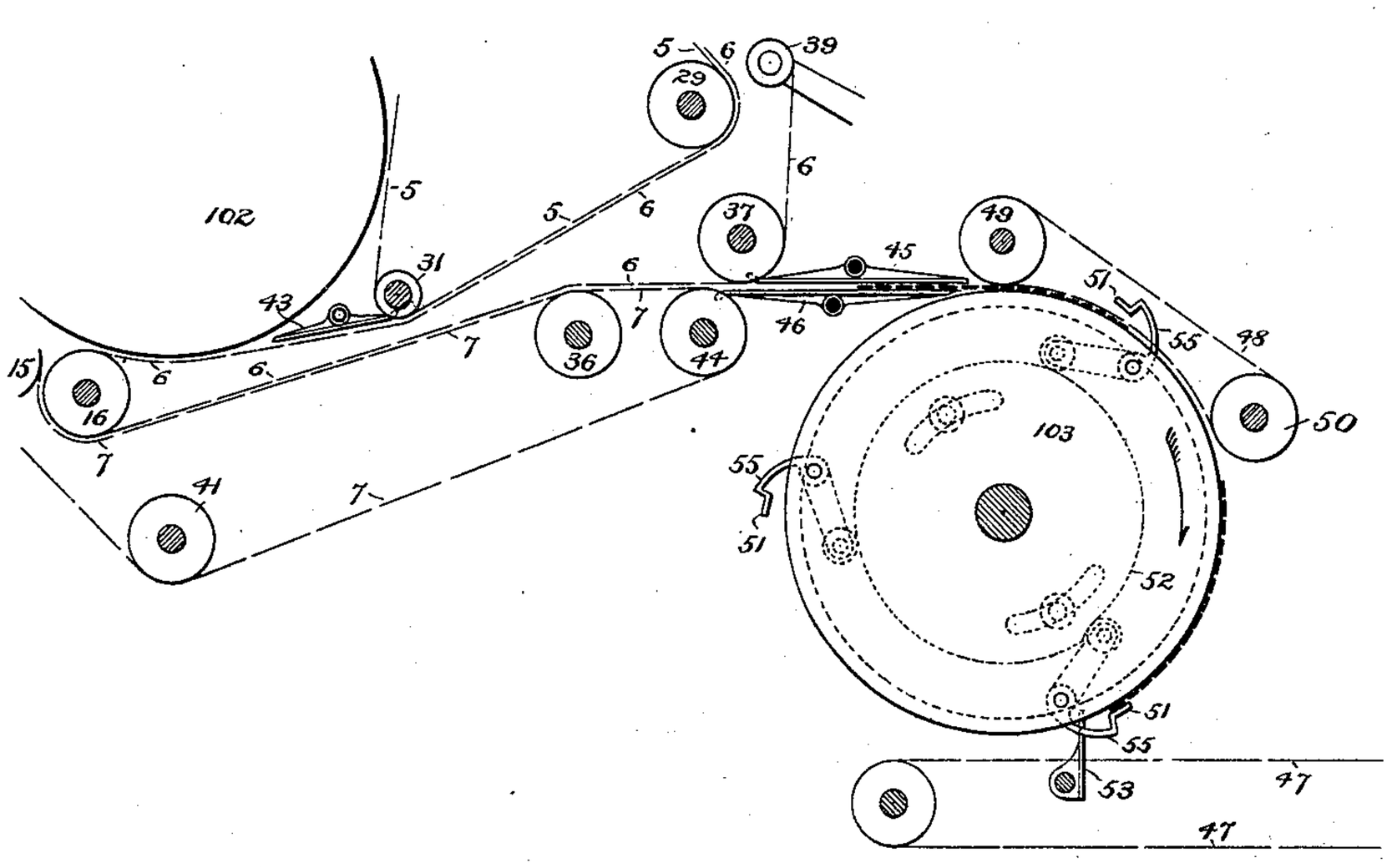
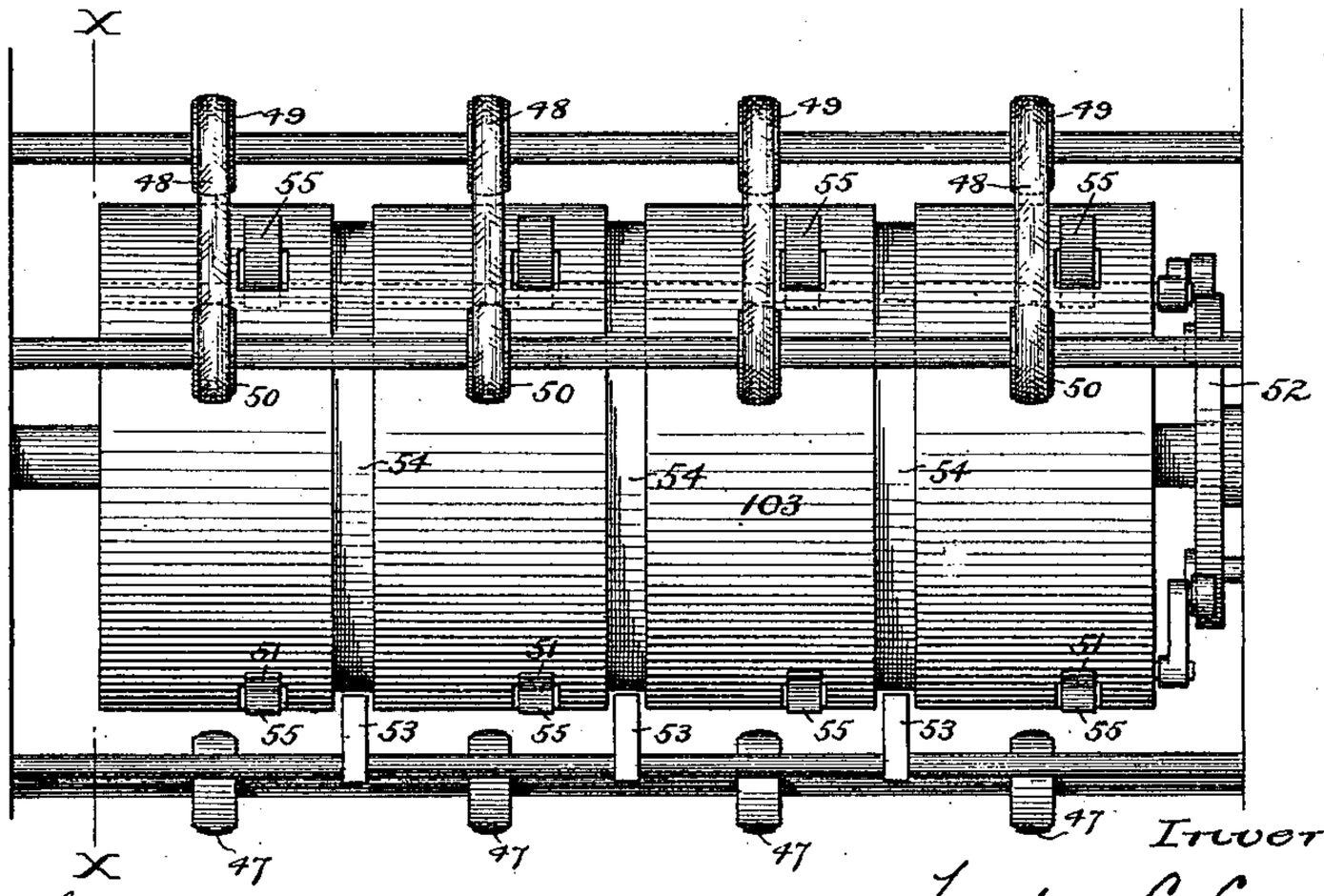



