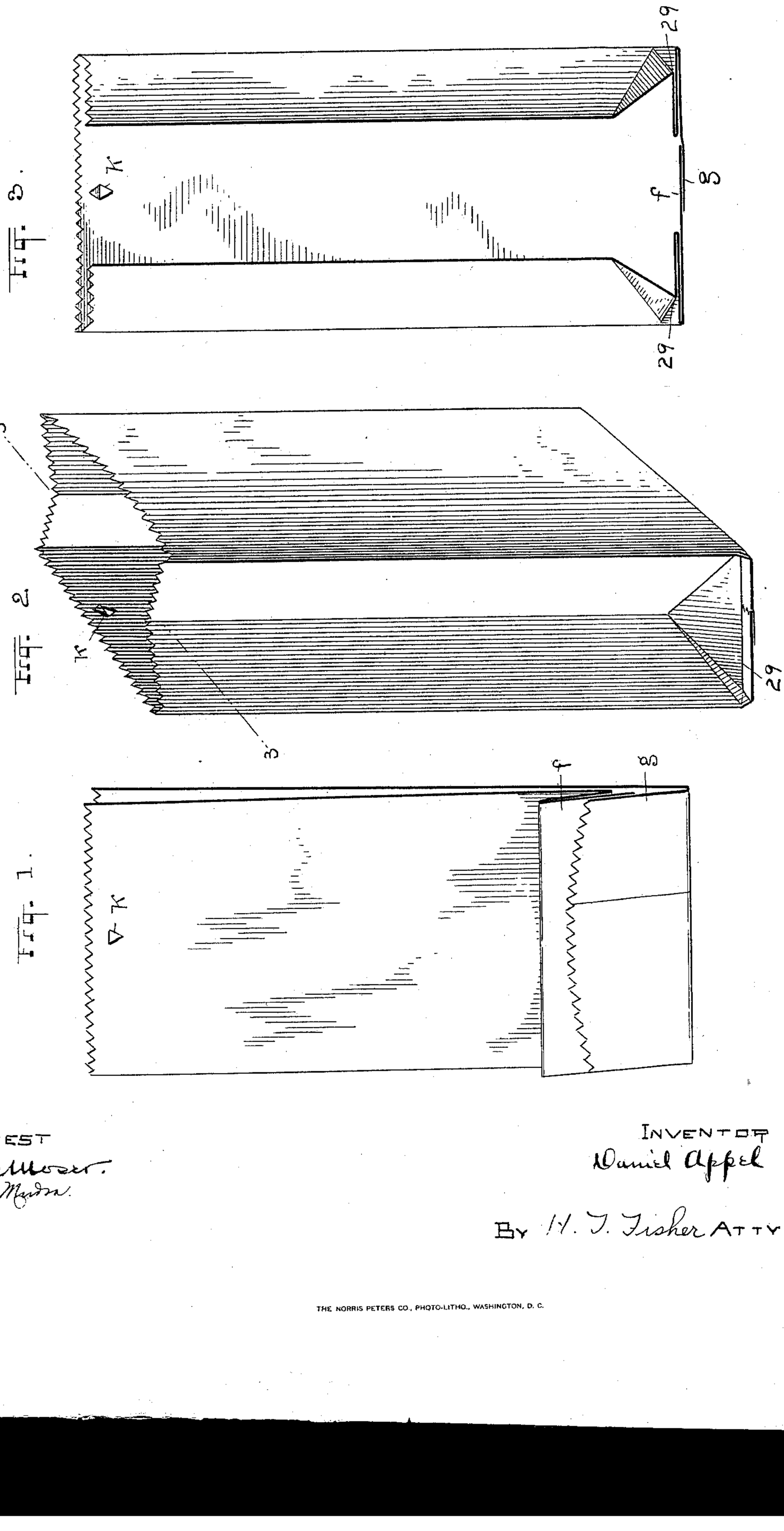
No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 1.



Attest
R. B. Moore.
H. L. Masson.

Inventor
Daniel Appel
By H. T. Fisher Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 2.

Fig. 6.

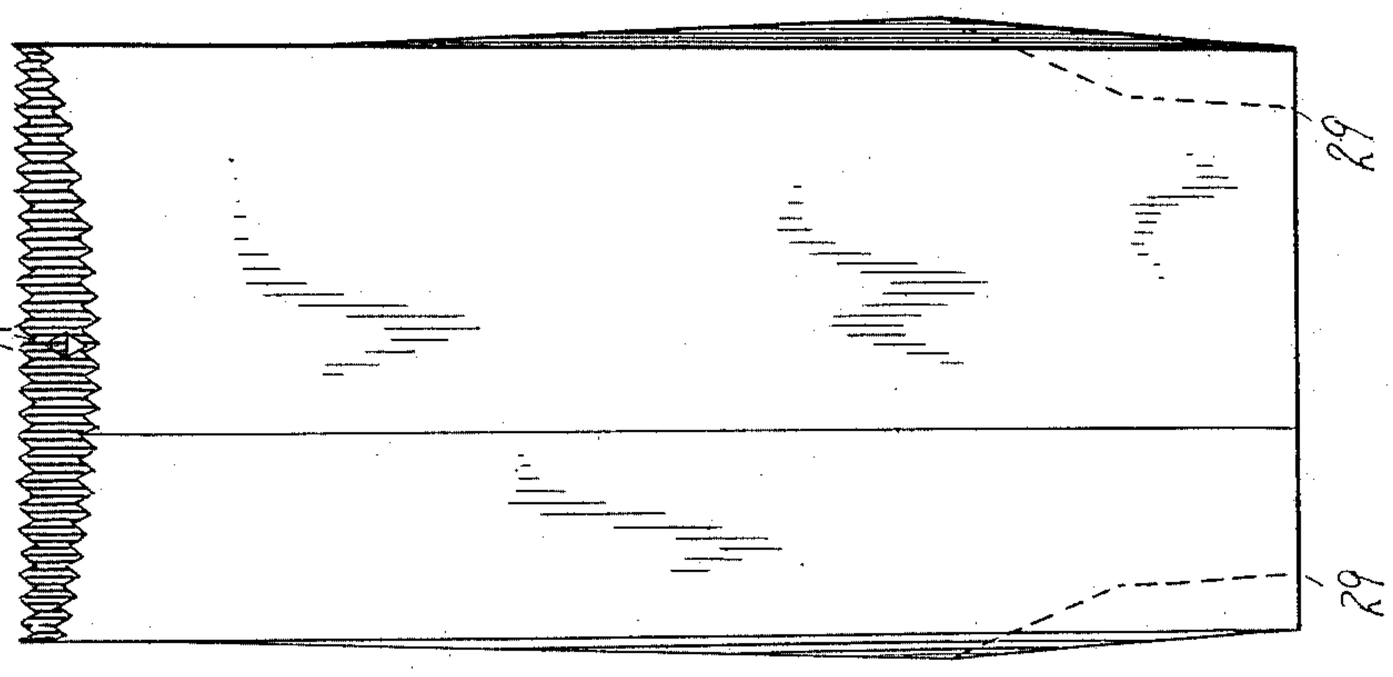


Fig. 5

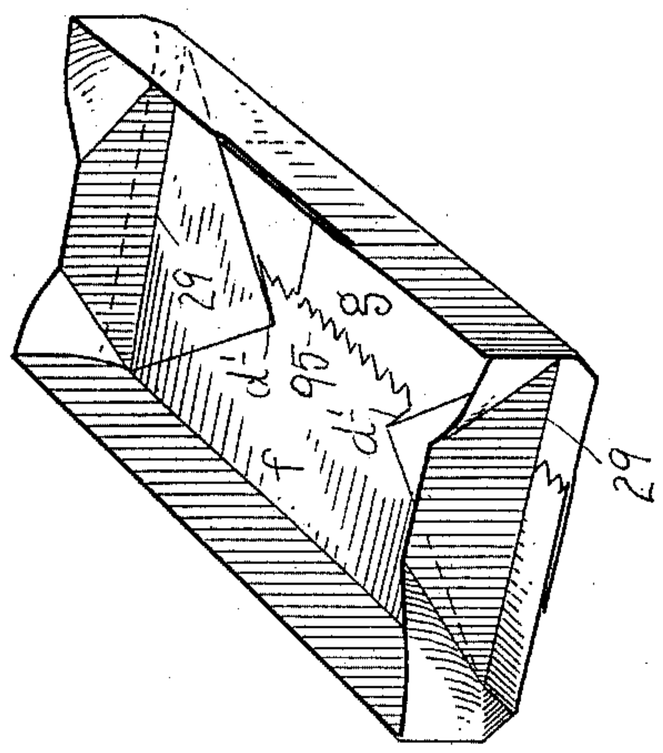
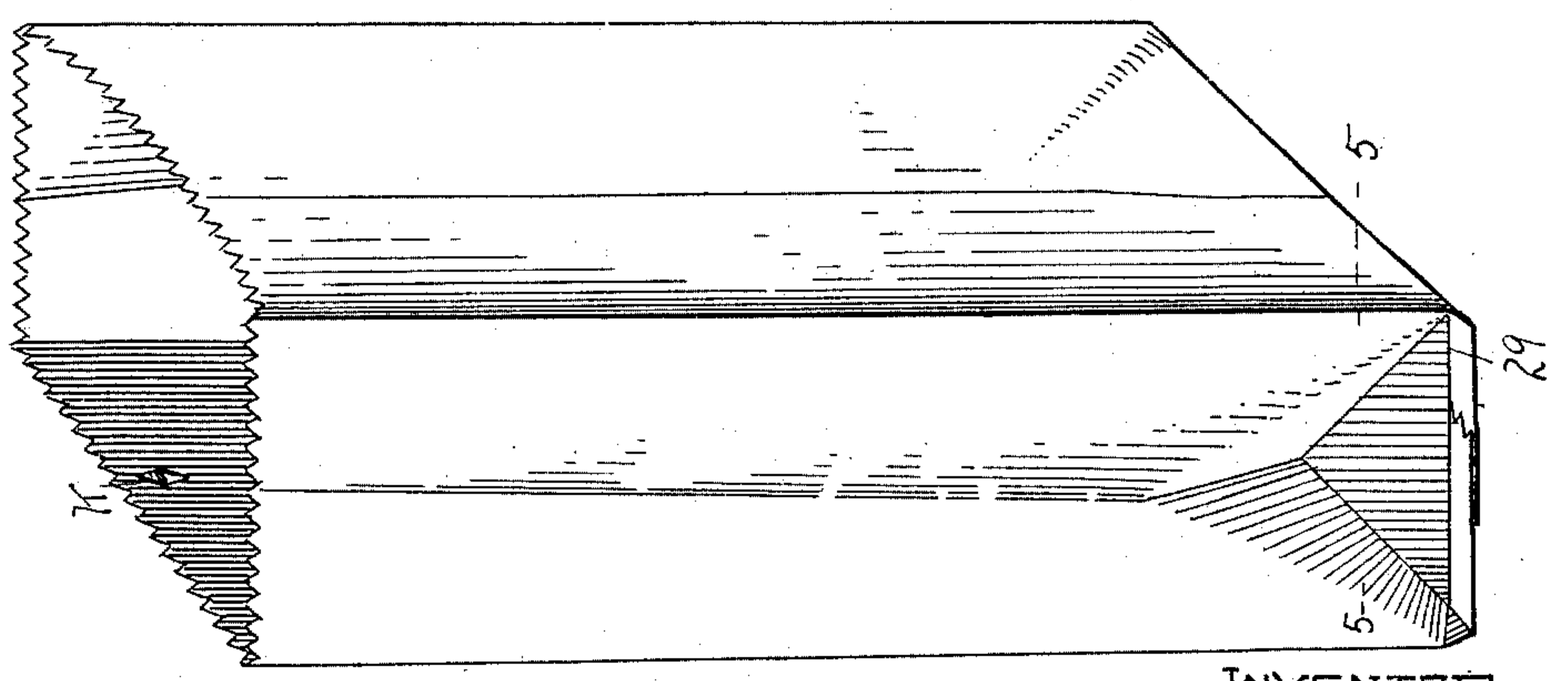


Fig. 4.



