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L. C. CROWELL.

WRAPPING AND FOLDING MACHINE.

No. 549,110. Patented Nov. 5, 1895.

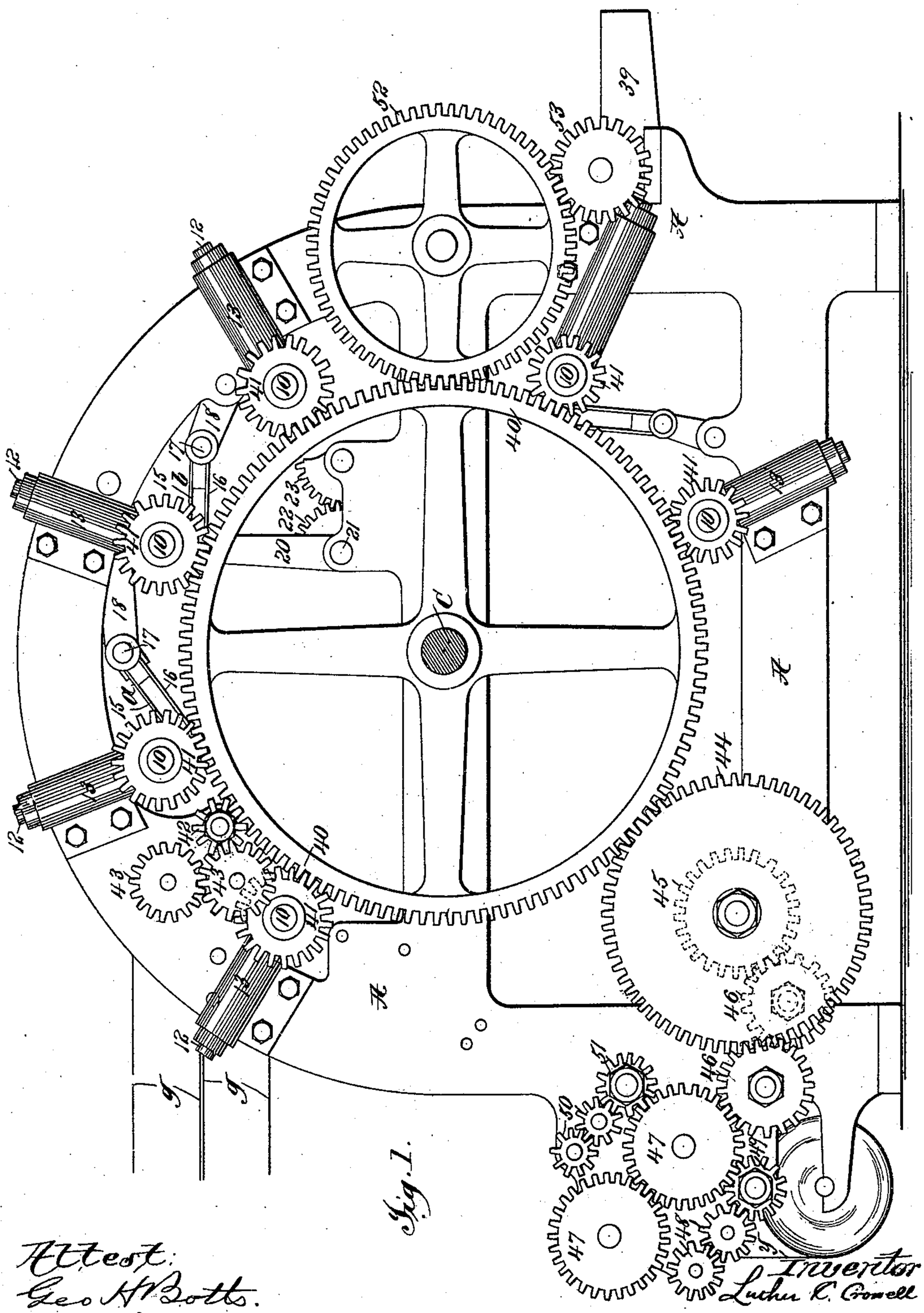

Fig. 1.

Attest:
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C. J. Sawyer

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(No Model.) 14 Sheets—Sheet 2.

L. C. CROWELL.

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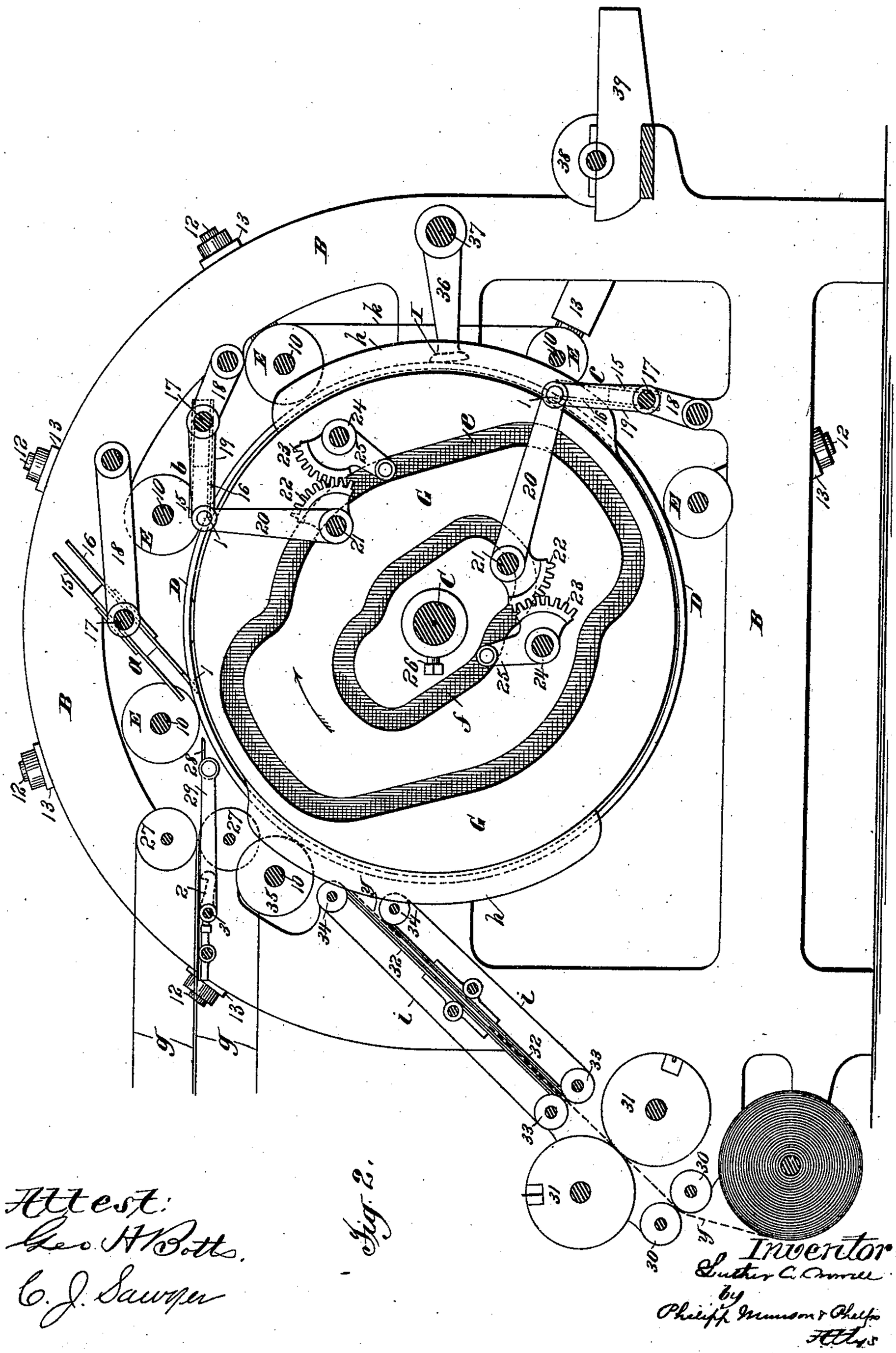

Fig. 2.

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(No Model.) 14 Sheets—Sheet 3.

L. C. CROWELL.

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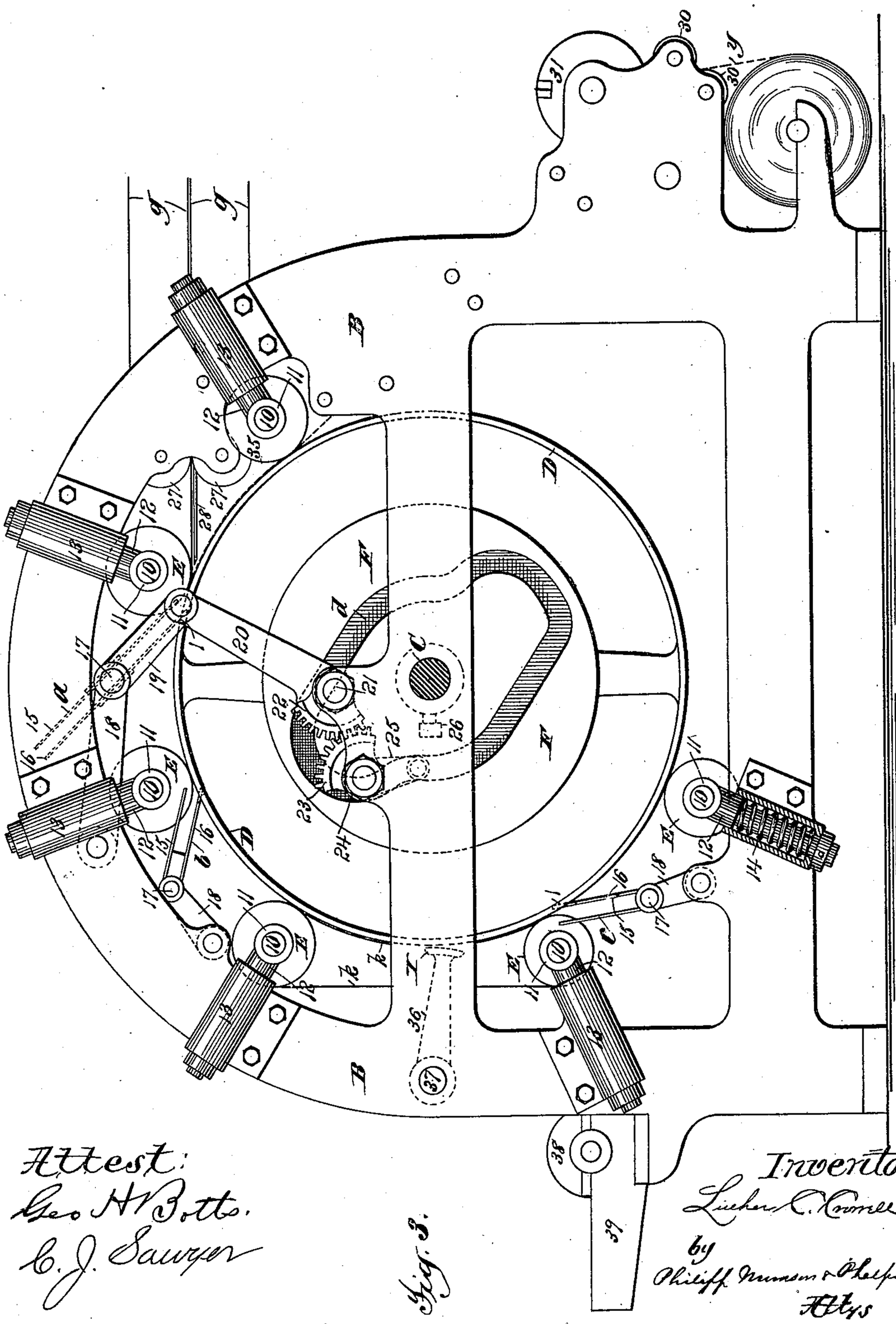

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Fig. 3.

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L. C. CROWELL.