Fig. 9.




Attest:
Geo. H. Graham
J. A. Torrey

Inventor,
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# UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR TO R. HOE & CO., OF NEW YORK, N. Y.

## SHEET-DELIVERY APPARATUS.

SPECIFICATION forming part of Letters Patent No. 332,236, dated December 15, 1885.

Application filed October 23, 1884. Serial No. 146,256. (No model.)

*To all whom it may concern:*

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Sheet-Delivery Apparatus, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

In United States Letters Patent No. 269,021, granted December 12, 1882, I have shown and described a folding delivery apparatus which is adapted to operate in connection with a web-perfecting printing-machine to deliver the printed product in sheets, or associated pairs of sheets, having two parallel transverse folds, or in half-sheets folded once transversely. The mechanism shown in said Letters Patent by which this is accomplished consists, essentially, of two folding and cutting cylinders, each of which is provided with a pair of co-operating folding-rolls, and is operated, when sheets or associated pairs of sheets are being delivered, to impart one of the two parallel transverse folds to each sheet or pair of sheets, and when half-sheets are being delivered to impart the single transverse fold to alternate sheets.

The present invention relates to a mechanism having many of the general characteristics of that shown in the Letters Patent referred to, it being the object of the invention to simplify said mechanism in many of its details, and also to provide means by which the full sheets, or associated pairs of full sheets, may, when desired, be given a longitudinal fold after they have received the first and before they receive the second transverse fold.

To these ends the invention consists in various details of construction and combinations of mechanisms, all of which will be hereinafter so fully explained and particularly pointed out as to render a further preliminary description unnecessary.

