

No. 668,719.

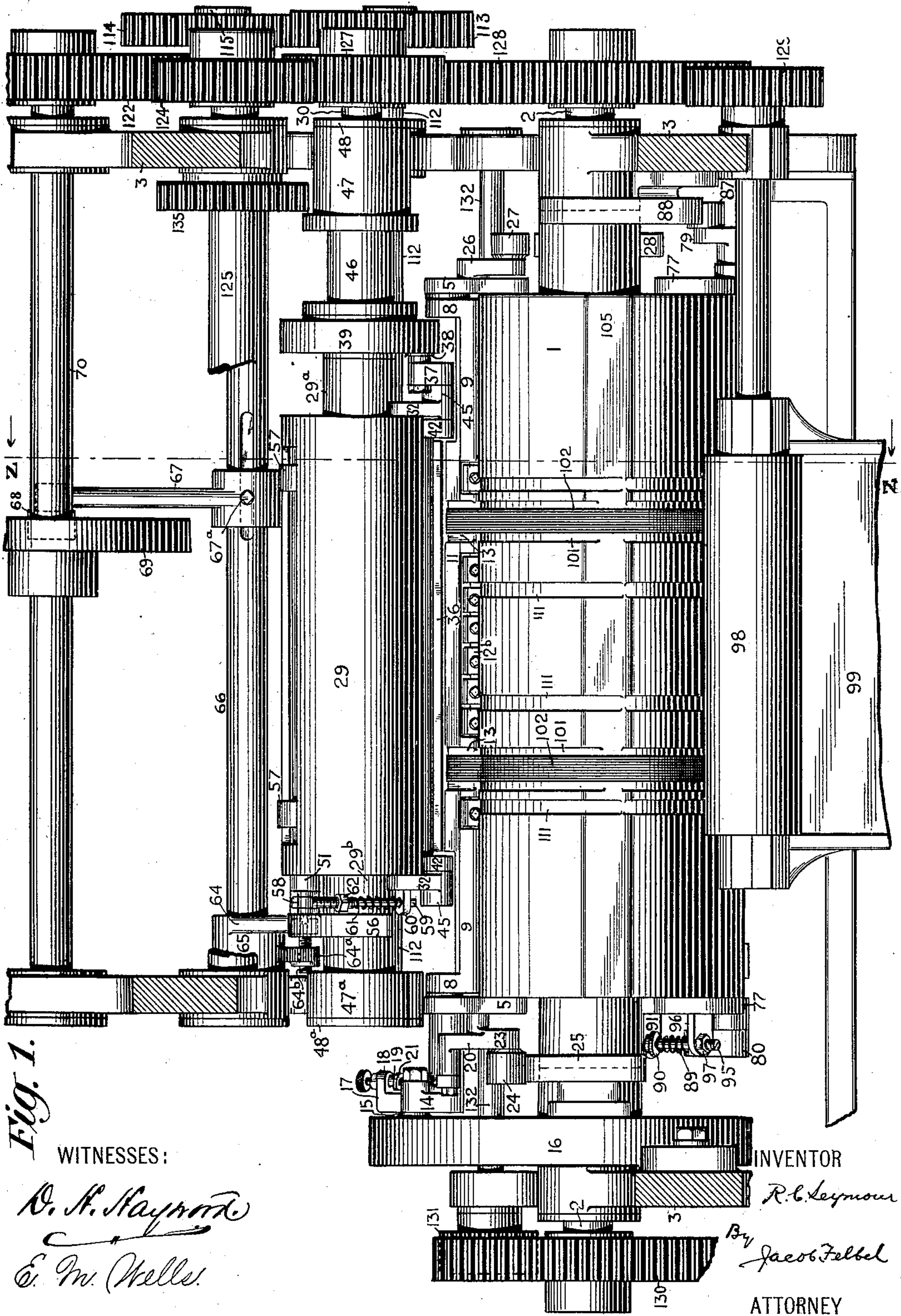
Patented Feb. 26, 1901.

R. C. SEYMOUR.
FOLDING MACHINE.

(Application filed Mar. 13, 1900.)

(No Model.)

16 Sheets—Sheet 1.



No. 668,719.

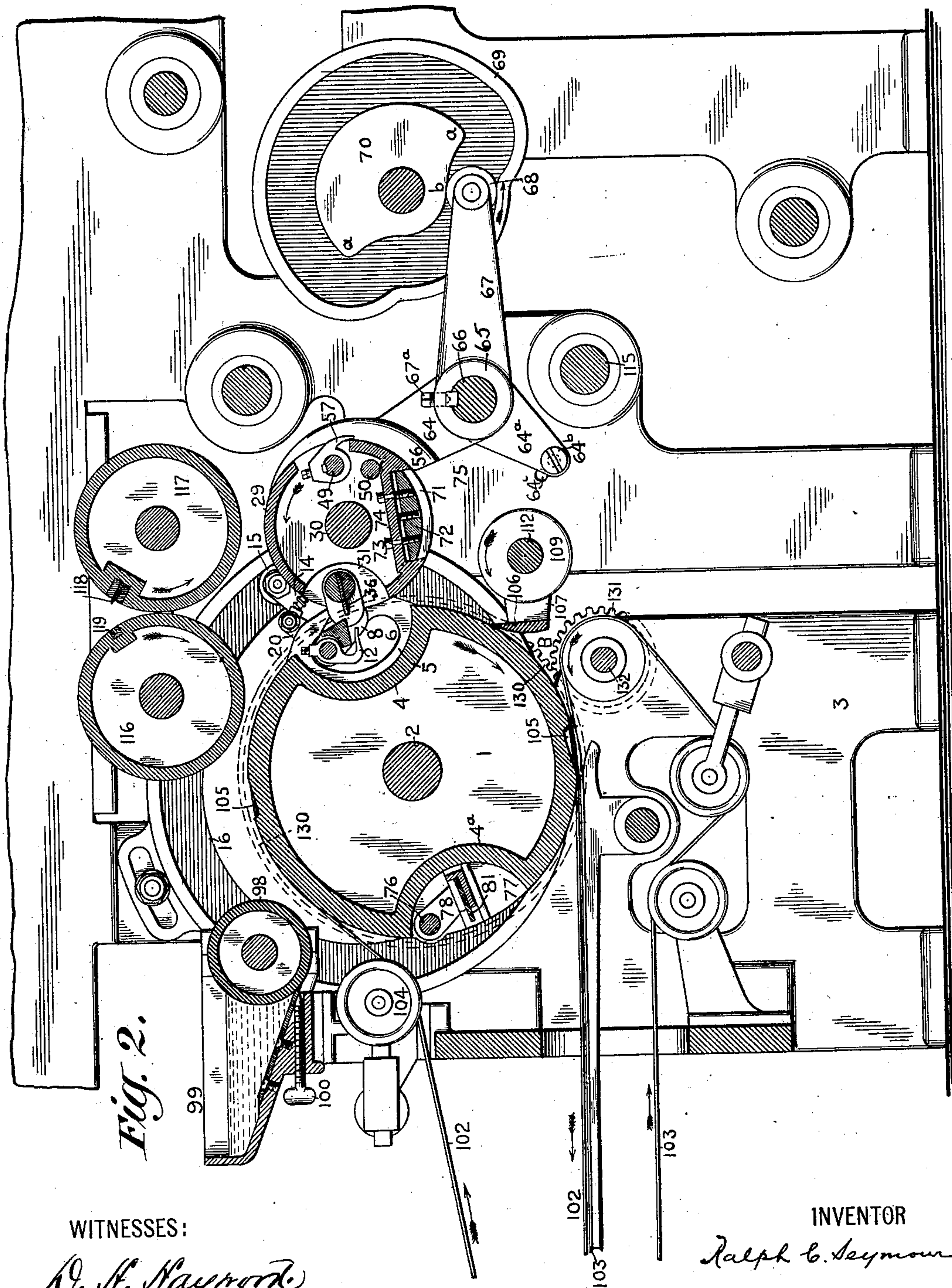
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(Application filed Mar. 13, 1900.)

(No Model.)

16 Sheets—Sheet 2



WITNESSES:

R. H. Hayworth

E. M. Wells.

INVENTOR
Ralph C. Seymour
BY
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No. 668,719.

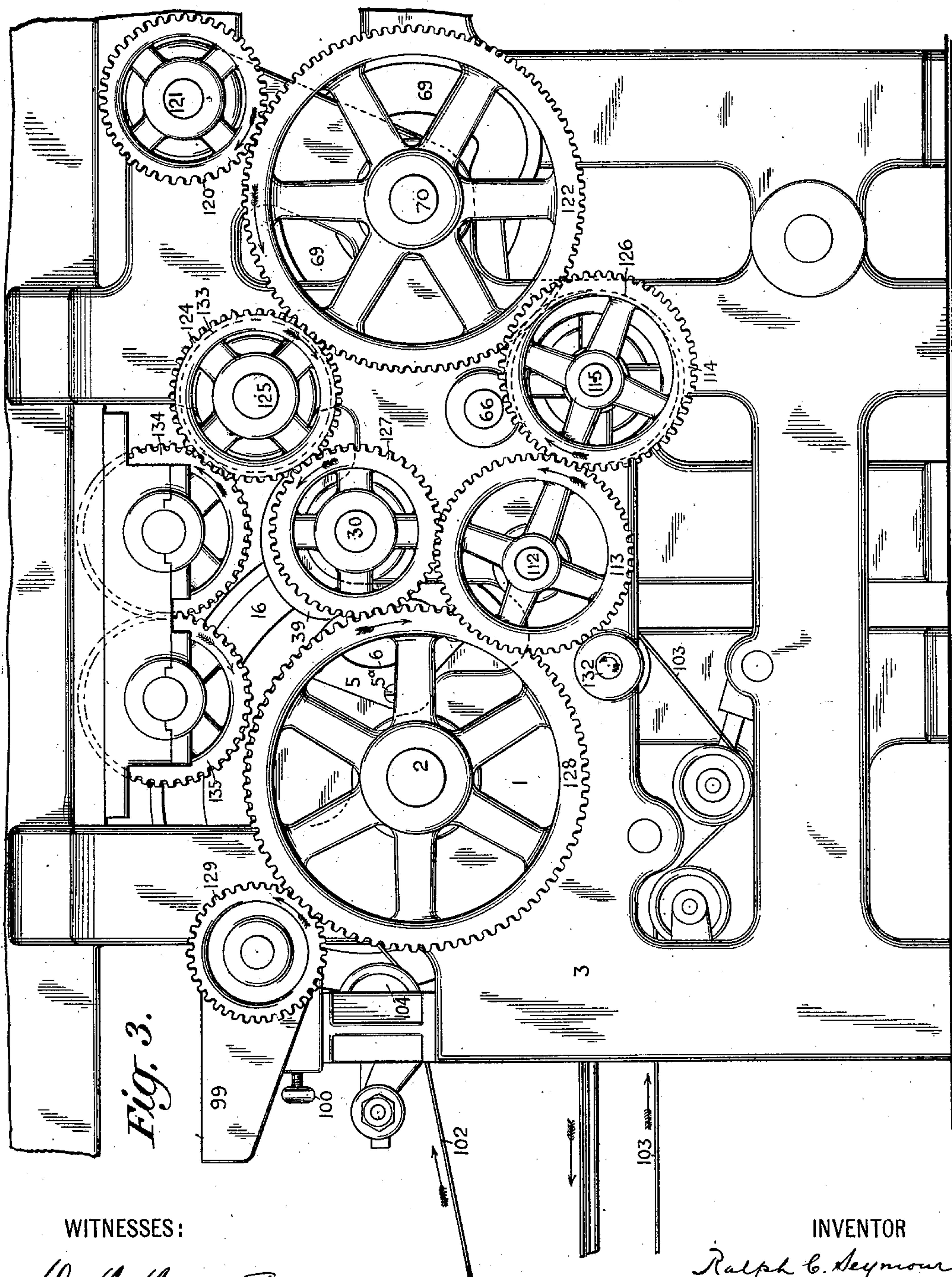
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(No Model.)

16 Sheets—Sheet 3.



WITNESSES:

R. H. Hayport
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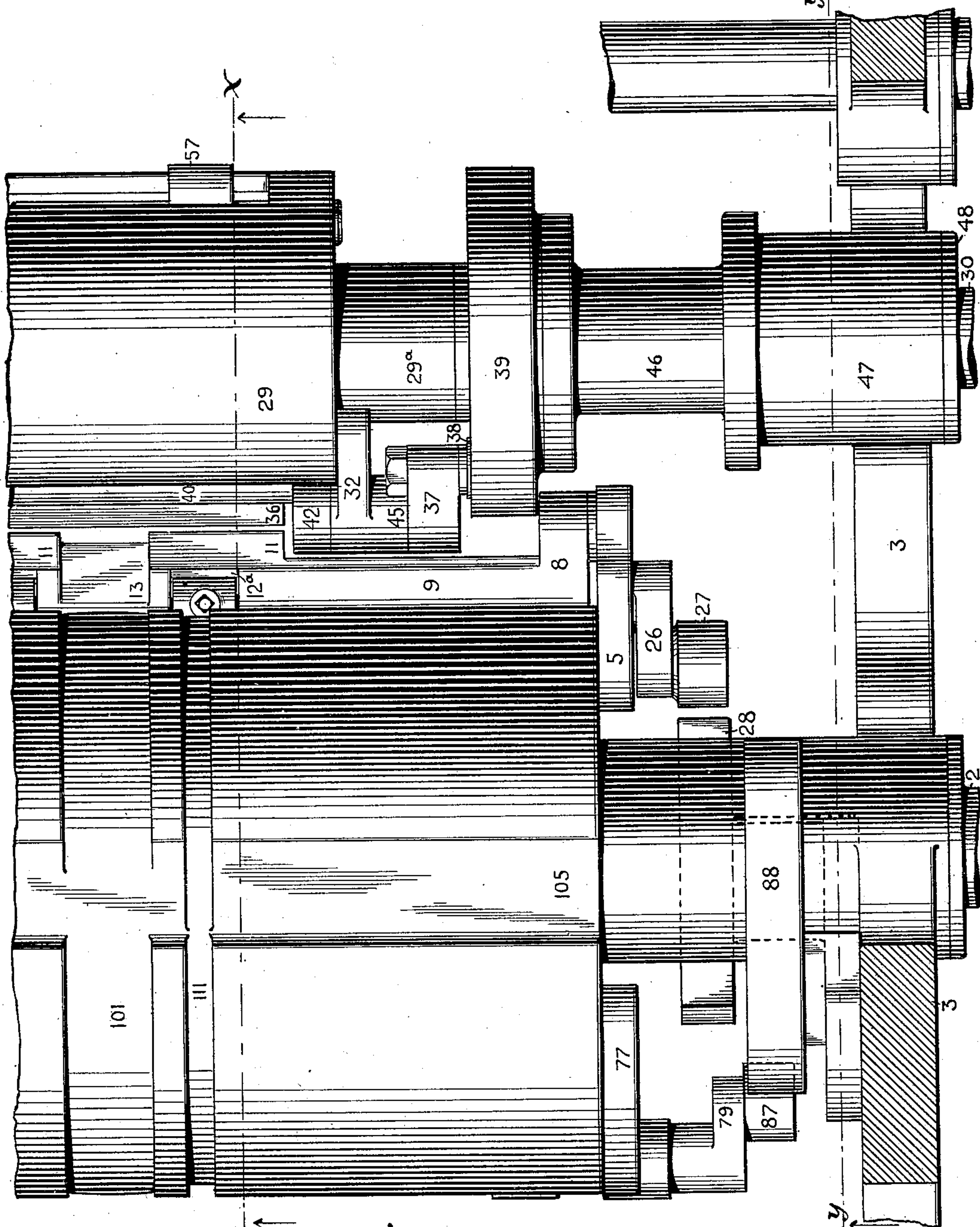
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(Application filed Mar. 13, 1900.)

(No Model.)

16 Sheets—Sheet 4.



WITNESSES:

D. H. Maynard
E. M. Wells

Fig. 4.

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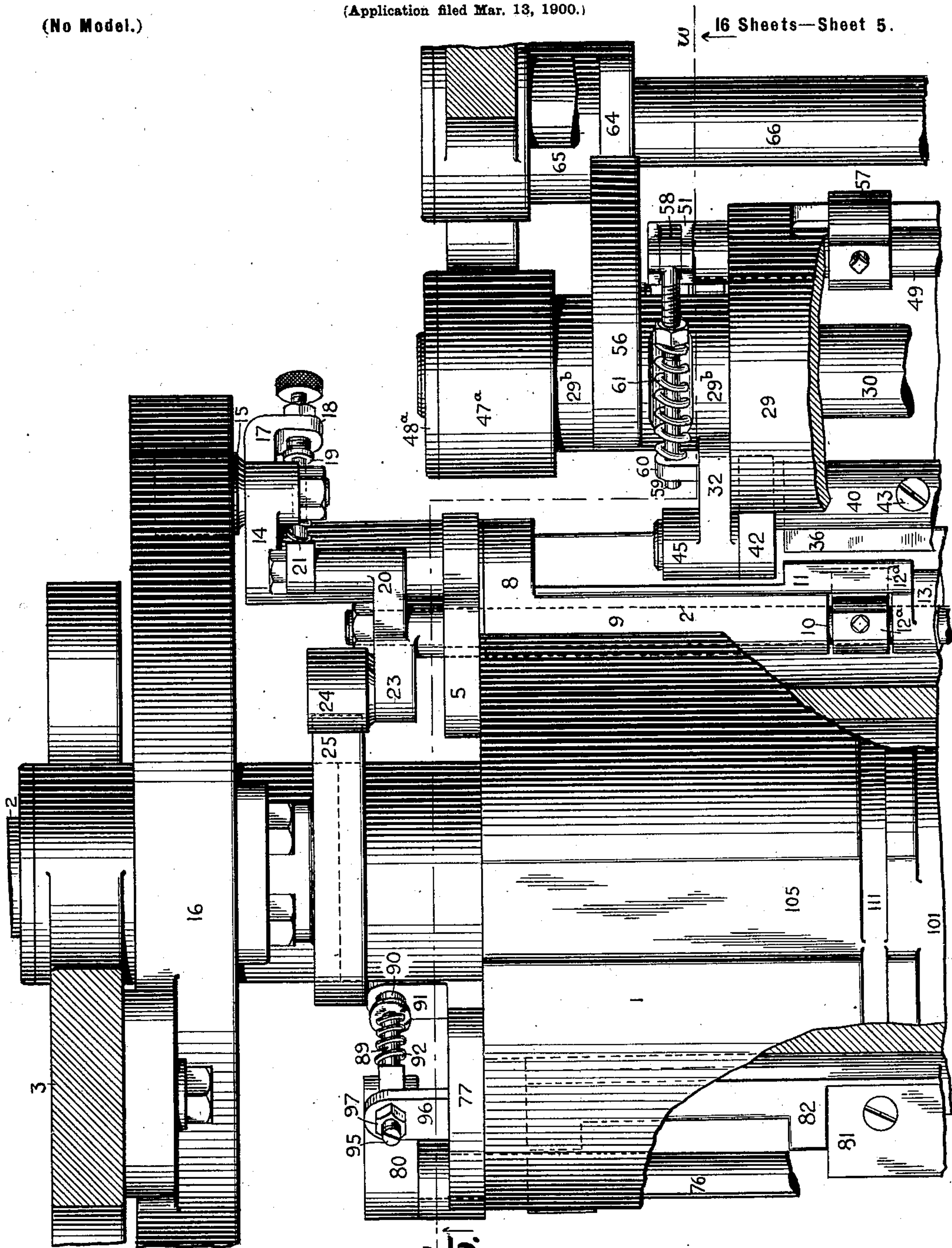
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(No Model.)



WITNESSES:

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Fig. 5.

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No. 668,719.