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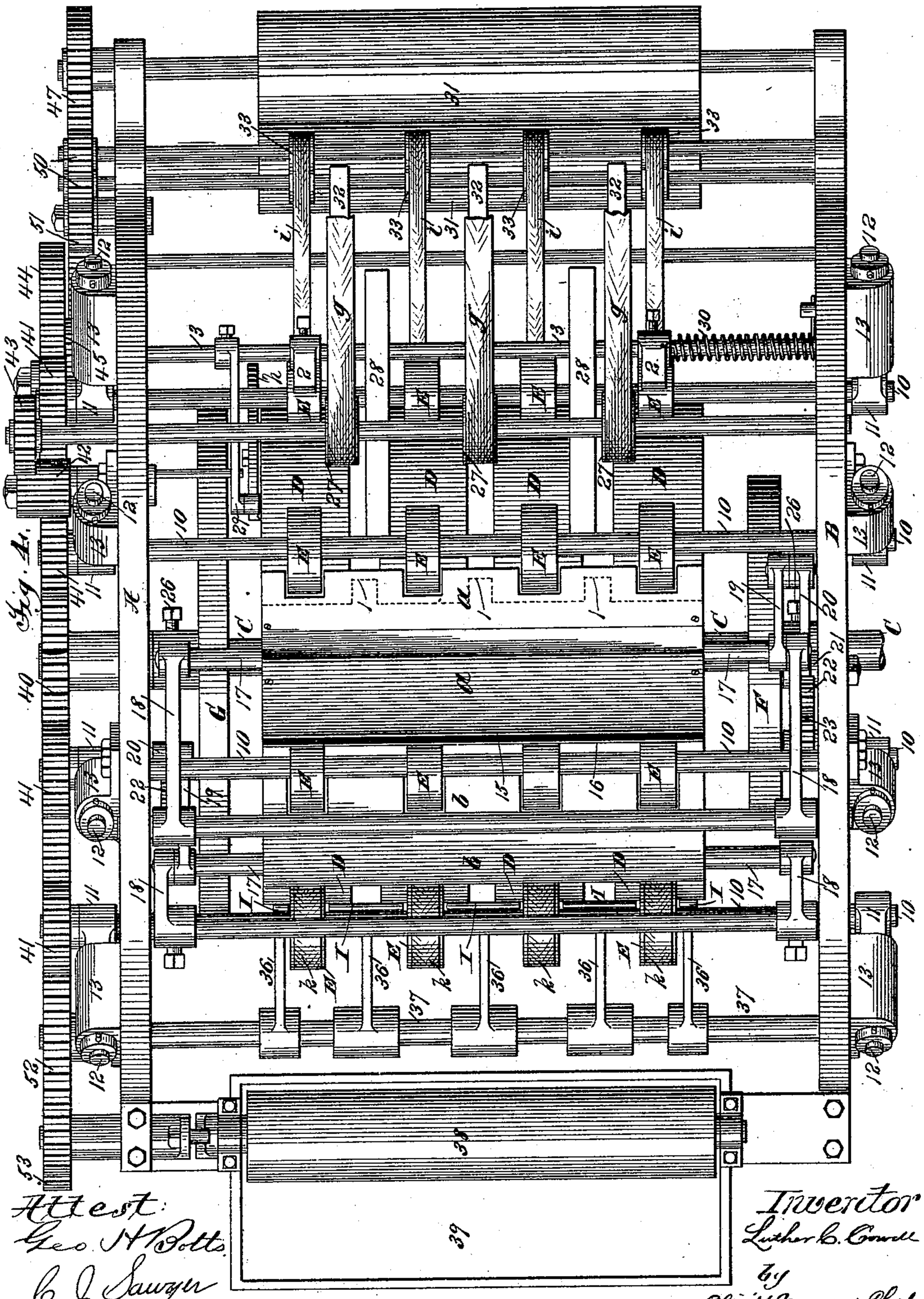

Fig. 4.

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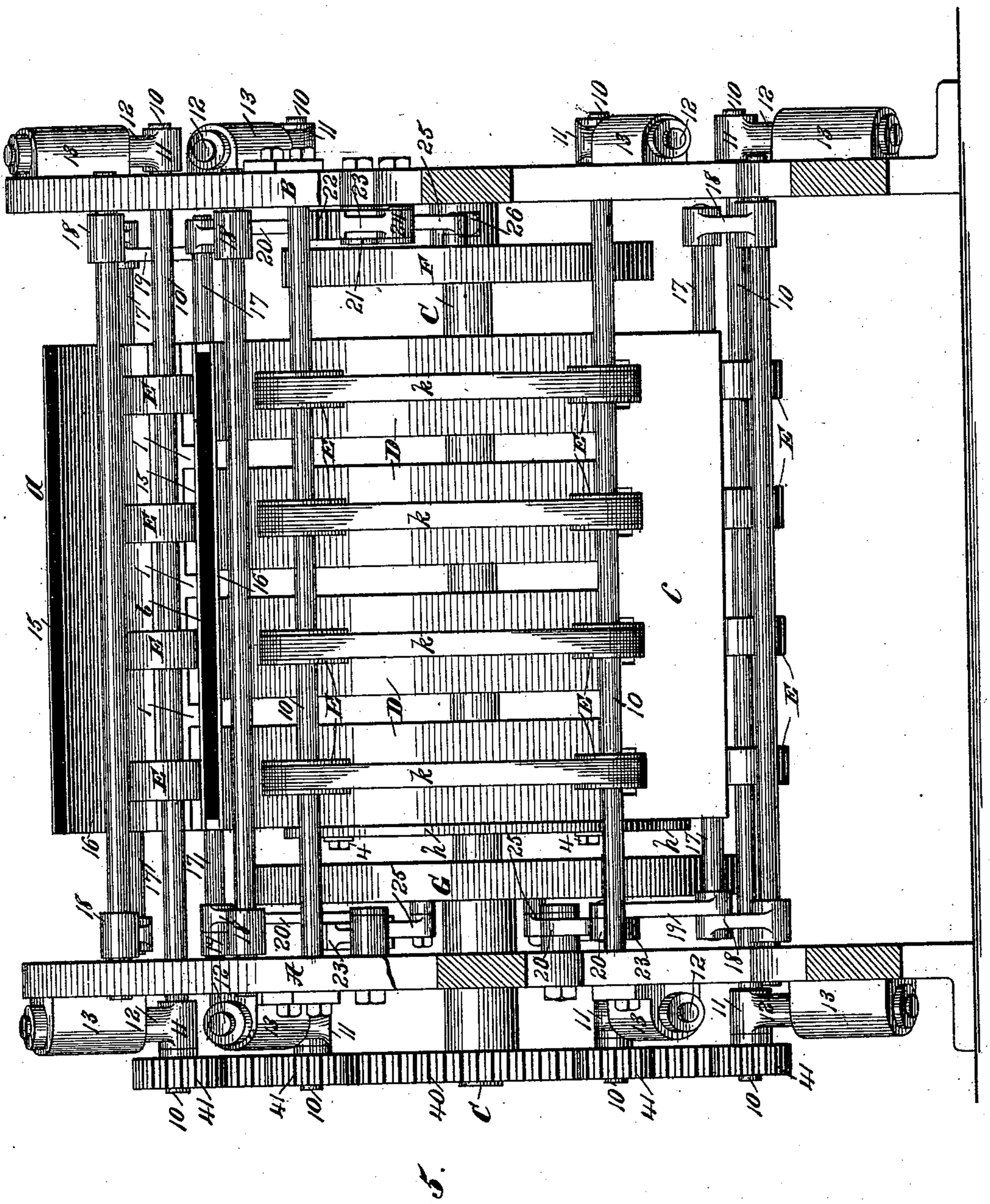

Fig. 5.

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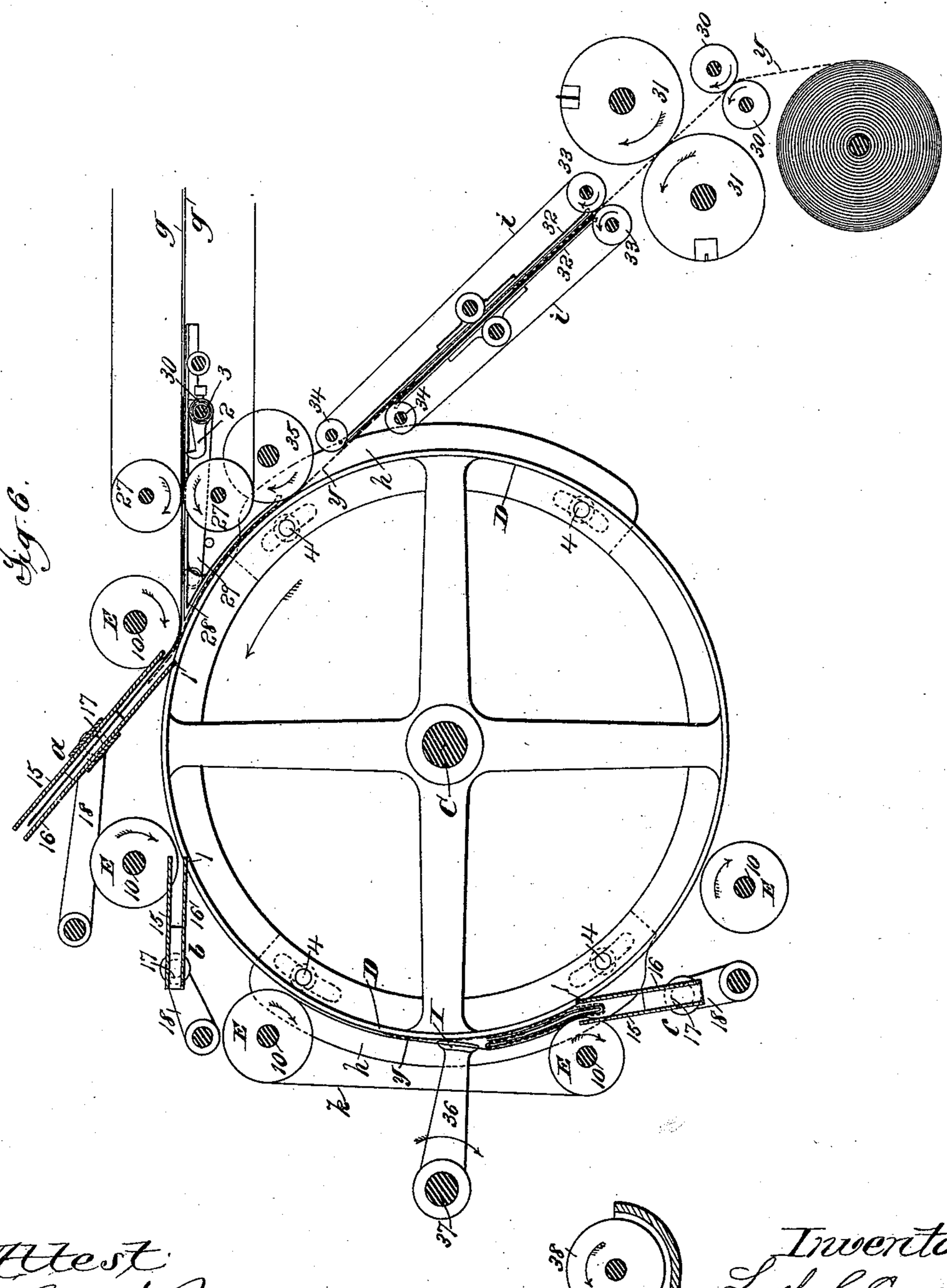
Fig. 6.



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WRAPPING AND FOLDING MACHINE.

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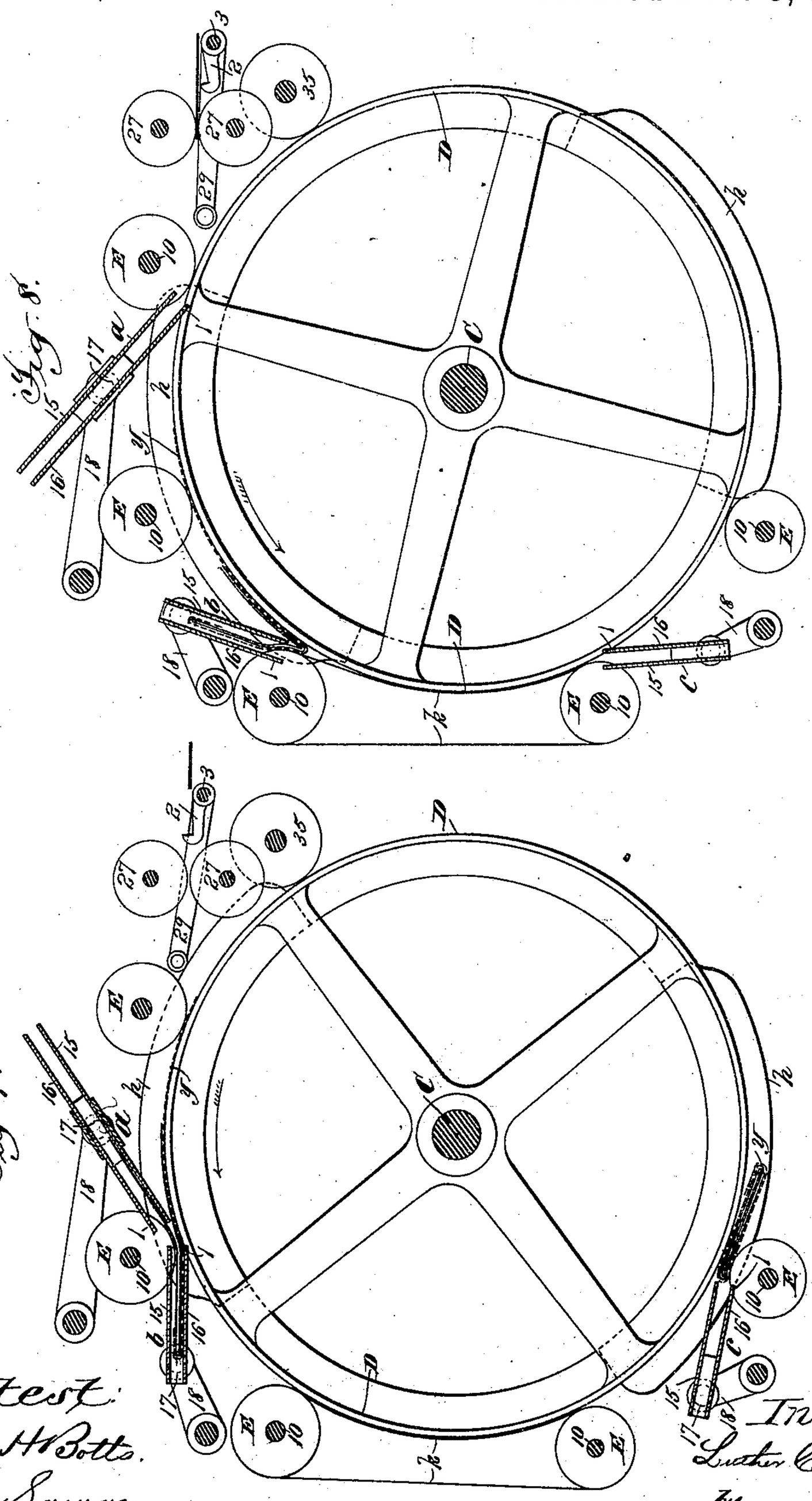