In the accompanying drawings, Figure 1 is a sectional elevation of a delivery mechanism embodying the present invention, the sheet laying or piling mechanism, and also the supporting frame-work and the gears for communicating motion to the various parts, being omitted. Fig. 2 is a similar view showing the parts adjusted to the proper position to operate upon half-sheets. Fig. 3 is an end elevation, looking from the right of Figs. 1 and 2, the parts being in the position shown in Fig. 2. Fig. 4 is a partial plan view of the mechanism, taken upon the line *x x* of Figs. 2 and 3. Fig. 5 is a view similar to Figs. 1 and 2, showing the longitudinal folder arranged parallel with instead of at right angles to the transverse folding mechanism. Fig. 6 is a plan view of the longitudinal folding mechanism when the same is arranged as shown in Fig. 5. Fig. 7 is a partial plan view of the mechanism, taken upon the line *x x* of Fig. 5. Fig. 8 is a partial side elevation of the longitudinal folder, the same being taken upon the line *z z* of Figs. 5 and 6. Fig. 9 is a front elevation of the sheet laying or piling mechanism; and Fig. 10 is a side elevation of the same, taken upon the line *x x* of Fig. 9.

Referring to said drawings, it is to be understood that the delivery mechanism therein shown comprises two transverse folding mechanisms, which in the embodiment shown consist of a rotating cylinder provided with two rotating folding-blades and two pairs of co-operating rolls, a longitudinal folding mechanism which is arranged to act upon the sheets after they have been acted upon by the first and before they have been acted upon by the second of the transverse folding mechanisms, a sheet-conveying mechanism consisting of tapes and pulleys, by which the sheets are delivered from the first transverse folding mechanism to the longitudinal folding mechanism, and thence to the second transverse mechanism, or directly from the first to the second of the transverse mechanisms, and a sheet laying or piling mechanism.

Referring particularly to Fig. 1, it is to be understood that the web of paper, after having been perfected by any common form of web-printing mechanism, is entered between the cutting-cylinders 100 101, which operate in the usual manner to partially sever the web upon the lines between the printed sheets. After passing the cylinders 100 101, the web

is entered between the series of tapes 8 9, which are accelerated in the usual manner, so as to complete the severance of the sheets from the web, and provide proper working-spaces between them in their line of travel.

The tapes 8 9 are arranged as follows: The tapes 8 pass around pulleys 10; thence around pulleys 11 12; thence for a short distance in contact with the folding-cylinder 102 and between the pair of folding-rolls 13 14; thence around pulleys 17; thence upward around pulleys 18, returning around pulleys 20. The tapes 9 pass around pulleys 21; thence around pulleys 11 12; thence around the folding-cylinder 102, returning around pulleys 22. By this arrangement it will be seen that the successive sheets severed from the web are carried by the tapes 8 9 onto the surface of the folding-cylinder 102. This folding-cylinder is provided with two rotating folding-blades, 23 24, which are located at opposite points upon the cylinder, and are constructed and operated in the usual manner, and with two pairs of folding-rolls, 13 14, 15 16, with which the blades 23 24 co-operate to fold the sheets from the cylinder. This cylinder is also provided with three sets of grippers, 25 26 27, which are also of the usual construction and operated in the usual manner, the sets 25 26 being located at opposite points upon the cylinder, between the blades 23 24, while the set 27 is located just in the rear of the blade 24. The purpose of this arrangement will be made clear when the operation of the mechanism is explained.