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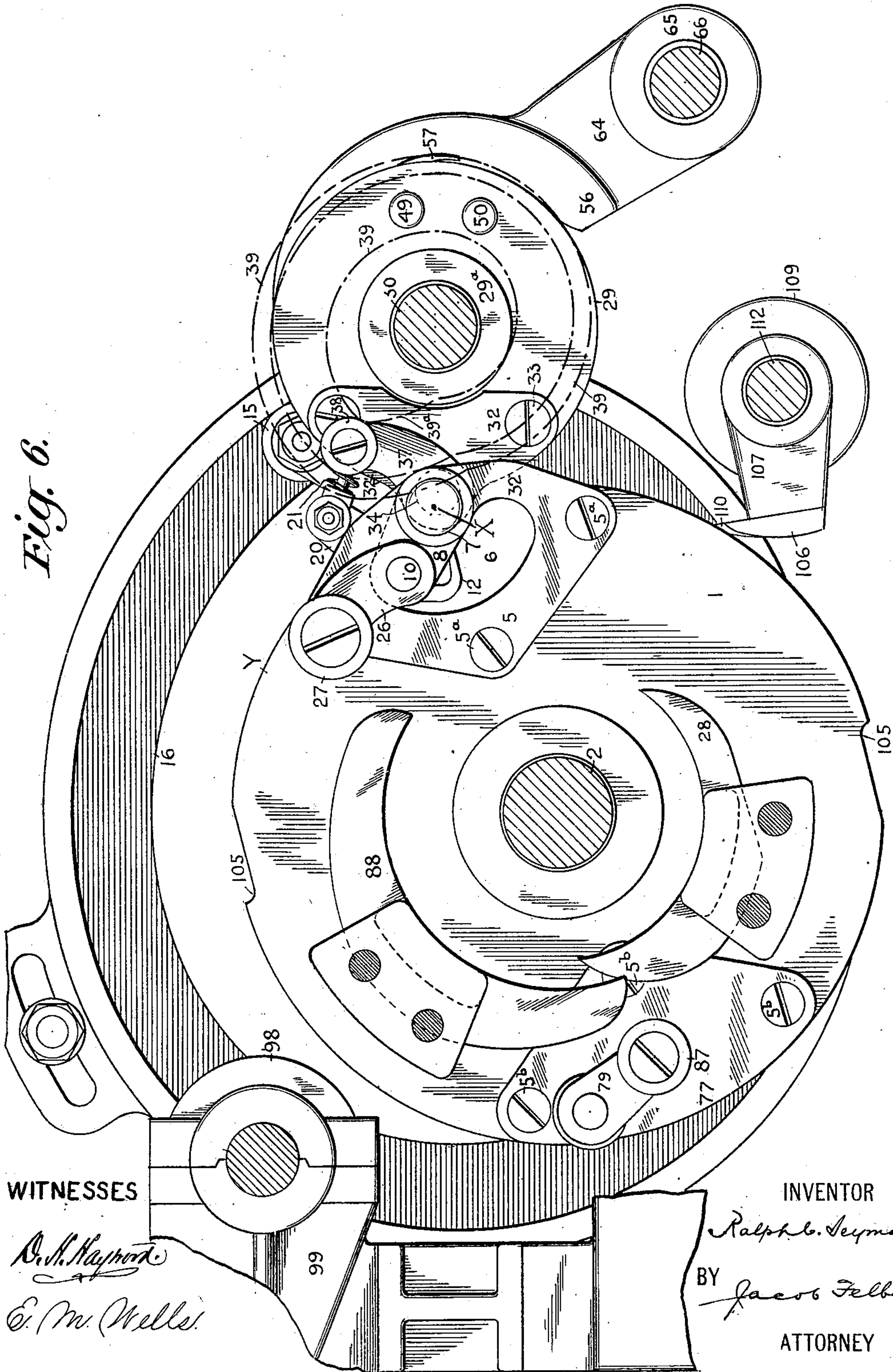
R. C. SEYMOUR.
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(Application filed Mar. 13, 1900.)

(No Model.)

16 Sheets—Sheet 6.

Fig. 6.



WITNESSES

R. H. Haywood
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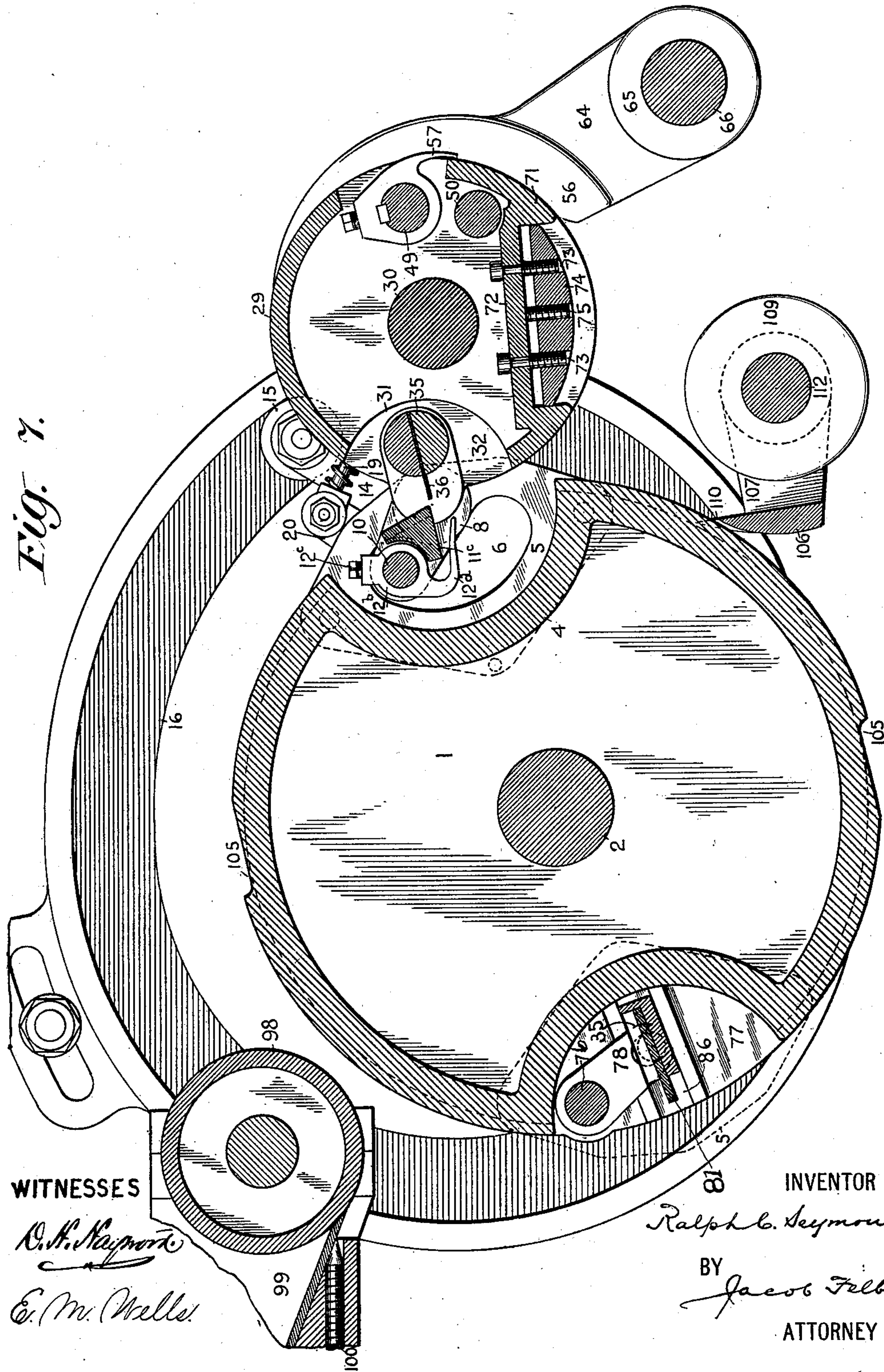
R. C. SEYMOUR.
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(Application filed Mar. 13, 1900.)

(No Model.)

16 Sheets—Sheet 7.

Fig. 1.



WITNESSES

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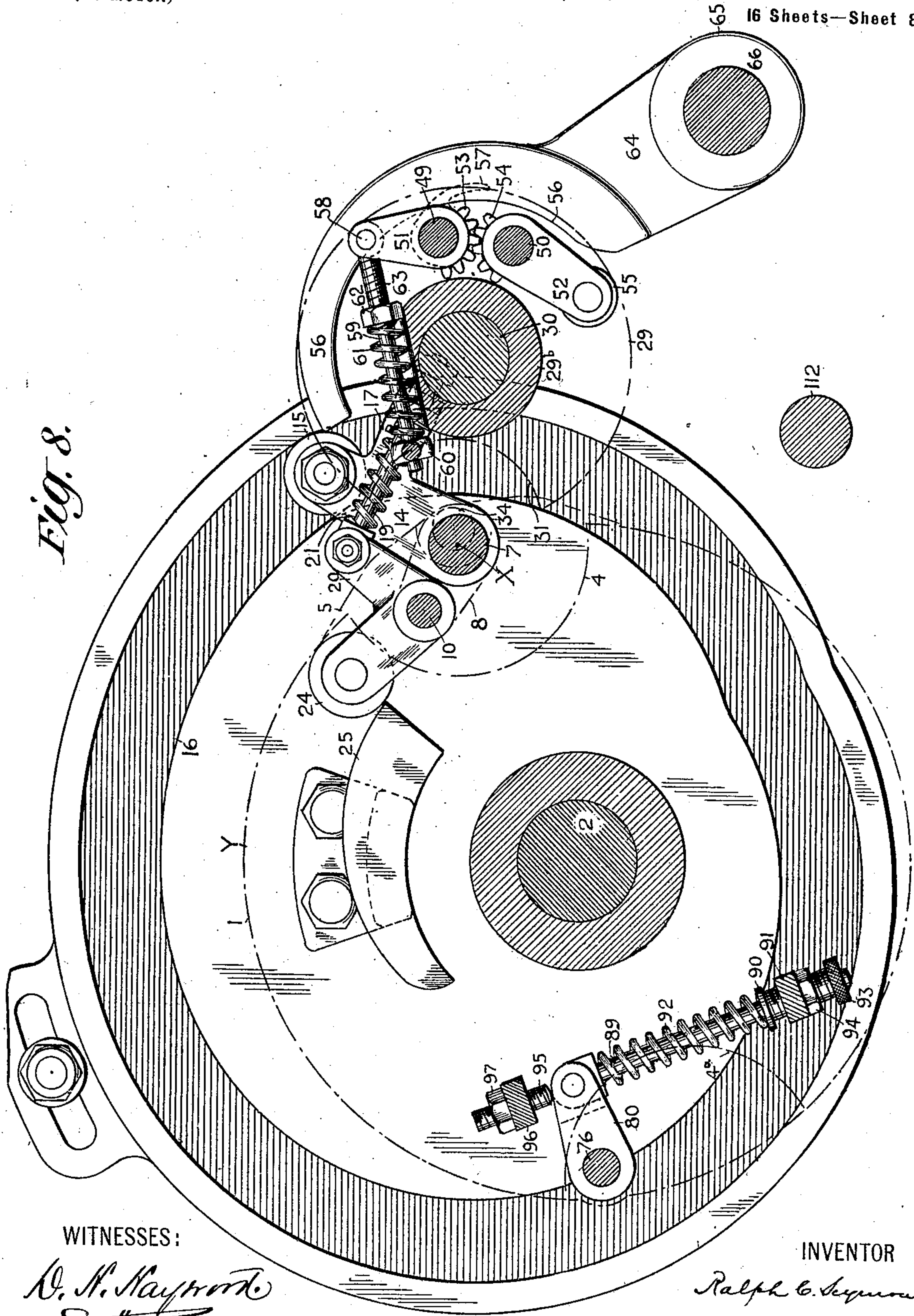
Patented Feb. 26, 1901.

R. C. SEYMOUR.
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(No Model.)

(Application filed Mar. 13, 1900.)

16 Sheets—Sheet 8.



WITNESSES:

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No. 668,719.

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R. C. SEYMOUR.
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(No Model.)

16 Sheets—Sheet 9.

Fig. 10.

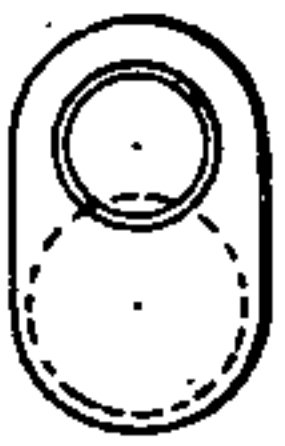


Fig. 12.

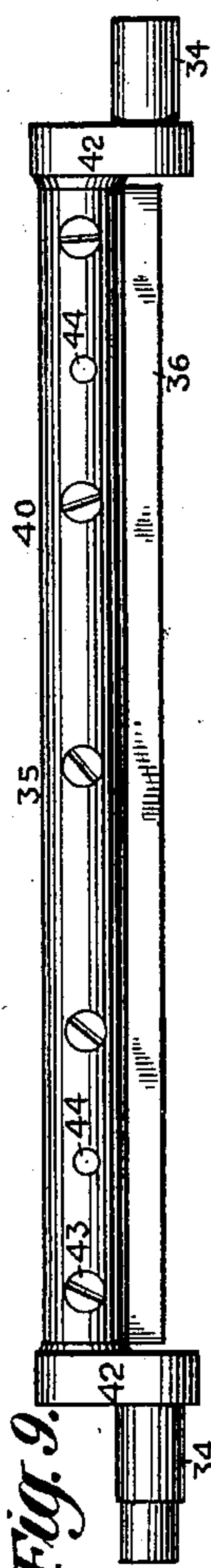


Fig. 9.

WITNESSES:

R. H. Maymont
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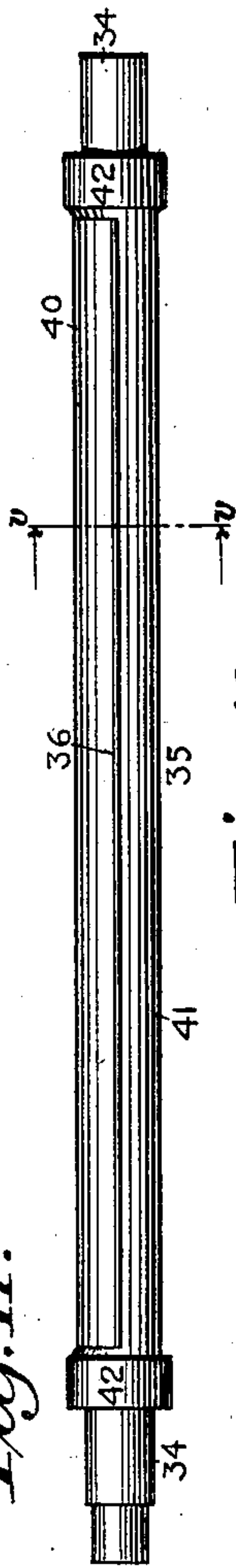


Fig. 11.

Fig. 13.

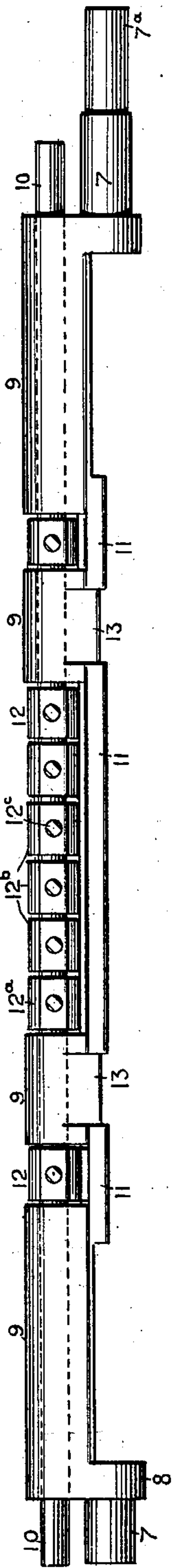


Fig. 14.

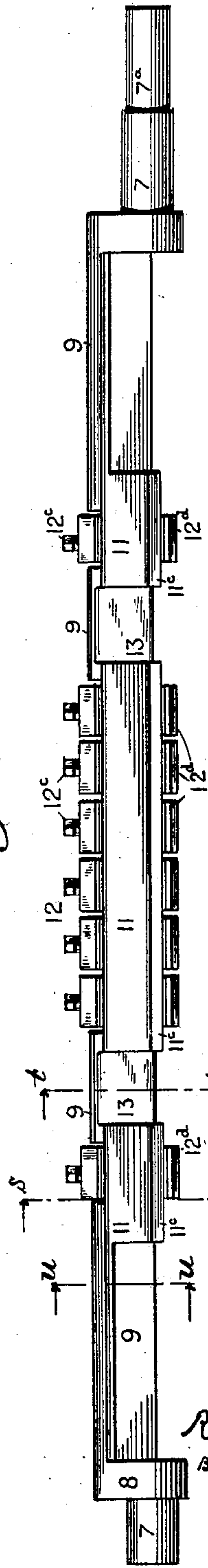


Fig. 18.

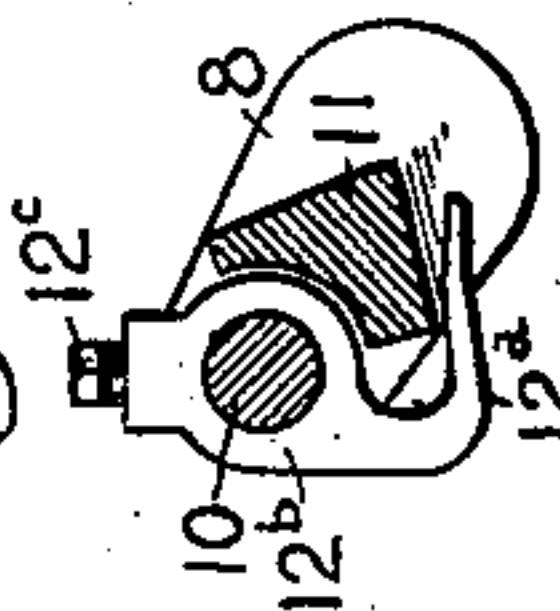


Fig. 17.

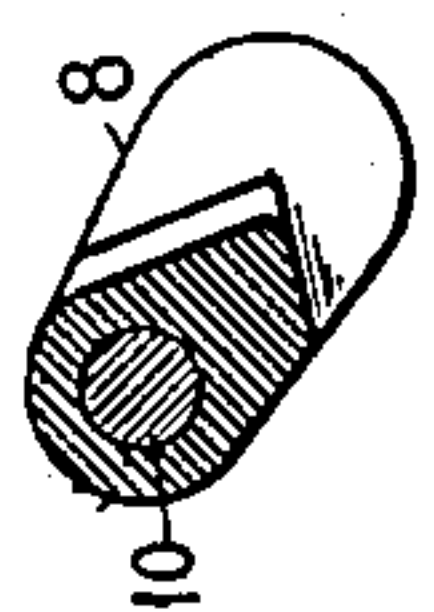


Fig. 16.

