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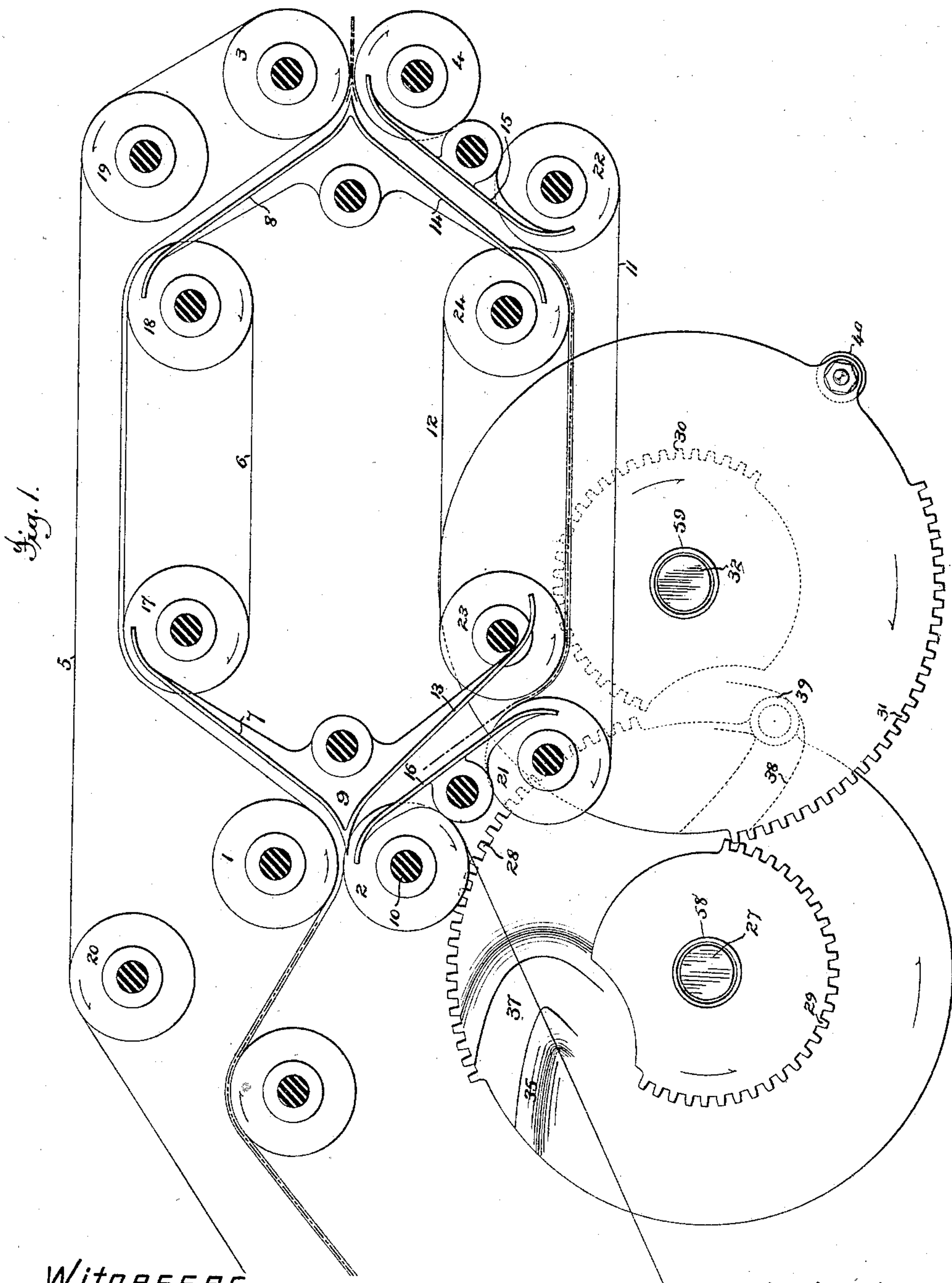
8 Sheets—Sheet 1.

L. C. CROWELL.

SHEET DELIVERY APPARATUS.

No. 277,548.

Patented May 15, 1883.



Witnesses,

C. C. Perkins.
Geo. H. Graham

Inventor,

Luther C. Crowell,
by Munson & Philipp
Attys.

(No Model.)

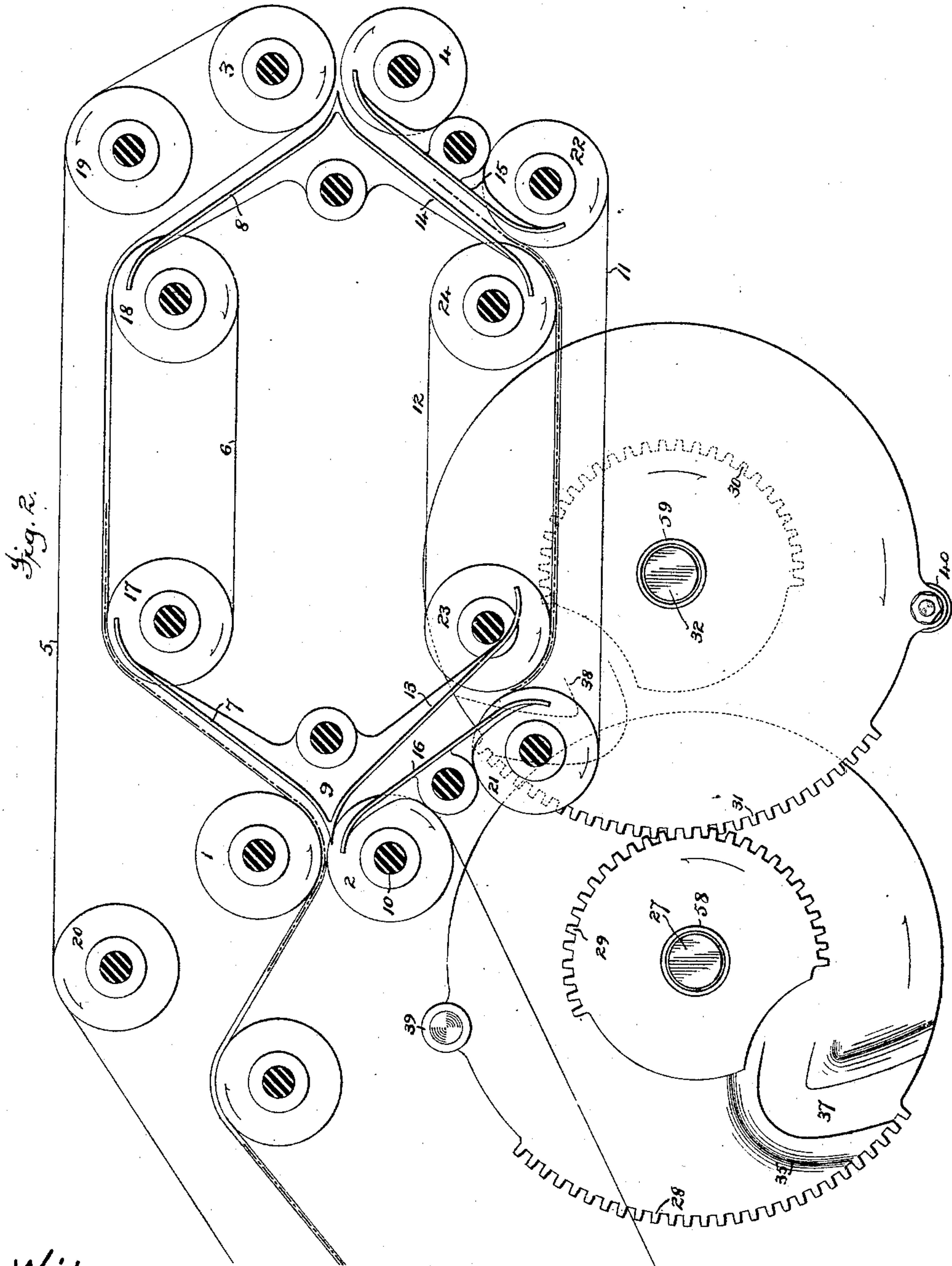
8 Sheets—Sheet 2.