The folding-rolls 13 14 and 15 16 are provided with three series of co-operating tapes, 5 6 7, which are arranged as follows, and which, together with the tapes 8, act to convey the folded sheets away from the rolls: The tapes 5 pass around the roll 14; thence around pulleys 28, located directly beneath the pulleys 17 and arranged to turn loosely upon a transverse shaft, 94; thence downward around pulleys 29, which are mounted upon a shaft journaled in the ends of a pair of arms, 30, extending from the shaft 94; thence inward around pulleys 31; thence upward around pulleys 32, and downward again around adjustable pulleys 33, returning around pulleys 34. The pulleys 32 34 are mounted upon shafts which are journaled in brackets 91, secured to the side frames of the machine, as shown in Figs. 1, 2, 3, and 5, while the shaft of the pulleys 33 is mounted in arms extending from a rock-shaft, 40, which is journaled in the side frames of the machine, and is provided with means by which the pulleys can be shifted so as to keep the tapes at the proper tension. The tapes 6 pass around pulleys 35, located in front of the pulleys 28; thence downward around the pulleys 29; thence beneath the cylinder 102 and around the folding-roll 16; thence outward above pulleys 36 44, and around pulleys 37; thence upward around pulleys 39, mounted upon arms extending from a rock-shaft, 92, which is journaled in the side frames of the machine, and is provided with an arm or handle, 93, by which the pulleys can be shifted so as to keep the tapes at the proper tension; thence rearward, returning around pulleys 38, which are mounted upon a shaft which is journaled in the ends of the arms 30. The tapes 7 pass around the folding-roll 15; thence beneath the folding-roll 16, and outward above the pulleys 36, and around the pulleys 44, returning around pulleys 41. A series of stationary guides, 43, are located between the pulleys 31 and the cylinder 102, so as to co-operate with the tapes 6 in conveying the sheets from said pulleys to the cylinder. As the sheets emerge from between the pulleys 37 44, they pass between stationary guides 45 46 onto the surface of a rotary carrier or fly, 103, (see Figs. 9 and 10,) which is similar in construction to that shown in United States Letters Patent No. 281,754, dated July 24, 1883, which operates to pile the sheets upon a series of slowly-moving tapes, 47, to be conveyed from the machine. The carrier or fly is provided with three sets of grippers, 51, which are operated by a stationary cam, 52, in the usual manner, to take and release the sheets delivered to the carrier at the proper times, and with a series of co-operating stops, 53, the ends of which enter circumferential grooves 54, formed in the carrier, as shown in Fig. 9. The stops 53 are located just in advance of the axis of the carrier 103, so as to arrest the sheets as they are released by the grippers 51 and prevent them from being carried beyond the proper point. In the structure shown in the Letters Patent referred to the successive sheets were pressed away from the carrier or fly, so as to prevent them from fouling with the incoming sheets, by means of projections formed upon the carrier just in advance of the grippers. In the present case, however, these projections are omitted from the carrier, the same function being performed by projections 55, formed upon the backs of the grippers. By forming the grippers in this manner, so that they will perform the function of the projections shown in the former structure, the construction of the carrier is simplified, and an equally effective means is provided for keeping the successively-delivered sheets pressed away from the carrier. The carrier or fly 103 is provided with a series of short co-operating tapes, 48, which pass around pulleys 49 50 and serve to hold the leading ends of the sheets onto the carrier until taken by the grippers.

The sheet laying or piling mechanism just described may also be provided with mechanism such as shown in my application for Letters Patent filed October 6, 1884, No. 144,808, to cause irregularities in the pile of sheets, so as to permit it to be divided into lots containing some predetermined number without the necessity of counting.

The mechanism thus far described is, as will hereinafter appear, capacitated to deliver full sheets, or two or more associated full sheets with two parallel transverse folds, or half-sheets folded once transversely.

While the full-sheet product, when delivered in this form, is suitable for many purposes, yet it is sometimes desirable, particularly where the sheet is of large size or is printed with eight pages, that it should be folded to smaller dimensions. It is therefore desirable that the apparatus should be provided with mechanism by which, when desired, the full-sheet product can be delivered with one longitudinal fold, in addition to the transverse folds just mentioned, and that this mechanism should be so arranged that this longitudinal fold will be imparted after the first and before the second of the transverse folds. To effect this a switch, 56, (see Fig. 1,) is located between the pulleys 17 28, and is arranged so that the sheets folded between the rolls 13 14 may be directed either into the bite of the tapes 5 6, to be conveyed directly to the folding-rolls 15 16, or into the bite of the tapes 8 and a co-operating series of tapes, 4, to be conveyed to the longitudinal folder 104, to be afterward returned to the rolls 15 16, as will hereinafter appear.

The longitudinal folder 104, as herein shown, is of substantially the construction shown and described in United States Letters Patent No. 281,619, granted July 17, 1883, although it may be of the construction shown in my application for Letters Patent filed February 8, 1884, No. 120,116, or of any other approved form. It is provided with the usual rolls, 63 64, between which the sheets pass as they leave the folder, and with suitable tapes, as the pairs or series 2 3, which operate to conduct the sheets over its surface and between the rolls 63 64 and to the subsequent folding mechanism.

The folder 104 may be so arranged that the rolls 63 64 will be either parallel with or at right angles to the cylinder 102. As shown in Figs. 1, 2, 3, and 4, it is so arranged that the rolls 63 64 are at right angles to the cylinder. When the folder is in this position, its base is parallel with the cylinder 102, and the tapes 4, which co-operate with the tapes 8 to conduct the sheets from the pulleys 17 28 to the folder, are arranged as follows: These tapes pass around pulleys 42, located just above the pulleys 35 and in front of the pulleys 17; thence upward around pulleys 57; thence around pulleys 58, located just at the base of the longitudinal folder, returning around pulleys 59 60. The length of the pathway formed by the tapes 4 8, and also the tension of said tapes, can be regulated at pleasure by means of a series of pulleys, 61, which are mounted upon the ends of adjustable arms 62, extending from a transverse shaft, 75. It will be observed that when the folder is arranged in this position the sheets are necessarily so turned that as they emerge from the rolls 63 64 they are moving in a plane at right angles to that in which they have previously moved, and this fact makes it necesssary, in order to present the sheets a second time to the cylinder 102 to receive their third fold, that they should be turned back to their original line of travel. For this purpose a turning-bar, 65, is provided, and the tapes 2 3 are so arranged as to conduct the sheets around this bar and turn them back to their original line of travel before presenting them for the third or final fold.