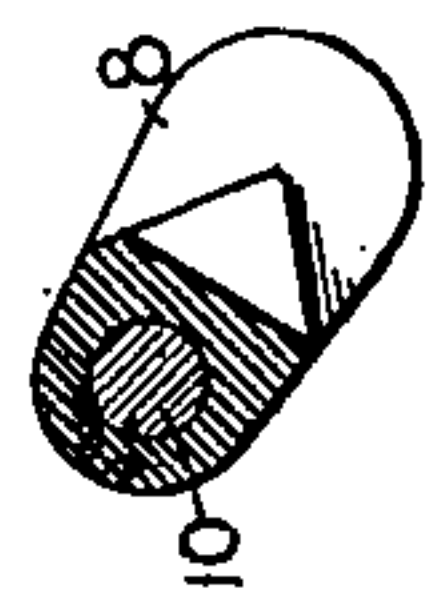
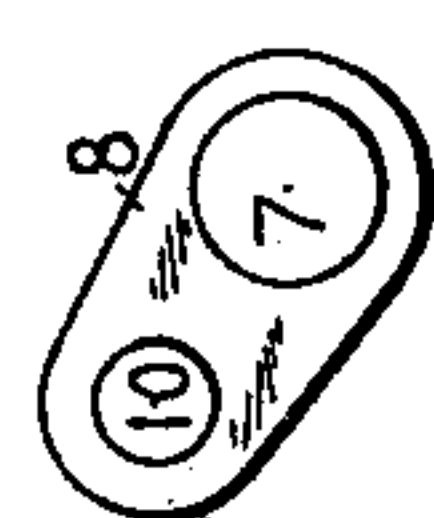


Fig. 15.



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(No Model.)

16 Sheets—Sheet 10.

Fig. 19.

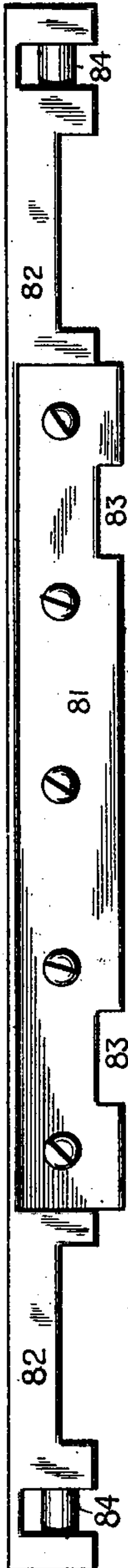


Fig. 20.



Fig. 21.

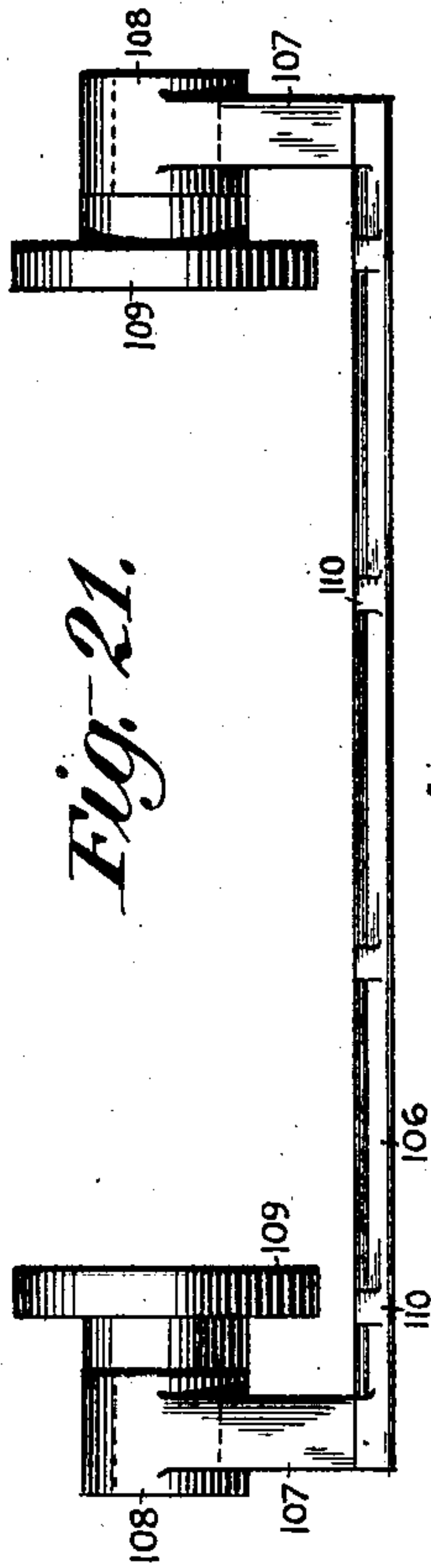
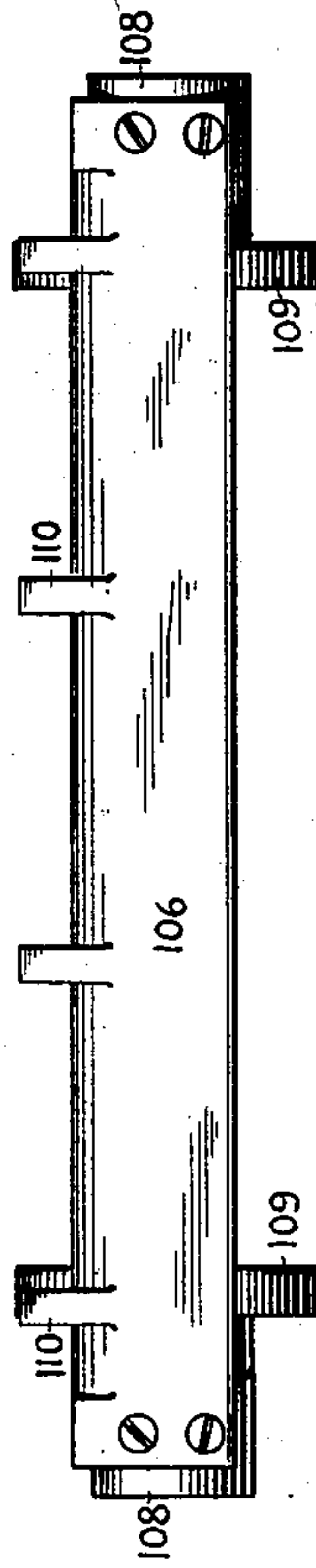


Fig. 22.



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R. C. SEYMOUR.
FOLDING MACHINE.

(Application filed Mar. 13, 1900.)

(No Model.)

16 Sheets—Sheet II.

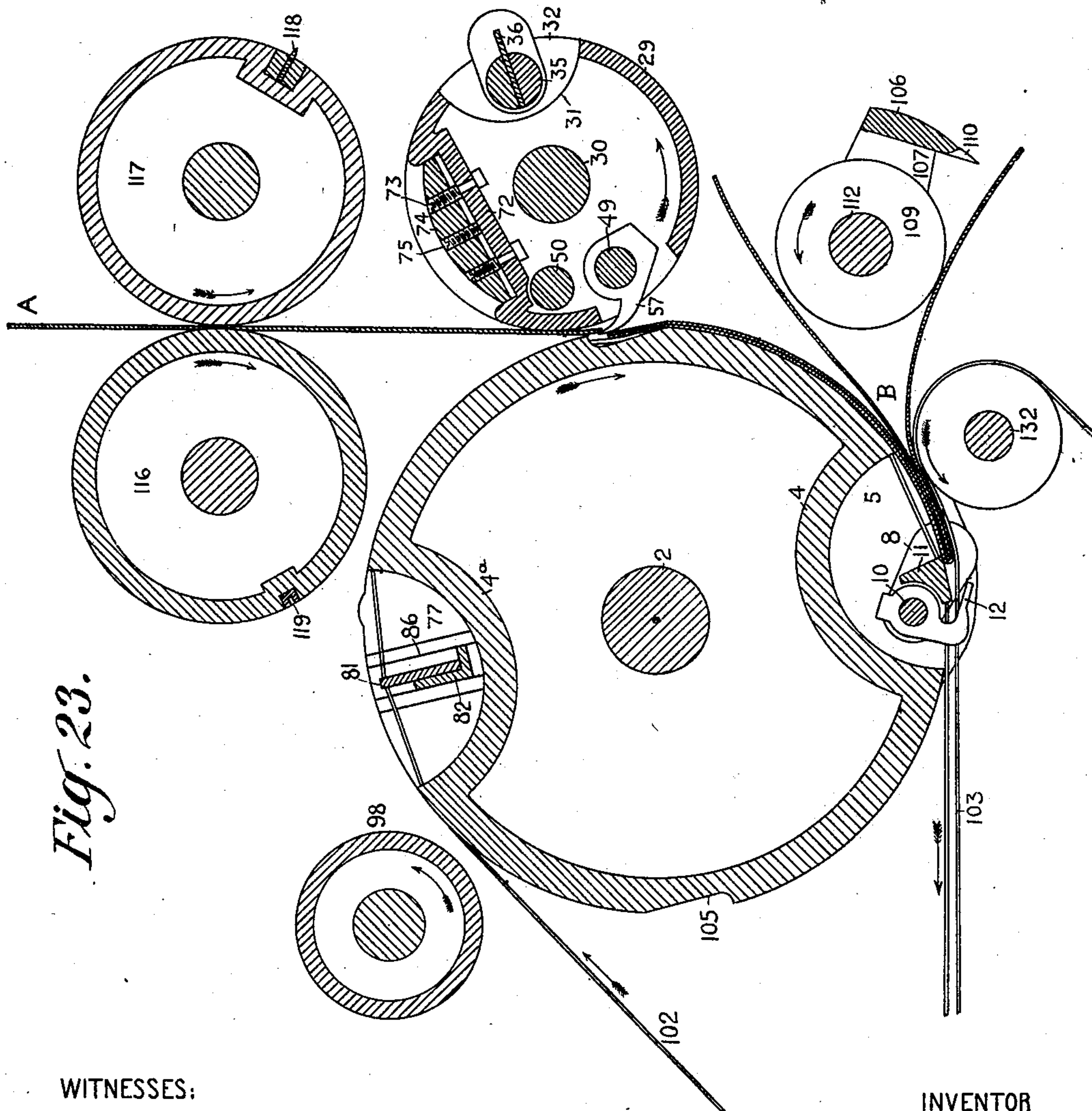


Fig. 23.

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(No Model.)

(Application filed Mar. 13, 1900.)

16 Sheets—Sheet 12.

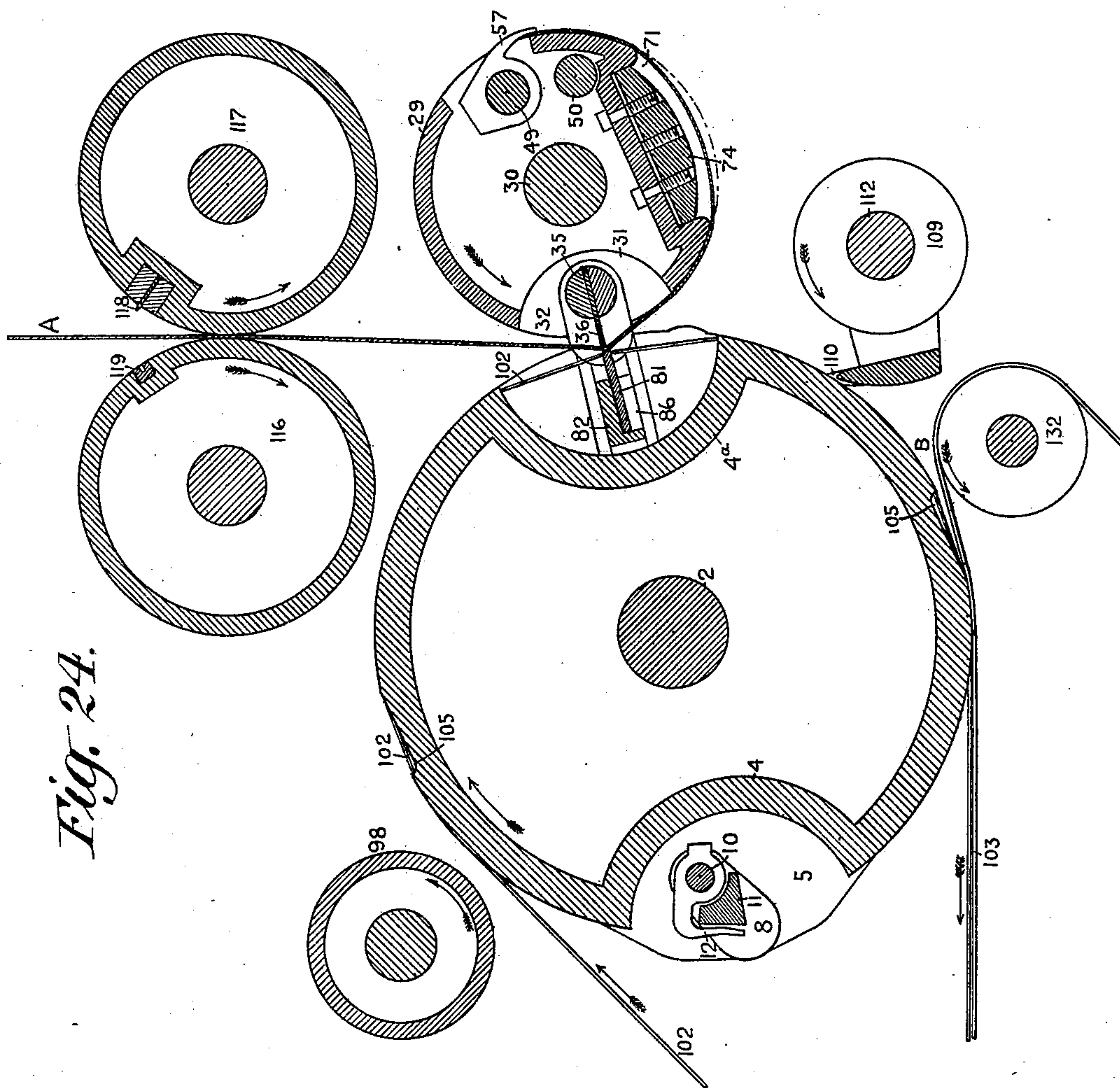


Fig. 24.

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(Application filed Mar. 13, 1900.)

16 Sheets—Sheet 13.

(No Model.)

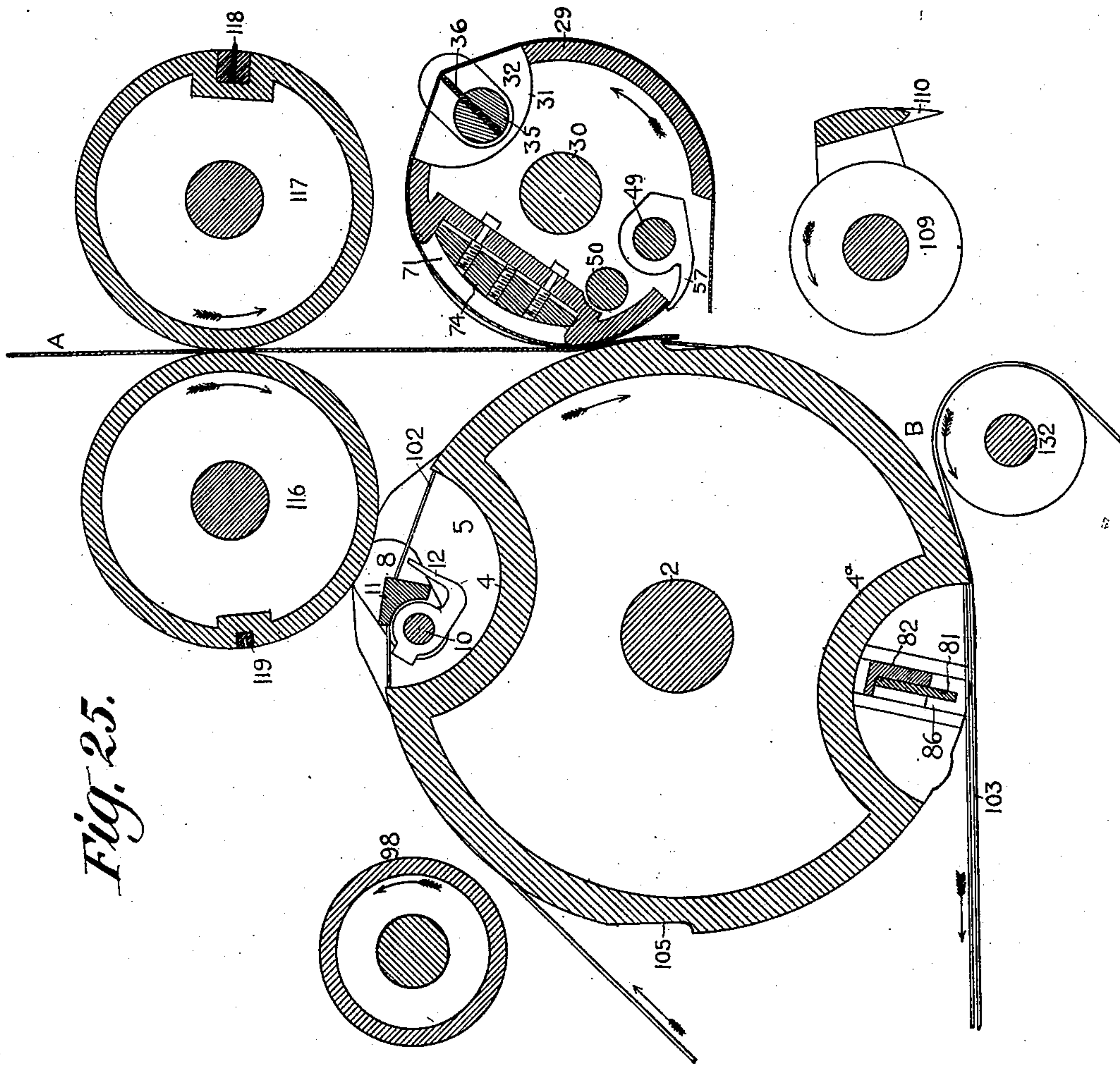


Fig. 25.

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No. 668,719.

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R. C. SEYMOUR.
FOLDING MACHINE.

(No Model.)

(Application filed Mar. 13, 1900.)

16 Sheets—Sheet 14.

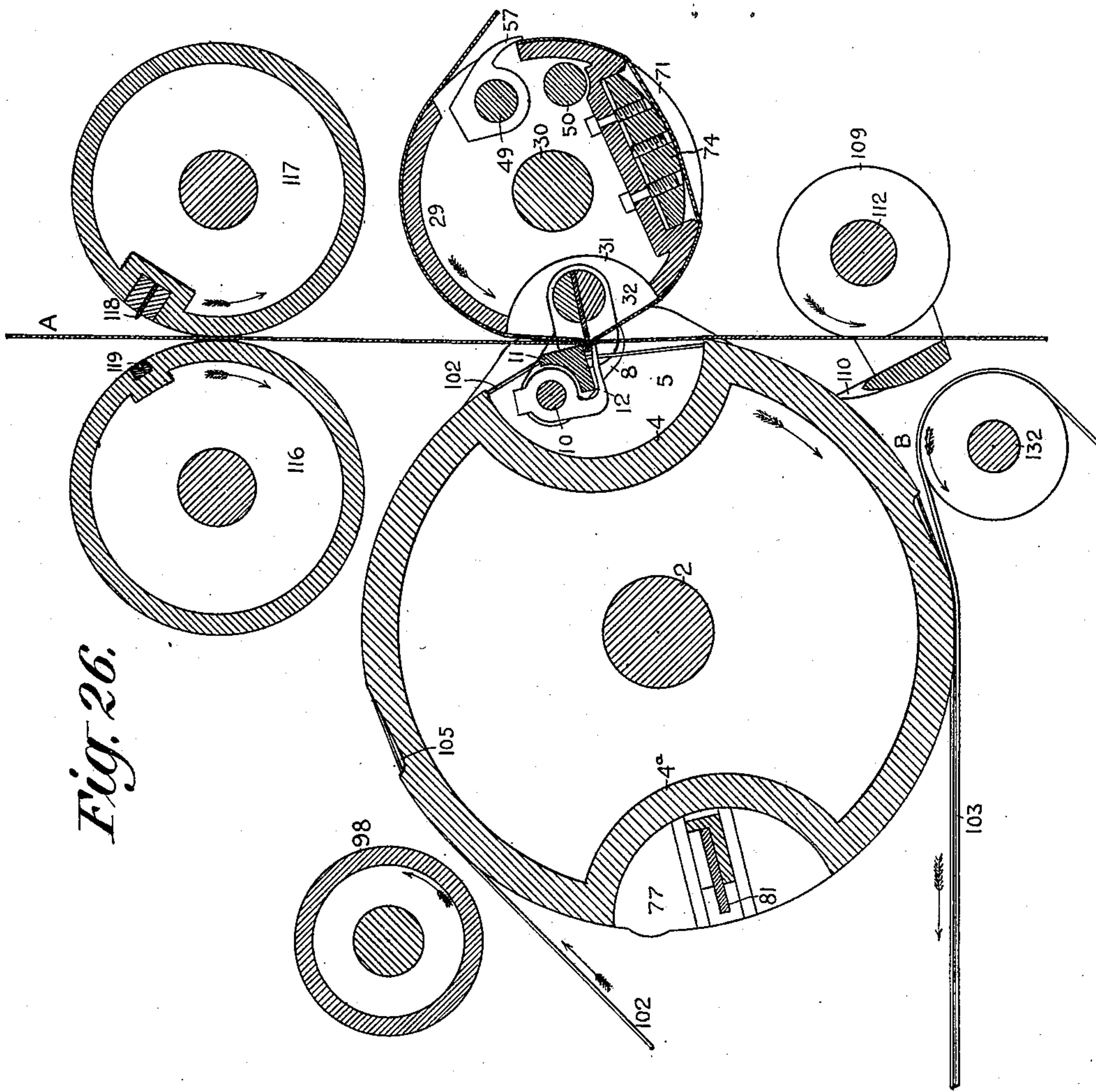


Fig. 26.