Attest:
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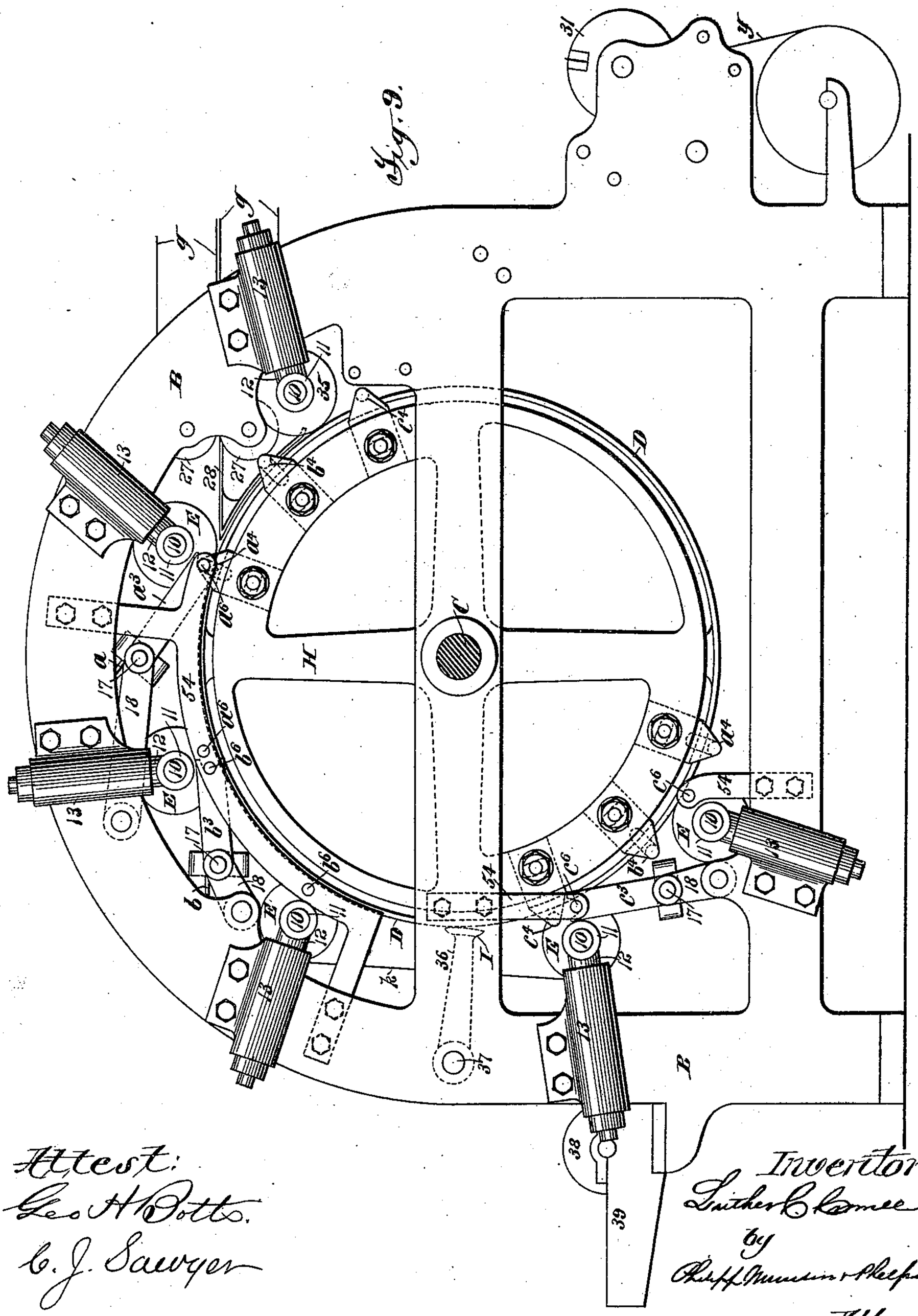

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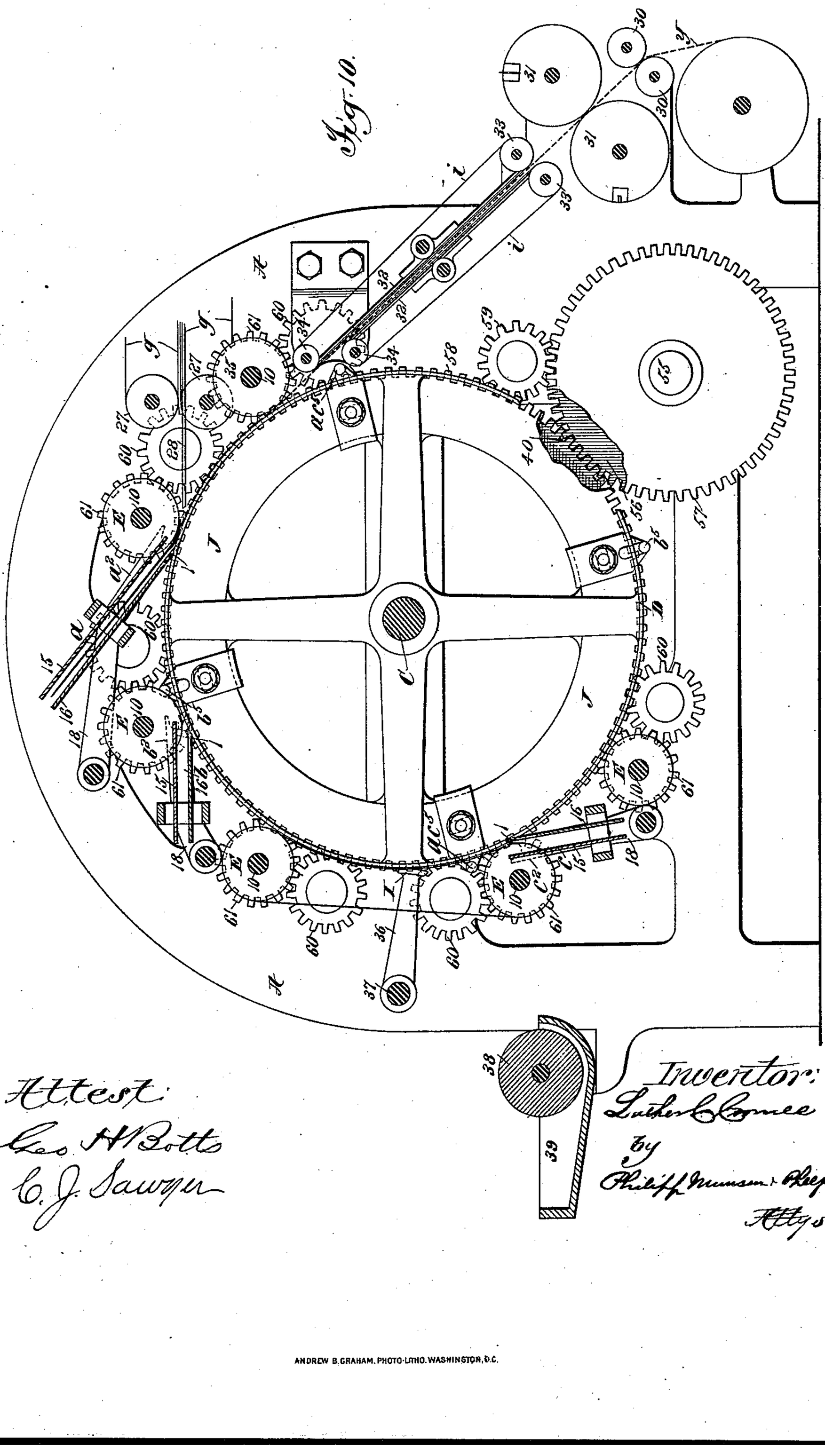

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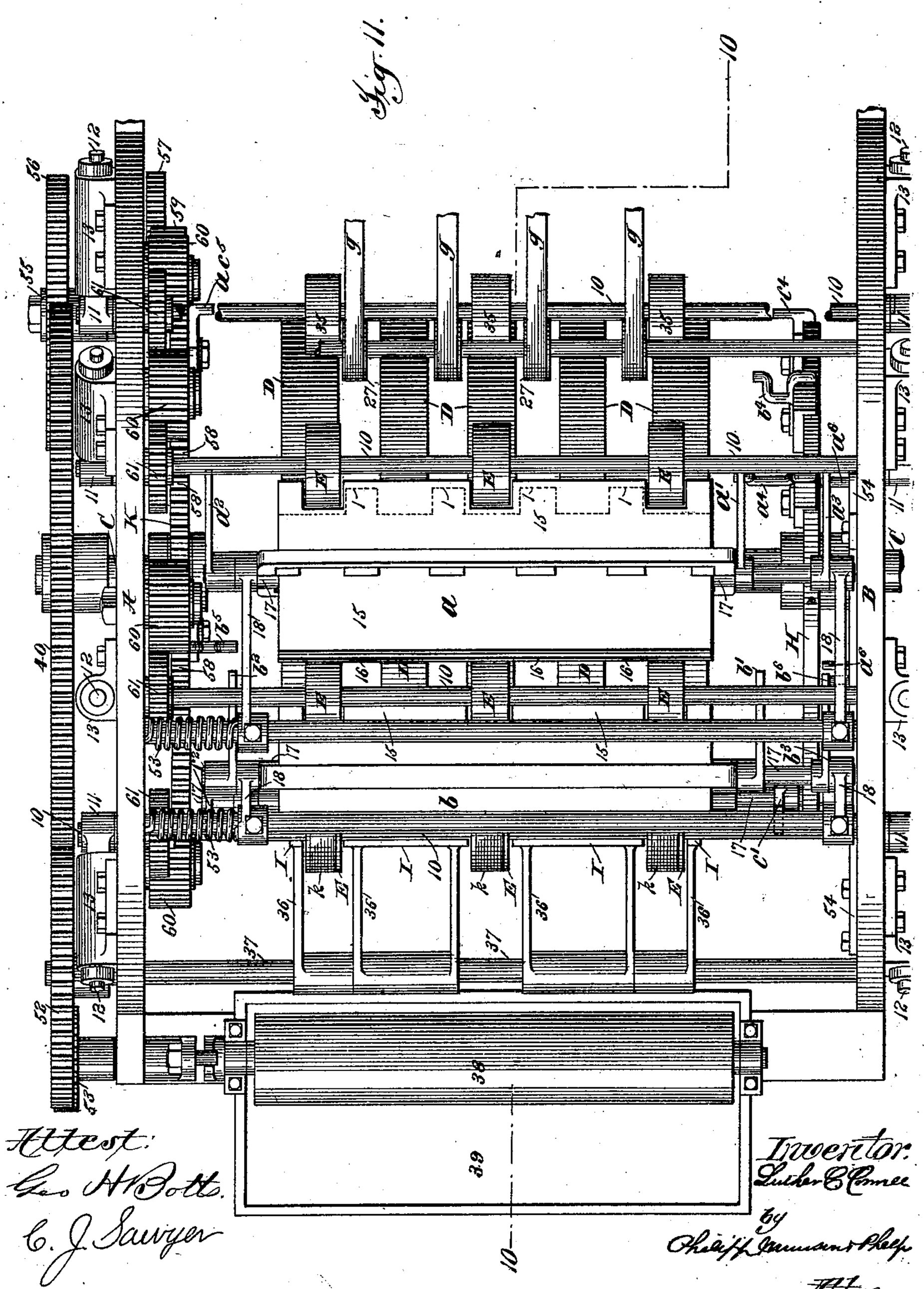
Fig. 11.



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L. C. CROWELL.