The arrangement of the tapes 2 3 is as follows: The tapes 2 pass around pulleys 19, located above the pulleys 18; thence above the pulleys 57, and downward across the face of the folder 104, (see Fig. 2,) passing around one of its turning-edges; thence inward between the rolls 63 64; thence laterally around the turning-bar 65, (see Figs. 1, 2, and 3,) and backward around pulleys 67, located directly beneath the pulleys 60, returning around pulleys 68 69, as shown in Figs. 2 and 3. The tapes 3 pass around pulleys 19; thence above the pulleys 57, and downward across the face of the folder 104, passing around its opposite turning-edge, (see Fig. 3;) thence inward between the rolls 63 64, where they unite with the tapes 2; thence laterally beneath the tapes 2 and around pulleys 70; thence backward around skew-pulleys 72, (see Fig. 4,) returning around pulleys 68 69. The space between the pulleys 35 67 is bridged by stationary guides 73, which co-operate with the tapes 4 to carry the sheets from the pulleys 60 67 to the pulleys 35 42. The space between the pulleys 70 and the turning-bar 65 is bridged by stationary guides 86, (see Figs. 2 and 4,) which are arranged to support the sheets against the tapes during their passage from the pulleys to the bar. The forward ends of these guides are secured to the turning-bar, and their rear ends are secured to a longitudinal bar, 71, one end of which is secured to the turning-bar and the other to a bar extending transversely of the machine. The space between the bar 65 and the pulleys 60 is also bridged by like guides, 87, which lie directly above the tapes 2. The rear ends of these guides are secured to the turning-bar and their forward ends to a bar, 88, extending transversely of the machine.

The operation of the apparatus just described is as follows: If it is desired to deliver the product in the form of full sheets having two parallel transverse folds only, one of the knives in the cutting-cylinders 100 101 will be removed, the shaft 94 will be adjusted so as to bring the arms 30 to the position shown in Fig. 1, and secured in said position by means of the handle or lever 74, the pulleys 33 39 being suitably adjusted to give the tapes 5 6 the proper tension, the grippers 26 will be rendered inoperative, and the switch 56 will be secured in the position shown in said figure, so as to direct the sheets from between the tapes 5 8 into the bite of the tapes 5 6. As the end of the partially-severed web passes forward between the tapes 8 9, said tapes being accelerated, as before stated, will complete the severance of the sheets from the web and provide the necessary working-spaces between them. As the end of the first sheet passes around the pulleys 12 and arrives upon

the surface of the cylinder 102, it will be taken by the grippers 27 and carried forward upon said cylinder until the folding-blade 23 arrives in proper position to fold said sheet off from the cylinder into the bite of the rolls 13 14, at which time said grippers will be operated to release the leading end of the sheet, and simultaneously therewith the blade 23 will be operated, so as to give the sheet its first transverse fold between the rolls 13 14, from which rolls the sheet, now folded once transversely, will pass forward between the tapes 5 8, and be directed by the switch 56 into the bite of the tapes 5 6, to be presented to the under side of the cylinder 102. When the cylinder has completed one revolution, the leading end of the second sheet will have arrived upon its surface, and the grippers 27 will be again operated so as to take the sheet, and the operation just described will be repeated. Just before the second sheet is folded off the cylinder by the blade 23 the leading end of the first sheet which has been directed into the bite of the tapes 5 6 will emerge from beneath the guides 43, and will be taken by the grippers 25 and carried forward upon the surface of the cylinder 102 until the blade 24 arrives in position to fold the same between the rolls 15 16, at which time the grippers 25 will be operated to release the sheet, and the blade 24 operated to fold the same into the bite of said rolls, as indicated in Fig. 1, thus giving to the sheet a second transverse fold parallel to the first. As the leading end of the second sheet emerges from beneath the guides 43, the grippers 25 will have again arrived in position to take said sheet, and the operation just described will be repeated, and thus the sheets will continue to be presented in succession to each of the two folding-blades, so as to receive two parallel transverse folds. From the rolls 15 16 the twice-folded sheets will pass forward between the tapes 6 7, and be projected between the guides 45 46 and onto the surface of the carrier 103, as shown in Fig. 10, to be taken by the grippers 51 and laid upon the tapes 47.