WITNESSES:

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(No Model.)

16 Sheets—Sheet 15.

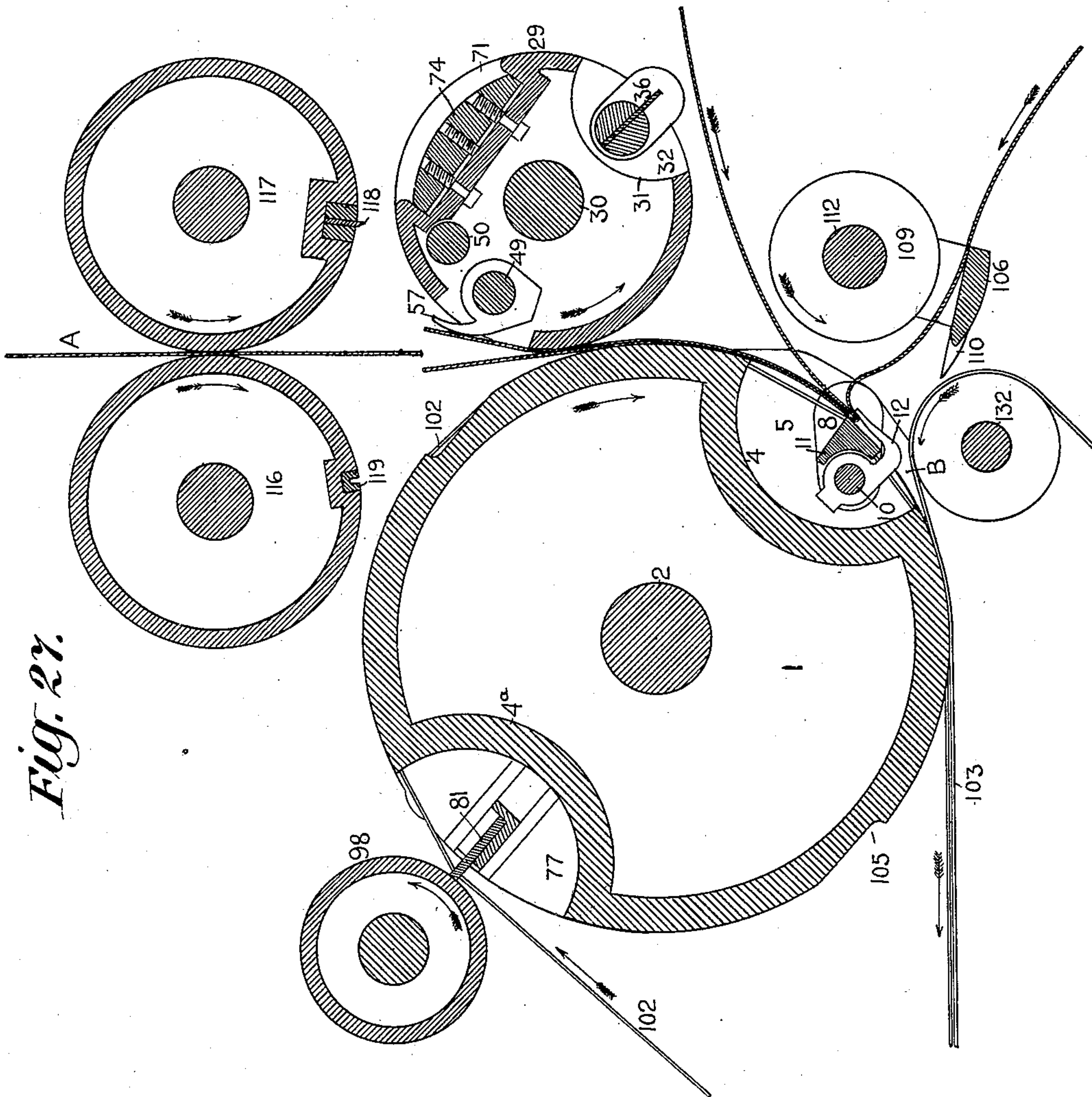


Fig. 27.

WITNESSES:

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(No Model.)

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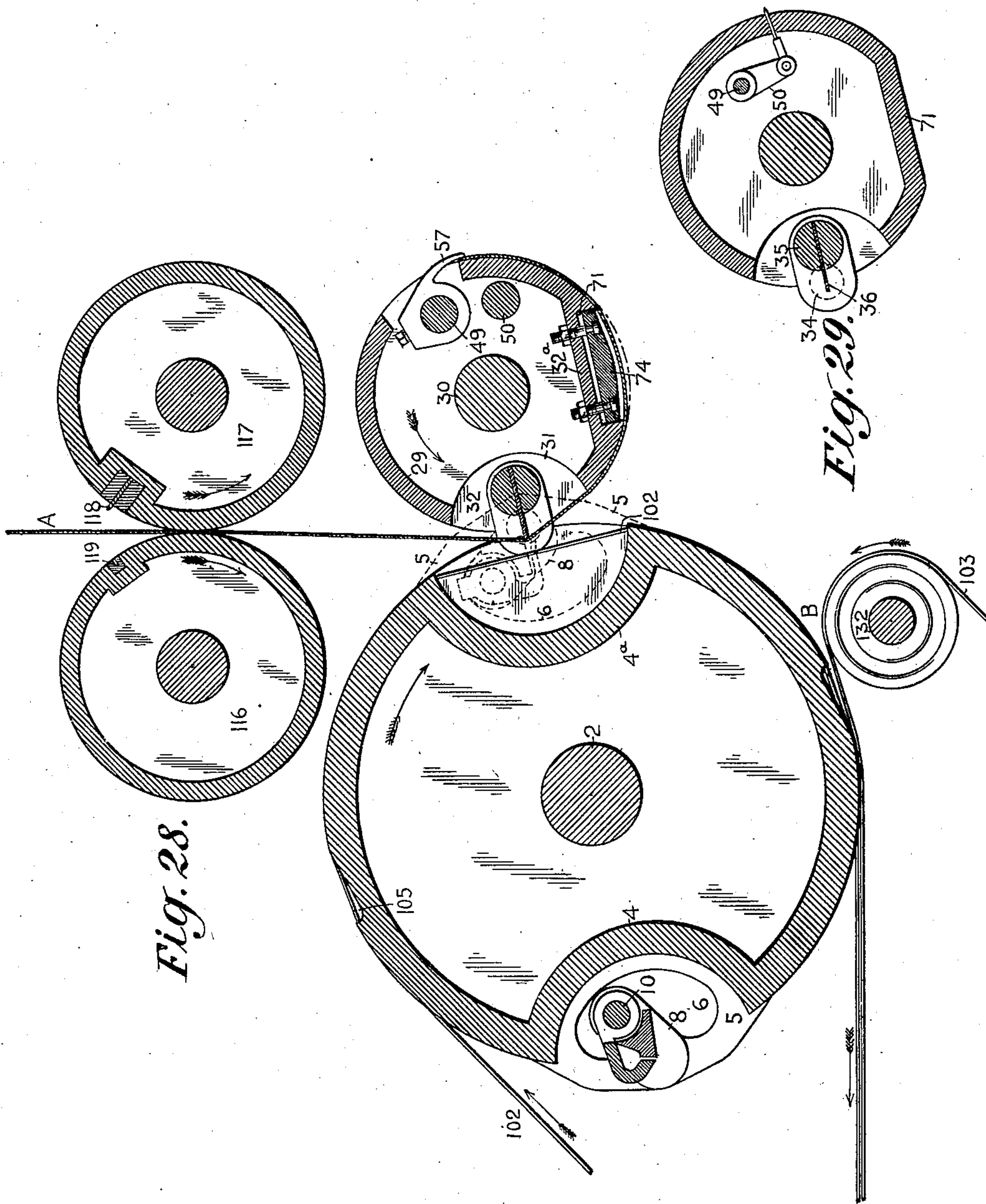


Fig. 28.

Fig. 29.

WITNESSES:

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UNITED STATES PATENT OFFICE.

RALPH C. SEYMOUR, OF SOUTH ORANGE, NEW JERSEY, ASSIGNOR TO THE
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INGTON, CONNECTICUT, AND NEW YORK, N. Y.

FOLDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 668,719, dated February 26, 1901.

Application filed March 13, 1900. Serial No. 8,447. (No model.)

To all whom it may concern:

Be it known that I, RALPH C. SEYMOUR, a citizen of the United States, and a resident of South Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Folding-Machines, of which the following is a specification.

My invention relates to folding-machines, and embodies, among other features, certain devices made the subject-matter of Letters Patent No. 629,928, granted to me August 1, 1899, as well as certain improvements upon said devices.

The following are some of the principal objects which I have had in view in devising the present folding-machine: First, to employ, essentially, the folding-blade and folding-jaws set forth in my aforesaid Letters Patent and to improve their construction and arrangement and mode of operation, so as to adapt them better to combine with other devices in the production of a more full or comprehensive folding-machine; second, to adapt them in a folding-machine to fold either single sheets or a plurality of sheets; third, to provide means for controlling the web, so that a more accurate or even fold may be made; fourth, to provide means for pasting together collected sheets, and, fifth, to improve generally the construction and operation and provide a better and more accurately working machine.

Other objects will hereinafter appear in connection with the description of the invention.

My invention consists in various features of construction and combinations and arrangements of devices and parts, all as will be hereinafter more particularly described, and pointed out in the appended claims.

In carrying out my invention I provide, among other novel devices, two cylinders, one of which I call the "folding-blade" cylinder and the other the "folding-jaw" cylinder. The folding-blade cylinder is provided with a set of grippers or its well-known equivalent, a set of impaling-pins, for seizing the leading end of a web of paper which may be coming from the printing-machine and for carrying around

said end of the web a certain part of the revolution of the cylinder before it is detached into a sheet from the remainder of the web. I also provide the said cylinder with a folding-blade constructed on the principle of the folding-blade in my aforesaid patent and so mount and arrange and operate this blade as that its working edge always protrudes beyond the periphery of its cylinder or carrier. I also provide said cylinder with means between the sheet-seizing devices and the protruding folding-blade for enabling the sheet to yield when the folding-blade strikes the web of paper and puts a tension thereupon before the sheet is detached from the web, so as to relieve the web or sheet from strain and possible rupture, the sheet-seizing means not being adapted to yield to any such strain or tension, and I also preferably so construct the means for enabling the sheet to yield as that said means may be adjusted to regulate the amount of yield or slack in the paper according to the character of the paper and the work being done. The gripper mechanism for seizing the leading end of the sheet is combined with cam mechanism by which the grippers may be opened at every revolution of the cylinder or during alternate revolutions thereof, according as the machine is running to fold single or superposed sheets. The gripper mechanism is also so organized as that the gripping-fingers may be rendered wholly inoperative, if desired, while folding single sheets.

The folding-jaw cylinder is provided with folding-jaws substantially like those set forth in my aforesaid patent. There may be two sets of these folding-jaws at diametrically opposite sides of the cylinder or there may be only one set of said jaws at one side and a pasting-blade upon the opposite side, with the necessary mechanism in either case to operate the device or devices which may for the time being be in use. When it may be desired to fold every successive sheet, then two sets of folding-jaws are employed, because the folding-jaw cylinder is twice the diameter of the folding-blade cylinder; but when it may be desired to collect and paste sheets and

fold only once during each revolution of the folding-jaw cylinder, then one pair of the folding-jaws is removed and the pasting-blade is substituted therefor. The latter has
 5 a reciprocatory radial action and coöperates at the proper time with the normally protruding folding-blade to apply a line of paste on the first sheet taken of the two to be collected. The folding-cylinder is also provided
 10 with tapes for leading off the folded product to suitable delivery mechanism. There is also provided a rotatory stripping device that operates to strip or deflect the loose end of a sheet of paper away from the folding-jaw cyl-
 15 inder and prevent it from entering the tape-pathway ahead of the folded edge of the paper.

In the accompanying drawings, Figure 1 is a top plan view of a folding-machine embody-
 20 ing my improvements, some of the parts being broken away and others omitted in order to show other portions of the machine. Fig. 2 is a vertical section taken at the line $z z$ of Fig. 1. Fig. 3 is a side elevation taken from
 25 the right-hand side of Fig. 1. Fig. 4 is an enlarged top plan view of the right-hand half or portion of the machine and similar to the right-hand half or portion of Fig. 1, but without gearing and pasting mechanism. Fig. 5
 30 is an enlarged top plan view of the left-hand half or portion of the machine, and likewise is similar to the left-hand half of the machine shown at Fig. 1, certain parts, however, being broken away and portions of the frame-
 35 work being omitted to facilitate an understanding of the view. Figs. 4 and 5, held side by side, represent together an enlarged top plan view of the machine minus the pasting mechanism and gearing and other minor
 40 parts shown fully in other views. Fig. 6 is a longitudinal vertical section taken at the line $y y$ of Fig. 4. Fig. 7 is a longitudinal vertical section taken at the line $x x$ of Fig. 4. Fig. 8 is a longitudinal vertical section taken
 45 at the line $w w$ of Fig. 5. Fig. 9 is a plan view of the folding-blade and its support. Fig. 10 is an end view thereof. Fig. 11 is a short elevation of the same. Fig. 12 is a cross-section taken at the line $v v$ of Fig. 11.
 50 Fig. 13 is a top plan view of one of the sets of jaws of the folding mechanism. Fig. 14 is a front elevation thereof. Fig. 15 is an end elevation of the same. Fig. 16 is a cross-section taken on the line $u u$ of Fig. 14. Fig.
 55 17 is a cross-section taken at the line $t t$ of Fig. 14. Fig. 18 is a cross-section taken at the line $s s$ of Fig. 14. Fig. 19 is a side elevation of the pasting-blade. Fig. 20 is an edge view thereof. Fig. 21 is a plan view of
 60 the stripper-fingers and their supports. Fig. 22 is an elevation of the parts shown in Fig. 21, taken from the inner side. Figs. 23, 24, 25, 26, and 27 are skeleton or diagrammatic views showing some of the features of my
 65 improvements and illustrating a complete cycle of the operations of the mechanisms illustrated. Fig. 28 is a diagrammatic view

showing the use of two sets of folding-jaws, and Fig. 29 is a sectional view showing mod-
 70 ifications.

In the various views the same parts will be found designated by the same numerals of reference.

1 represents a folding-cylinder mounted upon a shaft 2, suitably supported in side
 75 frames 3 and rotated in any desired manner. Said cylinder is formed or provided with a deep arc-shaped groove 4, extending longitudinally of the cylinder and for its whole length, and at each end of the cylinder in line with
 80 said groove is attached by screws 5^a a bracket or bearing-plate 5, formed or provided with an arc-shaped slot 6, which is formed about the axis X as a center, and which axis lies in or coincides with the peripheral line Y of the
 85 cylinder 1. At the front side of each bracket or bearing-plate 5 is a hole or bearing which receives a journal or trunnion 7, extending laterally and horizontally from an arm 8,
 90 which extends obliquely upward. The parallelly-arranged arms 8 project into the groove 4 in the cylinder and support therein in eyes or bearings 9, formed at the upper ends of said arms, a cross-shaft 10, which at each end
 95 extends out through the slot 6 and passes out or beyond the said plate 5. Between the tubular bearings 9 and joining them, so as to form one rigid structure, is a part 11, that constitutes one of the jaws of the fold-gripping
 100 mechanism. The other folding-jaw 12 of the folding mechanism is secured upon the shaft 10. Both jaws 11 and 12 are adapted to swing together about the axis X or about the trunnions 7 for every first quarter of the revolution of the cylinder 1, and the jaw 12 is adapt-
 105 ed to swing independently of the jaw 11 for the purpose of gripping the fold of the sheet and also for releasing the same at the proper times, as will hereinafter be more fully explained.

The folding-jaw 11 comprises a continuous bar extending across the machine and formed or provided between its ends with a flat or
 110 plane working face 11^c. The independently-movable jaw 12 also comprises a bar or shaft of suitable length; but in lieu of a continuous coacting jaw-face, as in my aforesaid patent, the said independently-movable jaw 12
 115 comprises a series of independent gripping sections or members 12^a. These consist each of an eye portion 12^b, that fits upon the shaft 10 and is secured by a set-screw 12^c, that passes through a tapped hole in the member, and a gripping finger portion 12^d, that is
 120 adapted to coact with the face 11^c on the bar portion of the folding-jaw 11. At Fig. 13 I have shown centrally a group of six unitary gripping fingers or devices and on each side thereof a single similar gripping device, a
 125 space being left between the ends of the central group of fingers and the isolated single fingers for the accommodation of tapes on the folding-jaw cylinder 1, the jaw 11 being cut
 130 away or depressed at 13 at said spaces for the

passage of said tapes. These independent folding jaws or fingers 12^a all oscillate together with the shaft 10, but are independently adjustable thereon both lengthwise and radially. They are adjustable lengthwise so that they may be set equidistantly or at proper distances apart on said shaft. The main purpose of the radial adjustment is to insure that each gripping jaw or finger may properly grasp or press the sheet against the face 11^c of the folding-jaw 11. If the gripping-jaws 12^a were all made of one piece, or continuous, as in my former patent, while such continuous jaws might be so constructed and mounted as that originally they would bear all along the line against the face 11^c of the companion folding-jaw, yet in time, when wear should occur or for some other reason, one or more portions of such continuous jaw might fail to contact with the face 11^c, and the sheet would not be properly grasped by the pair of folding-jaws, the fold would be improperly made, and the sheet would be likely to get entangled or caught in the tapes or other carrying-off mechanism; but by making the jaws of a series of narrow independent pieces they may be nicely adjusted at the outset and may from time to time, as they fail to grasp the sheet properly, be readjusted, so that there is always continuous and even pressure upon the paper and proper coaction with the face 11^c of the opposing jaw. While I prefer to use the isolated end jaws arranged between the long eyes or bearings 9, these, however, may be omitted, and while I have shown a group of six independent jaw members 12^a it will be understood, of course, that a greater or a lesser number thereof may be used instead.