ATTEST

D. C. Bellvert.

H. L. Medora.

INVENTOR.

Daniel Appel.

BY H. T. Fisher ATTY

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 3.

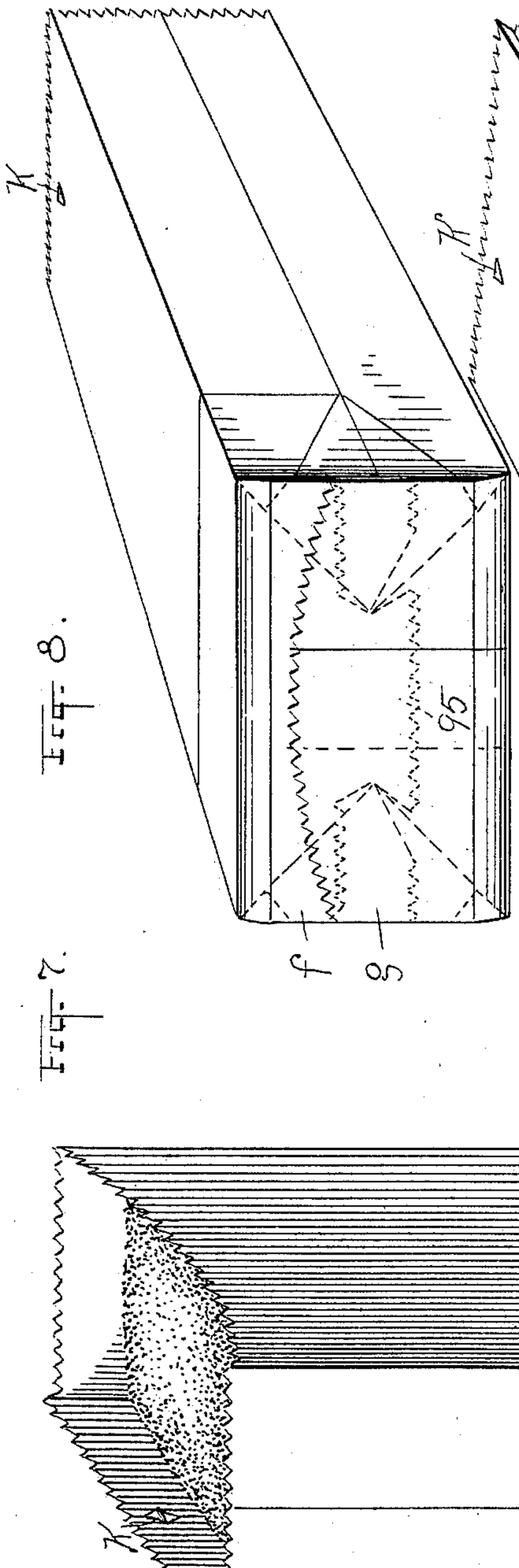


Fig. 8.

Fig. 7.

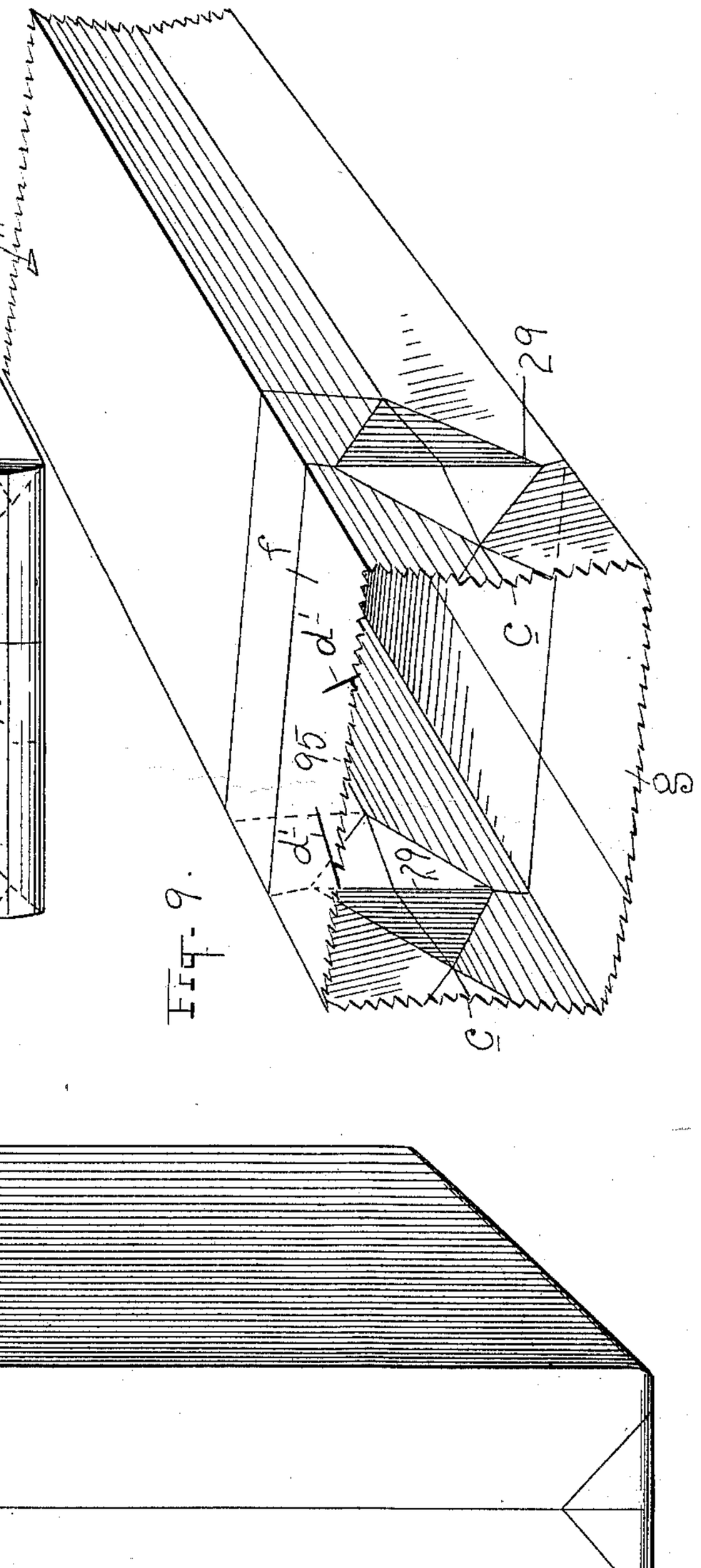


Fig. 9.

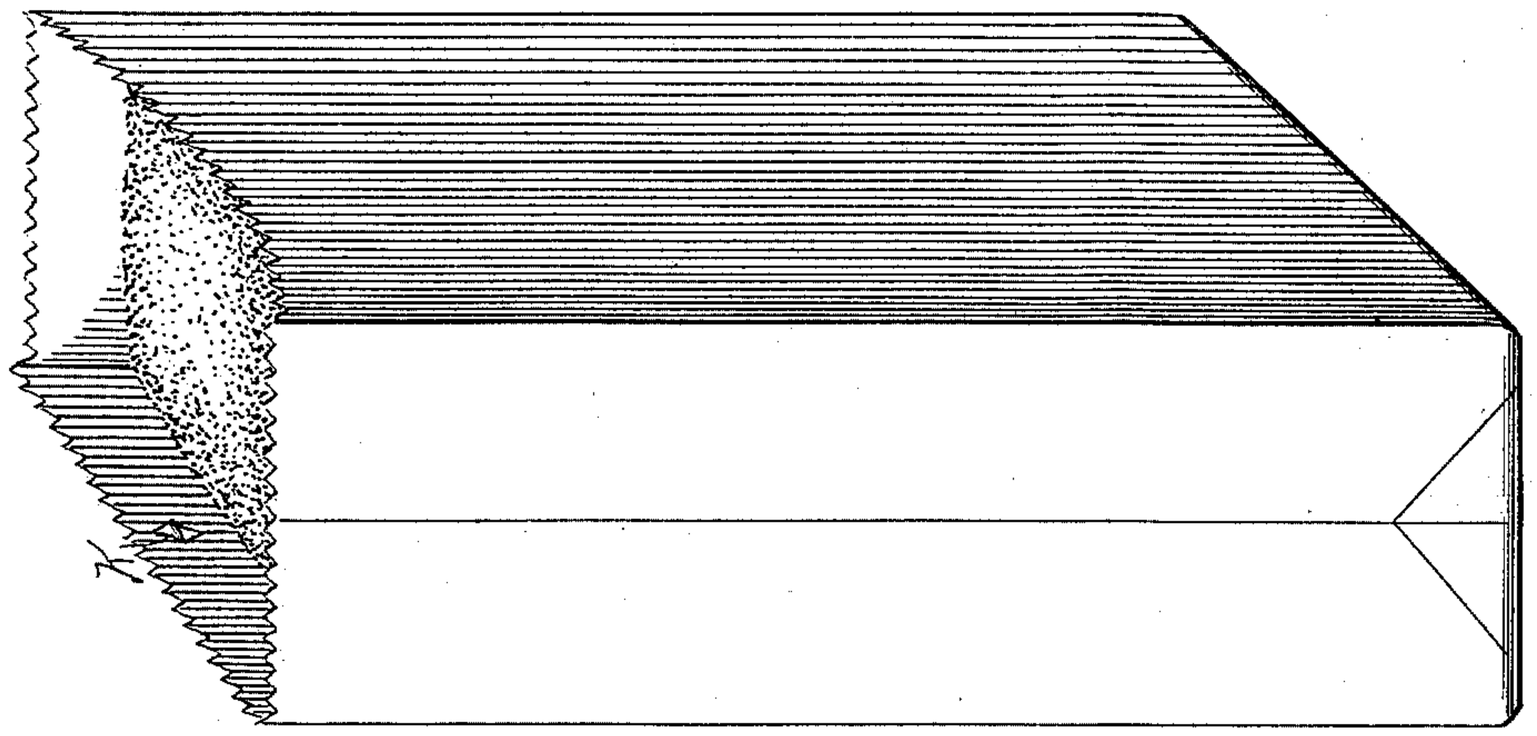


Fig. 6.