L. C. CROWELL.

SHEET DELIVERY APPARATUS.

No. 277,548.

Patented May 15, 1883.



Witnesses,

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(No Model.)

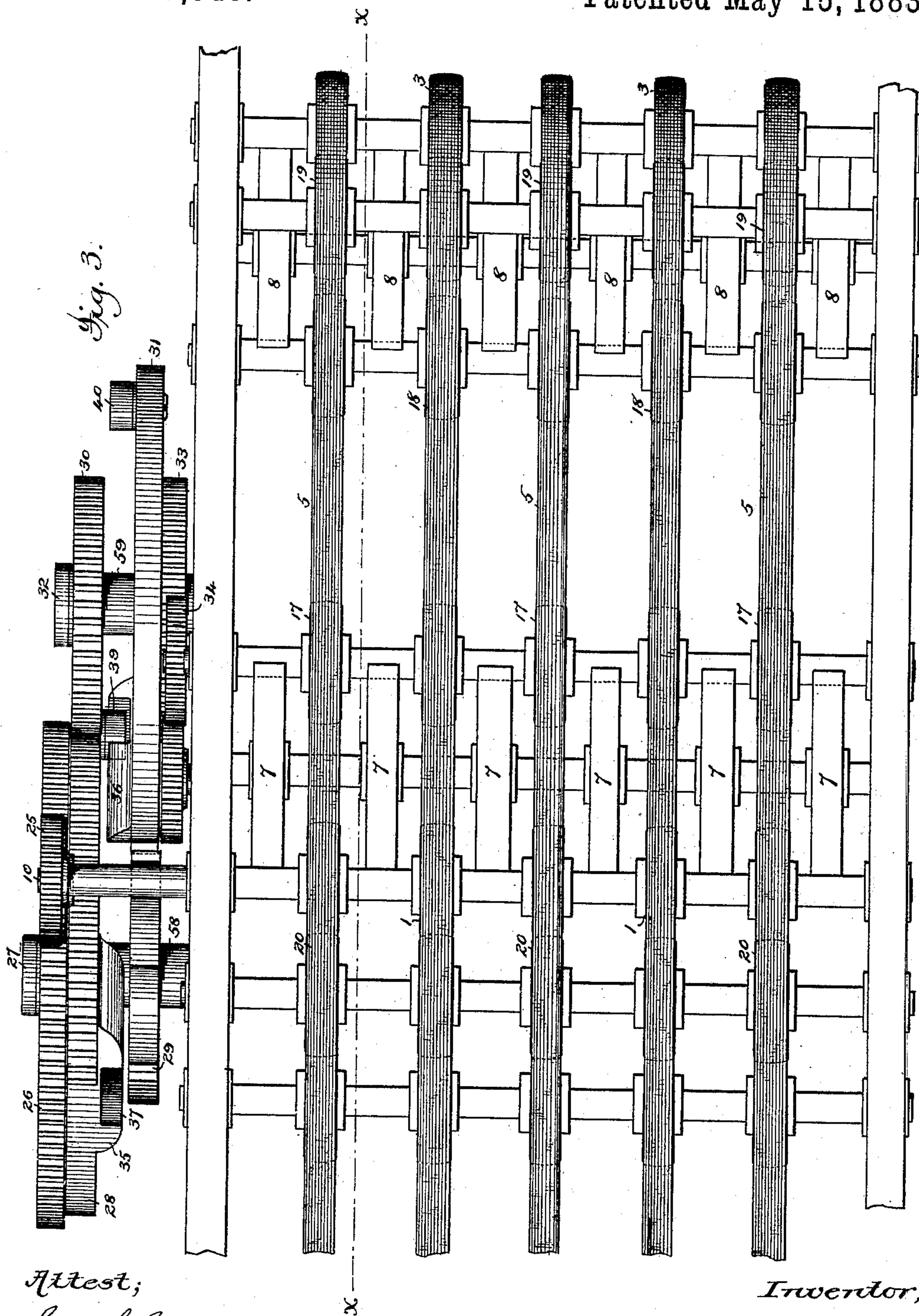
8 Sheets—Sheet 3.

L. C. CROWELL.

SHEET DELIVERY APPARATUS.

No. 277,548.

Patented May 15, 1883.