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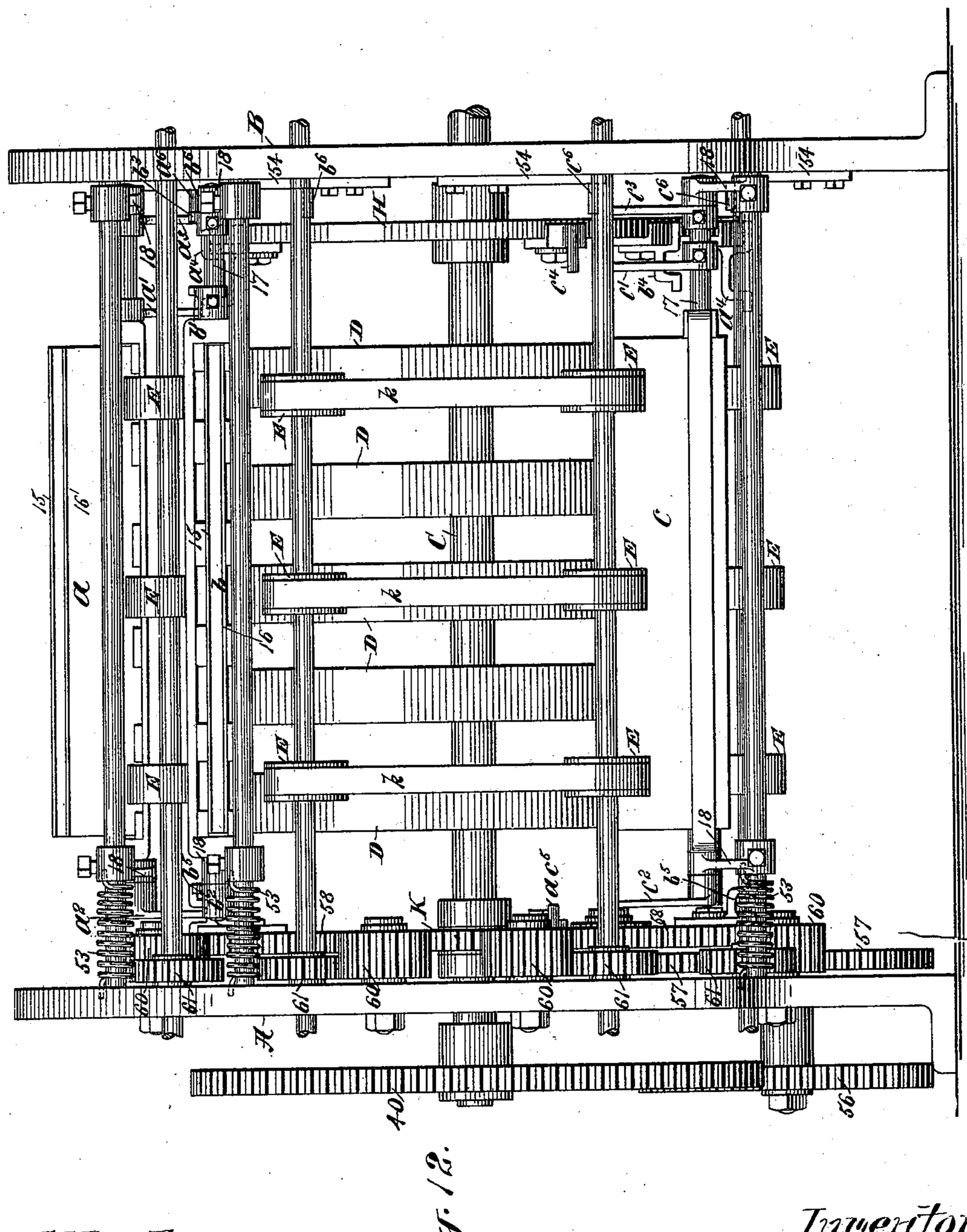

Fig. 1.

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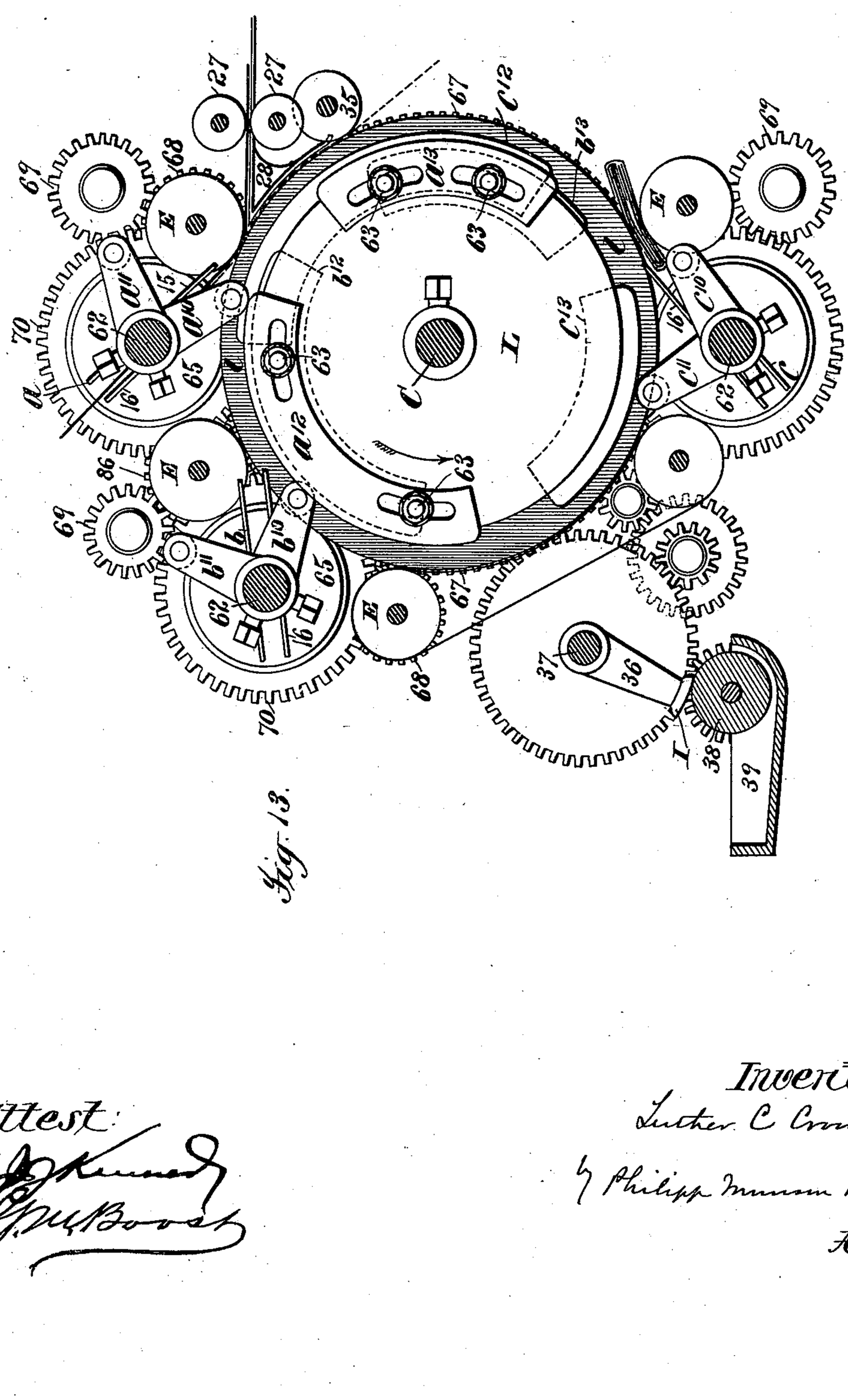

Fig. 13.

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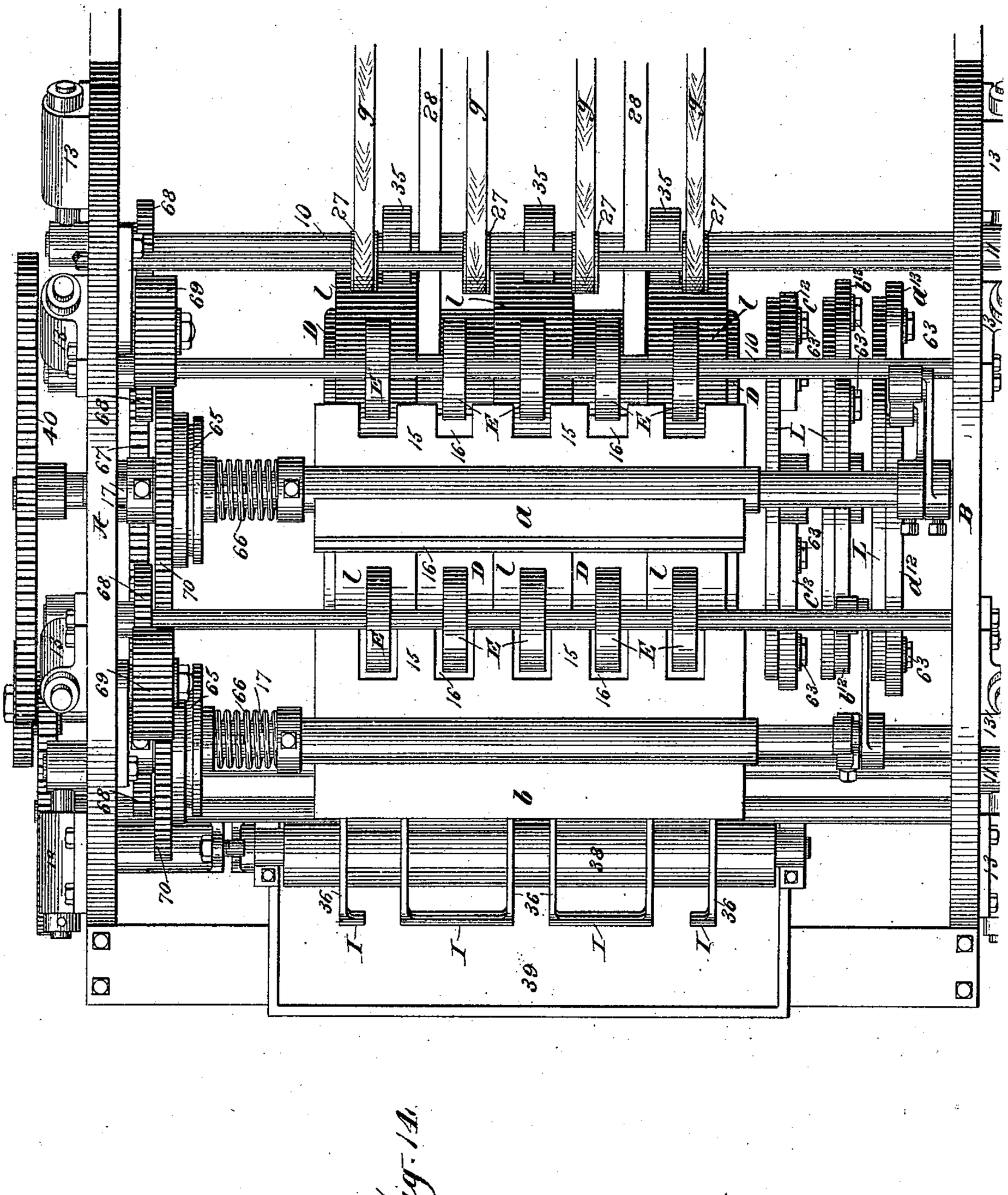

Fig. 14.