ATTEST
R. F. Sullivan
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INVENTOR
Daniel Appel
By H. J. Fisher Atty

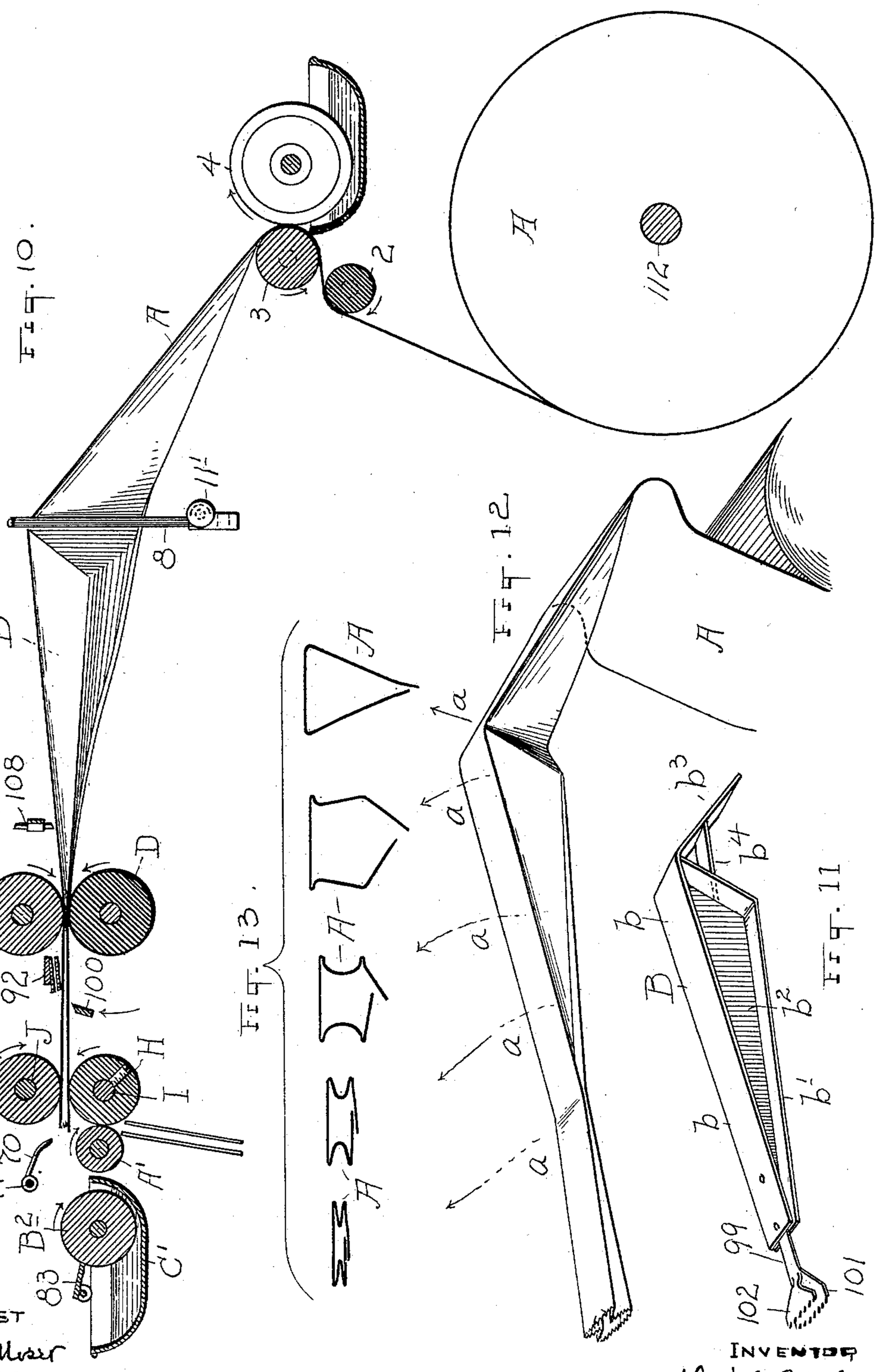
No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 4.



ATTEST

R. B. Moser

H. L. Mosher

INVENTOR

Daniel Appel

BY H. T. Fisher ATTY

No. 619,262. Patented Feb. 14 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 5.

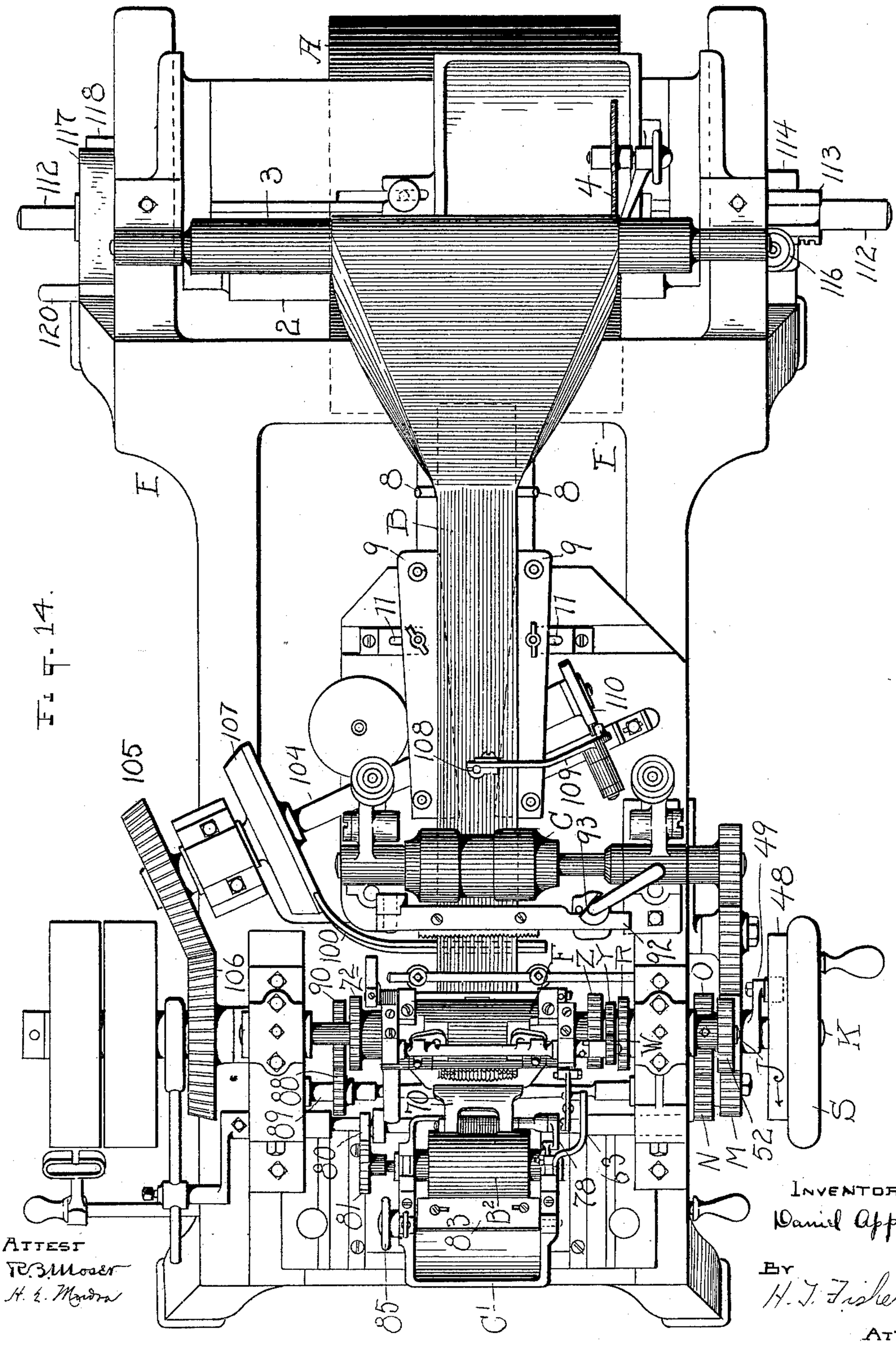


Fig. 14.

Attest
T. B. Moser
H. E. Mowbray

Inventor
Daniel Appel
By
H. J. Fisher
Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

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Fig. 15.