If it is desired that the sheets, in addition to the two transverse folds just described, shall receive a longitudinal fold between the two transverse folds, the switch 56 will be shifted so that the sheets, instead of being directed from the tapes 5 8 into the bite of the tapes 5 6, will be directed into the bite of the tapes 4 8, to be conveyed to the longitudinal folder. The sheets then, as they are folded by the blade 23 between the rolls 13 14, instead of passing directly to the under side of the cylinder 102, will pass upward between the tapes 4 8, and be conveyed across the face of the longitudinal folder 104 and between the rolls 63 64 by the tapes 2 3, where they will receive a second fold at right angles to the first fold. After passing the rolls 63 64 the sheets thus folded will be conveyed by the tapes 2 3 around the turning-bar 65, and be presented in proper position between the pulleys 60 67, by which they will be advanced to the pulleys 35 42, from which they will be directed by the switch 56 into the bite of the tapes 5 6, to be conveyed to the under side of the cylinder 102, as in the operation first described. Just before the fourth sheet taken by the grippers 27 arrives in position to be folded between the rolls 13 14, the leading end of the first sheet, which has been directed into the bite of the tapes 4 8, as just described, will emerge from beneath the guides 43, and be taken by the grippers 25, and will, as the blade 24 arrives in proper position, be folded between the rolls 15 16, thus receiving a third fold at right angles to the second and parallel to the first, and thus the operation will continue to be repeated, the sheets being delivered to the carrier or fly 103 and laid upon the tapes 47, as already described. If it is desired that the product shall consist of two or more full sheets associated together and folded as just described, it is only necessary to provide means by which two or more sheets will be associated before they are presented to the cylinder 102, and this may be done either by printing upon a double or triple width web, which is afterward split, and has its sections associated before they are presented to the cutting-cylinders, or by printing upon a single-width web, and associating the succeeding sheets by any of the well-known mechanisms for that purpose. If it is desired that the product shall consist of half-sheets folded once transversely, the cutting-cylinders 100 101 will be provided with two cutting-blades, so as to sever the web into sheets of one-half the ordinary length, the grippers 27 will be rendered inoperative, and the grippers 26 will be rendered operative. The cam which operates the grippers 25 will be shifted so that said grippers, instead of being closed to grasp the sheet as it emerges from beneath the guides 43, will be closed to grasp it as it arrives upon the cylinder, the swinging arms 30 will be shifted to the position shown in Fig. 2, and secured there by the lever 74, the pulleys 33 39 will be so adjusted as to properly regulate the length of the tapes 5 6, and the switch 56 will be shifted to the position shown in Figs. 1 and 2. When the leading end of the first half-sheet arrives upon the cylinder 102, it will be taken by the grippers 26, and will be carried forward upon the cylinder until the folding-blade 23 arrives in position to fold the same between the rolls 13 14, at which time it will be released by the grippers and folded between said rolls by said blade, as shown in Fig. 2, after which it will pass forward between the tapes 5 8, and be directed by the switch 56 into the bite of the tapes 5 6, to be presented to the under side of the cylinder. As the leading end of the second half-sheet arrives upon the cylinder, it will be taken by the grippers 25, and will be carried forward upon said cylinder, as shown in Fig. 2, until the folding-blade 24 arrives in position to fold the same between the rolls 15 16, at which time it will

be released by the grippers and folded between said rolls by said blade. In the meantime, however, the first half-sheet, which was folded between the rolls 13 14 and directed into the bite of the tapes 5 6, will have emerged from beneath the guides 43 just in the rear of the fold-line of the second half-sheet, which has been taken by the grippers 25, so that as said second half-sheet is folded between the rolls 15 16 by the blade 24 the first half-sheet, underlying the same, as shown in Fig. 2, will be directed therewith between said rolls, so that the two half-sheets will be associated one upon the other and pass forward together between the tapes 6 7 to the grippers of the carrier or fly 103, and so the operation will continue to be repeated, the alternate half-sheets being taken by the grippers 26 25, and folded by the blades 23 24, and delivered in pairs to the fly. By this means it will be seen that the half-sheets are delivered folded to the same dimensions as the full sheets, and that this is accomplished without causing any of the parts of the apparatus to perform any greater number of operations, or to operate with any greater rapidity than when delivering full sheets.

As before stated, the longitudinal folder 104 may be so arranged that the rolls 63 64, instead of being at right angles to the cylinder 102, will be parallel with said cylinder. Such an arrangement of the folder is shown in Figs. 5 to 8, inclusive.