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Knapp Munson & Keep
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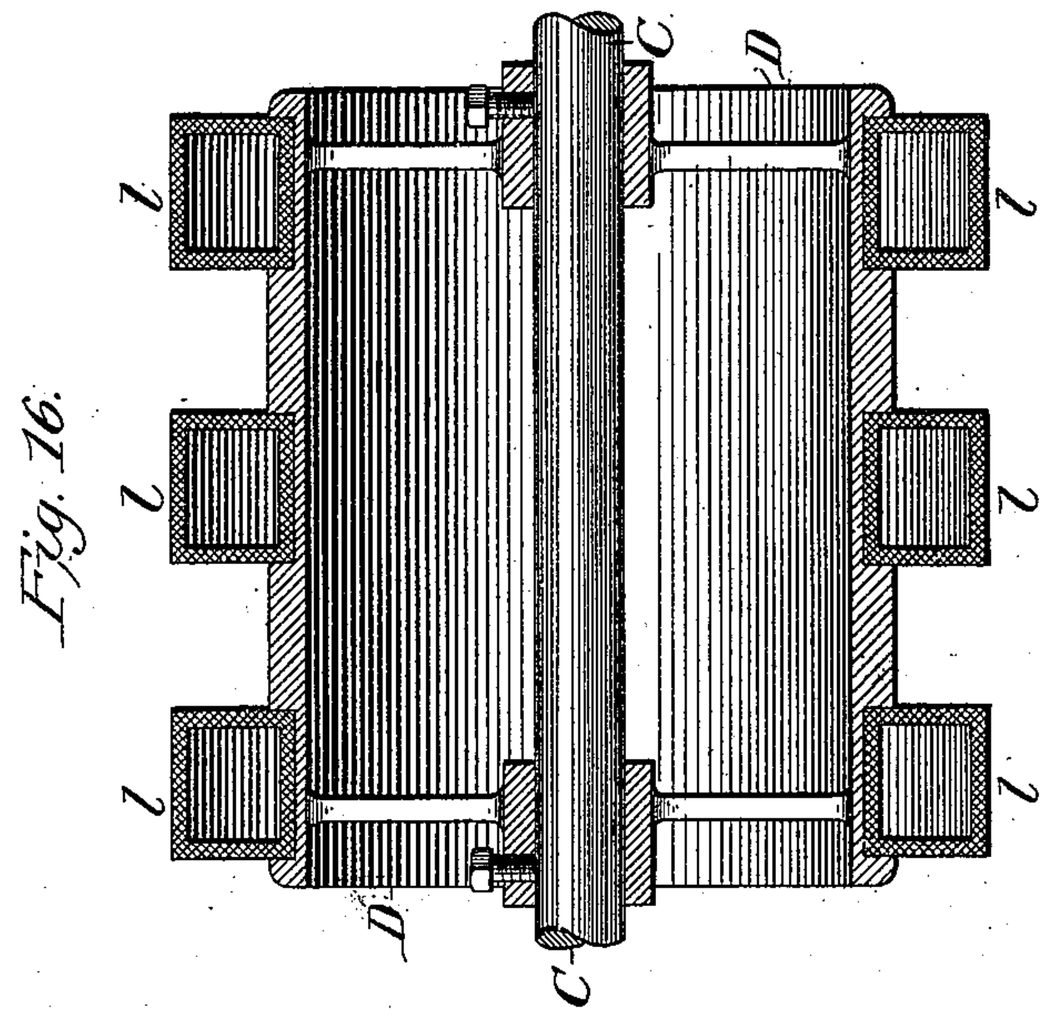

Fig. 16.

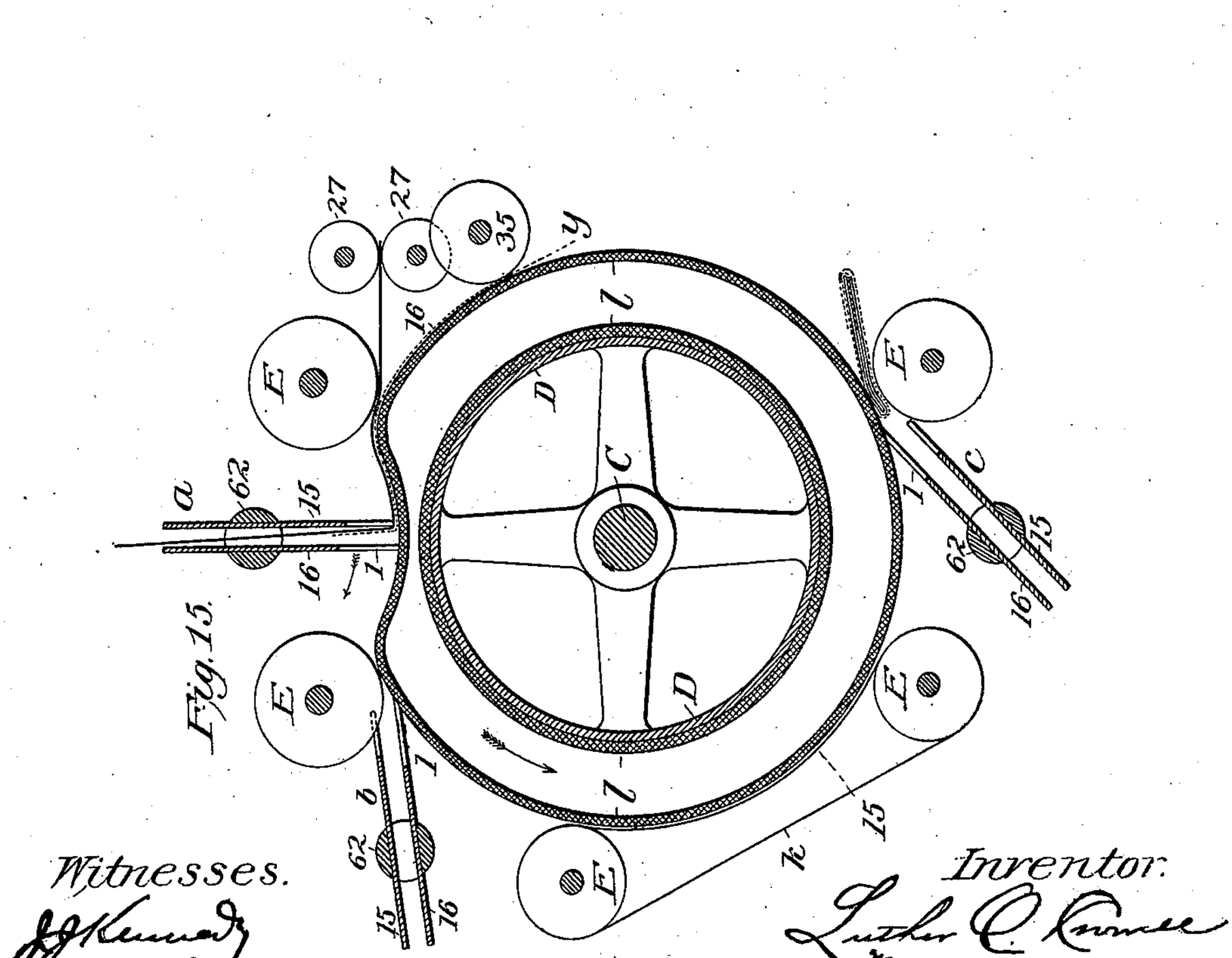

Fig. 15.

Witnesses.

H. C. Kennedy

C. J. Sawyer

Inventor:

Luther C. Crowell

by Church Munson & Phelps

attys.

UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ROBERT HOE, THEODORE H. MEAD, AND CHARLES W. CARPENTER, OF NEW YORK, N. Y.

WRAPPING AND FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 549,110, dated November 5, 1895.

Application filed May 12, 1893. Serial No. 474,025. (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 Wrapping and Folding Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of the present invention is to provide an improved folding-machine, and especially to provide an impoved machine for folding and wrapping newspapers and other publications. This object is attained by the use of a plurality of feeding devices and a plurality of carriers, one mounted between each two successive feeding devices, these carriers being arranged to receive the sheet and guide it into proper position to be folded, and, when the article has been fed partially past the folding-plate of the carrier, to move so as to carry the folding-plate from the feeding device from which the article has been received to the next feeding device over the surface of an abutment or wiper, and thus to double or fold the sheet against the abutment or wiper and transfer the fold-line of the sheet to the next feeding device. The number of feeding devices and carriers may be varied in accordance with the number of operations upon the sheet desired, the last carrier in a wrapping-machine being arranged to double or fold over the wrapper just at the edge of the folded sheet, so that the pasted end of the wrapper is pressed down and secured by the last feeding device to which this carrier transfers it. It is evident that the construction of machines operating on this principle may be varied widely, that the feeding devices, carriers, and abutment may be of different forms and their arrangement and movement be varied within wide limits. It is preferable however, to use an abutment moving in the direction of movement of the carriers in folding the paper, and a simple and efficient machine is produced by arranging a series of feeding devices, preferably feeding-rolls, about the surface of a rotating cylinder which coacts with the rolls to advance the paper and at the same time forms the abutment against which the sheet is folded as the carriers are moved over and with the cylinder. The carriers combined with this cylinder and feeding devices consist, preferably, of two parallel plates or sets of fingers mounted, respectively, between the successive rolls, and these carriers are preferably mounted to swing in opposite directions over the cylinders to fold the sheet and return to normal position, although the carriers may rotate and be returned to position on a full rotation. It is desirable that the folding-plate of the carrier should lie close to the surface of the cylinder in receiving and delivering the sheet, and that it should also follow the surface of the cylinder at the proper distance in moving over it to fold the sheet. It is necessary, therefore, that provision be made for permitting the carrier or surface to yield as the carrier passes over it, and this is preferably accomplished by moving the carrier from and toward the surface of the cylinder during the movement of folding or transferring the sheet. It is desirable, also, that the carrier should have, in addition to the movement along the surface of the cylinder, a movement toward the feeding-roll to which the sheet is transferred, so as to carry the fold-line of the doubled sheet positively into position to be gripped by the cylinder and said feeding-roll, and on its return should be moved toward the feeding-roll from which the sheet is received, so as to assure the proper reception of the sheet by the positioning of the carrier close to the roll. These results are secured, preferably, by mounting the carriers pivotally in swinging arms, so that the carriers have a movement on their own axis, by which the folding-plates are swung over the cylinder and are carried by the arms to and from the surface of the cylinder, so as to be carried outward from the cylinder sufficiently to permit the sheet to be folded between the carrier and cylinder, and are then carried inward and forward again, so as to deliver the fold-line of the sheet positively into the grip of the cylinder and roll to which it is transferred. The rolls may be mounted rigidly if the machine is to be used with sheets of the same thickness, the positions of the different rolls

relatively to the cylinder being adjusted in accordance with the number of plies of the sheet as it is advanced by each roll; but I prefer to use spring-pressed rolls, thus enabling the machine to be used with sheets of different thickness.

In order to secure certainty in the reception and delivery of the sheet by the carrier the feeding-rolls and cylinder are preferably formed of disks or provided with circumferential grooves, and the carrier formed to enter between the disks or into the grooves of the rolls in receiving and delivering a sheet, and the guiding portion of the carrier is preferably made to enter the cylinder in receiving a sheet, so that the sheet is fed into the carrier without risk of abutting against the edges of the carrier, and the fold-line is carried farther within the grip of the cylinder and the next feeding-roll than would otherwise be possible. This folding and wrapping mechanism may be fed by hand, or any suitable feeding devices for automatically advancing papers and wrappers to the wrapping mechanism in proper time, together or independently of each other, may be combined therewith. The wrapper may previously be cut to the desired size and fed to the folding and wrapping mechanism as sheets or fed from the web and severed in the machine. This folding and wrapping mechanism may be combined with a printing-press, so that the papers may be printed, folded, and wrapped by a single machine, suitable wrapper, feeding, and pasting devices being added, the wrapping mechanism herein shown being of sufficient capacity to be applicable to rapid web-printing presses.

In the accompanying drawings, forming a part of this specification, there is shown a complete folding and wrapping machine of the general construction above described, which will be found an efficient and convenient embodiment of the present invention, and certain modifications thereof and a detailed description of the same will be given, and the features forming the invention specifically pointed out in the claims.

In the drawings, Figure 1 is a side elevation of the gear side of the machine. Fig. 2 is a sectional elevation taken inside the frame on the same side of the machine. Fig. 3 is a side elevation of the opposite side of the machine. Fig. 4 is a plan view. Fig. 5 is a rear end elevation with the pasting devices removed. Figs. 6, 7, and 8 are diagrammatic sectional elevations taken inside the frame on the same side of the machine as Fig. 3, showing the parts in different positions during the operation of folding and wrapping a sheet. Figs. 9 to 12 show a modified form of machine. Fig. 9 is a partial side elevation. Fig. 10 is a vertical section on the line 10 of Fig. 11. Fig. 11 is a plan view, and Fig. 12 a rear end elevation with the pasting devices removed. Figs. 13 to 16 show another modification. Fig. 13 is a partial side elevation. Fig. 14 is a plan view. Fig. 15 is a cross-section on the line 15 of Fig. 14. Fig. 16 is a central longitudinal section of the cylinder.

Referring to said drawings, the frame of the machine may be of any suitable construction for supporting the operating parts. As shown, it consists simply of the vertical side frames A B. In these frames is mounted centrally of the machine the main shaft C, which carries a large cylinder D, this cylinder being preferably formed, as shown, of a series of disks mounted upon the shaft C at suitable distances apart to form grooves of the required width between the disks, although it will be understood that a grooved continuous cylinder may be used, if preferred.

About the cylinder D are arranged a plurality of feeding-rolls E, these rolls being arranged at considerable distances apart, according to the length of the paper to be doubled or folded between them, and preferably being formed of disks set at suitable distances apart, as shown, or provided with grooves in some other manner. The cylinder D may be of any suitable size and any number of these feeding-rolls E be used in accordance with the number of folds of the sheet desired. There are shown, however, five of these rolls making a construction by which a sheet may be thrice folded or twice folded and wrapped. These rolls E may be mounted rigidly if the machine is to be used only with sheets of the same thickness; but it is preferable to make the rolls spring-pressed, in order to accommodate sheets of different thicknesses, and moreover this construction is preferable even with sheets of the same thickness. Any suitable construction may be used for this purpose; but there is shown a common arrangement in which the shafts 10 of the rolls E are mounted in bearings 11, having stems 12, supported in hollow studs 13 on the frame, the bearings being spring-pressed to force the rolls toward the cylinder by coiled springs 14 within said studs.