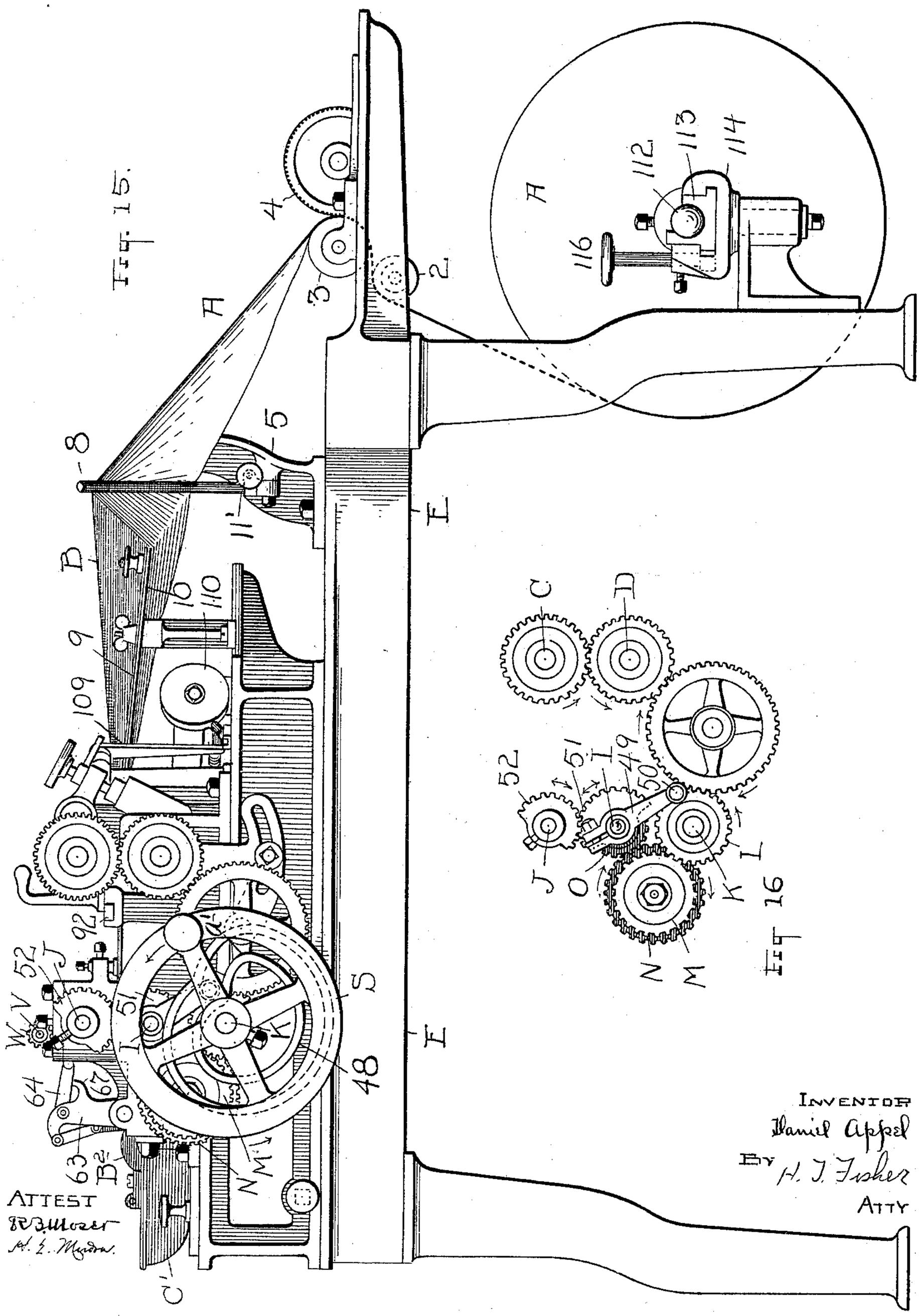

Fig. 16

Witnesses
W. B. Moser
M. L. Hyde

Inventor
Daniel Appel
By H. T. Fisher
Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 7.

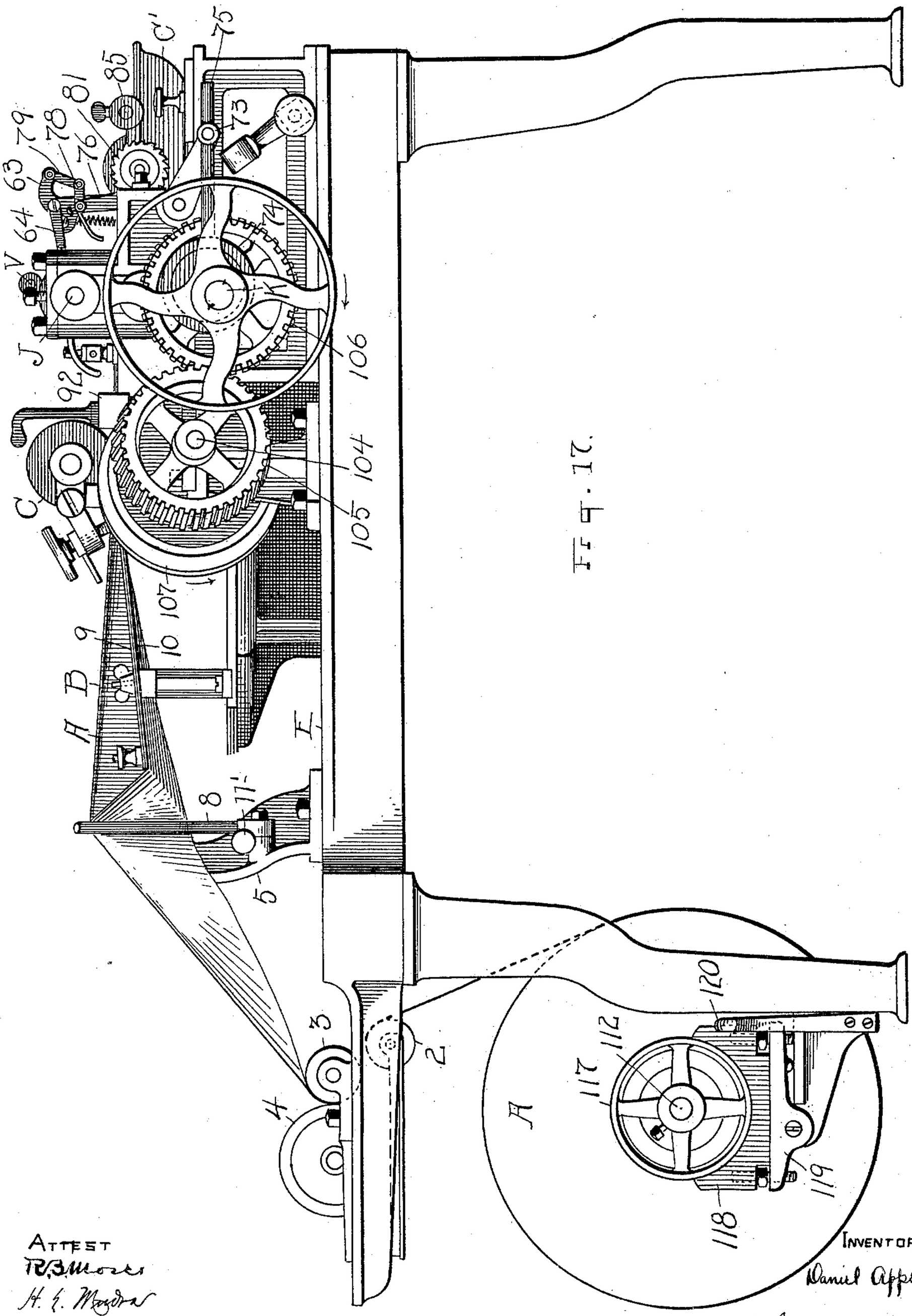

FIG. 17.

Attest
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H. E. Mayer

Inventor
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By H. T. Fisher Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 8.

Fig. 18.

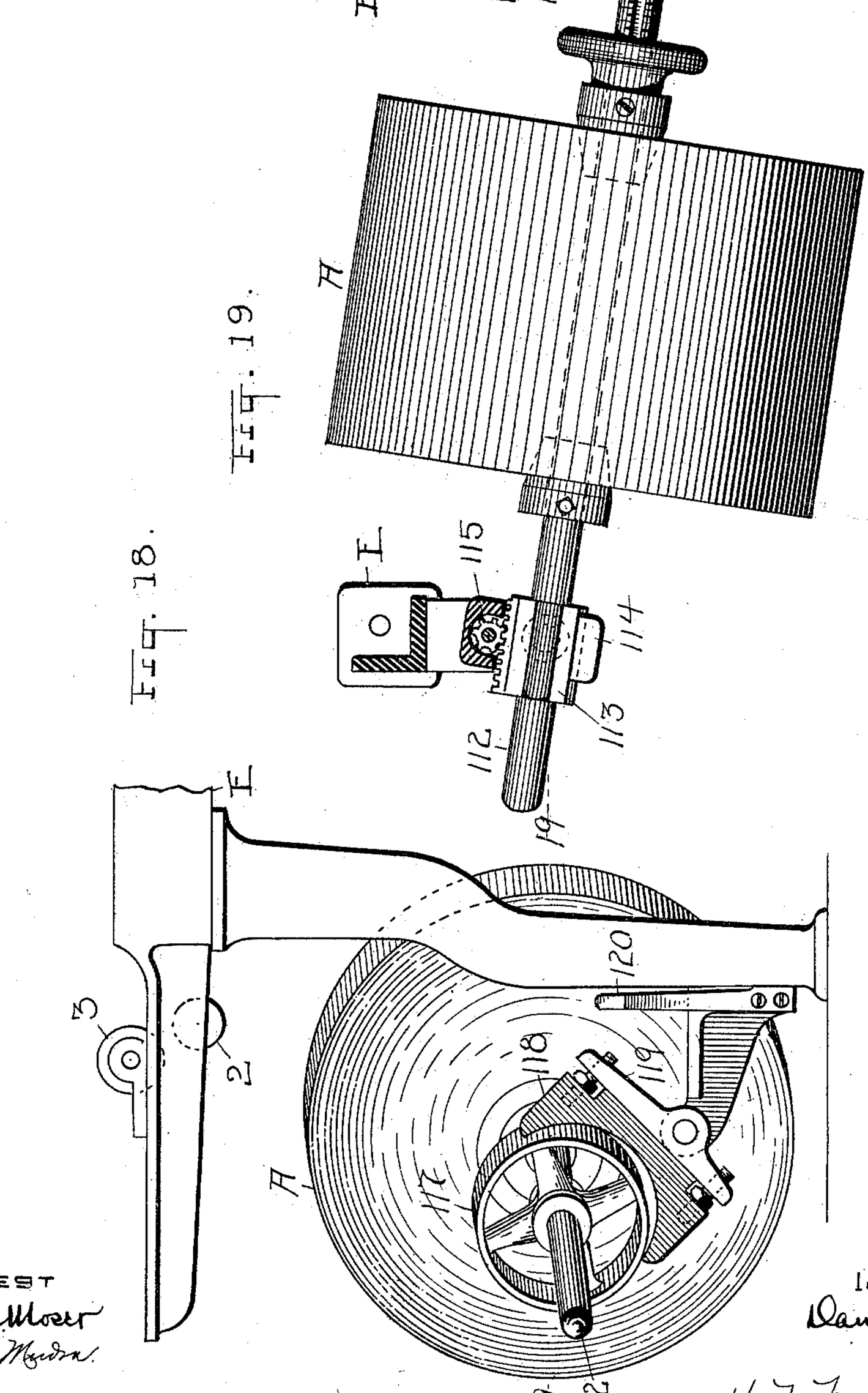

Fig. 19.

Attest
R. B. Moser
H. L. Medora

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By H. J. Fisher Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 9.