In the organization first described it is necessary to arrange the turning-bar 65 so as to act upon the sheets after they have received the longitudinal fold; but when the rolls 63 64 are placed parallel with the cylinder 102 it is necessary to arrange the turning-bar so as to act upon the sheets before they receive their longitudinal fold. As a consequence of this difference in the arrangement of the folder, rolls, and turning-bar, the tapes 2 3, instead of passing directly from the pulleys 19 across the surface of the folder, pass forward around the turning-bar 65, (see Fig. 6,) and thence laterally around pulleys 77, (see Figs. 5 and 8,) located just above the base of the folder. From these pulleys the tapes 2 pass across the face of the folder and around one of its turning-edges, and thence inward between the rolls 63 64, from which point they pass around the pulley 67, (see Fig. 5,) returning, as in the organization already described, around the pulleys 68 69. The tapes 3 pass across the face of the folder and around its opposite turning-edge, from which point they pass inward and meet the tapes 2, and together with said tapes pass between the rolls 63 64, from which point they return around skew-pulleys 72 and the pulleys 68 69.

Co-operating with the tapes 2 3 to convey the sheets from the pulleys 57 to the turning-bar 65 are a series of stationary guides, 76, which are located directly beneath the tapes, as best shown in Fig. 6, and have their forward ends secured to the bar 65, while their rear ends are supported upon a transverse bar, 84, secured to the bar 65 and the frame of the machine. A similar set of guides, 85, running at right angles to the guides 76 and supported thereby, are arranged to co-operate with the tapes 2 3 to convey the sheets from the turning-bar to the pulleys 77, as also shown in Fig. 6.

Co-operating with the tapes 2 3 to convey the sheets around the pulleys 77 and onto the surface of the folder 104, are a series of short supplemental tapes, 81, which pass around pulleys 78, located directly above the pulleys 77; thence downward around the pulleys 77 and inward around pulleys 79, located just below said pulleys 77, returning around pulleys 80, as shown in Fig. 8. It will be observed that in this organization the guides 86 87, which co-operate with the tapes 2 to convey the sheets from the rolls 63 64 to the pulleys 60 67, are dispensed with, a series of supplemental tapes, 82, which pass around the roll 64 by the side of the tapes 2 3, and thence around pulleys located at the sides of the pulleys 60 42, returning around pulleys 83, being used in their stead.

The operation of the organization just described is substantially the same as that already explained in connection with the other figures of the drawings, and consequently a very brief description will suffice. The switch 56 being turned to the position shown in Fig. 5, the sheets folded between the rolls 13 14 will pass forward between the tapes 4 8, from which they will be taken by the tapes 2 3 and carried along the guides 76 and around the turning-bar 65. After passing the bar 65 they will be conveyed beneath the guides 85, by the tapes 2 3, into the bite of the tapes 2, 3, and 81, by which they will be carried downward around the pulleys 77 onto the face of the folder 104, and from thence by the tapes 2 3 across the face of the folder and between the rolls 63 64, where they will receive a longitudinal fold, as already stated, after which they will pass into the control of the tapes 2 82, to be conveyed to the tapes 5 6, by which they will be presented to the bottom of the cylinder 102, to receive a third fold, in the manner already described.

Although the system of taping herein shown and described is regarded, all things considered, as the best for giving the required movements to the sheets, yet it will readily be understood that it may be varied in many of its details without departing from the invention. If preferred, the cutting-cylinders 100 101 may be dispensed with and the unsevered web led directly to the folding-cylinder 102. When the apparatus is thus organized, the cylinder 102 will be provided with suitable cutting-grooves and with a co-operating cylinder carrying suitable severing-knives, and, there being no working-spaces provided between the sheets, impaling-pins will be used in place of the grippers 25 26 27. The cylinder 102, instead of being of a circumference equal to the length of a full sheet plus one of the working-

spaces between the sheets, will, in such case, be of a circumference equal to only the length of a sheet, and the length of the various pathways through which the sheets pass will of course be so adjusted that the sheets will be presented to the cylinder 102 in proper position to receive their final fold.

It is of course to be understood that any of the other well-known forms of mechanism for piling the sheets may be used instead of the form herein shown, if preferred.

The frame-work for supporting the various parts of the apparatus, as well as the gears for driving the many parts of the same, have for the most part been omitted in the drawings, as such parts can be readily supplied by any ordinary intelligent mechanic.

The mechanism hereinbefore described is that which embodies the invention in what I regard as the best form; but it may be varied within wide limits without departing from some of the most important features of the invention. The mechanism for imparting the longitudinal fold, instead of being of the form shown, may consist of a pair of folding-rolls and an oscillating or reciprocating blade, and the folding-rolls may in such case be arranged either parallel with or at right angles to the cylinder 102. If the rolls are arranged parallel with the cylinder 102, the turning-bar 65 will be arranged to act upon the sheets before they are presented to the rolls, while if the rolls are arranged at right angles to the cylinder the turning-bar will be arranged to act upon the sheets after they have passed the rolls. When the mechanism for imparting the second or longitudinal fold is of this character, the tapes for conducting the sheets from and returning them to the cylinder 102 will of course have to be arranged in a manner somewhat different from that shown; but this can be readily done by any one familiar with this class of machinery. In this case, also, the third fold, instead of being parallel with the first and at right angles to the second, will be parallel with the second and at right angles to the first. This order of making the folds will not in most cases be found as desirable as that first described, and consequently it is preferable that the longitudinal folding mechanism should be of the character shown.