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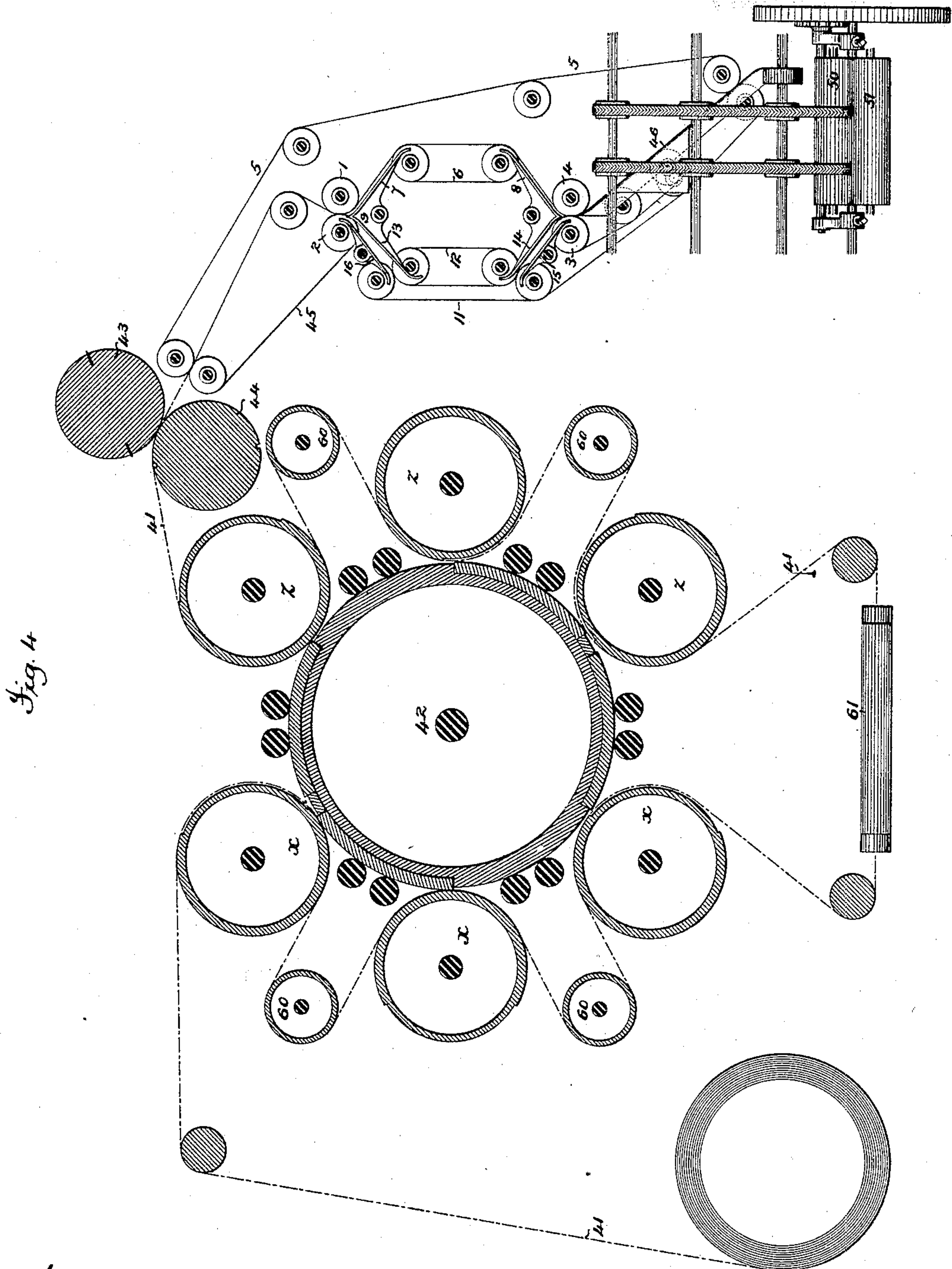
(No Model.)

8 Sheets—Sheet 4.

L. C. CROWELL.
SHEET DELIVERY APPARATUS.

No. 277,548.

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Witnesses.

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(No Model.)

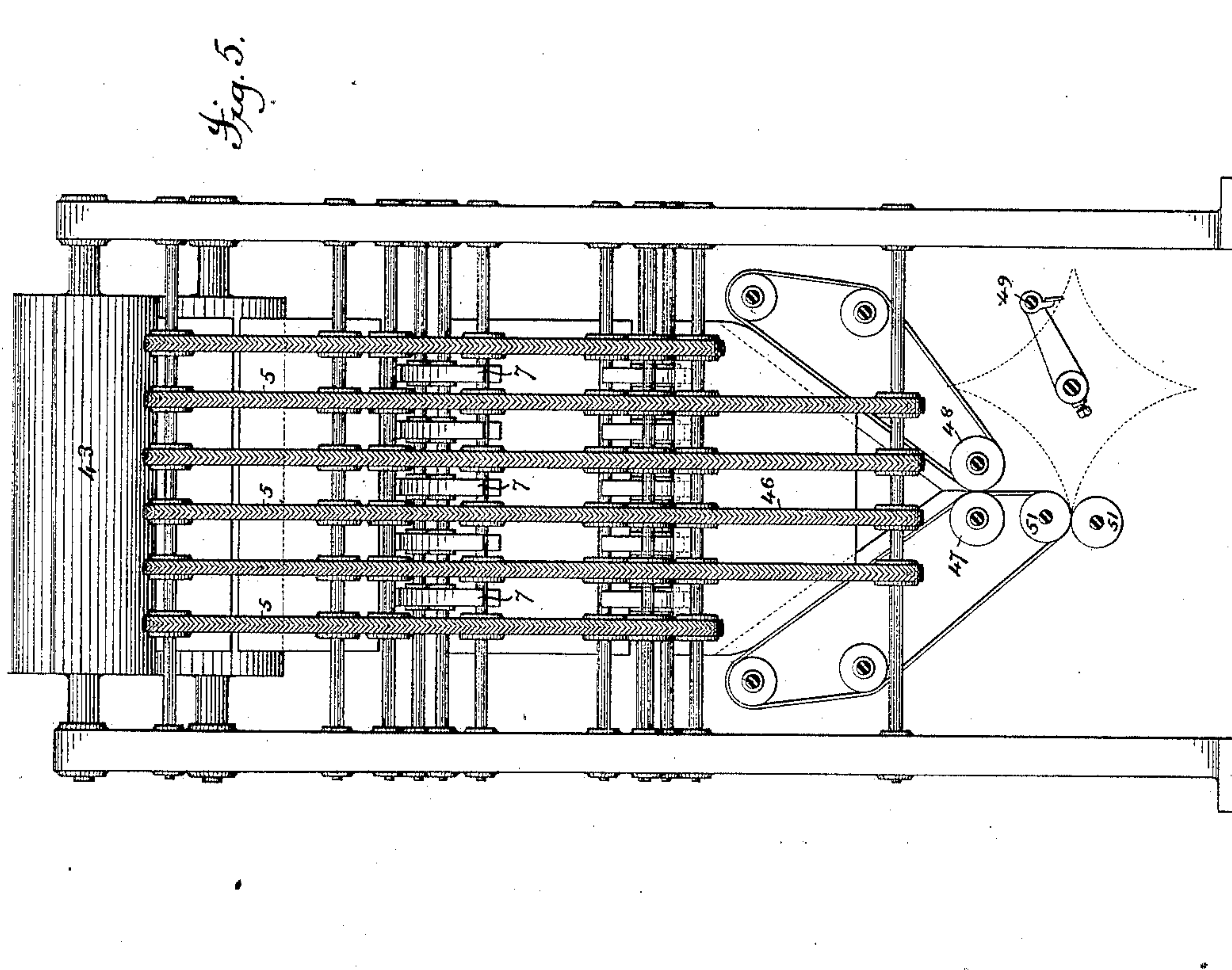
8 Sheets—Sheet 5.