One of the trunnions 7 of the U-shaped gripper frame or casting 11 is elongated, as at 7^a, and is provided with an arm 14, that carries an antifriction-roller 15, which engages with a stationary grooved cam 16, supported on the framework, and which controls the movement of the gripper mechanism as a whole, as in my former patent. The crank-arm 14 is provided with a lateral extension 17, that carries a lug 18, which is perforated for the passage of a rod 19, that is carried by a crank-arm 20, secured to the shaft 10. Upon the rod 19 is a coiled spring 21, which bears at one end against the lug 18 and at its opposite end against the crank-arm 20 or a piece thereon. Normally the spring is in compression, and hence its action is to force the two arms 14 and 20 apart, and therefore to close the jaws 11 and 12, constituting the folders.

The shaft 10 is provided with another crank-arm 23, preferably made integral with the arm 20, the two forming together a bell-crank, and on the outer end of said arm 23 is mounted an antifriction-roller 24, that engages with a stationary cam-face 25, which is bolted to the inner side of the large stationary cam 16, the said cam 25 being adapted to rock the shaft 10 for the purpose of swinging the jaw

12 away from the relatively-fixed jaw 11, so as to open the grippers when the fold of a sheet is to be grasped thereby. On the opposite end of the shaft 10 is a crank-arm 26, having an antifriction-roller 27, that cooperates with a cam 28, bolted to the right-hand side frame 3, for the purpose of opening the folding-jaws at the proper time to release the folded sheet.

29 is a drum or cylinder mounted to turn with a shaft or axle 30, driven in any suitable way and in unison with the folding-cylinder. In this cylinder 29 is formed or provided a longitudinal groove or depression 31, curved or arc-shaped in end view, and at each end of the cylinder is provided a bearing-plate or bracket 32, secured by screws 33 and provided with a hole to act as a bearing for a trunnion or pintle 34, extending laterally at each end from a longitudinally-arranged knife or blade support 35 and provided with a tucking or folding knife or blade 36, adapted to double or fold the sheet into the bite of the jaws 11 and 12. The pintles 34 are preferably arranged in the peripheral line of the folding-blade cylinder 29, and the right-hand pintle is prolonged and provided with a crank-arm 37, which bears a roller 38, that travels in a grooved cam 39, connected with the right-hand framework of the machine. The tucking or folding blade 36 is secured between two half-round bars 40 and 41, the latter of which is formed integrally with an end piece 42 of the blade frame or support. The blade 36 is perforated at suitable points for the passage of screws 43 and dowel-pins 44, which pass through holes in the upper or separate clamping bar 40 and enter holes in the bar 41, some of which are tapped for the points of the screws. The blade is thus securely clamped between the bars 40 and 41 of the frame or support, which, it will be noted, is U-shaped or crank-shaped. The working edge of the blade 36 projects always beyond the periphery of the cylinder 29. The pintles 34 are supported in bosses 45 on the brackets 42 at the ends of the cylinder. The cam 39 is supported at the inner end of a cylindrical flanged distance-piece 46, which is secured within a hub-boss 47, constituting a part of the framework 3 and preferably provided with a lining or brass 48. The shaft of the collecting-cylinder 29 passes through the cylinder, through one hub 29^a thereof, through the cam 39 at one end, through the distance-piece 46 and hub-boss 47, and is provided at its outermost end with a driving-gear, while the opposite end of said shaft after passing through the other cylinder-hub 29^b is extended outwardly through the hub-boss 47^a, likewise provided with a brass bushing as 48^a. The shaft is keyed to the cylinders at the hub portions thereof, so that the cylinder and the shaft turn together.

The collecting or blade cylinder 29 is provided with a gripper mechanism which is peculiarly constructed and operated, the operation depending upon whether the cylinder is

acting to collect or superpose sheets or not. At Fig. 8 it will be observed that there are two shafts 49 and 50 journaled in the collecting-cylinder, the former having a rocker-arm 51 and the latter a rocker-arm 52. The arm 51 is provided with a toothed sector 53, which meshes with a toothed sector 54 on the arm 52, which latter is provided with an anti-friction-roll 55, that coacts with a cam 56, to be presently described. The shaft 49 is provided with a set of gripper-fingers 57, which clamp the sheet upon the periphery of the cylinder 29. To the free end of the crank-arm 51 is pivotally connected at 58 a rod 59, whose opposite end takes a bearing in a lug 60, projecting laterally from one of the bearing-plates or brackets 32. Surrounding said rod is a coiled spring 61, which bears against said lug and also against a nut 62, the latter being adjustable upon a threaded portion 63 of said rod so as to vary the tension of said spring. The said spring mechanism, as described, operates to hold the grippers normally closed or pressing upon the surface of the cylinder.

The cam 56 is curved or C-shaped and supported upon the upper end of an arm 64, whose hub 65 is secured upon a rock-shaft 66, extending across the machine and mounted in suitable bearings in the framework. To said shaft 66 is secured a horizontal rocker-arm 67, having at its outer end an anti-friction-roller 68, which travels in a grooved cam 69, mounted on a revolving shaft 70, likewise extending across the machine and suitably mounted in the framework. This grooved cam is adapted, through the rocker-arms 67 and 64, to move the C-shaped or curved cam toward and away from the shaft of the collecting-cylinder 29 or in and out of the path of rotation of the roller 55 on the rocker-arm 52 upon the collecting-cylinder, so that at the proper times the grippers 57 may be opened or may be permitted to remain closed.

The collecting-cylinder 29 is preferably provided with a peripheral depression or flattened or sunken portion 71, extending from end to end of the cylinder and between the tucking or folding blade and the gripper-fingers, for the purpose of enabling the sheet in the grasp of the grippers to yield or give whenever the paper is projected by the folding-blade or when the latter is tucking the fold of the sheet into the jaws of the folding-cylinder, so as to relieve the sheet of any undue strain or tension, which might cause it to tear or be ruptured, and so as to cause the short length of paper which is tucked or taken up by the folding-jaws to be drawn from this portion of the sheet, as will be hereinafter more fully explained. The depressed or sunken portion 71 is preferably provided with a segmental adjustable bed 72, held in position by means of screw-bolts 73, having cylindrical necks, supported in holes in a plate 74, cast with the cylinder, and having also threaded ends to engage the holes in the bed

72. These bolts not only support the bed, but afford a means for adjusting the same radially of the cylinder so that its curved face may be moved in or out to the required extent relatively to the periphery of the cylinder to regulate the amount of slack or yield in the sheets, as may be necessary. The bed is held in its adjusted position by means of a set-screw 75, passing inwardly from the bed and bearing against the outer face of the plate 74. The bolts are preferably headed on the inside of the cylinder after their cylindrical ends have been passed through the holes in the plate.

Referring again to the folding-cylinder 1, it will be observed that there is an arc-shaped depression 4^a formed diametrically opposite the similar depression 4, and in said depression 4^a may be arranged either another set of folding-jaws or a pasting mechanism, according to the character of the work being done; but I have shown arranged in said depression a pasting mechanism which comprises a shaft 76, having bearings at its ends in plates or brackets 77, secured by screws 5^b to the ends of the cylinder, rocker-arms 78, rocker-arms 79 and 80, a pasting-blade 81, and its support 82.

The pasting-blade support consists of a yoke or casting formed with a seat or depression, upon which is screwed a sheet-metal pasting-blade 81, which is cut away at 83 to clear the tapes. The ends of the blade-support 82 are provided with round pins 84, which are embraced by forks 85, formed on the free ends of the rocker-arms 78, there being one rocker-arm at each end of the cylinder to engage the two pins 84 on the support 82. The latter is guided in a radial in-and-out movement by a straight groove or way 86, formed on the inner side of each of the end plates or brackets 77. On one end of the shaft 76, outside of the cylinder, is the rocker-arm 79, bearing an anti-friction-roll 87, that engages with a fixed cam 88 on the framework, and on the other end of said shaft is the other rocker-arm 80, which is connected to a spring stop mechanism that normally holds the blade within the depression in the cylinder. The blade is projected beyond the surface of the cylinder by the cam 88 against the tension of the spring mechanism, which consists of a rod 89, pivoted at one end to the crank-arm 80, which is bifurcated to receive the same, and riding freely at its opposite end in a screw-bushing 90, supported in an earpiece 91, cast integrally with the bracket 77. Surrounding the rod 89 is a coiled spring 92, one end of which bears against the head of the rod and the other against the inner flanged end of the threaded bushing 90, the outer end of the latter being provided with a knurled finger-piece or button 93, by which the exteriorly-threaded bushing may be screwed in and out of its bearing in the ear 91 for the purpose of adjusting the tension of said spring, a jam-nut 94 being provided to hold the bushing in its adjusted po-

sition. Above the spring-pressed rod 89 is a stop 95 in the form of a screw passing through a threaded hole in a lug 96, also cast on the bracket 77. A set-nut 97 is provided for maintaining the stop in any position to which it may be adjusted. Said stop is adapted to arrest the return motion of the rocker-arm 80 under the pressure of the coiled spring 92. When the blade is slid outwardly by the action of the cam 88, crank-arm 79, shaft 76, and rocker-arms 78, it moves into contact with a paste-roller 98, which takes paste from a fountain or box 99, provided with an adjusting-screw 100 to regulate the flow of the paste to the roller.

The folding-cylinder is formed or provided with grooves or depressions 101 for the accommodation of tapes or carrying-bands 102, which pass partially around said cylinder and which coact with another set of carrying tapes or bands 103, mounted on the framework. The tapes 102 on entering pass under tension-rollers 104, thence partially around the cylinder and back in a horizontal direction parallel with the tapes 103 to suitable rollers or pulleys, (not shown,) about which they run. As will be seen at Fig. 4, the depressions or cut-aways 13 in the folding-jaw 12 are arranged in line with the tape-grooves 101 in the folding-jaw cylinder and are of such depth that the tapes pass over said folding-jaws back of the line at which the fold is made when the tucking-blade doubles the paper into the bite of the jaws 11 and 12, as shown at Fig. 26, and hence the tapes are not struck by the folding-blade and do not interfere with the tucking of the paper into the folding-jaws. The cut-aways or depressions in the paster-blade are likewise in line with the tape-depressions 101 in the folding-jaw cylinder, and hence when the paster-blade is projected and is traveling under the tapes the latter lie in said depressions, and hence the projection of such paster-blade does not effect a lifting of the tapes from the surface of the folding-jaw cylinder nor transfer paste to said tapes, which would be the case if the paster-blade were made with a continuous unnotched edge.

On diametrically opposite sides of the folding-jaw cylinder 1 are beveled and curved depressions 105, sort of hook-shaped in cross-section, which extend along for the entire length of the cylinder. The leading edge or head of the web overlaps one of the depressions 105, as shown at Fig. 25. This depression is not a slot—that is to say, the cylinder is not perforated or cut through thereby—and the result is that when the cylinder is in rapid motion the air passes into the depression and around and against the back of the overlapping portion of the web and causes the latter to fly outwardly, whereby the leading end of the web is assisted or started away from the surface of the cylinder just in advance of its approach to the tape-pathway, so as to avoid the liability of the leading end of the web entering said pathway, it being under-

stood that the sheet should enter the tape-pathway fold first, and hence the leading end or single ply of the web or sheet should pass down beyond the plane of the tape-pathway and allow the folded or doubled portion of the sheet to enter said pathway first.

While the depression and the air acting therein next the cylinder constitute a sort of pneumatic stripper for the end of the web, I prefer to employ in addition thereto positive mechanical devices for insuring the stripping of the leading end of the web from the folding-jaw cylinder whether the machine be operated with very light paper or with heavy paper. To this end I have added a rotary stripper device, which is shown at Figs. 21 and 22 and comprises a U-shaped frame or skeleton cylinder consisting of a main longitudinal bar portion 106 and lateral arms 107, provided with bearings 108 and integral circular guide-flanges 109, overhanging the bar 106. The latter is formed or provided at suitable intervals with a series of stripper-fingers 110, projecting out beyond the inner edge of said bar, so as to coact with a series of circular grooves or depressions 111, formed in the folding-jaw cylinder 1 at intervals corresponding with the spacing of the stripper-fingers 110. The shaft 112 is supported near its ends in suitable bearings in the side frames 3 of the machine and passes through the eyes or bushings 108 and the flanges 109 of the rotary stripper device, and at the right-hand end of the machine (at which is located most of the gearing) said shaft is provided with an eccentric gear 113, with which meshes another eccentric gear 114, that is fast on a shaft 115, extending across the machine and mounted in suitable bearings in the framework. The main purpose of rotating the strippers or stripping-fingers by means of eccentric gears is to cause said strippers to move slower than the surface speed of the folding-jaw cylinder or, in other words, slower than the speed at which the sheet is traveling at the time they coact with said cylinder, and thus insure that said strippers shall get under the sheet and strip it from the cylinder every time. The stripping-fingers make one revolution with each revolution of the folding-blade cylinder. If collecting is being done, the stripping-fingers work idly at alternate revolutions; but if no collecting is being done they work at every revolution upon the lower end of the web. When the stripping-fingers enter the periphery of the folding-jaw cylinder just ahead of the advancing sheet, their speed is slowest, and hence the advancing sheet is traveling faster than the rotative speed of the stripper, thereby causing the sheet positively to be deflected or carried away from the cylinder and guided away from the mouth of the tape-pathway, the leading end of the sheet thus acted upon being caused to pass between the stripping-fingers and their shaft and preferably between the fingers and the flanges 109, which keep the free end of the web from flapping

unduly. The stripping-fingers rotate in the same direction as the folding-blade cylinder and move downwardly in the general direction of the descending sheet; but since they move slower than the head of the sheet the latter is caused to pass over the points of the fingers and to be deflected from said cylinder and to therefore come under the control of the rotating fingers.

The radius of the stripping-finger frame or skeleton cylinder is equal to the radius of the tucking or folding blade cylinder, and as the machine is now organized the stripper-fingers make a complete rotation in equal time with the folding-blade cylinder; but as the movement of the stripper-fingers at the beginning of the stripping operation is slower than the movement of the folding-blade cylinder and of the head of the sheet (which travels at the same surface speed as the folding-blade cylinder) it follows that the stripper-fingers must at a later period be speeded up so as to come around again at the proper time to meet and strip the head or leading end of the next sheet. This acceleration of the speed of the stripping-fingers is effected by the eccentrically-arranged gears 113 and 114. It will be understood, however, that it is not absolutely essential for the stripper-fingers to have the variable speed described, for the skeleton cylinder or rotary stripper-finger frame may be smaller in diameter than is shown, so that the tips of said fingers may run at a slower peripheral speed and yet come around at the proper moment always to meet the head of the next sheet. However, so long as the stripper-fingers when in engagement with the grooves in the folding-jaw cylinder move at a lower rate of speed than that of the advancing sheet it is unimportant whether they move at a higher speed at other parts of their revolution or at a uniform speed throughout the entire revolution. It will be observed that the stripper-fingers take the head of the sheet away from the folding-cylinder and lead it backwardly to the most advantageous position for permitting the doubled or folded portion of the sheet to pass first into the tape-pathway.

I will now describe the operation of the machine when organized, as illustrated, to collect and paste together two sheets from a continuously-fed web and to fold and deliver the same to a tape-pathway or other suitable delivery mechanism. The web of paper may be assumed as proceeding from a suitable printing-press, of which the folding-machine may constitute a part, as in this case, if desired. While I have indicated some of the framework of the printing-machine proper, I have omitted all the working mechanism thereof. The web A of printed paper in the example shown is illustrated as descending vertically and in between a pair of cutting-cylinders 116 and 117, provided, preferably, with cutting-blades 118 and 119, as in the Cottrell patent, No. 391,949, dated October 30, 1888.

These cylinders 116 and 117 are of the same diameter as the tucking or folding blade cylinder 29 and are of half the radius of the folding-jaw cylinder 1, so that they and the folding-blade cylinder make two revolutions to each revolution of the folding-jaw cylinder.

Referring now more particularly to Fig. 23, it will be observed that the head of the web is about to be seized by the gripper-fingers 57 on the tucking-blade cylinder 29. At Fig. 24 the cylinder 29 and the cylinders 116 and 117 are represented as having made one-half of a revolution, with the head of the sheet still clamped upon the surface of the cylinder 29 by the grippers 57, and the folding-jaw cylinder as having made a quarter of a revolution and the pasting-blade 81 as having been brought into register with the tucking or folding blade 36. In this view it will be noted that the tucking-blade and the paster-blade are both in positions radially of the axes of their respective cylinders and coincident with a line joining said axes or shafts 2 and 30, at which time the projecting edge of the folding-blade presses the outer side of the paper against the edge of the paster-blade and causes a deposit of a line of paste upon the inner side of said paper. It will also be noted that the free edge of the tucking-blade is projected beyond the periphery of its cylinder and causes a bending-out or shed-like condition of the paper about said edge at the line of the paster-blade, and inasmuch as this shedding or projecting of the paper by the folding-blade takes place while the grippers 57 still have a hold upon the leading end of the paper and before the tail end of the sheet has been cut off by the said feeding and cutting cylinders 116 and 117 it follows that the portion of the paper between the grippers and the folding-blade which overlies the depression 71 in the folding-blade cylinder 29 is slightly drawn into said depression under the outward tension upon the paper exerted by said folding-blade, and hence that a slack in the paper is created, or the paper is enabled to yield under the strain, so as to avoid the liability of its being torn away from the grippers or rupturing elsewhere, which would ensue but for the provision of said depression. At Fig. 25 the folding-blade cylinder is represented as having made slightly more than half of a revolution beyond the position shown at Fig. 24, the cutting-cylinders as having revolved also to the same extent and as having cut off the tail end of the first sheet, and the folding-jaw cylinder as having made slightly more than a quarter of a revolution. In this view the grippers 57 are shown as still maintaining their hold upon the leading end of the sheet and the detached tail of the sheet as traveling around with the cylinder. The view also shows the leading end or head of the next sheet from the web as having been fed down between the folding-blade cylinder and the folding-jaw cylinder and as having been superposed or collected upon a

portion of the sheet held on the folding-blade cylinder. In the next view, Fig. 26, the folding-blade or collecting cylinder and the cutting-cylinders are shown as having made a little less than half of a revolution beyond the position shown at Fig. 25 and the folding-jaw cylinder as having made a little less than a quarter of a revolution. In this view it will be observed that the collecting-cylinder 29 has made just one complete revolution and the folding-jaw cylinder has made just one-half of a revolution from the positions shown at Fig. 24, and now instead of the paster-blade being in operative conjunction with the folding-blade the folding-jaws 11 and 12 are in coöperative relation with said folding-blade, which, as shown, has now just doubled or folded the two sheets into the bite of said jaws. The gripping-fingers 57 have all this time maintained their hold upon the leading end of the first sheet, which has traveled around with said cylinder about one and one-half revolutions, and that portion of the sheet which received a line of paste by the coaction of the tucking-blade and the pasting-blade has remained in the same position, riding upon the edge of said tucking or folding blade during a full revolution of the cylinder 29. While the pasted portion of the sheet upon the cylinder 29 has been making this full revolution, the next sheet on the web has been traveling down between the two cylinders 1 and 29 and has reached the position shown at Fig. 26, there being no grippers, as 57, to meet the head of the second sheet and to take it around with the cylinder 29. When the middle of the second sheet arrives at about the line joining the axes of the cylinders 1 and 29, at which time the folding-blade and the folding-jaws also come into alinement, the two sheets are folded or doubled into the bite of the folding-jaws upon the paste-line of the first sheet, and said sheets are thereby caused to adhere together. They are then carried by said jaws to the tape-pathway, the mouth or entrance of which is indicated at B. When the folding-blade and the folding-jaws approach each other and commence to act upon the superposed sheets, the gripper-fingers 57 have still a hold upon the leading end of the first sheet and the tail end of the second sheet has not been severed from the web. Owing to these conditions the tucking of the paper within the folding-jaws requires an additional slack or yield on the part of the first sheet of paper on the cylinder 29, and this it is enabled to have by reason of the presence of the depression 71 in the surface of said cylinder. The said additional slack is required when the paper is tucked within the folding-jaws on account of a portion of the paper being looped or doubled into the folding-jaws, thus shortening, substantially to the extent of one-half the amount of the doubled portion or loop, the length of the first sheet between the fold and the grippers 57, and since the grippers have

hold of the leading end of the first sheet at this time there must be enough give to the paper to enable the fold to be made. (See Fig. 26.) It may be stated here that in the beginning the folding-blade does not strike the first sheet exactly on the line where it will be folded on the second revolution—that is, on the line which will coincide with the center of the fold; but this first sheet when pushed into the folding-jaws during the second revolution is pulled or drawn into the exact or center line of the fold by means of the further tension due to the doubling of the paper into the jaws, this further tension being taken care of entirely by the depression 71 in the cylinder, which is deep enough to allow an additional or further slacking of or give to the paper. Thus when the fold of the two sheets is effected they may be folded along the center lines of their margins or folds in such a manner as that their meeting edges will coincide or register instead of overlap, as is liable to happen in folding-machines where collecting is done, and which is exceedingly objectionable, particularly for high-class book or magazine work. Soon after the two sheets have been doubled into the folding-jaws, as illustrated at Fig. 26, the tail end of the outside sheet is severed, the grippers 57 release the head of the first sheet, and the parts assume the conditions shown at Fig. 27, at which it will be seen that the gripping-jaws are carrying the superposed and folded sheets fold foremost into the tape-pathway, and at this time the head of the first sheet has dropped away from the collecting-cylinder and is moving between the latter and the rotary stripper, while the tail of the first sheet is traveling around parallel with the tail of the second or superposed sheet and between the two cylinders and the head or first half of the second sheet is in the control of the rotary stripper. From this view it will be seen that all four plies of the superposed sheets are now approaching the tape-pathway from various directions and that they will soon meet and become parallel and lie one on top of the other in said pathway, as will be found illustrated at Fig. 23, wherein the folding-jaws are shown as now having been opened and the folded sheets as having passed into the control of the superposed sets of tapes, by which they will be carried along to any suitable point or place of delivery, either to a receptacle or to another cross-folding mechanism, according to the character of the work in hand. Fig. 23 shows both the beginning and the ending of the cycle of operations of collecting, pasting, folding, and delivering two superposed sheets. The working edge of the folding-blade stands always projected beyond the periphery of the collecting-cylinder 29 and does not have any in-and-out motion relatively to the axis of its cylinder, as is usual, and which reciprocating motion is objectionable, especially in high-speed machines, where the action is neces-

sarily harsh and impairs the accuracy of the fold to be made and materially shortens the life of the machine, besides which the mechanism for effecting the projection and retraction of the blade is constantly getting out of order and requiring the services of a mechanic to effect the necessary repairs.