The mechanism for imparting the first and third folds may also be of a different form from that shown without departing from some of the important features of the invention. Instead of a single cylinder, 102, which is capacitated to impart the two folds, a folding mechanism of the character shown in the Letters Patent No. 269,021, before referred to, may be employed, a switch or switches corresponding to the switch 56 being located in the pathway leading from one of the folding-cylinders to the other, and so arranged that the sheets can be sent directly from the first to the second cylinder, or from the first cylinder to the longitudinal folding mechanism, and then to the second cylinder; or, when separate mechanisms are provided to impart the first and third folds, such mechanisms may be of any of the ordinary forms of folding mechanism.

From the foregoing it will be seen that the present invention consists not so much in specific improvements in the various mechanisms employed as in the general arrangement and combinations of mechanisms for performing the several operations.

What I therefore claim is—

1. The combination, with a transverse, a longitudinal, and a second transverse folding mechanism arranged to act upon the sheets in the order named, of a sheet-conveying mechanism arranged to deliver the sheets from the first to the second and thence to the third folding mechanism, or from the first directly to the third folding mechanism, all substantially as described.

2. The combination, with two mechanisms arranged to impart parallel folds to the sheets, of a mechanism located between the two and arranged to impart a fold at right angles to the other two, and a sheet-conveying mechanism arranged to deliver the sheets from the first to the second and thence to the third folding mechanism, or from the first directly to the third folding mechanism, substantially as described.

3. The combination, with two parallel transverse folding mechanisms, of a longitudinal folding mechanism arranged to act upon the sheets after the first and before the second of said transverse folding mechanisms, and a sheet conveying and turning mechanism arranged to deliver the sheets from the first to the second and thence to the third folding mechanism, or from the first directly to the third folding mechanism without turning, all substantially as described.

4. The combination, with the cylinder 102, provided with two sets of folding mechanisms arranged to act alternately, of a sheet-conveying mechanism arranged to deliver the sheets folded off the cylinder by one of said mechanisms back to the cylinder in position to be associated with those folded off by the other of said mechanisms, all substantially as described.

5. The combination, with the cylinder 102, provided with two sets of folding mechanisms arranged so as to be made to act alternately or successively at pleasure, of a sheet-conveying mechanism arranged to deliver the sheets folded off the cylinder by the first of said mechanisms back to the cylinder in position to receive a second fold by the second of said mechanisms, all substantially as described.

6. The combination, with the cylinder 102, provided with two sets of folding mechanisms arranged so as to be made to act alternately or successively at pleasure, of a sheet-conveying mechanism arranged to deliver the sheets folded off the cylinder by the first of said mechanisms back to the cylinder in position to receive a second fold by the second of said mechanisms, or to be associated with those folded

off by the second mechanism, all substantially as described.

7. The combination, with the cylinder 102, provided with two sets of folding mechanisms, of an adjustable sheet-conveying mechanism, by which the sheets folded off the cylinder by one of said mechanisms are delivered back to the cylinder in position to be operated upon by the other of said mechanisms, and by which the travel of the sheets between said mechanisms is varied, all substantially as described.

8. The combination, with the cylinder 102, provided with two sets of folding mechanisms, of an intermediate folding mechanism arranged to act upon the sheets after the first and before the second of said mechanisms upon said cylinder, and a sheet-conveying mechanism, by which the sheets are delivered from the first mechanism of the cylinder to the intermediate folding mechanism, and thence to the second mechanism of the cylinder, or directly from the first to the second mechanism of the cylinder, all substantially as described.

9. The combination, with the cylinder 102, provided with two sets of folding mechanisms, of the longitudinal folder 104 and a sheet-conveying mechanism, by which the sheets are delivered from the first mechanism of the cylinder to the folder 104, and thence to the second mechanism of the cylinder, or directly to the second mechanism of the cylinder, all substantially as described.

10. The combination, with the cylinder 102, provided with two sets of folding mechanisms, of the longitudinal folder 104 and a sheet-conveying mechanism arranged to deliver the sheets from the first mechanism of the cylinder to the folder 104, and thence to the second mechanism of the cylinder, all substantially as described.

11. The rotating carrier or fly 103, having the grippers 51, provided with the projections 55 upon their backs, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:
J. A. HOVEY,
A. N. JASBERA.