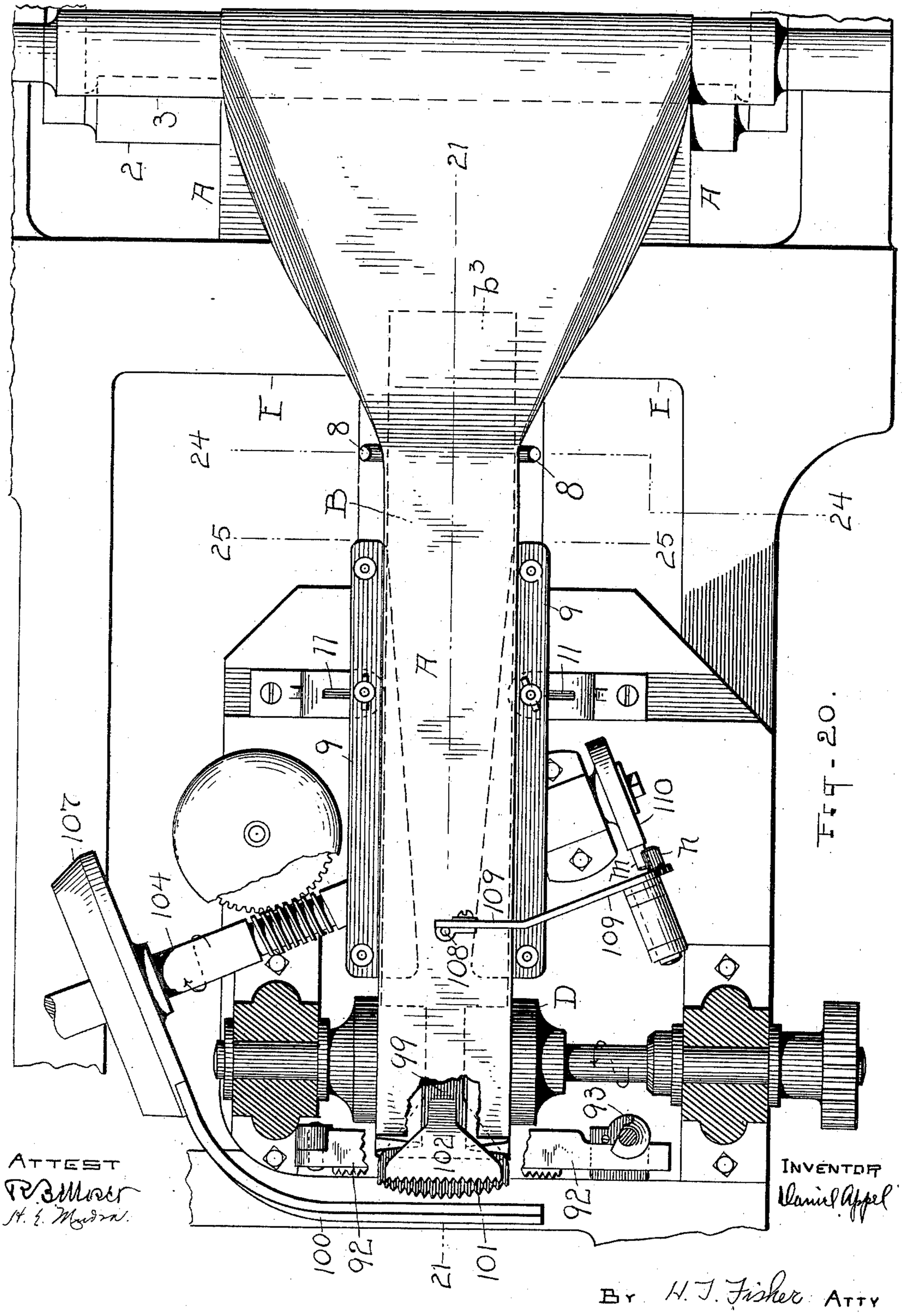

Fig. 20.

ATTEST
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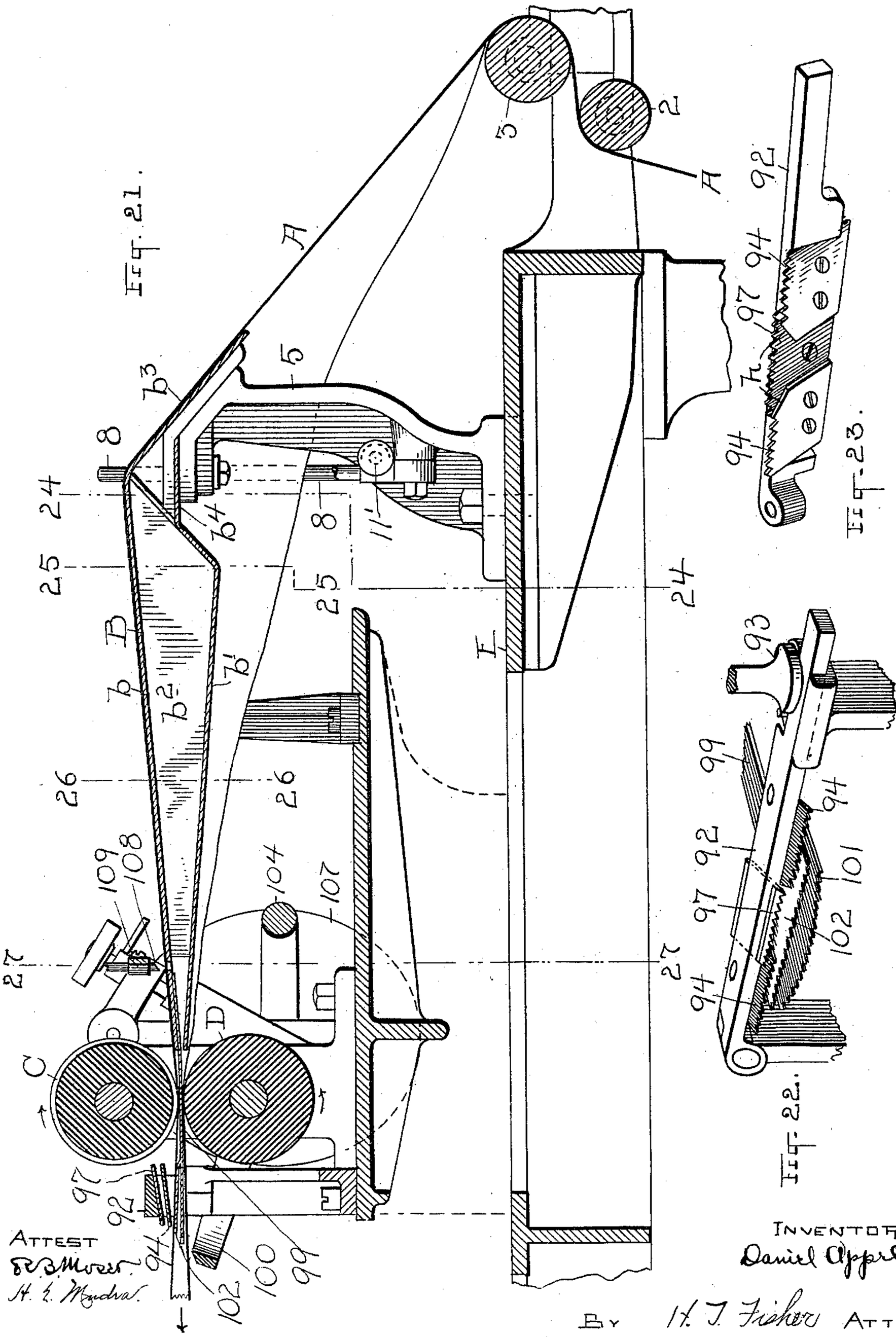
No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 10.



ATTEST
R. B. Moore
H. E. Mayhew.

INVENTOR
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By H. J. Fisher Atty

No. 619,262.

Patented Feb. 14, 1899.

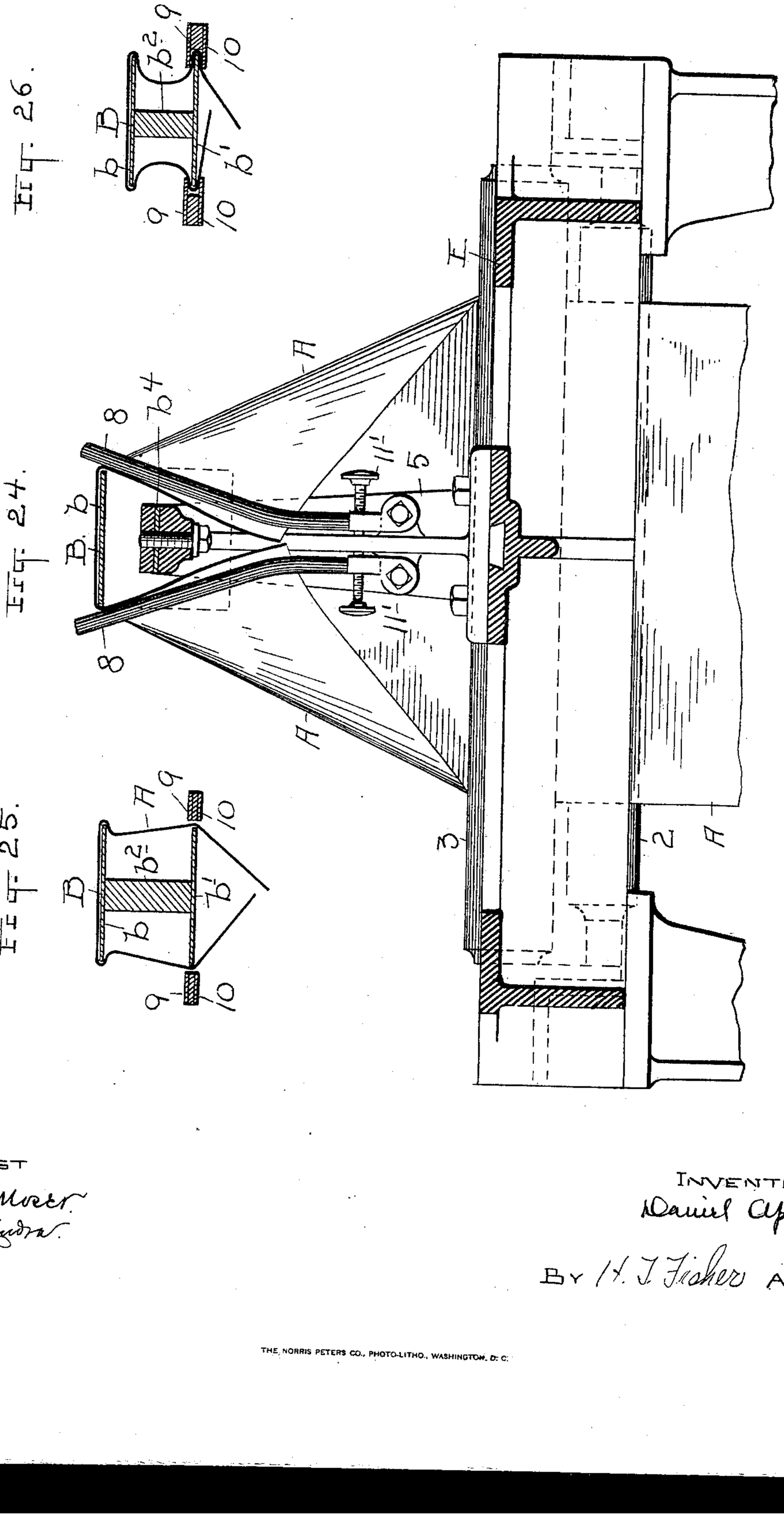
D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.)