It will be noted that the projecting folding-blade of my collecting-cylinder is so mounted and operated as that it has a feathering motion somewhat similar to that set forth in my aforesaid patent—that is to say, as it approaches the folding-jaws at near the point where the fold is to be made it moves gradually from a position on one side of a radial line to the center of the cylinder to said radial line at the same moment that the floating folding-jaws of the folding-cylinder move to a radial line with reference to the axis of their cylinder—and that the folding-blade runs in parallelism with the floating folding-jaws while the paper is being doubled into the bite of said jaws and also while the folding-blade is receding from said jaws, after which said folding-blade passes to the other side of said radial line and to a position to coact again properly with the folding-jaws the next time. It will be observed that the axis or pintle 34 of the folding-blade is arranged in the peripheral line of the cylinder 29, so that the working edge of the blade always moves in the same circular path, whether vibrating independently of the cylinder or moving bodily therewith. The grooved cam 39 (shown in dotted lines at Fig. 6) is sort of snail-shaped and receives the antifriction-roll 38 on the upwardly-projecting arm 37 at one end of the axis 34 of the folding-blade. As shown at Fig. 6, the roller is at the highest point of the cam, at which time the folding-blade is in the position shown at Figs. 2 and 7. The cam being stationary, the roller runs down the lower part of the cam, and the blade-frame is thereby tilted and the blade brought to the position shown at Fig. 26, which is the center position of the vibratory movement of the blade, at which position the tucking or folding is done, as shown in the last-mentioned figure. In moving from its first position to the center position the folding-blade and the folding-jaws on the folding-cylinder 1 travel parallelly, and from this center position to the other extreme of vibration of the folding-blade the said folding-jaws also travel parallelly therewith, but along diverging paths, so that the two members are gradually separated. When the roller 38 is at the middle of the lowering portion 39^a of the cam, the folding-blade is in the position shown at Fig. 26 and is in or nearly in a line drawn between the center of the folding-jaw cylinder and the center of the collecting-cylinder, and when the said roller is at the bottom of the abrupt lowering cam-face 39^a the folding-blade has passed out of engagement with the folding-jaws on the folding-cylinder and is tilted to its other extreme. From this

point the cam rises gradually, and the folding-blade is gradually swung to the opposite extreme again, so as to be in the position represented by Fig. 7, when the roller again reaches the highest point of the cam 39, as shown at Fig. 6. It will also be observed that the axis of vibration or pintle 7 of the folding-jaws as a whole is in the peripheral line of the folding-jaw cylinder 1 and that the said folding-jaws have a floating motion independently of said cylinder, substantially like that of the folding-blade, and in substantial accordance with the folding-jaws shown and described in my said patent. This motion of the folding-jaws is effected and controlled by the rocker-arm 14, roller 15, and adjustable grooved cam 16, which latter is so shaped as to cause the jaws to work parallelly while coacting with the folding-blade and to turn said jaws backwardly relatively to the cylinder, so as to avoid any bends or creases in the sheet, and enable the cylinder to deliver the folded edge about tangentially of its surface and in substantial alinement with the body of the sheet. When the crank-arms 14, 20, and 22 are in the positions shown in Fig. 8, the jaws are in an open condition and are a little past the position shown at Fig. 7, wherein the folding-jaws are shown as having just come into parallelism with the folding-blade, with which they travel parallelly until these two members are in the center line between the axes of the two cylinders, (see Fig. 26,) at which moment the sheet is doubled into the folding-jaws, and then these members travel parallelly a further distance until the folding-jaws arrive at about the position shown at Fig. 23, when they are opened by the roller 27 under the action of the cam 28, when the sheet is released and delivered tangentially of the cylinder 1. Thereafter the folding-jaws are gradually rotated reversely by means of the cam 16 until they take a position nearly radially of the folding-cylinder, as shown at Fig. 7. The cam 28 opens the jaws to release the sheet against the tension of the spring 21, which immediately closes said jaws after the roller 27 passes off said cam 28. Just before the parts arrive at the position shown at Fig. 7 the roller 24 rides up on the cam 25 and the jaws are opened to the condition shown at Fig. 7. As soon as the folding-blade has tucked the sheet into the space between the jaws the roller 24 passes off the cam 25, and the spring 21 causes said jaws to close again, and the folded paper is carried around to the delivery-point. When collecting is being done, the C-shaped or curved cam 56 is held away from the path of the roller 55 by the cam 69 from the time that the grippers take the sheet until the collecting-cylinder has made about a full revolution, when the cam 56 is then moved up in the direction of the axis of said cylinder into position to act upon the roller 55 and open the grippers and release the sheet, which release-

ment takes place when the cylinder has made about one-half of a revolution more. When the roller 55 strikes the cam 56, it and the arm 52 move inwardly about the axis 50, and through the gears 54 and 53 the shaft 49 is rocked, the gripper-fingers 57 thereon elevated or opened, and the rocker-arm 51 moved inwardly against the tension of its spring mechanism. The cam 56 is elongated or extends around for nearly one-half the circumference of the cylinder and holds the grippers open until the roller 55 runs off the inner or upper free end of said cam, at which time the grippers are about at a horizontal line through the axis of the collecting-cylinder and receive the leading end of the next sheet before they close under the action of the spring 59. The collecting-cylinder makes two revolutions to one revolution of the grooved cam 69. While the concentric portion *a a* of the grooved cam is acting on the roller 68 the C-shaped cam 56 is held away from the collecting-cylinder and no action is had upon the grippers. When the concentric portion *b b* of the grooved cam 69 is acting on the roller 68 the C-shaped cam 56 is held inwardly or nearer the axis of the cylinder and in the path of rotation of the roller 55. The concentric portion *b b* represents about one-half a revolution of the collecting-cylinder or about one-quarter of a revolution of the cam 69. The cam or eccentric portions *a* to *b* represent the rise and fall of the cam 56 or the inward and outward movements of said cam relatively to the collecting-cylinder.

When it may be desired to run the machine without collecting and to use the grippers for taking every sheet, the arm 67, carrying the roller 68, that engages with the grooved cam, is slid to the right, Fig. 1, on its shaft 66, so as to disengage the roller 68 from the cam, and the said arm is then made fast in its inoperative position by a set-screw 67^a, the shaft 66 being preferably grooved and the hub of the arm having a feather to ride therein. The shaft 66 has no gears, but simply rocks in its bearings in the side frames. Hence to keep said shaft in proper position to hold the C-shaped cam 56 (whose hub is fast on one end of said shaft) in position to act on the grippers of the collecting-cylinder at every revolution there is cast with said hub an arm 64^a, which is provided with a transverse bolt 64^b, which screws into the side frame. This holds the shaft 66 and keeps the cam 56 in such relationship to the grippers 57 that they are opened and closed at every revolution of the collecting-cylinder. Of course when the machine has to do collecting again the arm 64^a is unbolted and the roller 68 connected up with the grooved cam 69.

When it may be desired to run the collecting-cylinder without opening the grippers at all, and thus permit the sheet to come straight down until folded, the shaft 66 is locked in its bearings, so that the cam 56 is held out of

operative relation to the grippers. This is accomplished (after disconnecting the roller 68 from the cam 69) by swinging the arm 64^a to the left at Fig. 2 just far enough to carry the cam 56 out of reach of the gripper mechanism or the roller 55 and then screwing the bolt 64^b into another hole 64^c in the frame to register therewith.

The paste-blade lies normally within its housing, with its outer edge below the periphery of the folding-cylinder; but at the proper time the blade is projected to receive paste, after which it is retracted again before imparting its paste to the paper and remains within its housing until it becomes necessary again to project it to take a further supply of paste. As the pasting-blade approaches the paste-roller 98 the roll 87 runs into contact with the outer edge of the fixed cam 88, and the latter causes the shaft 76 to be rocked in a direction to vibrate the arms 78 outwardly and the arm 80 downwardly against the tension of the spring 92. In moving outwardly the arms 78 carry the paste-blade 86 radially and the outer edge of the blade is projected just far enough to strike or move in contact with the periphery of the paste-roller and to receive therefrom a sufficient quantity of paste for one operation, as illustrated at Fig. 27. From this point the roller 87 begins gradually to run down the cam 88 and the blade is gradually retracted under the reaction of the spring 92, and at or about the time the said roller parts company with said cam the spring has returned the arm 80 against its stop 95 and the blade has been retracted to normal position. When the pasting-blade arrives at the position shown at Fig. 24, in line with the folding-blade 36, the latter presses the paper against the pasted edge of the pasting-blade and a certain quantity of paste is transferred to the paper along a line transversely of the paper to cause adherence of the pasted sheet and the sheet to follow. The pasted sheet is in the grasp of the grippers on the collecting-cylinder and makes an additional revolution therewith, by which time the middle portion of the succeeding sheet has come into register with the pasted portion of the first sheet, and the two are doubled into the bite of the jaws of the folding-cylinder, as illustrated at Fig. 26, and at which operation the two sheets are pasted together along the fold-line and thereafter travel away together to the delivery-point.

When it may be desired to run the machine without collecting, or, in other words, to fold each successive sheet upon itself, the pasting-blade is removed and another pair of folding-jaws, such as 11 12, are substituted therefor, as shown diagrammatically at Fig. 28. To effect this substitution, the shaft 76 and all of its connected parts and the end plates 77 and the pasting-blade are all removed from the cylinder and in place thereof end plates, similar to the end plates 5 and similar to those on the opposite side of the cylinder, are

screwed onto the cylinder at the depression 4^a, the screws or bolts entering the same holes that they enter when the plates 77 are in position, and then the folding-jaw mechanism complete, similar to that now exhibited at the depression 4, is fitted to the opposite side of the cylinder, all in such manner that at each half-revolution of the folding-cylinder a single sheet is tucked into one or the other of the set of similar folding-jaws, and the doubled sheet is carried away and delivered in the same manner as the superposed sheets are delivered.

Although I have shown and thus far described the machine as organized to paste two sheets together when collecting is being done, it will nevertheless be understood that the pasting mechanism may be omitted or thrown out of use and the sheets collected or superposed and doubled together and carried off in the manner described without at the same time pasting them together at the line of fold.

It will be noted at Figs. 1 and 3 that nearly all of the gearing for effecting movements of the rotative parts is located on the right-hand side of the framework. Through a train of gears from the printing-machine gears (not shown) the power is transmitted to a gear 120 and a shaft 121, mounted in bearings in the framework. Gear 120 meshes with a spur-gear 122 on shaft 70. Gear 122 meshes with gear 124 and shaft 125 and extends across the machine. Gear 122 also meshes with a gear 126, concentric on shaft 115. On this shaft is mounted the eccentric gear 114, which meshes with the eccentric gear 113 on shaft 112, that carries the rotary stripper. Gear 124 meshes with gear 127 on the shaft of the collecting-cylinder, and gear 127 meshes with gear 128 on the shaft of the folding-jaw cylinder. Gear 128 meshes with gear 129 on the pasting-roller shaft. On the same shaft to carry the gear 128, but at the opposite end of the shaft, is a gear 130, that meshes with a pinion 131 on a shaft 132, that drives the tape mechanism 103. On the shaft 125, carrying gear 124, is also a gear 133, which meshes with a gear-wheel 134 on the knife-cylinder 117, and gear 134 meshes with a companion gear 135 on the other cutting-cylinder 116.

Referring now to Figs. 28 and 29, I have shown at Fig. 28 the folding-cylinder provided with two sets of folding-jaws in lieu of one set of folding-jaws and one paster-blade, as in the other views, so that each single or successive sheet may be doubled, the substituting set of folding-jaws being shown, preferably, in dotted lines. I have shown at Fig. 29 the folding-blade or collecting-cylinder provided with impaling-pins for taking the leading ends of the sheets in lieu of grippers, as shown in the other views, the said pins being adapted to be projected and withdrawn, so as to impale and release the sheets in the usual way and by means not necessary for me to illustrate, since the same are well known in the art. The said collecting-cylinder is

also provided with a flattened portion or depression, as 71, for enabling the paper when pressed outwardly by the folding-blade to yield or move toward the axis of the cylinder, as hereinbefore described; but in this construction or modification the said depression in the periphery of the cylinder is not provided with an adjustable bed or plate, which latter is the preferred construction. I have devised other forms or modifications of the invention, (not shown herein;) but these will form the subjects-matter of other applications. The principle of operation, however, is substantially the same in all and in the machine or organism in which the invention is herein carried out may be described as follows: The leading end of the web is grasped or held on the collecting-cylinder by the grippers, pins, or other equivalent devices, and as the cylinder turns the paper begins to envelop the cylinder. Since the paper feeds or advances at a uniform speed, the portion thereof which covers the depression lies in a curve or arc concentric with the axis of the cylinder, or substantially so—that is to say, the paper considered edgewise lies in substantially the same curve or arc as it would if the periphery of the cylinder were uniformly cylindrical or unbroken. When the cylinder has made about one-half of a revolution, the folding-blade is in its working position and projected beyond the peripheral curve of the cylinder, forcing the paper slightly outwardly from the collecting-cylinder, thereby putting the paper under tension, since the leading end of the web is still held by the grippers or other seizing means and the rear portion of the web has not been severed, but is still in the bite of the cutting-cylinders. The portion of the paper which overlies the depression yields or moves inwardly under the tension, and the portion thereof between the depression and the folding-blade is enabled to slip back over the surface of the cylinder to an extent sufficient to compensate for the projection or shedding of the web by the folding-blade. The paper under these circumstances moves inwardly—say to the full-line position shown at Fig. 24, or thereabout—as only a portion of the slack is taken up by the folding-blade at this time, it being assumed that the machine is operating to collect sheets. At the folding operation, which occurs at or during the second revolution of the collecting-cylinder, the severed sheet and the web are together tucked by the folding-blade between the folding-jaws, which operation takes place before the leading end of the severed sheet is released by the grippers or pins and before the cutting-cylinders have cut off the second sheet. In the case of the second sheet the slack necessary to enable the paper to enter between the folding-jaws is secured by the provision that the leading end thereof shall be free or disconnected from the collecting-cylinder, so that it can be drawn back as far

as required; but in the case of the first sheet its unattached or tail-end portion on the collecting-cylinder cannot be dragged back by the folding-blade sufficiently for the purpose owing to the binding action of the blade upon the sheet as it enters the jaws and also on account of the friction between the two sheets. Hence when the first sheet is put under tension at the tucking or folding operation the portion thereof overlying the depression yields or moves inwardly from the full-line position shown at Fig. 24 to about the full-line position shown at Fig. 26. Thus by the provision of the depression on the collecting-cylinder the fold may be inserted between the gripping-jaws before the final release of the paper by the grippers or pins and before the web is finally severed, whereby the paper is kept under better or more positive control until the completion of the tucking or folding operation, thus enabling the work to be accomplished with precision and with the high speed desired in this class of machines. The outer face of the bed or plate in the depression is convex, so as to provide a raised portion (which may be of any suitable conformation) on the outer or working surface of the plate, upon which the paper may bear when put under tension by the folding-blade. By setting this plate in or out the slack of the paper can be nicely regulated for all classes of work.

So long as the paper is enabled to yield when put under tension by the folding-blade and before it is released by the grippers or impaling-pins and before the web is severed it is immaterial what construction of folding-blade and folding-jaws be used, although my improvement is especially adapted to a machine embodying the peculiar construction of folding devices herein shown.

Various changes in detail construction and in the means for operating the various parts may be made without departing from the gist of my several improvements, and it will also be understood that parts of my invention may be used without others in machines differently organized or constructed as a whole.

For convenience and to simplify the description I have herein referred to a "single sheet," to a "first sheet," to "second sheets," and to "two sheets," or the like; but it will be understood, of course, that the machine may be operated to fold a plurality of sheets as a single product and also to collect and fold two or more of such products. In machines which have been constructed in accordance with my improvements and which are now operating the folding-machine is combined with a printing-press that employs the widest web of commerce, which web is severed longitudinally to form a plurality of parallel webs, which in the printing-machine and by the usual means of turning-bars or equivalent devices are associated and pasted together and come to the folding-machine proper in a pack or series of superposed webs

and which may for the purpose of this case be regarded as an individual web. This compound web is severed transversely into a single product after being seized by the collecting-cylinder, and this product is either folded or doubled off alone or remains on the collecting-cylinder until the succeeding portion of the compound web is associated therewith and the two are doubled off together. At the same time, however, the machine is adapted to operate with single-ply sheets. Hence I would have the terms herein used construed to cover sheets or products cut off from single-ply webs as well as sheets or products detached from webs composed of two or more plies.

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

1. In a folding-machine, the combination of a sheet-collecting mechanism, including a cylinder which is provided with means for holding the leading edges of sheets, and a folding mechanism, including a folding-blade carried by said cylinder and constantly projecting beyond the periphery thereof, and a second cylinder provided with folding-jaws constructed to coact with said folding-blade to fold the collected sheets.

2. In a folding-machine, the combination of a cylinder, gripping-fingers thereon, means for causing said gripping-fingers to seize alternate sheets, a folding-blade carried by said cylinder, and a second cylinder provided with folding-jaws for coaction with said folding-blade to fold the superposed sheets.