L. C. CROWELL.

SHEET DELIVERY APPARATUS.

No. 277,548.

Patented May 15, 1883.



Witnesses,

C. C. Perkins.
W. H. Graham

Inventor,

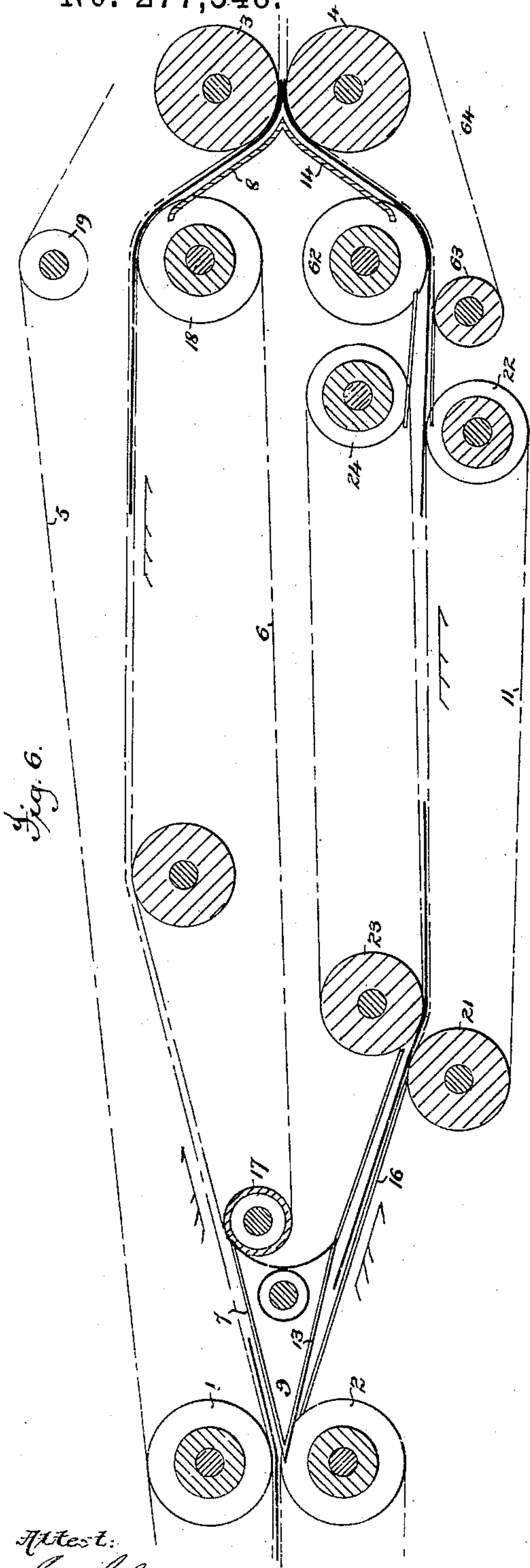
Luther C. Crowell,

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Attys.

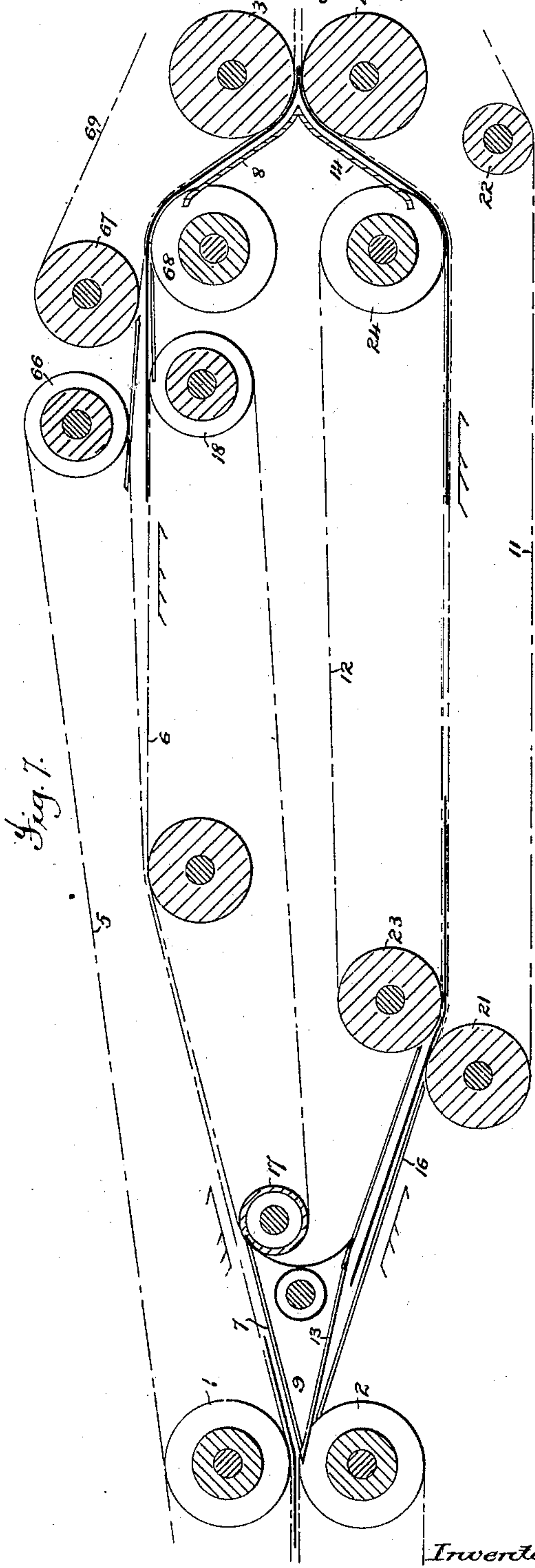
L. C. CROWELL.
SHEET DELIVERY APPARATUS.

No. 277,548.

Patented May 15, 1883.



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(No Model.)