22 Sheets—Sheet 11.



Attest

R. B. Moser

H. C. Mudra.

Inventor

Daniel Appel.

By H. J. Fisher Atty

No. 619,262. Patented Feb. 14, 1899.

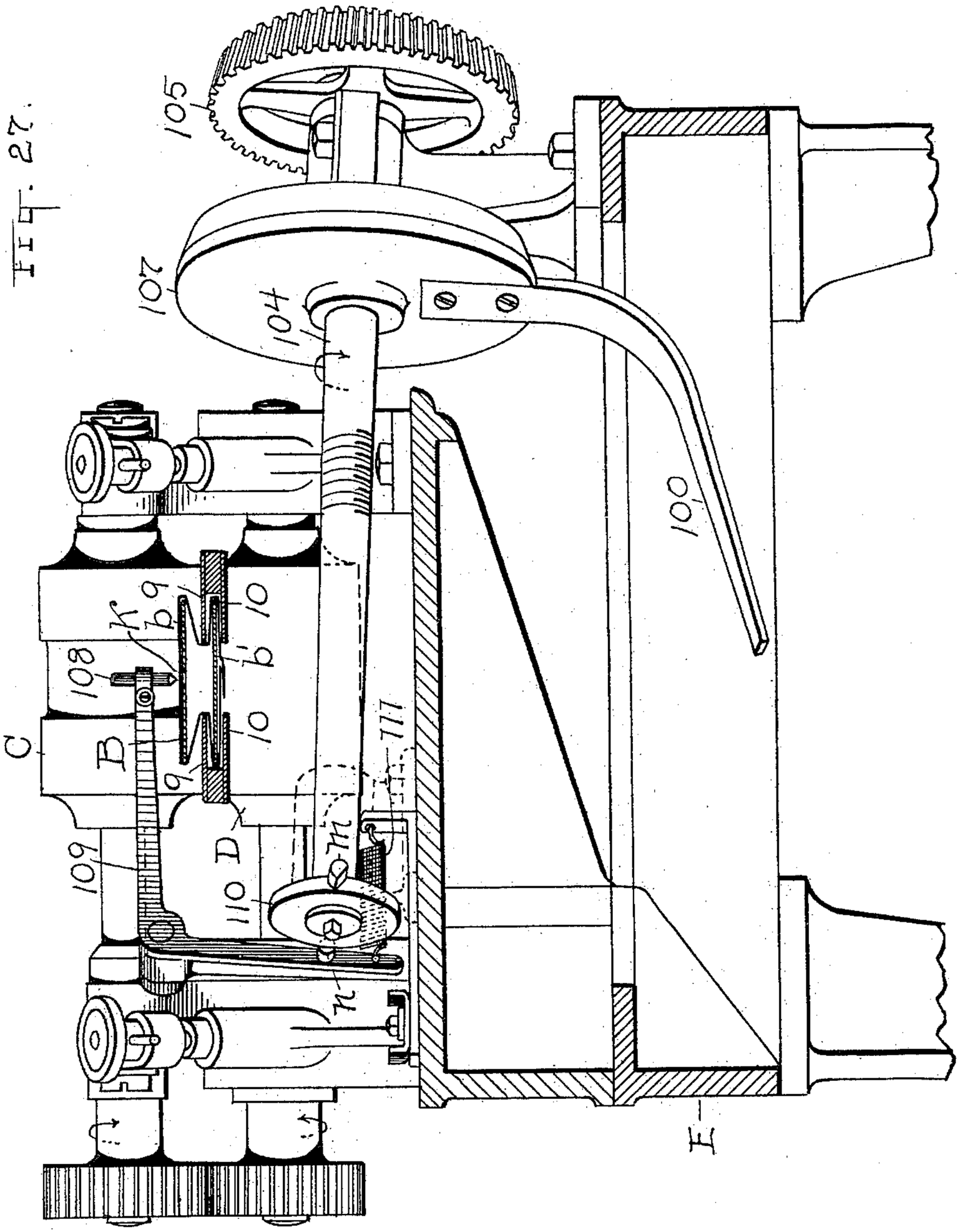
D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 12.

Fig. 27.



Attest
T. C. Sullivan
H. L. Medina.

Inventor
Daniel Appel.

By H. J. Fisher Atty.

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 13.

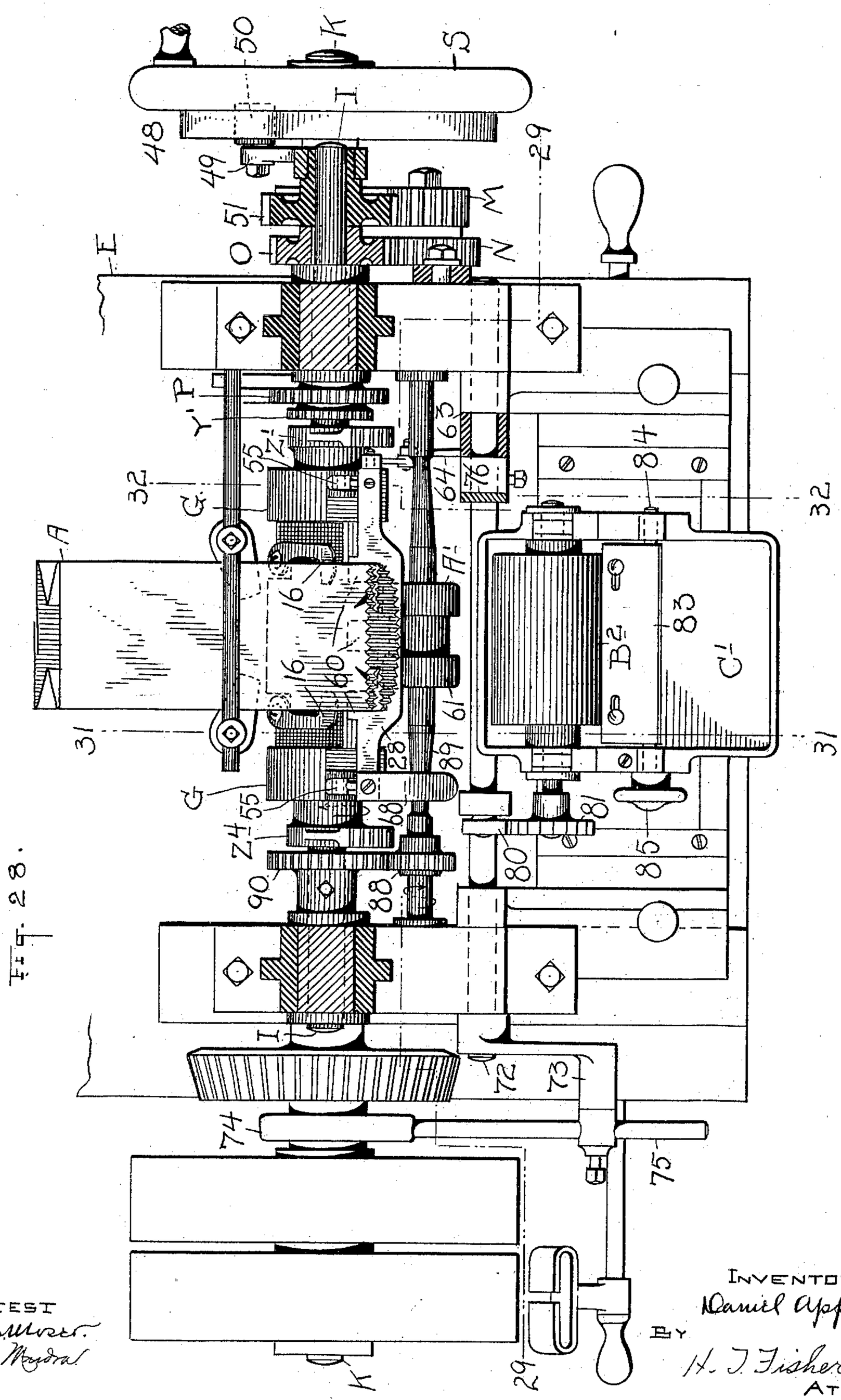


FIG. 28.

ATTEST
R. B. Moser.
H. C. Maydwell

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Daniel Appel
BY
H. J. Fisher
ATTY

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 14.

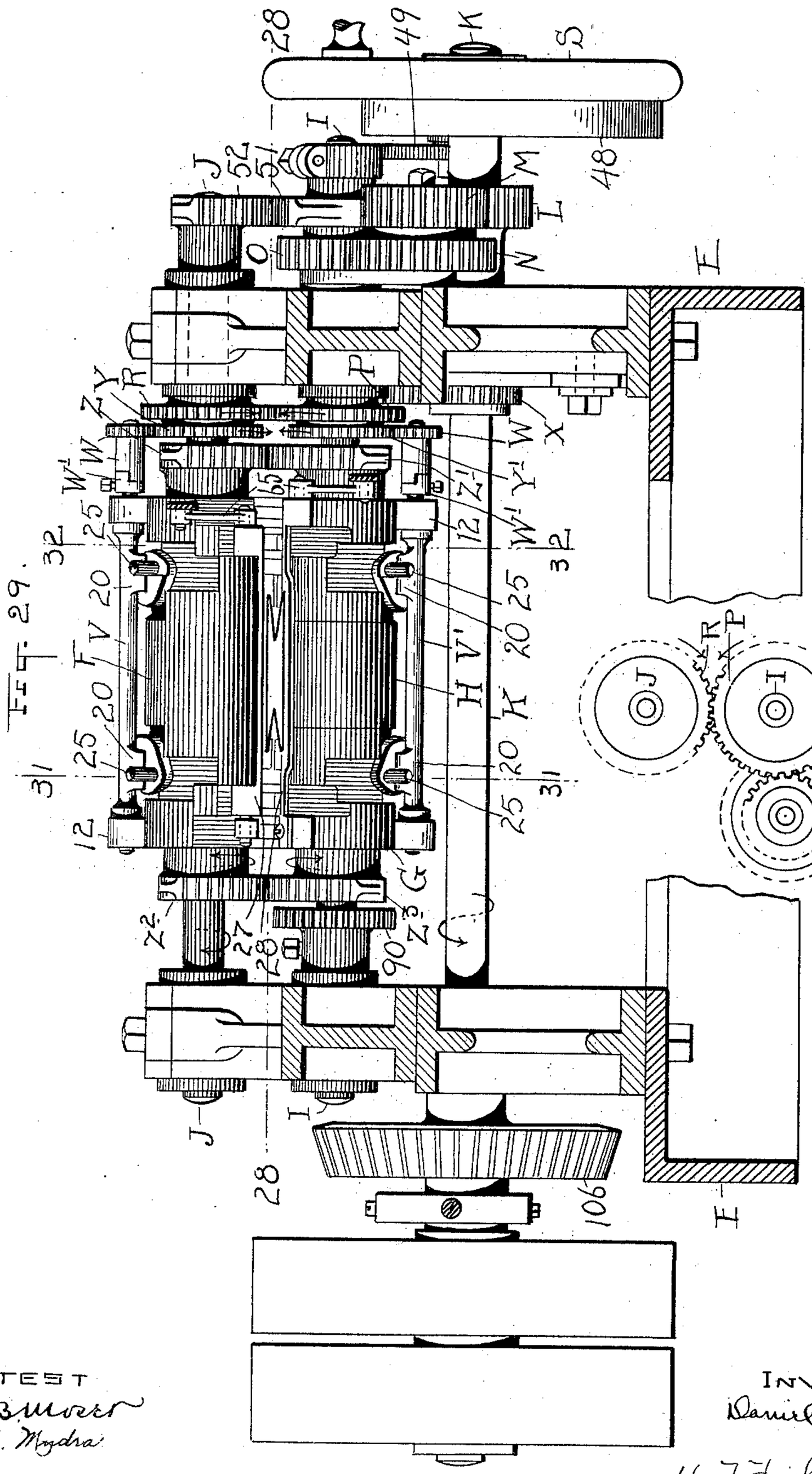

FIG. 29.