3. In a folding-machine, the combination of a rotatory cylinder provided with means for holding the leading end of a web, a folding device mounted upon said cylinder, means constructed to coact with said folding device to produce a fold in the web, and means provided upon said cylinder between said holding means and said folding device for enabling the paper to yield at the folding operation, and before it is released from said holding means.

4. In a folding-machine, the combination of a rotatory cylinder provided with means for holding the leading end of a web, a folding-blade mounted upon said cylinder, folding-jaws constructed to coact with said folding-blade to produce a fold in the web, and means provided upon said cylinder between said holding means and said folding-blade for enabling the paper to yield at the folding operation before it is released from said holding means.

5. In a folding-machine, the combination of a rotatory cylinder provided with means for holding the leading end of a sheet, a folding-blade mounted upon said cylinder and constantly projecting beyond the periphery thereof, means provided upon said cylinder between said holding means and said folding-blade for enabling the paper to yield, and a second rotatory cylinder provided with folding-jaws constructed to cooperate with said

folding-blade to produce a fold in the sheet.

6. In a folding-machine, a collecting-cylinder provided with means for holding the leading ends of sheets and also provided with folding devices, and further provided with means arranged between said holding means and said folding devices for enabling the paper to yield at the folding operation and while the leading end of the paper is still in the grasp of said holding means.

7. In a folding-machine, a collecting-cylinder provided with means for holding the leading ends of sheets and also provided with a constantly-projecting folding-blade whereby the sheets are projected, and means arranged between said holding means and said folding-blade for enabling the paper to yield during the folding operation and while its leading end is held by said holding means.

8. In a folding-machine, the combination of a pair of cutting-cylinders, a cylinder provided with means for holding the leading end of the web and provided also with a folding device, and means constructed to coact with said folding device to fold the paper before it is severed from the web by said cutting-cylinders and also before it is released from said holding means.

9. In a folding-machine, the combination of a pair of cutting-cylinders, means for holding the leading end of the web, and folding mechanism constructed to produce a fold in the paper before it is severed from the web by said cutting-cylinders and before the leading end of the paper is released by said holding means.

10. In a folding-machine, the combination of a pair of cutting-cylinders, a cylinder provided with a folding-blade, and a cylinder provided with folding-jaws, said folding-blade and folding-jaws being constructed to produce a fold in the paper before it is severed from the web by said cutting-cylinders.

11. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder provided with means for holding the leading end of the web, and also provided with a folding-blade which constantly projects beyond the periphery thereof, and mechanism constructed to coöperate with the said folding-blade to produce a fold in the paper before it is severed from the web.

12. In a folding-machine, the combination of a pair of cutting-cylinders, a sheet-collecting mechanism including a cylinder which is provided with means for holding the leading ends of sheets, and a folding mechanism including both a folding-blade, carried by the last-mentioned cylinder, and folding-jaws constructed to coact with said folding-blade to fold the collected sheets before the last sheet is severed from the web and before the paper is released from the collecting-cylinder.

13. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder provided with gripping-fingers, means for causing said gripping-fingers to seize alter-

nate sheets, a folding-blade carried by said third cylinder, and a fourth cylinder provided with folding-jaws for coaction with said folding-blade to fold the superposed sheets before the web is finally severed and before the paper is released from said gripping-fingers.

14. In a folding-machine, the combination of a pair of cutting-cylinders, devices for holding the leading end of the web, mechanism for producing a fold in the paper before the web is severed and before the paper is released from said holding means, and means arranged between said holding means and said folding mechanism for enabling the sheets to yield at the folding operation.

15. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder provided with means for holding the leading end of the web and also provided with paper-folding devices, mechanism constructed to coöperate with said folding devices to produce a fold in the paper before it is severed from the web and before the paper is released from said holding means, and means arranged upon said third cylinder between said holding means and said paper-folding devices for enabling the paper to yield at the folding operation.

16. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder provided with a constantly-projecting folding-blade, and means coöperating with said folding-blade to produce a fold in the paper before it is severed from the web by said cutting-cylinders.

17. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder provided with devices for holding the leading end of the web, a folding-blade arranged upon said third cylinder and constantly projecting beyond the periphery thereof, and a fourth cylinder provided with mechanism for coacting with said folding-blade to produce a fold in the paper before it is severed from the web and before the paper is released from said holding means.

18. In a folding-machine, the combination with a sheet-collecting mechanism, including a cylinder provided with devices for seizing the leading ends of sheets and an intermittently-operative cam for releasing the paper from the control of said seizing devices and for thereafter holding said seizing devices open until they arrive at the sheet-receiving point and then releasing said seizing devices so as to enable them to grasp the leading end of another sheet, of folding devices carried upon said cylinder, and mechanism constructed to coact with said folding devices to fold the collected sheets together.

19. In a folding-machine, the combination with sheet-collecting mechanism, including a cylinder provided with grippers for seizing the leading ends of sheets, and cam mechanism controlling said grippers and constructed to operate them so that they seize alternate sheets only and then release them after the cylinder has made about one and one-half revolu-

tions, of a folding-blade carried by said cylinder, and mechanism constructed to coact with said folding-blade to fold the collected sheets together.

20. In a folding-machine, a collecting mechanism including a rotatory cylinder, a rock-shaft thereon, means carried by said rock-shaft for seizing the leading ends of sheets, an arm geared to said rock-shaft, a cam constructed to engage said arm to cause the shaft to be rocked to release the paper, and means for moving said cam intermittently out of operative position.

21. In a folding-machine, a collecting mechanism including a rotatory cylinder, a rock-shaft thereon, means carried by said rock-shaft for seizing the leading ends of sheets, an arm geared to said rock-shaft, a cam constructed to engage said arm to cause the shaft to be rocked to release the paper, an arm on which said cam is mounted, and a rotary cam constructed to control said arm so as to intermittently move the first-mentioned cam out of operative position.

22. In a folding-machine, a collecting mechanism including a rotatory cylinder, a rock-shaft thereon, means carried by said rock-shaft for seizing the leading ends of sheets, an arm and a toothed sector on said rock-shaft, a second rocking arm 52 having a toothed sector engaging with that first mentioned, a cam constructed to engage said arm 52 to cause the shaft to be rocked to release the paper, an arm 64 on which said cam is supported, a rock-shaft upon which said arm 64 is mounted, a second arm 67 carried by said rock-shaft, and a rotatory cam constructed to intermittently vibrate said second arm 67, said rock-shaft, and said cam-carrying arm.

23. In a folding-machine, the combination with a collecting mechanism, including a rotatory cylinder, independently-movable means carried thereby for seizing the leading ends of sheets, a cam constructed to cause said seizing means to release the sheets, and means for automatically moving said cam intermittently out of operative position, of means for locking said cam at will out of operative position.

24. In a folding-machine, the combination with a collecting mechanism, including a rotatory cylinder, independently-movable means carried thereby for seizing the leading ends of sheets, a cam constructed to cause said seizing means to release the sheets, and means for automatically moving said cam intermittently out of operative position, of means for maintaining said cam at will constantly in operative position, and means for locking said cam at will out of operative position.

25. In a folding-machine, the combination with a collecting mechanism, including a rotatory cylinder, a rock-shaft thereon, means carried by said rock-shaft for seizing the leading ends of sheets, an arm and a toothed sector on said rock-shaft, spring mechanism connected to said arm, a second rock-shaft car-

rying an arm 52, and a toothed sector 54, a cam constructed to engage said arm 52 to cause the shaft to release the paper, and means for moving said cam intermittently out of operative position, of means for maintaining said cam at will constantly in operative position, sheet-folding devices also carried by said cylinder, and mechanism constructed to coact with said sheet-folding devices to fold at will either collected or single sheets.

26. In a folding-machine, the combination with a collecting mechanism, including a rotatory cylinder, a rock-shaft thereon, devices controlled by said rock-shaft for seizing the leading ends of sheets, an arm and a toothed sector 53 on said rock-shaft, spring mechanism connected to said arm, a second rock-shaft carrying an arm 52 and a toothed sector 54, a cam for rocking said shafts to cause said seizing devices to release the sheets, and means for automatically moving said cam intermittently into and out of operative position, of means for maintaining said cam constantly in operative position, a folding-blade carried by said cylinder, and a cylinder provided with folding-jaws constructed to coact with said folding-blade to fold at will either collected or single sheets.

27. In a folding-machine, the combination of a collecting mechanism, including a rotatory cylinder, a rock-shaft thereon, gripping-fingers carried by said rock-shaft, an arm on said rock-shaft having a toothed sector and connected to spring mechanism, a second rock-shaft, an arm 52 thereon, and a toothed sector 54, a cam constructed to move said arm 52 and rock said shafts to enable the gripping-fingers to release the paper, and means for automatically moving said cam intermittently into and out of operative position, of means for maintaining said cam constantly in operative position, a folding-blade mounted upon said cylinder and constantly projecting beyond the periphery thereof, a cylinder provided with independently-movable folding-jaws constructed to coact with said folding-blade to fold at will either collected or single sheets, and means for causing said folding-blade to move independently upon its cylinder to accommodate the independent motion of said folding-jaws.

28. In a folding-machine, the combination with a collecting mechanism, including a rotatory cylinder, independently-movable devices carried thereby for seizing the leading ends of sheets, a cam constructed to move said seizing devices to release the sheets, and means for moving said cam intermittently into and out of operative position, of means for maintaining said cam constantly in operative position, folding devices carried by said cylinder mechanism constructed to coact with said folding devices to produce a fold in the collected or single sheets before said cam causes said seizing devices to release the paper, and means provided upon said cylinder between said seizing devices and said

folding devices to enable the paper to yield at the folding operation.

29. In a folding-machine, the combination with a pair of cutting-cylinders and a collecting mechanism, including a third cylinder, independently-movable devices carried by said third cylinder for seizing the leading ends of sheets, a cam constructed to move said seizing devices to release the sheets, and means for moving said cam intermittently into and out of operative position, of means for maintaining said cam constantly in operative position, folding devices carried by said third cylinder, mechanism constructed to coact with said folding devices to produce a fold in the collected or single sheets before the web is finally severed by said cutting-cylinders and before said cam causes said seizing devices to release the paper, and means provided upon said third cylinder for enabling the paper to yield at the folding operation.

30. In a folding-machine, the combination of a collecting-cylinder, a second cylinder geared thereto, mechanism for transferring the collected sheets in a folded condition to the second cylinder, and means for delivering the sheets fold first from said second cylinder and with the folded portion of the sheet in substantial alinement with the body thereof.

31. In a folding-machine, the combination with cutting-cylinders, a cylinder provided with folding-jaws and a collecting-cylinder provided with suitable means for holding the leading end of a web and provided also with a folding-blade, of means upon the collecting-cylinder for permitting the paper thereupon to yield when put under tension by the folding-blade, before the paper is released from said holding means and before the web is severed by the cutting-cylinders.

32. In a folding-machine, the combination with cutting-cylinders, and a cylinder provided with folding-jaws, of a collecting-cylinder provided with suitable means for holding the leading end of a sheet and provided also with a folding-blade, engagement of the folding-blade with the folding-jaws being effected by reason of their moving in converging curvilinear paths, and the leading end of the paper being held by said holding means during the entrance of the paper between the jaws, and means upon the collecting-cylinder for permitting the paper thereon to yield during such entrance.

33. In a folding-machine, the combination with cutting-cylinders, and a cylinder provided with folding-jaws, of a collecting-cylinder provided with only a single set of grippers for clamping the leading end of alternate sheets and provided also with a folding-blade and means for opening said grippers to release the alternate sheets only during the second revolution of the cylinder, whereby the first sheet is carried around with said collecting-cylinder and the second sheet is fed be-

tween the collecting-cylinder and the folding-jaw cylinder, with its leading end disengaged, and whereby the two sheets are tucked together between said folding-jaws and carried away thereby.

34. In a folding-machine, the combination with cutting-cylinders, of a cylinder provided with folding-jaws suitably constructed for receiving the fold radially and delivering it tangentially and in substantial alinement with the body of the sheet, and a collecting-cylinder provided with a suitable feathering-blade constructed to tuck the paper between said folding-jaws, the engagement of the tucking-blade with the folding-jaws being effected by reason of their moving in converging curvilinear paths, and the collecting-cylinder being also provided with means for holding the leading end of the paper during the tucking operation and with means for enabling the paper to yield during the tucking operation.

35. In a folding-machine, a collecting-cylinder provided with means for holding the leading end of a web and which hold the same until after the fold has been made, and provided with a folding-blade constructed to assume working position at each revolution of the cylinder, whereby the web is put under tension by said folding-blade at one or more revolutions of the cylinder, and also provided with means for enabling the paper to yield under such tension.

36. In a folding-machine, the combination with cutting-cylinders and a cylinder provided with folding-jaws, of a collecting-cylinder provided with suitable means for holding the leading end of a web and provided also with a folding-blade, a portion of the periphery between said holding means and said folding-blade being depressed or cut away, so as to enable the sheet to move inwardly when put under tension by the folding-blade, before the paper is released from said holding means and before the web is severed by the cutting-cylinders.

37. In a folding-machine, the combination with cutting-cylinders, a cylinder provided with folding-jaws, and a collecting-cylinder provided with suitable means for holding the leading end of a web and provided also with a folding-blade, of adjustable means upon the collecting-cylinder for permitting the paper thereupon to yield when put under tension by the folding-blade, before the paper is released from said holding means and before the web is severed by the cutting-cylinders.

38. In a folding-machine, the combination with cutting-cylinders and a cylinder provided with folding-jaws, of a collecting-cylinder provided with suitable means for holding the leading end of a web and provided also with a folding-blade, the collecting-cylinder having, between said holding means and said folding-blade, a depression and an adjustable bed therein, whereby the paper is permitted to yield when put under tension by the fold-

ing-blade, before the paper is released from said holding means and before the web is severed by the cutting-cylinders.

39. In a folding-machine, the combination
5 of a revolving cylinder provided with means for holding the leading end of a sheet, so that the sheet is wrapped around the entire cylinder, means for causing the sheet to be fed to the cylinder, at a speed equal to the peripheral speed thereof, and a folding-blade
10 carried by said cylinder and projecting radially beyond the periphery thereof, a portion of the periphery between said holding means and said folding-blade being depressed,
15 so as to enable the sheet to move inwardly when put under tension by the folding-blade.

40. In a folding-machine, the combination of a revolving cylinder provided upon one side with folding-jaws, and provided upon its opposite side with a depression, a revolving co-
20 acting cylindrical paper-carrier, of one-half the diameter of the said folding-jaw cylinder, said paper-carrier being provided with means for holding the leading ends of alternate
25 sheets of paper, and being also provided with a projecting blade for tucking the collected sheets between said folding-jaws at alternate revolutions of the paper-carrier, means for enabling the paper upon the paper-carrier to
30 yield when engaged by the projecting folding-blade at the first revolution of the paper-carrier, and means for enabling the paper to yield still more at the tucking operation, upon the second revolution of the paper-carrier.

41. In a folding-machine, the combination
35 of a pair of cutting-cylinders, a cylinder provided with a pair of folding-jaws, a companion cylinder provided with a projecting folding-blade, a set of grippers on the latter cylinder for holding the leading end of the web
40 during one or more revolutions and during the time the fold is being made, and means between said grippers and the folding-blade for enabling that portion of the web between
45 the end held by the grippers and the part to be folded to yield during the folding operation.

42. In a folding-machine, a revolving cylinder provided with grippers for clamping the
50 leading end of a sheet, following the grippers means for enabling the paper to yield, and following said last-mentioned means a projecting folding-blade, the construction and arrangement being such that the paper may
55 yield between the grippers and the folding-blade as soon as the folding-blade acts to put tension on the paper.

43. In a folding-machine, the combination of cutting mechanism, a revolving cylinder,
60 folding-jaws thereon, and a coacting revolving cylindrical paper-carrier provided with means for engaging at its first revolution the leading end of a sheet, and provided with a constantly-projecting folding-blade for tuck-
65 ing the paper between said gripping-jaws at the second revolution of the paper-carrier before the sheet is released and before it is cut

off from the web, and provided further with means for enabling the sheet to yield upon being engaged by the said folding-blade upon
70 the first revolution of the paper-carrier and to yield still further at the tucking operation, upon the second revolution thereof.

44. In a folding-machine, the combination of a revolving collecting-cylinder provided
75 with a folding-blade and in advance of the latter with means for enabling the paper to yield, and a coacting revolving cylinder provided with suitable folding-jaws for receiving the folded edge of the paper radially and
80 for delivering it tangentially and in substantial alinement with the body of the sheet.

45. In a folding-machine, the combination of a revolving drum, means for feeding the paper thereon at the same speed at which the
85 surface of the drum is traveling, means for holding the paper on said drum, a folding-blade which puts the paper under tension while it is held, and means in advance of said folding-blade for enabling the paper, when
90 put under tension, to move toward the axis of the drum, and thereby yield to the tension.

46. In a folding-machine, a revolving paper-carrier provided with means for holding the
95 leading end of a sheet and also provided with a folding-blade, and further provided in advance of the folding-blade with means for enabling the paper to slip back around the surface of the paper-carrier, independently of said holding means but while held thereby,
100 when it is put under tension by the folding-blade.

47. In a folding-machine, a revolving paper-carrier provided with means for engaging the
105 leading end of a sheet, adjustable means for providing slack in the paper when wound thereon, and a folding-blade constructed to take up slack in the paper while held at its leading end, to an extent determined by the
110 adjustment.

48. In a folding-machine, the combination with a pair of cutting-cylinders, of a third cylinder provided with means for holding the
115 leading end of a sheet, a folding device arranged upon said third cylinder, and a fourth cylinder provided with a coacting folding device, said folding devices being brought into coöperative relation by their rotation about the axes of their respective cylinders and being constructed to fold the paper before it is
120 severed from the web and before the paper is released from said holding devices.

49. In a folding-machine, the combination with a pair of cutting-cylinders, of a third cylinder provided with means for holding the
125 leading end of a sheet, a folding device arranged upon said third cylinder, and a fourth cylinder provided with a coacting folding device, said folding devices being brought into coöperative relation by their rotation about
130 the axes of their respective cylinders and being constructed to fold the paper before the web is severed and before the paper is released from said holding devices, and means

provided upon said third cylinder for enabling the paper to yield at the folding operation.

50. In a folding-machine, the combination with a pair of cutting-cylinders, of a collecting-cylinder provided with a folding device, and a fourth cylinder provided with a coacting folding device, said folding devices being brought into coöperative relation by reason of their rotation about the axes of their respective cylinders and operating to fold the collected sheets before the web is finally severed by said cutting-cylinders.

51. In a folding-machine, the combination of a collecting-cylinder, a folding-blade mounted thereon and constantly projecting beyond the periphery thereof, and a cylinder of larger diameter provided with folding-jaws.

52. In a folding-machine, the combination of a pair of cutting-cylinders, a collecting-cylinder, a folding-blade mounted upon said collecting-cylinder and constantly projecting beyond the periphery thereof, and a cylinder of larger diameter provided with folding-jaws constructed to coact with said folding-blade to produce a fold in the paper before the web is finally severed.

53. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder, a folding device upon said third cylinder, and a fourth cylinder of greater diameter than the third and provided with a plurality of folding devices constructed to coöperate one at a time with the first-mentioned folding device, so as to produce a fold in the paper before the latter is severed from the web by said cutting-cylinders.

54. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder provided with means for seizing the leading ends of sheets, a folding device carried by said third cylinder, a fourth cylinder of greater diameter than the third and capable of carrying one or more sets of folding devices constructed to coöperate with the folding device upon said third cylinder, and means for enabling said third and fourth cylinders to coöperate at will either to fold sheets singly or to collect the sheets and fold them together, the fold being made in either case before the web is finally severed by said cutting-cylinders.