Between the rolls E are mounted carriers *a b c*, a carrier between each two feeding-rolls, except that space is left between two of the rolls previous to the last fold for applying paste to the wrapper. If the pasting mechanism be omitted or other pasting devices employed, it will be understood that one of the rolls E may be omitted. These carriers consist in the form shown of plates 15 16, preferably of thin sheet metal, mounted parallel with each other and supported by rods, these rods 17 being pivotally mounted in swinging arms 18, so as to rock in said arms while being carried by the arms to and from the cylinder. For actuating these carriers the following means are preferably used: As shown in these figures, the rod 17 at one end of the carrier has an arm 19, pivotally connected to a crank-arm 20, carried by a rock-shaft 21 mounted in the frame of the machine. This rock-shaft 21 carries also a sec-

ond crank-arm consisting of a segmental gear 22, which meshes with a segmental gear 23, carried by a sleeve 24 mounted on a stud in the frame. This sleeve 24 carries a crank-arm 25 having a bowl. The construction of these parts is the same for each of the carriers *a b c*, and the bowls on their respective operating crank-arms 25 run in cam-grooves *d e f*, formed in two cam-disks F G, carried by the shaft C at opposite sides of the machine, the two cam-grooves *e f* being shown as formed in the cam-disk G, so that carrier *a* is operated from one side of the machine and carriers *b c* from the other side; but it will be understood that this arrangement is only for convenience. These cams may be mounted in fixed positions relatively to the shaft C, if it be desired to operate on but one length of sheet and to make the folds always on the same line; but it is preferable to make the cams adjustable on the shafts, as it will be seen that by simply shifting the position of any cam the line of the sheet upon which the fold will be formed may be varied, so that a single machine may be used for folding sheets of widely-different lengths and for folding sheets on different lines, so as to produce a variety of products. In the construction shown, the cams F G are carried by sleeves loose on shaft C and are secured in their adjusted positions thereon by means of set-screws 26.

The carrier *a* is shown as extended above the rods 17, by which it is carried so as to support the leading edge of the sheet while it is fed into the carrier, and such support is desirable when the sheet consists of only one or two plies; but with sheets of considerable thickness and rigidity this may be found unnecessary, and this carrier may be formed in the same way as carriers *b c* in the construction shown, terminating at or just above the rods 17. If the carriers are formed of continuous plates 15 16, as shown in the construction now being described, they are both cut away at their inner edges, so as to enter the grooves in rolls E in receiving and delivering the sheet, and the plate 16 is preferably cut away so as to form fingers 1, entering the cylinder D in receiving a sheet, thus securing greater certainty of operation and rendering a high speed possible.

The plate 15, which forms the folding plate by which the sheet is folded against the surface of the cylinder, should be of considerable extent, so as to secure proper folding by engaging the fold-line through a considerable portion of the width of the sheet, and this plate, of course, should not project within the surface of cylinder D. The plate 16, however, which forms the guide for the sheet, may be formed of a series of narrow fingers, but little strength being required, and, as stated above, they preferably project slightly inside the surface of the cylinder in receiving the sheet. It may be found preferable to make guide 16 of such a series of fingers, as this leaves no edge outside the cylinder to be engaged by the sheet as it is fed forward into the carrier.

The construction thus far described may be used as a folding-machine, or papers and wrappers may be fed thereto by hand and the machine used as a hand-fed folding and wrapping machine, the paste being applied by hand or by any suitable devices. The machine shown, however, is adapted for use as a high-speed automatic folding and wrapping machine, the sheets or papers being represented as taken from a pair of feed-belts, which may be the delivery of a printing-press or to which the sheets or papers may be fed as sheets from a pile. It will be understood, however, that the invention does not depend upon any special form of paper or wrapper-feeding devices, but that these may be varied as desired.

Any suitable form of pasting devices may be used, and the paste applied at any desired point and either to the loose flap of the wrapper or to the layer of wrapper upon the paper. It is desirable, however, that the paste should be applied as late as possible, and there are shown devices for applying the paste to the wrapper just prior to the operation of the last carrier by which the flap of the wrapper is turned over for pasting. In the construction shown the sheets or papers are fed in by the belts *g*, extended around belt-pulleys 27, placed adjacent to the first feeding-roll E, the sheet being fed in by said belts over guides 28.

To secure the proper timing of the feed of the sheet relatively to the operation of the carrier *a* any suitable means may be provided; but there are shown stops 2, carried by a rock-shaft 3, mounted below said belts and actuated by a crank-arm 29, carrying a bowl, which runs upon cam-plates *h*, carried by the cylinder D at one end, so as to throw the stops outward into the path of the paper as it is advanced by the belts *g* and hold it until the proper time when one of the cams *h* passes the bowl on arm 29 and releases the rock-shaft, which is then rocked by spring 30 on the shaft to carry the stops below the belts and release the sheet. It will be understood than the cams *h* are so timed relatively to the cam *d*, by which the carrier *a* is operated, that the sheet is released by the stops 2 just at the proper time to reach the carrier *a* when it is in the position shown in Figs. 6 and 8. These cams *h* are preferably made adjustable by means of slots and set-nuts 4, so as to secure the accurate timing of the sheet, and by this adjustment, also, the machine may be capacitated to act on sheets of different lengths and to fold on different lines without adjustment of the cams *d e f*, as it is apparent that the fold-line of the sheet will depend upon the distance to which it is fed within the carrier *a*, and this depends upon the time at which the stops are lowered to release the sheet by the cam *a*.

The wrapper *y* is fed from a wrapper-roll by a pair of feed-rolls 30 and received from said rolls by a pair of perforating-rolls 31, by which the web is perforated on the line at which the wrapper is to be severed, the perforated wrapper then being advanced between guides 32 by feed-belts *i*, carried by pulleys 33 34, the pulleys 34 being placed closely adjacent to the cylinder D. The leading end of the wrapper-web is thus advanced between the cylinder D and a roll 35, preferably spring-pressed, and shown as mounted for this purpose in the same manner as the rolls E, previously described. This roll 35 rotates and the cylinder advances the wrapper at a speed accelerated over that of the tapes *i*, and a wrapper is thus snapped off on the line of perforations and advanced forward about the cylinder to the first roll E and carrier *a*, where it is associated with the paper.

The pasting devices are placed at the opposite side of the cylinder D from the point at which the wrapper and paper are fed in and just behind the last carrier. As shown, two of the rolls E are separated a sufficient distance to accommodate the pasting devices, and the paper, which at this time has been folded down to the size of the final product, is advanced between the rolls E by tapes *k*, extending between said rolls and coacting with the cylinder D. The paste is applied by means of a rotating paster I constructed to apply paste at the desired point and carried by arms 36 on a shaft 37, mounted in the frame of the machine, the paster being shown as cut away so as to accommodate the tapes *k*. The paste is supplied to the paster I by a fountain-roll 38 rotating in the usual fountain 39.

The operative parts of the machine are all actuated from the main shaft C, as follows: The shaft C carries outside the frame A a gear 40 of the same size as the cylinder, which meshes directly with gears 41 on the shafts 10 of the rolls E and on the shaft of the wrapper feeding and breaking roll 35, so that these rolls are driven by a direct gear connection with the shaft C and at the same surface speed as the cylinder D. The teeth of the gears 40 41 are made of sufficient length, so as to intermesh and drive the rolls E, although they may yield against the tension of the springs 14 to accommodate the folded paper. The tapes *g* are driven from the tape-rolls or pulleys 27, which are driven from the gear 40 by an intermediate 42, meshing with one of the gears 43, by which the shafts of said rolls are geared together. The wrapper-feeding mechanism is driven from the gear 40 at a lower rate of speed than the cylinder and rolls by a large intermediate 44, meshing with the gear 40 and small gear 45 on the same shaft and intermediates 46, connecting with small gear with gears 47, by which the perforating-rolls 31 are geared together. The feeding-rolls 30 are geared together by gears 48 and driven from one of the gears 47 by an intermediate 49, and the rolls 33 are likewise geared together by gears 50 and driven from the same gear 47 by intermediate 51. The shaft 37, carrying paster I, is driven directly from the gear 40 by a gear 52 on said shaft, and this gear 52 meshes with a gear 53 on the shaft of the fountain-roll 38. While this system of gearing forms a very simple and efficient construction, it will be understood, however, that any other suitable means for driving the parts of the machine may be used.

The operation of the construction will be understood from the following brief description in connection with the drawings, referring especially to Figs. 2, 3, and 6 to 8.

In the position shown in Figs. 2, 3, and 6 a sheet has been advanced by the tapes *g*, the stops 2 having been lowered by the spring 30 on the release of the arm 29 by the cam *h* on the cylinder D, and the sheet has been fed into the carrier *a*, which is just about to be actuated by the cam *d* to double the sheet against the surface of cylinder D and transfer the fold-line of the doubled sheet to the next roll E, the machine being illustrated as operating to fold a sheet twice on the middle line—that is, to form four plies of the original sheet and apply a wrapper thereto. The wrapper *y* has been broken from the perforated wrapper-web by the cylinder and roll 35 and advanced thereby to the roll E and within the carrier *a* on the under side of the sheet sufficiently to insure the wrapper being folded with and outside the paper. The cam *d* now acts upon the bowl on arm 25, so as to rock the segmental gear 23 and through the segmental gear 22 the shaft 21, so as to carry the crank-arm 20 on the axis of the carrier *a* forward in the direction of movement of the cylinder D, thus swinging the carrier *a* on its axis and in the same direction. At the same time the straightening out of the joint formed by the arms 20 19 carries the arms 18, on which the carrier *a* is mounted, away from the cylinder D, so as to withdraw the fingers 1 of the carrier out of the grooves in the cylinder D and raise the carrier from the cylinder sufficiently to enable the sheet to be doubled between the fingers and cylinder, while at the same time positively holding plate 16 of the carrier so close to the surface of the cylinder as to insure the accurate doubling or folding of the sheet. As the carrier is swung past the center of its path of oscillation and over the highest point of the cylinder-curve between the two rolls E, the continued movement of the arms 20 19 past the dead-center tends to shorten the length of the connection between the arms 18 and the fixed shaft 21, and thus the carrier is drawn downward again toward the surface of the cylinder and at the same time, by the compound movement of swinging on its axis and moving bodily toward the cylinder, is carried forward positively and close to the surface of the cylinder, so as to advance the fold-line of the doubled sheet positively into the grip of the cylinder D and

next roll E, the plate 15 entering the grooves in the roll, so as to carry the sheet as far as possible between them. The second carrier *b* is now in position to receive the sheet thus folded with the wrapper from the cylinder and roll E, to which the carrier *a* has delivered it, and the once-folded sheet is now fed into the carrier *b* with the wrapper overlapping the leading end and projecting behind the rear end. At the same time the rotation of the cylinder D has carried one of the cams *h* into position to engage the bowl on the arm 29 and has thus raised the stops 2 into position to engage the head of the next sheet, so as to hold it until the proper moment to secure the desired feed of the sheet into the carrier *a*. This position of the parts is shown in Fig. 7. The carrier *a* is now returned to position by the action of the cam *d* upon the bowl on arm 25, reversing the movement of the carrier previously described. The stops 2 are lowered by the passage of the cam *h* beyond the bowl on arm 29 and another sheet and wrapper are fed forward to the carrier *a* for repeating the operation just described. The carrier *b*, which has received the sheet and wrapper from the roll E, to which it was delivered by the carrier *a*, is now operated by the cam *e* in exactly the same manner as described in connection with the carrier *a* and the sheet doubled against the surface of cylinder D, and the fold-line of the sheet, doubled or folded twice on the middle line, is transferred into the grip of cylinder D and the next roll E.

In Fig. 8 the parts are shown with the cylinder D and the roll E just receiving the twice folded sheet from the carrier *b*. The wrapper now extends entirely about the sheet, with its leading end held between two layers of the same and its rear end projecting behind the sheet sufficiently to form the pasting-flap by which the wrapper is secured. The sheet in this form is now advanced by the tapes *k* and cylinder D, and as it advances the paster 36 lays a line of paste upon the pasting-flap between the tapes *k*, just in the rear of the next roll E and the sheet, with the flap thus pasted, passes into the grip of the cylinder D and roll E and is advanced thereby to the third carrier *c*, as shown in connection with the second sheet in Fig. 6. The cam *f*, by which the carrier *c* is actuated, is timed so as to permit the sheet to be fed entirely within the carrier *c*, so that, as the carrier is operated by the cam, as previously described in connection with the carrier *a*, the sheet is not doubled against the cylinder *d*, but only the flap of the wrapper *y*, the folding-plate 15 of the carrier *c* engaging the wrapper just behind the sheet. As this carrier is operated, therefore, the folded sheet is turned so as to lap the pasted wrapper-flap down upon the previous layer of wrapper upon the paper, and the sheet with the flap of the wrapper lapped over upon it is transferred between the cylinder D and the last roll E, so as to be advanced thereby and the flap of the wrapper pressed down and secured, the twice folded and wrapped paper thus being delivered from between the cylinder D and the last roll E, as shown in connection with the second paper in Fig. 7, the carrier *c* then being returned by the cam *f* into position to receive another sheet and wrapper, as shown in Fig. 8.