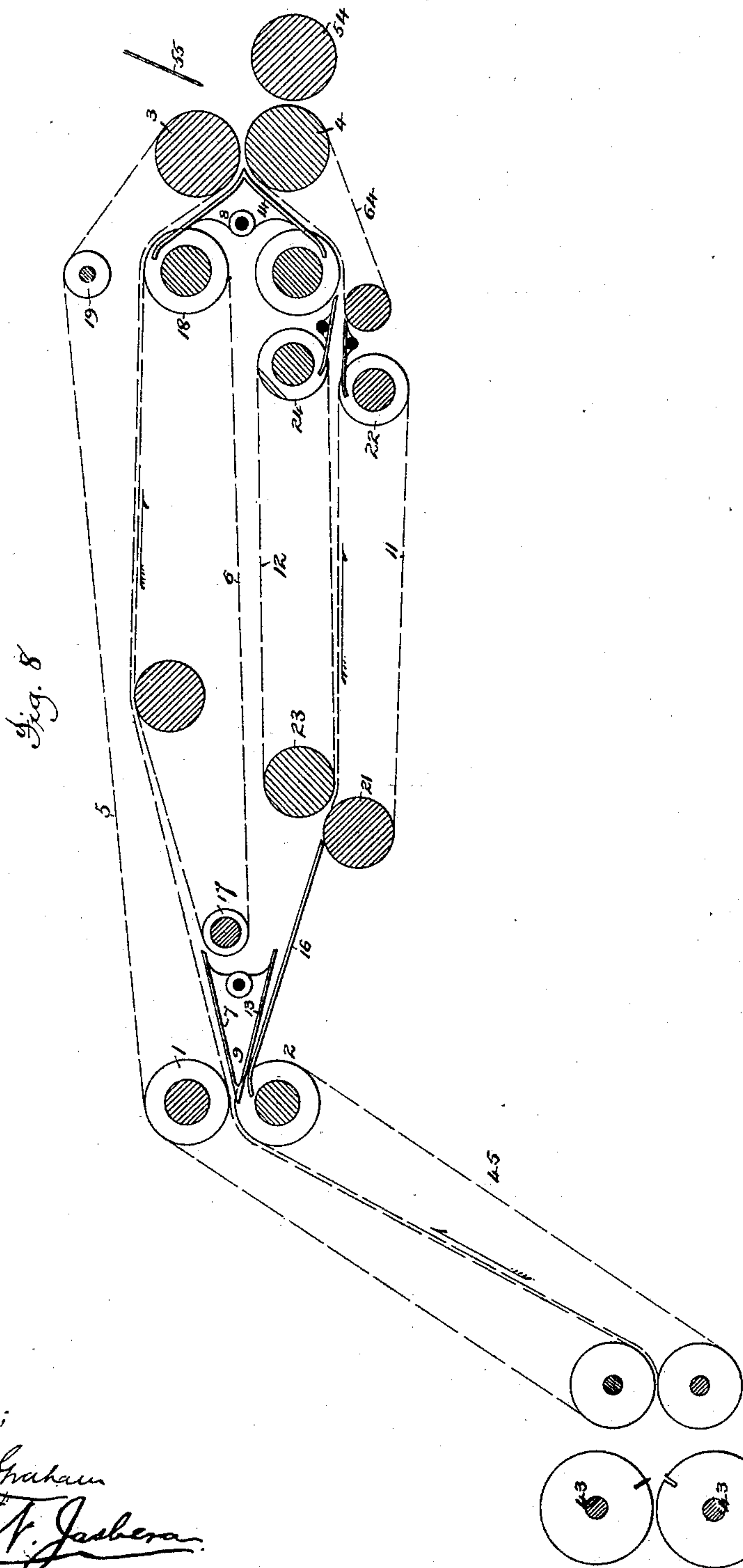
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L. C. CROWELL.

SHEET DELIVERY APPARATUS.

No. 277,548.

Patented May 15, 1883.



Attest;

Geo. H. Graham

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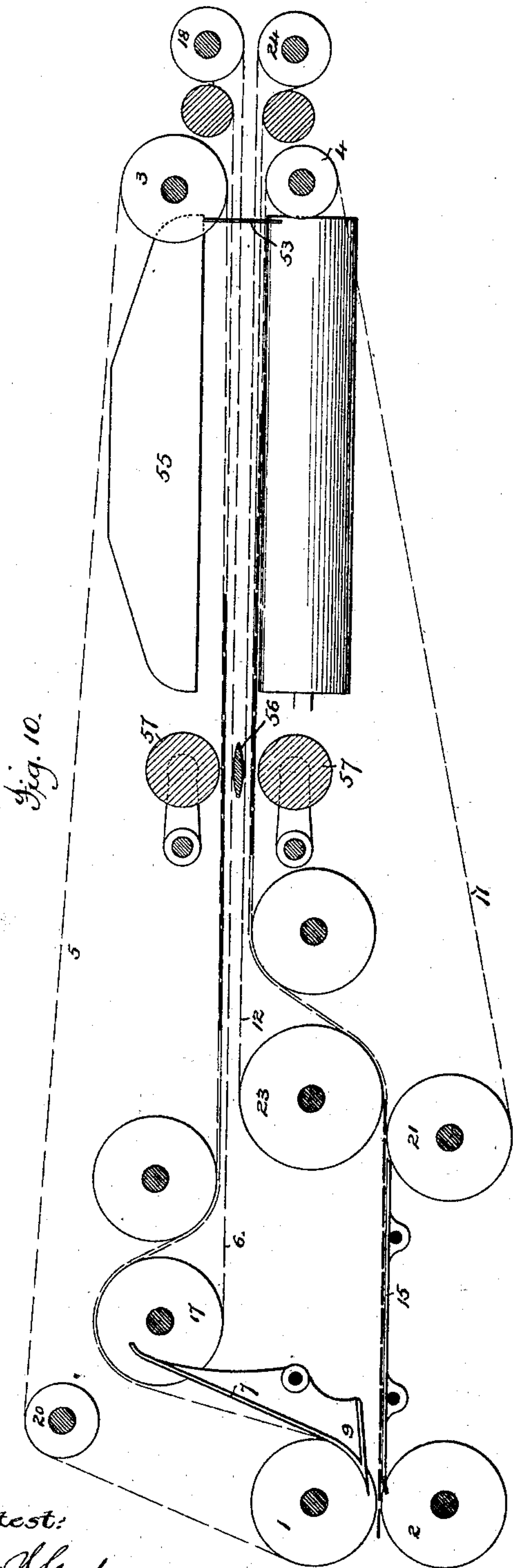
(No Model.)