FIG. 29a.

ATTEST
R. B. Moser
H. L. Moydra

INVENTOR
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BY H. J. Fisher ATTY

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 15.

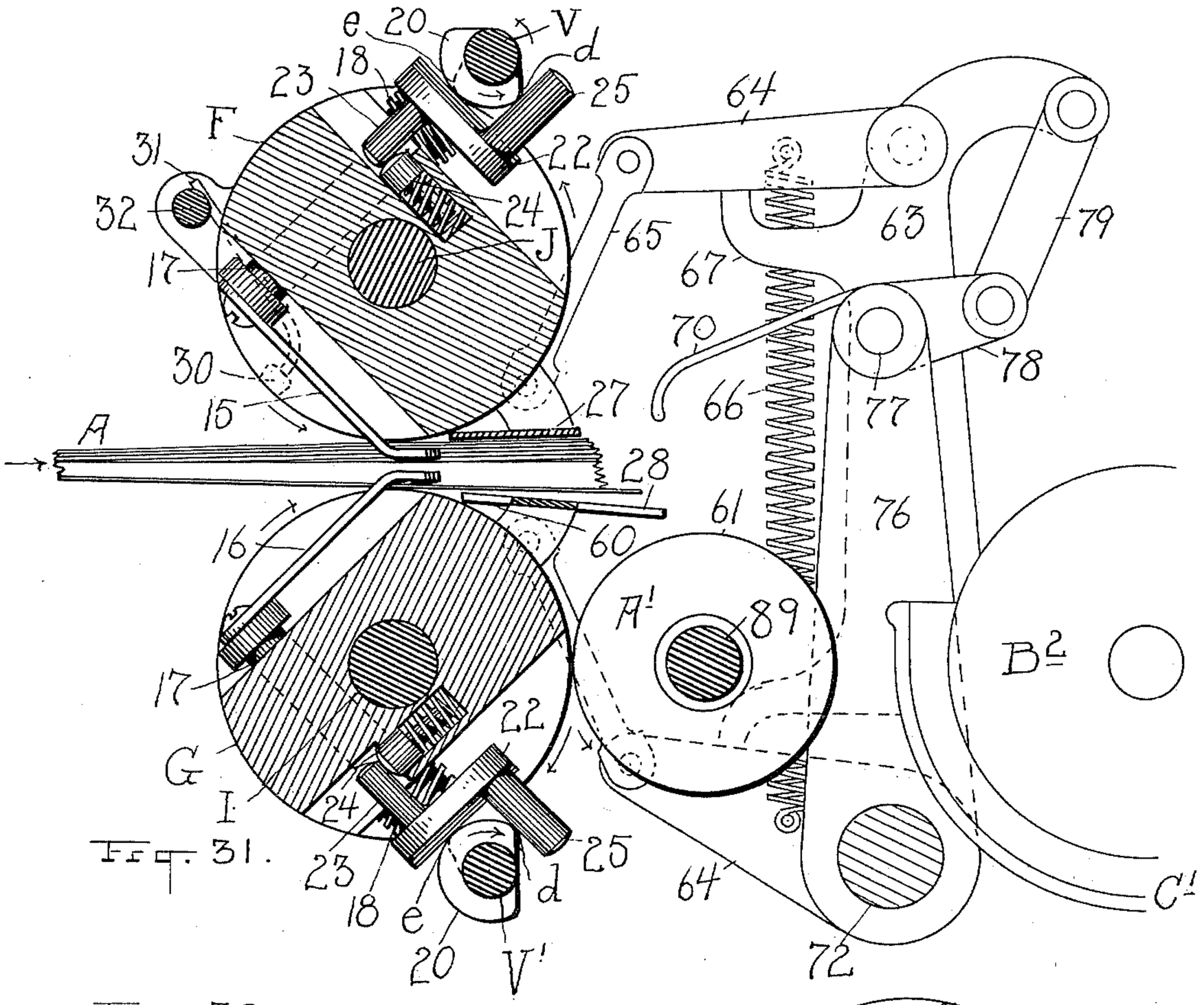
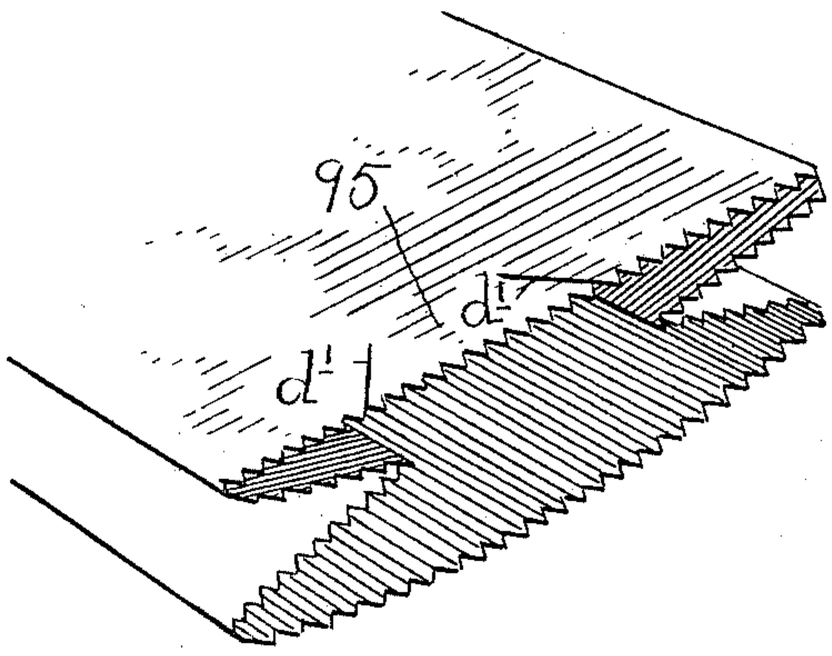


Fig. 31.

Fig. 30.



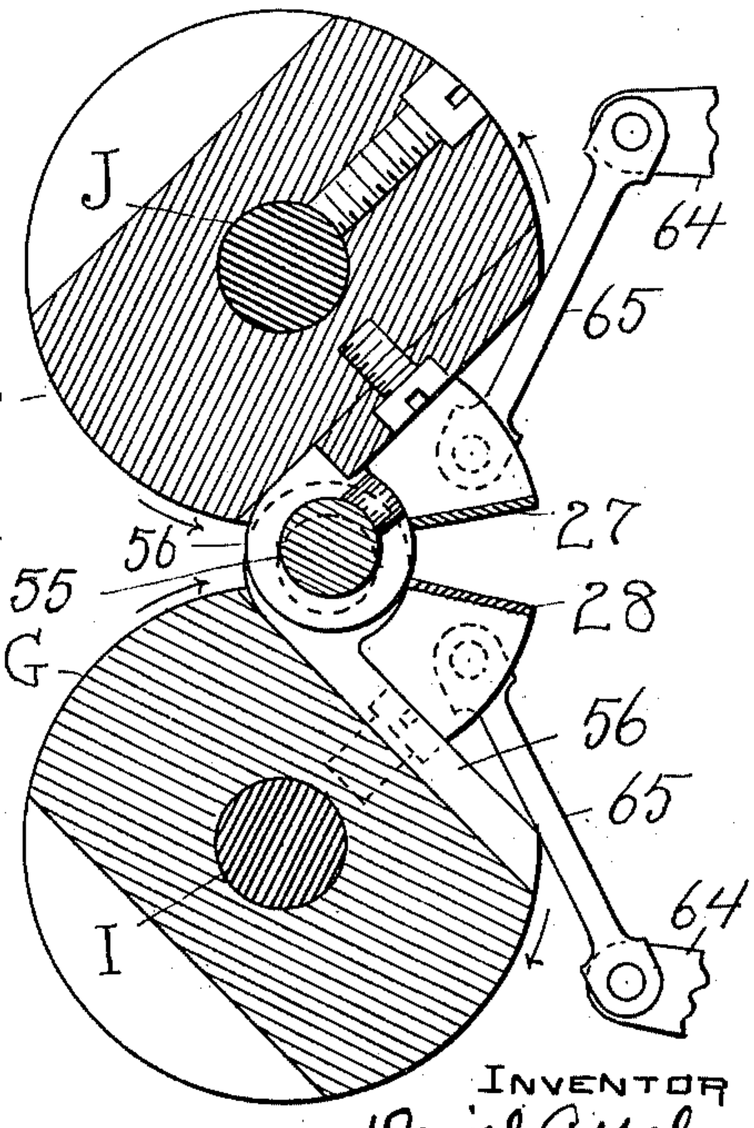


Fig. 32.

ATTEST
R. B. Moore.
H. E. Mowry.