55. In a folding-machine, the combination of a folding-blade, a cylinder, a pair of folding-jaws having a common axis of motion, a crank-arm attached to said axis and coöperating with a suitable cam, a separate axis upon which one of said jaws is pivotally mounted, a crank-arm attached to said separate axis, a cam for coacting therewith to cause an independent vibration of said separately-pivoted jaw and to hold it away from the relatively-fixed jaw while said jaws receive the fold of the sheet, spring mechanism for returning said jaw to normal position, and a second crank-arm attached to said separate axis and constructed to coact with an inde-

pendent cam for vibrating said separately-pivoted jaw so as to release the sheet.

56. In a folding-machine, the combination with a folding-blade constructed to project the sheet, of means for applying paste to the sheet at such projection.

57. In a folding-machine, the combination with a rotatory folding-blade constructed to project a sheet, of means for applying paste to the sheet at such projection.

58. In a folding-machine, the combination with a collecting-cylinder, of a folding-blade mounted thereon and constructed to project beyond the periphery thereof, and means for applying paste to the paper along the line projected by said folding-blade.

59. In a folding-machine, the combination with a rotatory collecting-cylinder, of a folding-blade mounted thereon and constructed to project beyond the periphery of the cylinder, means for applying paste to the paper at the portion projected by said folding-blade, and a pair of folding-jaws constructed to coöperate with said folding-blade to fold the collected sheets together at a subsequent revolution of said collecting-cylinder.

60. In a folding-machine, the combination with a suitable pasting device and folding-jaws, of a blade constructed to support the paper during the pasting operation and to tuck the paper between said folding-jaws at the folding operation.

61. In a folding-machine, the combination with a suitable pasting device and folding-jaws, of a rotatory blade constructed to support the paper during the pasting operation and to tuck the paper between said folding-jaws at the folding operation.

62. In a folding-machine, the combination of a rotatory collecting-cylinder, a folding device thereon, a second cylinder provided with a coacting folding device, a paste-receptacle, means for transferring the paste to the said second cylinder and thence to the paper upon said collecting-cylinder, and means for causing said folding device to fold the collected sheets at the paste-line.

63. In a folding-machine, a rotatory cylinder provided with a folding device and with a paste-transferring device, said devices being constructed to act alternately upon the paper during the rotation of the cylinder.

64. In a folding-machine, the combination with a folding-blade, of a rotatory cylinder, folding-jaws carried by said cylinder, and a paste-transferring device mounted upon said cylinder, whereby the paper is first pasted and subsequently folded during the rotation of the cylinder.

65. In a folding-machine, the combination with a rotatory collecting-cylinder, of a folding-cylinder running in unison therewith, coöperating folding devices mounted upon said cylinders, whereby the collected sheets are transferred from said collecting-cylinder to said folding-cylinder in a folded condition,

and means on the folding-cylinder for depositing paste upon the paper prior to the folding operation.

66. In a folding-machine, the combination
5 with a rotatory collecting-cylinder, of a second cylinder running in unison therewith, co-operating folding devices mounted upon said cylinders, and a paste-transferring device arranged upon said second cylinder and constructed to deposit paste upon the paper upon
10 said collecting-cylinder prior to the combined operation of said folding devices.

67. In a folding-machine, the combination
15 with a rotatory folding-blade and a rotatory set of folding-jaws, of a pasting device mounted to rotate with one of said folding elements and constructed to deposit paste upon the paper prior to the folding operation.

68. In a folding-machine, the combination
20 of a collecting-cylinder, a blade mounted thereon and constantly projecting beyond the periphery thereof, a paste-receptacle, and a rotatory device constructed to transfer paste from said receptacle to the paper at the portion thereof which is projected by said blade.
25

69. In a folding-machine, the combination
30 of a collecting-cylinder, a folding-blade mounted thereon and constantly projecting beyond the periphery thereof, a second cylinder, a paste-receptacle, a pasting device mounted upon said second cylinder and constructed to transfer paste from said receptacle to the paper at the portion thereof projected by said folding-blade, and suitable folding-jaws also
35 mounted upon said second cylinder and constructed to fold the paper at said pasted portion.

70. In a folding-machine, the combination
40 of a rotatory collecting-cylinder, a paste-receptacle provided with a feed-roller, a rotatory device constructed to contact at one portion of its revolution with said feed-roller and receive paste therefrom, and at another portion of its revolution to deposit paste upon
45 the paper carried upon said collecting-cylinder, a folding device mounted upon said collecting-cylinder, and a coöperative folding device connected to and mounted to rotate with said paste-transferring device, whereby
50 the paper is first pasted and then folded.

71. In a folding-machine, a paste-transferring device, a revolving carrier upon which
55 said paste-transferring device is mounted, and means for moving said paste-transferring device independently of said revolving carrier.

72. In a folding-machine, the combination
60 with a sheet-carrying cylinder, of a pasting device mounted thereon, mechanism for causing said pasting device to move outwardly and inwardly, a feeding-roller for depositing paste upon said pasting device, and a collecting-cylinder geared to said sheet-carrying cylinder and constructed to present the sheets
65 to said pasting device.

73. In a folding-machine, the combination
with a sheet-carrying cylinder, of a pasting

device mounted thereon, mechanism for causing said pasting device to move outwardly and inwardly, a feeding-roller for depositing
70 paste upon said pasting device, a collecting-cylinder geared to said sheet-carrying cylinder and constructed to present the sheets to said pasting device, and folding mechanism mounted upon said cylinders and constructed
75 to fold the paper after the pasting operation.

74. In a folding-machine, the combination
of a cylinder, a blade thereon for projecting the paper, a second cylinder geared to the first, and an inwardly and outwardly movable
80 paste-transferring blade mounted upon the second cylinder and constructed to deposit paste upon the paper at the portion thereof projected by said blade.

75. In a folding-machine, a collecting-cyl-
85 nder, a folding-blade thereon and constantly projecting beyond the periphery thereof, a folding-jaw cylinder geared to said collecting-cylinder, an inwardly and outwardly movable paste-transferring blade mounted upon said
90 folding-jaw cylinder, and means for causing said paste-transferring blade to deposit paste upon the paper where projected by said folding-blade.

76. In a folding-machine, the combination
95 of a rotatory cylinder, devices thereon for seizing the leading ends of sheets, a cam for causing said seizing devices to release the sheets, means for moving said cam automatically into and out of operative position, a
100 folding-blade mounted upon said cylinder, a second cylinder geared to the first, and folding-jaws together with a pasting device mounted upon said second cylinder, said cam being out of operative position when the paste is trans-
105 ferred to the paper by said pasting device, and said cam subsequently operating to release the sheets when the paper is folded.

77. In a folding-machine, the combination
110 of a pair of cutting-cylinders, a collecting-cylinder, a folding-blade mounted upon said collecting-cylinder and constantly projecting beyond the periphery thereof, means for applying paste to the paper at the portion projected
115 by said folding-blade, and a pair of folding-jaws constructed to fold the collected sheets together at a subsequent revolution of said collecting-cylinder and before the web is finally severed by said cutting-cylinders.

78. In a folding-machine, the combination
120 of a pair of cutting-cylinders, a collecting-cylinder, a folding device upon said collecting-cylinder, a fourth cylinder provided with a coating folding device, a paste-reservoir, means for transferring paste to said fourth cyl-
125 nder and thence to the paper upon said collecting-cylinder, and means for causing said folding device to fold the collected sheets at the paste-line before the web is finally severed by said cutting-cylinders.
130

79. In a folding-machine, the combination
of a pair of cutting-cylinders, a folding-blade, a cylinder provided with folding-jaws, and a paste-transferring device mounted upon said

folding-jaw cylinder, whereby the paper is first pasted and subsequently folded during the rotation of said folding-jaw cylinder and before the web is finally severed by said cutting-cylinders.

80. In a folding-machine, the combination of a pair of cutting-cylinders, a collecting-cylinder, a paste-reservoir provided with a feed-roller, a rotatory device constructed to engage said feed-roller at one portion of its revolution to receive paste therefrom, and to deposit the paste at another portion of its revolution upon the paper carried upon said collecting-cylinder, a folding device mounted to rotate with said paste-transferring device, and a co-operative folding device mounted upon said collecting-cylinder, whereby the paper is first pasted and then folded and severed from the web.

81. In a folding-machine, the combination of a pair of cutting-cylinders, a third cylinder provided with means for seizing the leading ends of sheets, a folding-blade mounted upon said third cylinder, a fourth cylinder provided with folding-jaws, a paste-transferring device carried by said fourth cylinder, whereby the paper receives a line of paste and is then folded and severed from the web and also released from said seizing devices, and means arranged upon said third cylinder for enabling the paper to yield at the folding operation.

82. In a folding-machine, the combination with a collecting-cylinder provided with a folding device, of a cylinder of greater diameter provided with means whereby it may be operated either as a folding-cylinder alone or as a combined pasting and folding cylinder.

83. In a folding-machine, the combination with a collecting-cylinder provided with a folding-blade, of a cylinder of greater diameter provided with folding-jaws and constructed to carry either a second set of folding-jaws or a paste-transferring device.

84. In a folding-machine, the combination of a rotatory cylinder, devices thereon for seizing the leading ends of sheets, a cam for causing said devices to release the sheets, means for automatically causing said cam to move into and out of operative position, means for locking said cam at will in operative position, a folding-blade mounted upon said cylinder, a second cylinder of larger diameter than the first, and folding-jaws mounted upon said second cylinder, the latter being constructed to carry either a second set of folding-jaws or a paste-transferring device, whereby when said cam moves automatically into and out of operative position, the sheets may be collected, pasted and folded, and whereby when said cam is locked in operative position, the sheets may be folded singly.

85. In a folding-machine, the combination of a rotatory cylinder, devices thereon for seizing the leading ends of sheets, a cam for causing said devices to release the sheets, means for automatically causing said cam to move

into and out of operative position, means for locking said cam at will out of operative position, a folding-blade mounted upon said cylinder, a second cylinder of larger diameter than the first, and folding-jaws mounted upon said second cylinder, the latter being constructed to carry either a second set of folding-jaws or a paste-transferring device, whereby when said cam moves automatically into and out of operative position, the sheets may be collected, pasted and folded, and whereby when said cam is locked out of operative position, the sheets may be folded singly.

86. In a folding-machine, the combination with a cylinder provided with a set of folding-jaws, of a pasting mechanism detachably mounted upon said cylinder so that said pasting mechanism may be removed and a second set of folding-jaws substituted therefor, and fixed cams for controlling said pasting mechanism and all of said folding-jaws.

87. The combination with a sheet-carrying device of a rotatory stripper for stripping the leading end of a sheet and leading it away from the sheet-carrying device.

88. The combination with a sheet-carrying cylinder of a stripper having a movement relatively to the surface movement of said cylinder and constructed to engage the leading end of the sheet and lead it away from said cylinder.

89. The combination with a sheet-carrying cylinder of a series of fingers having a movement relatively to said cylinder and constructed to enter between the sheet and the cylinder and guide the sheet away from said cylinder.

90. In a folding-machine, the combination with a sheet-carrying cylinder of a rotatory stripper constructed to enter between said cylinder and the leading edge of the paper and guide the latter away from the cylinder.

91. In a folding-machine, the combination with a folding-cylinder, of a rotatory stripper constructed to enter between the leading free edge of the paper and the cylinder and to guide the leading portion of the paper away from the cylinder while the folded portion of the paper is still in the grasp of the folding devices, and so that the folded portion may take the lead and be delivered in advance of what originally was the leading end so that the paper may be delivered from the cylinder fold first.

92. In a folding-machine, the combination of a sheet-carrying cylinder, peripheral grooves extending around said cylinder, stripping-fingers constructed to engage said grooves and to engage the leading end of the paper, and means for moving said stripping-fingers to lead the paper away from the cylinder so as to allow the folded portion of the paper behind to move forward ahead of said leading end and be delivered in advance thereof.

93. In a folding-machine, the combination with a sheet-carrying cylinder, of an independently-mounted rotatory stripper con-

structed to move with said cylinder, but at a slower speed so as positively to disengage the leading end of the paper from said cylinder, and also constructed to lead said end aside so as to enable the folded portion to take a position in advance thereof on said cylinder.

94. In a folding-machine, the combination with a sheet-carrying cylinder, of an independently-mounted stripper constructed to have a variable rotatory movement.

95. In a folding-machine, the combination with a folding-blade, of a cylinder provided with folding-jaws a tape-pathway, means for stripping the leading edge of the paper from said cylinder, thus enabling the folding-jaws to carry the folded portion of the paper into said tape-pathway in advance of what was the leading end of the sheet.

96. In a folding-machine, the combination with a folding-jaw cylinder and a tape-pathway, of a series of peripheral grooves extending around said cylinder, stripping-fingers engaging said grooves so as to guide the leading end of the sheet away from said cylinder and said tape-pathway, and means for enabling said folding-jaws to deliver the sheet fold first.

97. In a folding-machine, the combination with a revolving drum of a rotatable stripper connected thereto by eccentric gear-wheels.

98. In a folding-machine, the combination with two cylinders carrying sheet-folding devices, the construction and arrangement being such that the free leading end of a sheet or web may feed between and past said cylinders, of means for causing the sheet to be delivered fold first by one of said cylinders, means for carrying the folded sheet away from said delivering-cylinder, and means for causing the free leading end of the sheet or web to be deflected away from said carrying means until the folded portion has taken a position in advance of said free leading end of the sheet.

99. In a folding-machine, the combination with a folding-jaw cylinder constructed to deliver the sheet fold first, of means for carrying the sheet away from said cylinder, and a rotary stripper for stripping the free leading end of the sheet from said cylinder and deflecting said free leading end away from said carrying means, said stripper comprising a U-shaped frame having fingers and mounted on a shaft or axis and so arranged that the leading end of the sheet may pass within said frame as it is led away from said carrying means.

100. In a folding-machine, the combination with a folding-jaw cylinder constructed to deliver the sheet fold first, of means for carrying the sheet away from said cylinder, a rotatable stripper for stripping the free leading end of the sheet from said cylinder and deflecting said free leading end away from said carrying means, and eccentric gearing connecting said cylinder and said stripper.

101. In a folding-machine, the combination of a cylinder having a folding device and also

having means for seizing the leading ends of sheets, a cylinder geared thereto and having coacting folding devices and a longitudinal groove cut across its periphery at a point which during the revolution of said cylinders comes into register with the said seizing means upon the first-mentioned cylinder; the construction and arrangement being such that the leading end of the sheet overlaps said groove and by reason of the revolution of said second cylinder air is forced between the leading edge of the sheet and said second cylinder, whereby the paper is stripped therefrom, so that the sheet can be delivered fold first from said second cylinder.

102. In a folding-machine, the combination of a collecting-cylinder having means for seizing the leading ends of sheets and an arm for controlling said seizing means, a cam for moving said arm independently of said cylinder so as to cause said seizing means to release the sheets, an arm mounted upon a shaft and rigidly secured to said cam, a second arm mounted upon said shaft, and a cam constructed to rotate once during two rotations of said collecting-cylinder and to move said first-mentioned cam out of operative position at each alternate revolution of said collecting-cylinder.

103. In a folding-machine, the combination with a folding-cylinder provided with means for holding the leading ends of sheets and with sheet-folding devices, of a depression formed in said cylinder between said holding means and said folding devices, an adjustable plate arranged in said depression, whereby the amount of slack in the paper may be regulated, screws engaging threaded holes in said plate and secured in said cylinder against endwise motion, whereby said plate may be adjusted inwardly or outwardly, and a set-screw also engaging a hole in said plate and bearing against a part of said cylinder for locking said plate in its adjusted position.

104. In a folding-machine, the combination of a cylinder which may be run either as a collecting or a non-collecting cylinder, a sheet-folding device arranged thereon, a cylinder of larger diameter geared to said cylinder, an opening or depression formed in the periphery of said larger cylinder, a sheet-folding device arranged in said opening, and a second opening or depression formed in said larger cylinder diametrically opposite said first-mentioned opening or depression, wherein may be arranged either a paste-transferring device or a second folding device, and cam mechanism arranged outside of said cylinder for operating said folding devices and said paste-transferring device.

105. In a folding-machine, the combination of a rotatory carrier provided with folding devices, a rock-shaft mounted thereon, arms carried by said rock-shaft, a pasting-blade supported between said arms upon said rotatory carrier so that it may have a reciprocatory radial movement thereon, means for

enabling said arms to reciprocate said pasting-blade, a cam arranged outside of said rotary carrier and constructed to cause said rock-shaft to rock, a paste-bearing roller with
 5 which said pasting-blade engages at one reciprocation thereof, and a collecting-cylinder constructed to coact with said pasting-blade at another reciprocation thereof to cause a line of paste to be deposited upon the paper.

10 106. In a folding-machine, the combination of a cylinder, an opening or depression formed in the periphery thereof, end plates secured to said cylinder at said opening or depression, grooves formed in said end plates, a frame
 15 having a bearing at its ends in said grooves, a pasting-blade carried by said frame, a rock-shaft, arms on said rock-shaft for engaging said frame at its ends, and a fixed cam for rocking said rock-shaft.

20 107. In a folding-machine, a grooved cylinder, carrying-tapes running in said grooves, and a pasting-blade mounted upon said cylinder and having cut-away portions in register with said carrying-tapes.

25 108. In a folding-machine, the combination of two cylinders geared together, folding-jaws arranged upon one cylinder, means arranged upon the other cylinder for doubling sheets into said jaws, a set of carrying-tapes running around said folding-jaw cylinder, a co-
 30 operative set of carrying-tapes and means for enabling said jaws to deliver the paper fold first between said sets of tapes.

109. In a folding-machine, the combination
 35 of two cylinders, a set of carrying-tapes running around one of said cylinders, a coöperative set of carrying-tapes, and mechanism carried by said cylinders for collecting, pasting, folding and delivering the sheets
 40 fold first between said sets of carrying-tapes.

110. In a folding-machine, the combination of a grooved drum, tapes running in the grooves, and a folding device carried by said drum and provided with depressions for said
 45 tapes.

111. In a folding-machine, the combination of a cylinder provided with a folding-blade, a grooved drum provided with folding-jaws,

tapes running in the grooves in said drum, a coöperative set of tapes, depressions arranged
 50 in said folding-jaws for said tapes, and means for enabling said folding-jaws to deliver the sheet fold first between said sets of tapes.

112. In a folding-machine, the combination of two cylinders, a set of carrying-tapes running around one of said cylinders, means for
 55 coöperating with said set of tapes for leading sheets away from said cylinder, and mechanism carried by said cylinders for collecting, folding and delivering the sheets so that they
 60 may be led away fold first by said carrying-tapes and said coöperating means.

113. In a folding-machine, the combination of two cylinders, a set of carrying-tapes running around one of said cylinders, means for
 65 coöperating with said set of tapes for leading sheets away from said cylinder, and mechanism carried by said cylinders for collecting, pasting, folding and delivering the sheets so that they may be led away fold first by said
 70 carrying-tapes and said coöperating means.

114. In a folding-machine, the combination of a cylinder provided with a folding-blade, a grooved drum provided with folding-jaws, tapes running in the grooves in said drum,
 75 means for coöperating with said tapes for leading sheets away from said cylinder, depressions provided in said folding-jaws for said tapes, and means for enabling said folding-jaws to deliver the sheet so that it may
 80 be led away fold first by said sets of tapes and said coöperating means.

115. In a folding-machine, the combination with a folding-cylinder, of a radially-reciprocatory pasting-blade mounted thereon, spring-
 85 and-cam mechanism for actuating said blade, and an adjustable stop for said blade.

Signed at the borough of Manhattan, in the city of New York, county of New York, and State of New York, this 12th day of March, 90
 A. D. 1900.

RALPH C. SEYMOUR.

Witnesses:

E. M. WELLS,
 FLORENCE KEELING.