L. C. CROWELL.
SHEET DELIVERY APPARATUS.

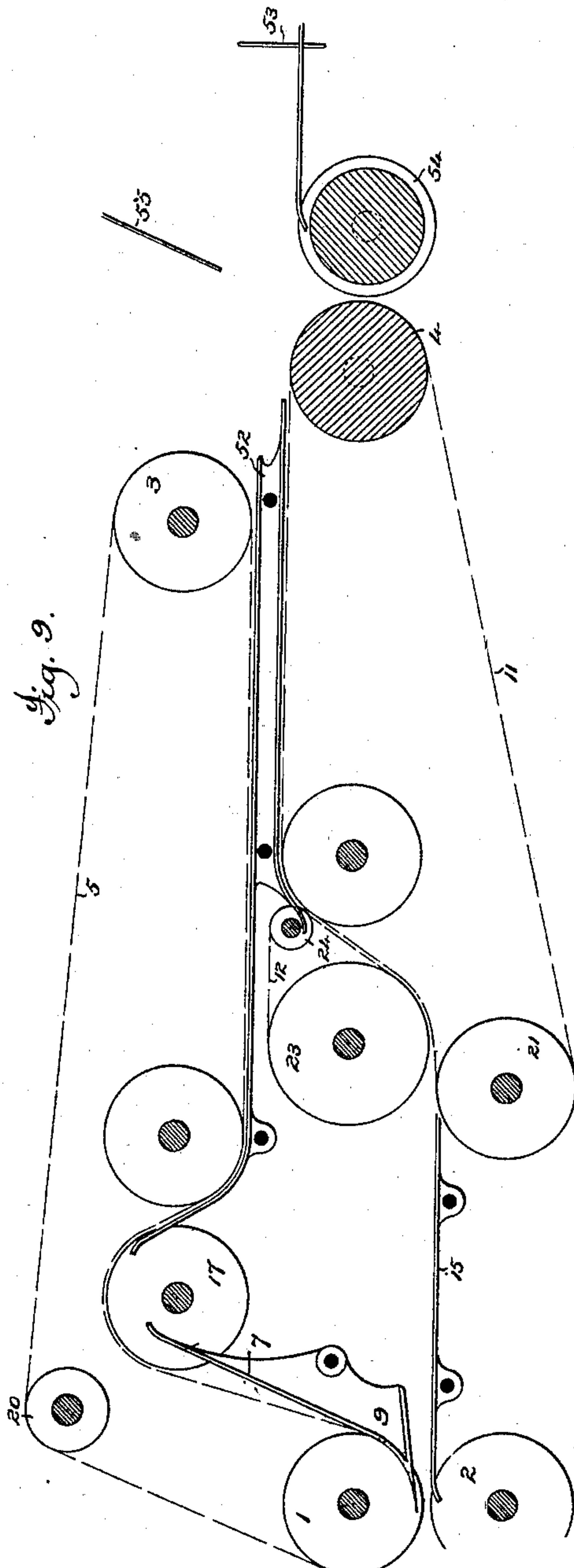
8 Sheets—Sheet 8.

No. 277,548.

Patented May 15, 1883.



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



Inventor,
Luther C. Crowell,
by Munson & Phillips
Attys

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. 277,548, dated May 15, 1883.

Application filed December 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing in the city of 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.

10 This invention relates to the delivery of sheets issuing from a web printing and severing mechanism, and particularly to that method of delivery by which two or more of the successively-produced sheets are associated to form a single product. In United States Letters Patent No. 269,159 I have described a method in which this association is effected by varying the speed of certain of the sheets of the series to be associated, so that the rear sheet or sheets will be permitted to overtake and overlap the advanced sheet until the forward ends of the several sheets of the series have been brought abreast, after which they will move forward at the same speed and issue together from a common exit, to be thereafter acted upon as a single product.

20 The present invention relates especially to a mechanism designed for carrying into operation said method, said mechanism consisting, broadly, of a series of pathways of equal or substantially equal lengths, which diverge from a common entrance and again unite at a common exit, and into which the sheets are successively directed, the tapes forming the said pathways being so driven that the sheet or sheets entering one or more of them will be delayed, so that when the several sheets arrive at the common exit they will be brought together with their leading ends abreast and their printed matter in proper register.

30 In the accompanying drawings, Figure 1 is a longitudinal vertical section of a mechanism embodying the invention in one of its forms. This view is taken upon the line *xx* of Fig. 3, the frame-work and certain of the gears being, however, omitted for the sake of clearness of illustration. Fig. 2 is a like view of the same mechanism, showing the parts in a different position. Fig. 3 is a plan view of the same. 40 Fig. 4 is a longitudinal vertical section of a web-perfecting printing and severing mechanism of the construction shown in my application for Letters Patent filed on the 2d day of December, 1882, when provided with a sheet-associating mechanism embodying the present invention, and also with a longitudinal and transverse folding mechanism adapted to co-operate therewith. Fig. 5 is a rear end elevation of the same. Figs. 6 and 7 show modified constructions embodying the invention. Fig. 60 8 shows the structure of Fig. 6 provided with a web-severing mechanism and a transverse folding mechanism. Fig. 9 shows the invention embodied in a modified construction and provided with a transverse sheet-folding mechanism; and Fig. 10 shows still another modified embodiment of the invention provided with a longitudinal sheet-folding mechanism.

Referring particularly to Figs. 1, 2, and 3, it is to be understood that the web has been perfected and severed into sheets by any ordinary form of web printing and severing mechanism—as, for example, that shown in Fig. 4—and that the sheets have been separated from each other in their line of travel, to provide working-spaces, by the well-known accelerated tapes and pulleys, or by other suitable means, before they enter between the rolls or pulleys 1 2.

Leading from the pulleys 1 2 to the pulleys 3 4 are two pathways of equal or approximately equal lengths. The upper of these pathways is formed by the series of tapes 5 6, the guide 8, and the tail 7 of the switch 9, the lower pathway being formed by the tapes 11 12, guides 14 15 16, and the tail 13 of said switch. The series of tapes 5, which may also be one member of the accelerated parting-tapes, pass beneath pulleys 1, above pulleys 17 18, around pulleys 3, above pulleys 19 20, and return around bending-pulleys, (not shown,) while the series 6 pass around pulleys 17 18. The series of tapes 11 12 of the lower pathway pass around pulleys 21 22 and 23 24, respectively. The shafts of the pulleys around which the tapes forming the upper pathway are passed are connected with each other and with the printing mechanism or other source of power by gears or otherwise, and are so timed that the sheets passing along this pathway will travel at their normal speed. The shafts of the pulleys 21 23, which drive the lower tapes

80 3 4 are two pathways of equal or approximately equal lengths. The upper of these pathways is formed by the series of tapes 5 6, the guide 8, and the tail 7 of the switch 9, the lower pathway being formed by the tapes 11 12, guides 14 15 16, and the tail 13 of said switch. The series of tapes 5, which may also be one member of the accelerated parting-tapes, pass beneath pulleys 1, above pulleys 17 18, around pulleys 3, above pulleys 19 20, and return around bending-pulleys, (not shown,) while the series 6 pass around pulleys 17 18. The series of tapes 11 12 of the lower pathway pass around pulleys 21 22 and 23 24, respectively. The shafts of the pulleys around which the tapes forming the upper pathway are passed are connected with each other and with the printing mechanism or other source of power by gears or otherwise, and are so timed that the sheets passing along this pathway will travel at their normal speed. The shafts of the pulleys 21 23, which drive the lower tapes

11 12, are geared together and receive a variable motion in the following manner: The shaft 10 of the pulleys 2 is provided with a gear, 25, which engages with a gear, 26, secured to a sleeve, 58, mounted upon a stud, 27, which sleeve also carries a pair of mutilated gears, 28 29, the latter being of one-half the size of the former. These gears engage alternately with a like pair of mutilated gears, 30 31, secured to a sleeve, 59, mounted upon a stud, 32, which sleeve also carries a gear, 33, which engages with a gear, 34, upon the shaft of pulleys 23.