While the machine has been illustrated and described as folding a sheet midway of its length, it will be apparent from an inspection of the drawings that the sheet may readily be folded upon any other line, it being necessary only to time the carrier and sheet-feeding devices, so that the carrier is actuated at the proper time to fold the sheet on the desired line.

In folding and wrapping comparatively thick newspapers and pamphlets it is frequently desirable to fold at one-third of the length, so as to form a product consisting of three plies of the original sheet. It is difficult to form the second fold in such case with the common folding-blade and roll constructions of folding mechanism or with others acting in the same way, as there is nothing to hold the free edge of the first fold as the second fold is made; but it will be seen that the present invention provides a construction excellently adapted for this method of folding, as the two plies of the sheet formed by the first fold are positively held within the carrier. In fact, this method of folding may be found preferable with the machine shown, as it is necessary then to double or fold only a single ply of the original sheet at each folding operation. It will be seen, also, that the machine is very simple, and it will be found efficient, durable, and of very high capacity, so that the machine is of great utility not only as a folding and wrapping or wrapping machine, but also as a folding-machine only, this utility being increased largely by the ease with which the machine may be adjusted, so as to fold sheets of different lengths or to fold sheets upon different lines. It will be seen, also, that this machine may readily be arranged so as to fold and wrap or to fold to different sizes, as desired. For instance, in the construction shown, the machine may readily be used as a folding-machine, folding three times, solely by throwing out the paster and timing the carrier *c*, so as to form a third fold, or the carrier *c* may be thrown out of operation and the twice-folded sheet delivered finally by the tapes *k*, or the carrier *b* thrown out of operation and the once-folded sheet delivered by any suitable means.

It is obvious that many other arrangements of devices for securing the proper movement of the carriers may readily be devised, and while the construction previously described shows the preferred construction, efficient machines may be made with other arrangements. Thus in Figs. 9 to 12 I have shown a modified construction in which the carriers are actuated to transfer the paper and returned

to position for receiving the next paper by two sets of actuating devices moving continuously in opposite directions. In this machine the general construction and arrangement is substantially the same as that previously described, and the same letters of reference will be applied to corresponding parts in the two constructions, the machine being described only so far as is necessary to explain the differences of construction. In this construction each one of the shafts 17, by which the carriers *a b c* are mounted in the swinging arms 18, is provided with an actuating crank-arm for swinging the carriers to transfer the sheets, these crank-arms being lettered, respectively, a' b' c', with corresponding crank-arms for returning the carriers to position, lettered, respectively, a^2 b^2 c^2, and corresponding stop-arms lettered, respectively, a^3 b^3 c^3, these arms consisting, in the form shown, of narrow plates of metal forked at their outer ends, so as to properly engage pins by which they are actuated or stopped in proper position. The actuating-arms a' b' c' are engaged at the proper time to actuate the carriers to transfer the sheet by pins a^4 b^4 c^4, corresponding to the respective carriers actuated thereby. The arms a^2 b^2 c^2 are engaged at the proper time to return the carriers to position for receiving the sheet by pins ac^5 b^5, corresponding to the respective carriers actuated thereby, the pins ac^5 actuating both the carriers *a* and *c* and the pin b^5 actuating only the carrier *b*, and for each carrier are provided two stops corresponding to the two positions of the carrier and engaging the stop-arms a^3 b^3 c^3 in their two positions, so as to hold the carriers accurately in position while the sheet is being fed in and out of the same and insuring the proper position of the carriers for the action of the actuating and return arms and pins, these pairs of stop-pins being lettered respectively, a^6 b^6 c^6, corresponding to the different carriers with which they coact. Each of the shafts 17 of the carriers *a b c* is provided with a spring 53, coiled thereon and secured to the frame and shaft, so that the rotation of the shaft 17 in folding and transferring the sheet puts the spring under tension.

It will be seen that there are two sets of both the actuating and return pins placed at exactly opposite sides of the machine. These two sets are used only because the machine is adapted to fold and wrap two papers at each revolution of the cylinder D. If but one paper were to be wrapped at each rotation, of course one set of each of these pins could be omitted, and it is apparent that the construction might readily be modified so as to handle more papers at each rotation of the cylinder.

It is necessary to move the actuating and return pins above described in opposite directions and time them properly, so as to secure the proper movement of the carriers. The means by which this result is attained are as follows: A disk H is secured on the shaft C so as to move with the cylinder D, and from the inner side of this disk the projecting pins a^4 b^4 c^4 project, these pins being of different lengths, and each, except the shorter one, being bent, as shown, or otherwise constructed so as to engage none of the actuating-arms except the one it is adapted to operate, these actuating-arms a' b' c' being offset or arranged at different distances from the disk H to secure this result. The stop-arms a^3 b^3 c^3 are at the same ends of the shafts 17 as the actuating-arms a' b' c' and outside the latter and the disk H, and the stops a^6 b^6 c^6 project inwardly from the frame B, or, as shown, from fixed brackets 54, carried by the frame B. A disk K is mounted loosely on shaft C just inside the frame A at the opposite side of the machine from the disk H, and the return-pins ac^5 b^5 project inwardly from the disk, the pins b^5 being bent, as shown, or otherwise constructed to pass the arms a^2 c^2 without engaging them.

The cylinder D and disks H K are actuated so as to secure the movement of the disk K in the opposite direction from the cylinder D and disk H by the following means: A stud 55, mounted in the frame A, carries two gears 56 57, respectively outside and inside the frame A, the gear 56 engaging gear 40 on shaft C, thus driving the stud 55 in the same direction as the shaft C. The disk K is provided with a gear 58 of the same size as gear 40, and this gear and the disk K are driven from gear 57 on stud 55 through an intermediate 59, so that the movement of the disk K is reversed from the shaft C; but the speed of the disks H K and cylinder D is the same. In this construction the rolls E may be driven directly from the gear 40, as in the construction previously described; but in connection with the gear 58 it is possible without complicated construction to provide for a greater movement of the rolls E from the surface of the cylinder D without interfering with the driving of the rolls E by driving these rolls from gear 58 through intermediates 60 and gears 61 on the shafts of the rolls, the intermediates and shafts being so mounted that as the spring-pressed rolls E move away from the cylinder D the movement is in such a line as to retain the gears 60 61 in mesh.

The operation of the construction will be understood from a brief description in connection with the description of the operation previously given in connection with Figs. 1 to 8. The position shown is the same as that shown in Figs. 2, 3, and 6, in which a paper and wrapper have been fed into carrier *a* and this carrier is just about to be actuated to double the sheet against the surface of cylinder D and transfer the fold-line of the doubled paper to the next roll E, the carriers *b c* also being in position to receive a paper. In this position each one of the stop-arms a^3 b^3 c^3 is in engagement with its respect-

ive rear stop a^6 b^6 c^6, and the carriers thus held in position. The actuating-pin a^4 has just engaged the actuating-arm a' and will carry this arm with it as the cylinder D continues its movement, thus rocking the shaft 17 to swing the carrier and double the paper against the surface of the cylinder D, and at the same time swinging the arms 18 on their shaft, so as to raise the shaft 17 and permit the carrier to pass over the cylinder, as previously described. By this rocking of the shaft 17 the spring 53 on the shaft is put under tension, which increases until the arm a' has passed its middle position, and the tension of the spring then acts to press the leading end of the carrier and fold-line of the paper down against the cylinder and secure the proper action of these parts as the cylinder rotates onward, the carrier being thus brought into the position shown in Fig. 2, in which position it is stopped and held accurately by the stop-arm a^3 engaging the forward stop a^6 of carrier a. The paper is then fed out from the carrier by roll E and cylinder D and transferred to carrier b, as in the construction previously described. When the paper has been fed into the carrier b the proper distance, the actuating-pin b^4 engages the actuating-arm b' of carrier b and the operation just described in connection with carrier a is repeated in connection with carrier b, and so with carrier c as the paper, with the rear end of the wrapper pasted by paster I, reaches this carrier, the carrier c being actuated by its actuating-pin c^4 engaging its actuating-arm c'. The carrier a remains in the position shown in Fig. 2, in which position it is held against accidental displacement by the stop-arm a^3 engaging the forward stop a^6, until one of the return-pins ac^5 engages the return-arm a^2, when this carrier is rocked in the opposite direction, or to the right in Figs. 9 and 10, and as the carrier passes its middle position the tension of the spring is relieved and the carrier returned by the spring to the position shown in Fig. 10, being stopped and held in said position accurately by the stop-arm a^3 engaging the rear stop a^6. In like manner the carriers b c remain in position after delivering the paper, being held by their respective stop-arms and forward stops until their respective return-arms b^2 c^2 are engaged by one of their respective return-pins b^5 ac^5, and are then returned to normal position, as shown in Figs. 9 and 10, in which position they are held by their respective stop-arms b^3 c^3 engaging the rear stops b^6 c^6.

In the constructions thus far described the carriers have a reciprocating movement, moving in opposite directions to transfer the sheet and to return to position for taking the next sheet, and are moved bodily from the cylinder in folding the sheets to permit them to pass over the convex surface of the cylinder and to secure their movement parallel with the surface of the cylinder, so as to press the sheet against the surface during folding. It will be understood, however, that this is not absolutely necessary, but the invention may be embodied in constructions in which the carriers move in but one direction, and that, moreover, the axial line of the carriers may be stationary and the cylinder be constructed so as to have a movement toward and from the carrier as the carrier is moved over it. Various constructions operating in this manner may be made and the proper movement of the carriers and action of the cylinder be secured by widely-different means. In Figs. 13 to 16, however, there is shown a simple construction in which rotating carrriers are used, these carriers being frictionally driven by their actuating-shafts and held in position against the friction by cams during the operation of receiving and delivering the papers, and in which the cylinder has a yielding surface formed of rubber tubes containing air or other suitable elastic medium, thus providing for the movement of the surface from and toward the carrier. In this construction the cylinder D is the same in construction and operation as previously described, except that its surface is formed of a series of tubes l, filled with air or other suitable elastic medium, so as to form a surface which will yield against the pressure of the carriers. As shown, three tubes are used, these tubes being arranged side by side and extending circumferentially about the cylinder. It will be understood, however, that any other suitable construction may be used for this purpose, it being necessary only that a part or the whole of the surface of the cylinder should be of sufficient elasticity to yield against the pressure of the carriers and return to position as the pressure of the carriers is removed. The carriers a b c are carried by shafts 62, mounted in fixed positions in the frames A B, and each of these shafts carries two arms, these arms being lettered, respectively, a^{10} a^{11}, b^{10} b^{11}, and c^{10} c^{11}, corresponding to their respective carriers, each of these arms being provided at its end with a bowl, which bowls at the proper time engage cams rotating with the shaft C and cylinder D, so as to hold the carriers in position during the receipt and delivery of the papers. These cams are carried by disks L, secured to the shaft C, and are adjustable thereon by means of set-nuts and slots 63, so that they may be adjusted into position accurately for the proper operation of the carriers, and this operation varies in accordance with the length of the sheet to be folded, the arms on the shafts 62 preferably being made adjustable also, as shown, for the same purpose. Two of these cams are provided for each carrier, one cam engaging each arm, and these cams are letttered, respectively, a^{12} a^{13} b^{12} b^{13} c^{12} c^{13}, corresponding by pairs to their respective carriers and arms. The shafts 62 to which the carriers a b c are secured are driven by cone friction-clutches 65, the two parts of the clutch being

pressed together by means of adjustable springs 66 on the shafts 62, as usual in such constructions. The shaft C carries inside the frame a large gear 67, which drives the rolls E through gears 68 on their shafts, and the driving members of the clutches 65 are driven from these gears 68 through intermediates 69 and gears 70 on the driving members of the clutches. The operation of this construction will be understood from a brief description in connection with the drawings.

The position shown in Figs. 13 and 14 corresponds to the position shown in Figs. 2 and 10, the carrier *a* being just about to be operated to transfer the paper to carrier *b*. In this position the arm a^{10} is just about to pass off the cam a^{12}, so as to allow the friction-clutch to rotate the shaft 62 to move the carrier *a* over the surface of the cylinder. As the cylinder continues its rotation the carrier is moved with the shaft 62 and the paper transferred to carrier *b* in the same manner as previously described in connection with the other constructions. Just as the carrier *a* reaches the proper position to transfer the paper to carrier *b* the arm a^{11} on the shaft of carrier *a* is engaged by the cam a^{13}, and the carrier is thus held stationary and accurately in position until the paper has been fed out from carrier *a* and into carrier *b*, when the cam a^{13} passes the arm a^{11} and the friction-clutch 65 again rotates the shaft 62 of carrier *a* until the carrier is brought into the position shown in Fig. 13, when the cam a^{12} again engages the arm a^{10} and holds the carrier in position until the paper and wrapper are fed in, when the operation is repeated. The operation of carriers *b c* is the same, the arms b^{10} b^{11} c^{10} c^{11} being engaged by their respective cams b^{12} b^{13} c^{12} c^{13}. As the carrier *a* is swung across the cylinder D in folding and transferring the paper the elastic tubes *l* yield, as shown in Fig. 15, so that the paper is thus held pressed against the surface of the cylinder and a proper folding action secured, while at the same time the carrier is allowed to swing across the cylinder. It will be evident that as the lower ends of the carrier rise after passing the middle position shown in Fig. 15 the gradual return of the tubes *l* to their normal state preserves the proper tension upon the paper.