It will be observed that the mutilated gears 28 29 30 31 are so proportioned that the gears 29 31 will pass out of engagement a little before the gears 28 30 come into engagement, and vice versa, from which it will be seen that if no means were provided to continue the motion of the gears 30 31 the parts would become inoperative as soon as this first disengagement took place. To prevent this the gears 28 31 are provided upon their faces with studs 39 40 and projections 35 36, in which are formed path-cams 37 38, into which, as the gears revolve, the studs 39 40 are caused to enter. These cams and studs are so shaped and positioned that as soon as either pair of the mutilated gears pass out of engagement the movement of the gears 30 31 and sleeve 59 will be continued by the co-operation of the cams and studs.

From the construction just described it will be seen that when the gear 28 is in engagement with the gear 30 the tapes 11 12 will be driven at the same speed as the tapes 5 6, but that as soon as the gears 29 and 31 come into engagement the speed of the tapes 11 12 will be reduced to one-fourth that of the tapes 5 6. For the purpose of avoiding abruptness in the transition from full-speed to one-fourth speed, and vice versa, which would cause jar and strain upon the machine, the cam 37 is so shaped that as soon as it comes into engagement with the stud 40 it will gradually increase the speed of the gears 30 31 until the engagement of the gears 28 30, while the cam 38 is so shaped that as soon as it comes into engagement with the stud 39 it will gradually reduce the speed of gears 30 31 until the engagement of the gears 29 31.

It is of course to be understood that the switch 9 is provided with the usual devices to cause it to oscillate at the proper times.

The operation of the apparatus will be as follows: The first sheet, as it emerges from between the pulleys 1 2, will be directed by the switch 9 into the lower pathway, where it will pass between the guides 16 and the tail 13 of the switch until its forward end enters the bite of the pulleys 21 23. The parts will be so timed with relation to each other that as the forward end of the sheet enters the bite of these pulleys the gear 28 will be in engagement with the gear 30, so that the sheet will continue to be advanced at its normal speed. As soon, however, as the rear end of the sheet has passed

from between the pulleys 1 2 the gears 28 30 will pass out of engagement, and the stud 39 will enter the cam 38 and continue the movement of the gears 30 31, but at a speed which is gradually reduced until the gears 29 and 31 are brought into engagement, when the speed of the tapes 11 12 will be reduced to one-fourth that which they had when they commenced to act upon the sheet. As soon as the rear end of the sheet has passed from between pulleys 1 2 the switch 9 will be operated so as to direct the second sheet into the upper pathway, (see Fig. 1,) where it will pass forward at its normal speed, thus rapidly gaining upon the sheet in the lower pathway, which is being advanced at one-fourth of said speed. The two sheets will thus continue to be advanced, the upper constantly gaining on the lower (see Fig. 2) until at the time they arrive at the bite of pulleys 3 4 their leading ends will be abreast of each other, so that the two will pass from between said pulleys superimposed one upon the other. Just before the leading end of the lower sheet arrives at the bite of the pulleys 3 4 the gears 29 31 will pass out of engagement, and the stud 40 will enter the cam 37, thereby gradually accelerating the speed of the tapes 11 12 until the end of the sheet arrives at the bite of the pulleys 3 4, at which time the gears 28 30 will again come into engagement, so that as the two sheets pass together from between the pulleys 3 4 the speed of the lower will be the same as that of the upper. In the meantime, the switch 9 having again been operated, the third sheet will be directed into the lower pathway, and the operation will continue to be repeated.

It will of course be seen that the length of the paths and of the sheets (including the working-spaces between them and the size and extent of the mutilated gears) must be so related to each other that the sheets passing through the lower pathway will be retarded to the proper extent. Any increase or decrease in the length of the sheets or of the working-spaces, or both, will of course require a corresponding change either in the length of the pathways or in the size or extent of the mutilated gears, or both. If the length of the sheet is increased, so that the rear sheet will be required to gain a longer distance in order to be brought abreast of the advance sheet, then it will of course be necessary either to increase the length of the pathway, so that the advance sheet will be retarded for a greater length of time, or to change the relative size of the mutilated gear, so that the retarding will be greater in degree, and vice versa. The associated sheets, after passing from between the pulleys 3 4, may of course be folded or operated upon by any suitable form of delivery apparatus.

In Fig. 4 the sheet-associating apparatus just described is shown in connection with a web printing and severing mechanism, and with a longitudinal and transverse folding mechanism, the whole being adapted to print and deliver a quarto or eight-page paper twice folded.

In this case the web of paper 41 is shown as perfected by a printing mechanism consisting of a type-cylinder, 42, two series of impression-cylinders, x and z , and a web-turner, 61, the former carrying the forms for printing the eight pages of the paper, and the latter being provided with register-rolls 60 and arranged and constructed so as to present the opposite sides to the forms in the manner described in my former application before referred to. The forms will be arranged in pairs located side by side with relation to the length of the cylinder, and will be arranged so that pages 1 8 and 3 6 will be printed upon one side of the web, and pages 2 7 and 4 5 upon the opposite side. The web, after being thus printed, will pass between the cutting-cylinders 43 44 and into the bite of the accelerated tapes 5 45, by which it will be severed into sheets, which sheets will be separated from each other in their line of travel to provide working-spaces between them. The sheets bearing the pages 1 8 and 2 7 will be directed by the switch 9 into the upper—or, as shown in this figure, the outer—pathway, while the sheets bearing pages 4 5 and 3 6 will be directed into the lower pathway, to be retarded in the manner already explained until the sheets in the upper pathway have been advanced, so as to be superimposed upon them as they issue together in pairs from between the pulleys 3 4. As the pairs of sheets thus associated emerge from between pulleys 3 4 they will be conducted over the longitudinal folder 46, by which they will be folded upon a line between their printed pages. The folder here shown is of the construction and is provided with tapes arranged in the manner shown in my application for Letters Patent filed on the 10th day of December, 1881, but may, if preferred, be of the construction shown in Letters Patent 233,997, or of any of the other approved forms for folders of this character. After being delivered from between the exterior turners 47 48, the once-folded sheet may be delivered to a fly or to carrying-tapes, to be conducted away from the machine; or, if preferred, it may be operated upon by a rotating folding-blade, as 49, so as to receive a cross-fold by passing between rolls 50 51, as shown in Fig. 5, after which it can be delivered in any approved manner.