It will be understood by those skilled in the art that many other modifications may be made in the general features of the constructions shown without departing from the invention and that the invention is not to be limited to the specific construction of the different parts, as these may be varied widely.

While an important feature of the invention consists in the combination of a plurality of carriers for folding a number of times or folding and wrapping, the invention includes also certain constructions employing only a single carrier, and certain features of construction not dependent on a plurality of carriers, all as specifically claimed hereinafter. It will be understood, also, that the term "sheet" is used in the specification and claims as a broad term to cover the article to be wrapped, whether consisting of one or more plies.

What I claim is—

1. The combination with a plurality of feeding devices, of an abutment between the feeding devices, a plurality of carriers mounted respectively between the successive feeding devices and arranged to receive the sheets therefrom, and mechanism for moving said carriers over the abutment and holding the carriers positively in position during their movement, whereby the sheet is folded and the fold line transferred to the next feeding device, and for returning the carriers to normal position, substantially as described.

2. The combination with a plurality of feeding devices, of an abutment between the feeding devices, and a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for rotating the carriers on their axes through a partial rotation to move them over the abutment and holding their axes positively in position during this movement, whereby the sheet is folded and the fold line transferred to the next feeding device, and for returning the carriers to normal position, substantially as described.

3. The combination with a plurality of feeding devices, of an abutment between the feeding devices, a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for rotating said carriers on their axes through a partial rotation to move them over the abutment to fold the sheet and advancing the carriers positively to carry the fold line to the next feeding device, and for returning the carriers to normal position, substantially as described.

4. The combination with a plurality of feeding devices, of an abutment mounted between the feeding devices, a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for positively rocking the carriers on their axes in opposite directions over said abutment, substantially as described.

5. The combination with a plurality of feeding devices, of an abutment between the feeding devices, a plurality of carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for positively rocking said carriers on their axes in opposite directions over the abutment and moving the axes of the carriers toward and from the abutment, substantially as described.

6. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of carriers mounted

respectively between the successive feeding devices and arranged to receive the sheets therefrom, and mechanism for moving said carriers over the cylinder to fold the sheet and transfer the fold line to the next feeding device, and for returning the carriers to normal position, substantially as described.

7. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for swinging said carriers over the cylinder to fold the sheet and transfer the fold line to the next feeding device, and for returning the carriers to normal position, substantially as described.

8. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for swinging said carriers over the cylinder to fold the sheet and advancing the carriers to carry the fold line positively to the next feeding device, and for returning the carriers to normal position, substantially as described.

9. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for swinging said carriers in opposite directions over said cylinder, substantially as described.

10. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for swinging said carriers in opposite directions over the cylinder and moving the carriers toward and from the cylinder, substantially as described.

11. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of carriers respectively between the successive feeding devices pivotally mounted in arms arranged to oscillate to and from the cylinder, and mechanism for swinging said carriers in opposite directions over the cylinder and moving the arms to and from the cylinder, substantially as described.

12. The combination with a rotating cylinder, of a plurality of spring pressed feeding rolls arranged about said cylinder and coacting therewith to advance a sheet, a plurality of carriers mounted respectively between the successive feeding rolls, and arranged to receive the sheet therefrom, and mechanism for actuating the carriers to fold the sheet against the cylinder and transfer the fold line of the folded sheet to the next feeding roll, and for returning the carriers to normal position, substantially as described.

13. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for rotating said carriers through a partial rotation over the cylinder and holding the axes of the carriers positively in position during this movement and for returning the carriers to normal position, substantially as described.

14. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for rocking said carriers on their axes in opposite directions over the cylinder to fold the sheet and transfer the fold line to the next feeding device and to return the carriers to normal position, substantially as described.

15. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and coacting with said cylinder to advance a sheet, a plurality of pivoted carriers mounted respectively between the successive feeding devices and arranged to receive the sheet therefrom, and mechanism for simultaneously rocking said carriers on their axes to swing the carriers in opposite directions over the surface of the cylinder and for positively moving their axes toward and from the surface of the cylinder, substantially as described.

16. The combination with paper and wrapper feeding devices and pasting devices for the wrapper, of a plurality of feeding devices, an abutment between the feeding devices, a plurality of carriers mounted respectively between the successive feeding devices, and mechanism for actuating said carriers to fold the paper and wrapper together against the abutment and transfer them to the successive feeding devices, and for returning the carriers to normal position, substantially as described.

17. The combination with paper and wrapper feeding devices and pasting devices for the wrapper, of a rotating cylinder, a plurality of feeding devices arranged about and coacting with said cylinder, a plurality of carriers mounted respectively between the successive feeding devices and mechanism for actuating said carriers to fold the paper and wrapper together against the cylinder and transfer them to the successive feeding devices and for returning the carriers to normal position, substantially as described.

18. The combination with paper and wrap-

per feeding devices and pasting devices for the wrapper, of a rotating cylinder, a plurality of feeding devices arranged about and coacting with said cylinder, a plurality of carriers mounted respectively between the successive feeding devices, and mechanism for swinging said carriers in opposite directions over said cylinder to fold the paper and wrapper together and transfer them to the successive feeding devices, substantially as described.

19. The combination with paper and wrapper feeding devices and pasting devices for the wrapper, of a rotating cylinder, a plurality of feeding devices arranged about and coacting with said cylinder, a plurality of carriers mounted respectively between the successive feeding devices, and mechanism for swinging said carriers in opposite directions over said cylinder and moving them toward and from the cylinder to fold the paper and wrapper together and transfer them to the successive feeding devices, substantially as described.

20. The combination with two feeding devices, of an abutment between the feeding devices, a pivoted carrier having a folding plate coacting with the abutment to fold a sheet and transfer it from one feeding device to the other, and mechanism for moving said carrier over the abutment and positively holding the carrier in position during this movement, one of said coacting members having a movement toward and from the other, substantially as described.

21. The combination with a plurality of feeding devices, of an abutment between the feeding devices, a plurality of pivoted carriers having folding plates coacting with the abutment to fold a sheet and transfer it from one feeding device to the next, and mechanism for moving said carriers over the abutment and positively holding the carriers in position during this movement, one of said coacting members having a movement toward and from the other, substantially as described.

22. The combination with two feeding devices, of an abutment and a pivoted carrier between said feeding devices, and mechanism for positively rocking said carrier over the abutment and for moving the carrier bodily toward and from the abutment, substantially as described.

23. The combination with two feeding devices, of an abutment and carrier between said feeding devices, said carrier being pivotally mounted at fixed points in arms pivoted to swing toward and from the abutment, and mechanism for simultaneously moving said carrier over the abutment and swinging said arms, substantially as described.

24. The combination with a rotating cylinder, of two feeding devices coacting therewith, a pivoted carrier having a folding plate coacting with the cylinder to fold a sheet and transfer it from one feeding device to the other, and mechanism for rocking the carrier on its axis to move the carrier over the cylinder and for positively holding the axis of the carrier in position during this movement, one of said coacting members having a movement toward and from the other, substantially as described.

25. The combination with an abutment, of two feeding devices coacting therewith, a carrier mounted between the feeding devices, and adjustable mechanism for moving said carrier over the abutment to fold the sheet whereby the line of fold may be varied, substantially as described.

26. The combination with an abutment, of a plurality of feeding devices coacting therewith, a plurality of carriers mounted respectively between the feeding devices, and adjustable mechanism for moving said carriers over the abutment to fold the sheet, whereby the line of fold may be varied, substantially as described.

27. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and co-acting with said cylinder, a plurality of carriers mounted respectively between the feeding devices, and adjustable mechanism for actuating said carriers to fold the sheet against the cylinder, whereby the line of fold may be varied, substantially as described.

28. The combination with a rotating cylinder, of a plurality of feeding devices arranged about and co-acting with said cylinder, a plurality of carriers mounted respectively between the feeding devices, mechanism for actuating said carriers to fold the sheet against the cylinder, said sheet feeding devices and carrier actuating mechanism being relatively adjustable to vary the line of fold, substantially as described.

29. The combination with paper and wrapper feeding devices and pasting devices for the wrapper, of a folding and wrapping mechanism having a plurality of feeding devices, an abutment, a plurality of carriers, and mechanism for actuating said carriers to fold the paper and wrapper together against the abutment, said paper feeding devices and carrier actuating devices being relatively adjustable, whereby the fold line may be varied, substantially as described.

30. The combination with an abutment, of a pivoted carrier, swinging arms in which said carrier is pivotally mounted, a crank on the axis of the carrier, and mechanism for controlling the movement of said carrier through said crank, substantially as described.

31. The combination with an abutment, of a pivoted carrier, swinging arms in which said carrier is pivotally mounted, a crank on the axis of the carrier, and mechanism for actuating said crank to move the carrier, substantially as described.

32. The combination with an abutment, of a pivoted carrier, swinging arms in which said carrier is pivotally mounted, a crank on the

axis of the carrier, and mechanism for actuating said crank to move the carrier in opposite directions, substantially as described.

33. The combination with a cylinder, of a plurality of pivoted carriers, a plurality of feeding devices arranged about the cylinder for feeding sheets to and from the successive carriers, cranks on the axes of the carriers, and a rotating member or members controlling said carriers through said cranks, substantially as described.

34. The combination with the cylinder D, of feeding rolls E, swinging arms 18, carrier *a* pivoted in said arms, and mechanism for actuating said carrier, substantially as described.

35. The combination with grooved cylinder D, of grooved feeding rolls E, swinging arms 18, carrier *a* pivoted in said arms and entering the grooves in said rolls, and having guiding fingers entering the cylinder in receiving a sheet, and mechanism for actuating said carrier, substantially as described.

36. The combination with cylinder D, of feeding rolls E, swinging arms 18, carrier *a* pivoted in said arms, cam disk F, and connections between said cam and carrier for actuating the latter in opposite directions, substantially as described.

37. The combination with cylinder D, of feeding rolls E, swinging arms 18, carrier *a* pivoted in said arms, adjustable cam disk F, and connections between said cam and carrier for actuating the latter in opposite directions, substantially as described.

38. The combination with cylinder D, of feeding rolls E, swinging arms 18, carrier *a* pivoted in said arms, cam disk F, segmental gear 23 rocked by said cam, lever 20 having gear 22, and link 19 between said lever and carrier, substantially as described.

39. The combination with cylinder D, of feeding rolls E, a plurality of carriers as *a*, *b*, *c*, and mechanism for actuating said carriers, substantially as described.

40. The combination with cylinder D, of feeding rolls E, a plurality of sets of swinging arms 18, a plurality of carriers as *a*, *b*, *c*, pivoted in said arms, and mechanism for actuating said carriers, substantially as described.

41. The combination with cylinder D, of feeding rolls E, a plurality of sets of swinging arms 18, a plurality of carriers as *a*, *b*, *c*, pivoted in said arms, mechanism for actuating said carriers, and pasting devices, substantially as described.

42. The combination with cylinder D, of feeding rolls E, a plurality of sets of swinging arms 18, a plurality of carriers as *a*, *b*, *c*, pivoted in said arms, mechanism for actuating said carriers, and a paster coacting with the cylinder rearward of the last carrier, substantially as described.

43. The combination with cylinder D, of feeding rolls E, a plurality of carriers, as *a*, *b*, *c*, pasting devices, and paper and wrapper feeding mechanism, substantially as described.

44. The combination with cylinder D, of feeding rolls E, a plurality of carriers, as *a*, *b*, *c*, and actuating devices for said carriers adjustable to vary the time at which the carriers act relatively to the feed of the sheet, substantially as described.

45. The combination with cylinder D, of feeding rolls E, a plurality of sets of swinging arms 18, a plurality of carriers pivotally mounted in said arms, and adjustable cam disks F, G, and connections for actuating said carriers substantially as described.

46. The combination with cylinder D, carrier *a*, and mechanism for actuating said carrier, of feeding belts *g* for advancing a sheet to the cylinder, stop 2, and cam *h* on the cylinder and connections for vibrating said stop, substantially as described.

47. The combination with cylinder D, carrier *a*, and mechanism for actuating said carrier, of feeding belts *g* for advancing a sheet to the cylinder, stop 2, and adjustable cam *h* on the cylinder and connections for actuating said stop, substantially as described.

48. The combination with cylinder D, of feeding rolls E, carrier *a* and mechanism for actuating said carrier, belts *g*, stop 2, and cam *h* on the cylinder and connections for actuating said stop, substantially as described.

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

LUTHER C. CROWELL.

Witnesses:
C. J. SAWYER,
T. F. KEHOE.