If at any time it should be desired with this mechanism to produce a four-page paper instead of an eight-page, it can readily be done by providing the form-cylinder with duplicate plates and securing the switch 9 in the position shown, so that all of the sheets will be caused to pass in succession into the upper pathway and emerge singly from between the pulleys 3 4, instead of in pairs.

When it is desired to print directly from the type instead of from stereotype-plates in the organization shown, it will be necessary to place the forms upon the cylinder 42 in such position that the columns of matter will lie parallel to the axis of the cylinder. In this case it will be found most desirable to cause

the sheets, after they are associated in pairs and pass from the pulleys 3 4, to be operated upon by a transverse instead of a longitudinal folding mechanism, as in such case the margin between the printed pages will lie transversely instead of longitudinally of the machine.

In Figs. 6 to 10, inclusive, modified forms of the associating apparatus are shown, in which the retarding of the advance sheet is effected by causing it to enter a pathway in which the tapes, instead of moving at varying speeds, move constantly at the same but a reduced rate of speed.

In the organization shown in Figs. 6 to 10, the distance between the pulleys 1 2 and 21 23 is increased, so that the sheets entering the lower pathway will not come into the control of the pulleys 21 23 until they are free from the pulleys 1 2, and the tapes 11 12, instead of moving at a variable speed, so as to gradually reduce and increase the speed of the sheets, move at a uniform but reduced rate of speed, so that the sheet, as soon as it enters the bite of the rolls 21 23, will be reduced from its normal to its minimum speed, and will continue at such reduced speed until the following sheet which has been directed into the upper pathway has overtaken it.

In the particular organization shown in Fig. 6, as soon as the two sheets are abreast of each other, the retarded sheet will be caused to resume its normal speed, so that the two sheets will pass forward together. This may be done by so arranging and timing the parts that the sheets will come abreast of each other just at the bite of the rolls 3 4; but it is preferable to make the tapes 11 12 slightly divergent, as shown, so that the sheet will not be firmly held as it emerges from between pulleys 22 24, and to provide just in advance of these pulleys a pair of full-speeded rolls or series of pulleys, as 62 63, and series of tapes 64, into the control of which the retarded sheet will be delivered as soon as the two sheets are abreast of each other, and by which it will be caused to resume its normal speed before it meets its companion sheet at the bite of the rolls 3 4.

In the organization shown in Fig. 7 the sheets, after being brought abreast of each other, are both advanced at a reduced rate of speed, so as to permit the speed of the devices which subsequently operate upon them to be proportionately reduced. To provide for this the rolls 3 4 and the tapes 11 12 are driven at the same rate of speed, the tapes 11, instead of returning around pulleys 22, being continued around roll 4, and the tapes 5, instead of passing around roll 3, returning around pulleys 66. In this case, also, the tapes 5 6 will be slightly divergent, and a pair of rolls or series of pulleys, 67 68, provided with tapes 69, passing around roll 3, will be located just in advance of pulleys 18 66. In this organization the sheet entering the upper pathway will gain upon the one in the lower pathway until the two are abreast, at which time it will enter

the bite of pulleys 68 and tapes 69 and have its speed reduced to that of the other sheet, after which the two will pass forward at the same speed and emerge together from between the rolls 3 4. The sheets, after being associated in either of the ways just described, may pass to a folding mechanism of any approved form—such, for example, as that shown in Fig. 8, which consists of an oscillating blade, 55, arranged to impart a transverse fold to the sheets by striking them between the roll 4 and a companion, 54, provided for that purpose. In this figure, also, the cutting and parting devices are shown.

In the organization shown in Fig. 9 the tapes 6 of the upper pathway are dispensed with, and in their stead fixed guides 52 are used, the sheets in that pathway being carried forward by the movement of the tapes 5 against said guides. In the lower pathway the tapes 12 are made very much shorter than in the structure shown in Fig. 1, the guides 52 holding the sheets in contact with the tapes 11. In this organization a transverse folding mechanism is also shown, by which the sheets, as they emerge from between the rolls 3 4, are brought to rest against a stop, 53, and then folded between the bite of rolls 4 54 by the folding-blade 55. In Fig. 10 substantially the same organization is shown, except that the series of tapes 6 12 are used instead of the rigid guides 52. The parts are so arranged that as the sheets are brought to rest against the stop 53 they will be struck from the tapes and folded longitudinally instead of transversely by the blade 55. In this case there are shown, in addition, devices for preventing the sheets from buckling or wrinkling as they are brought to rest against the stop 53. For this purpose a transverse plate, 56, is located between the series of tapes 6 12, just in advance of the folding mechanism. Above and below this plate are arranged a pair of oscillating rollers, 57, which by suitable devices are caused to move into contact with the bar 56 at the proper times to grasp the rear ends of the sheets passing between the tapes, so as to gradually arrest their progress and cause them to come against the stop 53 at a very slow rate of speed.

It will of course be seen that the order of operation in the various organizations may be reversed—that is to say, the first sheet may be directed into the upper pathway, while the second is sent into the lower, the mutilated

gears or other driving mechanism being so proportioned that the tapes 11 12, instead of being retarded, will be accelerated, so as to cause the second sheet to overtake and overlap the first.

If at any time, instead of delivering the sheets associated in pairs, it should be desired to deliver them singly, it can be done in any of the organizations shown, except that of Fig. 7, by securing the switch 9 in its lower position. All of the successive sheets will then be guided into the upper pathway and issue singly.

If it should be desired to associate more than two sheets, it can be done by increasing the number of pathways and causing the leading sheets to be retarded or the rear ones to be accelerated sufficiently to bring all abreast at the common exit. The same result may be accomplished by duplicating the apparatus and causing the succeeding pairs of sheets, as they emerge from between the pulleys or rolls 3 4, to be guided into different pathways, when one pair will be retarded or accelerated so as to bring the two pairs together at the final exit.

What I claim is—

1. The combination, with a series of pathways provided with tapes for advancing the sheets therein, of means for directing the sheets alternately into different pathways and means for causing the tapes of the different pathways to move at different speeds, all substantially as described.

2. The combination, with a series of pathways provided with tapes for advancing the sheets therein, of means for directing the sheets alternately into different pathways and means for imparting a variable speed to the tapes of certain of the pathways, all substantially as described.

3. The combination, with a series of pathways provided with tapes for advancing the sheets therein, and means for alternately directing the sheets into different pathways, of the mutilated gears 28 29 30 31, provided with cams 37 38 and studs 39 40, all 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,
T. H. PALMER.