INVENTOR
Daniel Appel.
By H. T. Fisher Atty

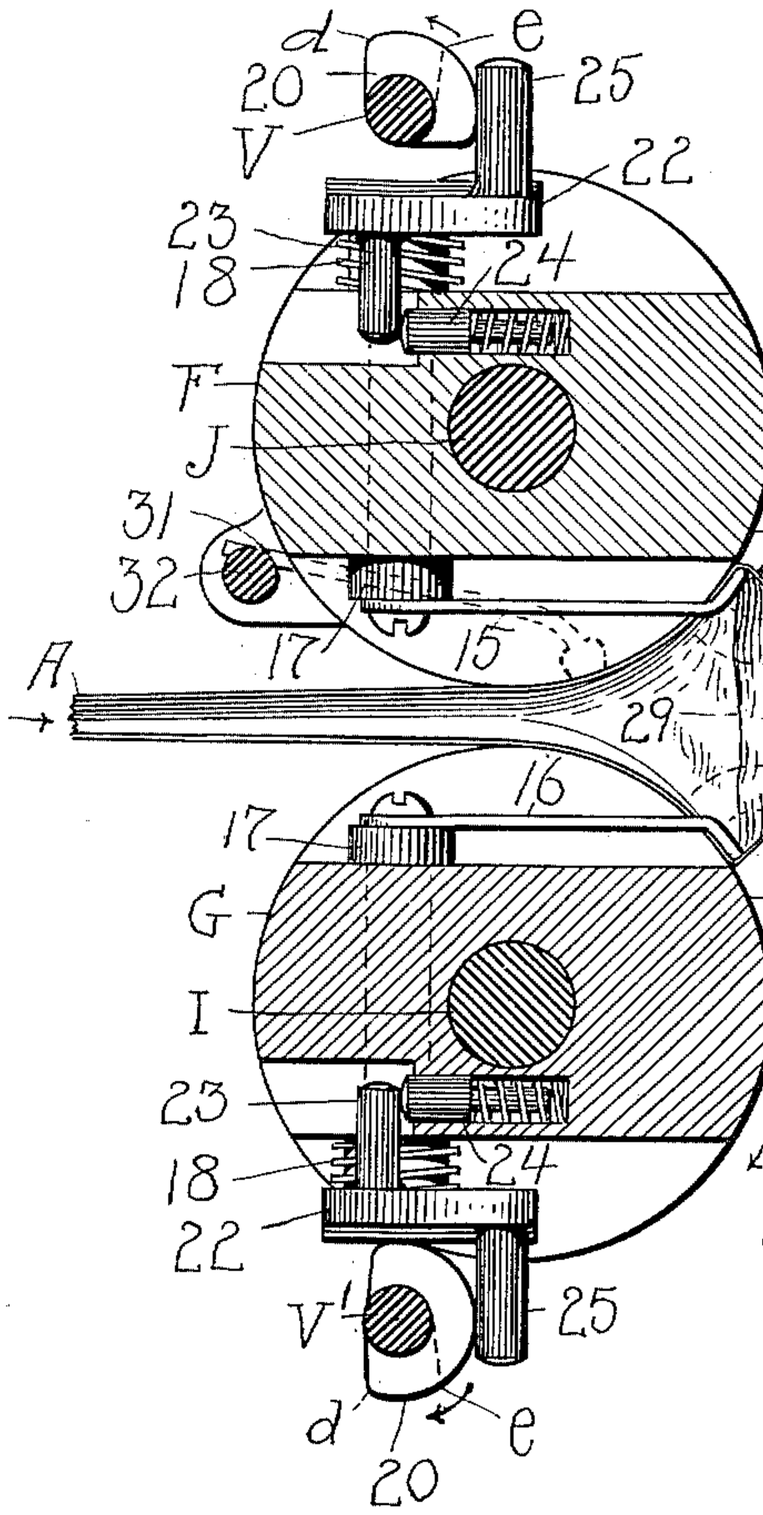
No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 16.



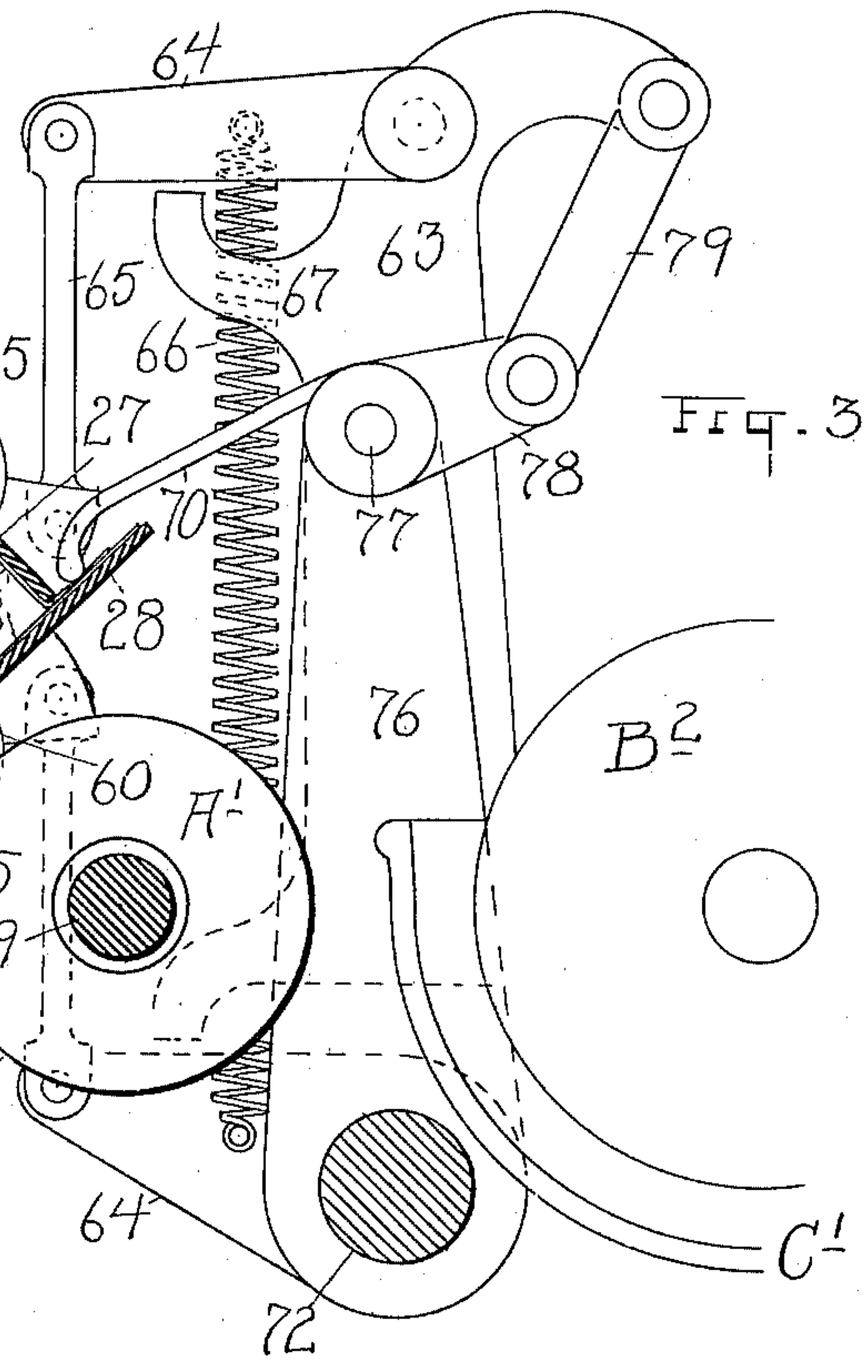
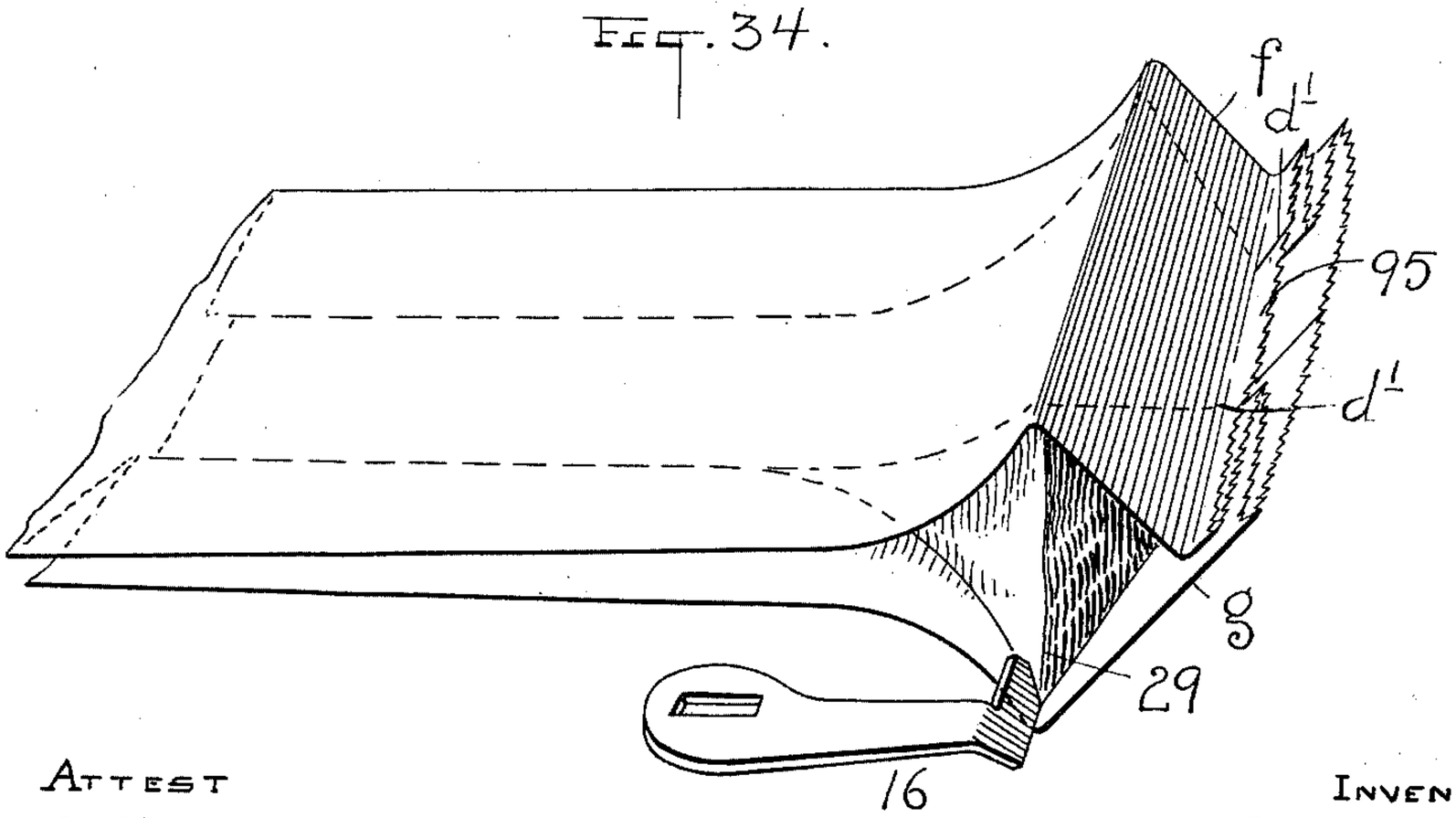


Fig. 33.

Fig. 34.



Attest
R. B. Moore.
H. E. Mudrow.

Inventor
Daniel Appel

By H. J. Fisher Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 17.

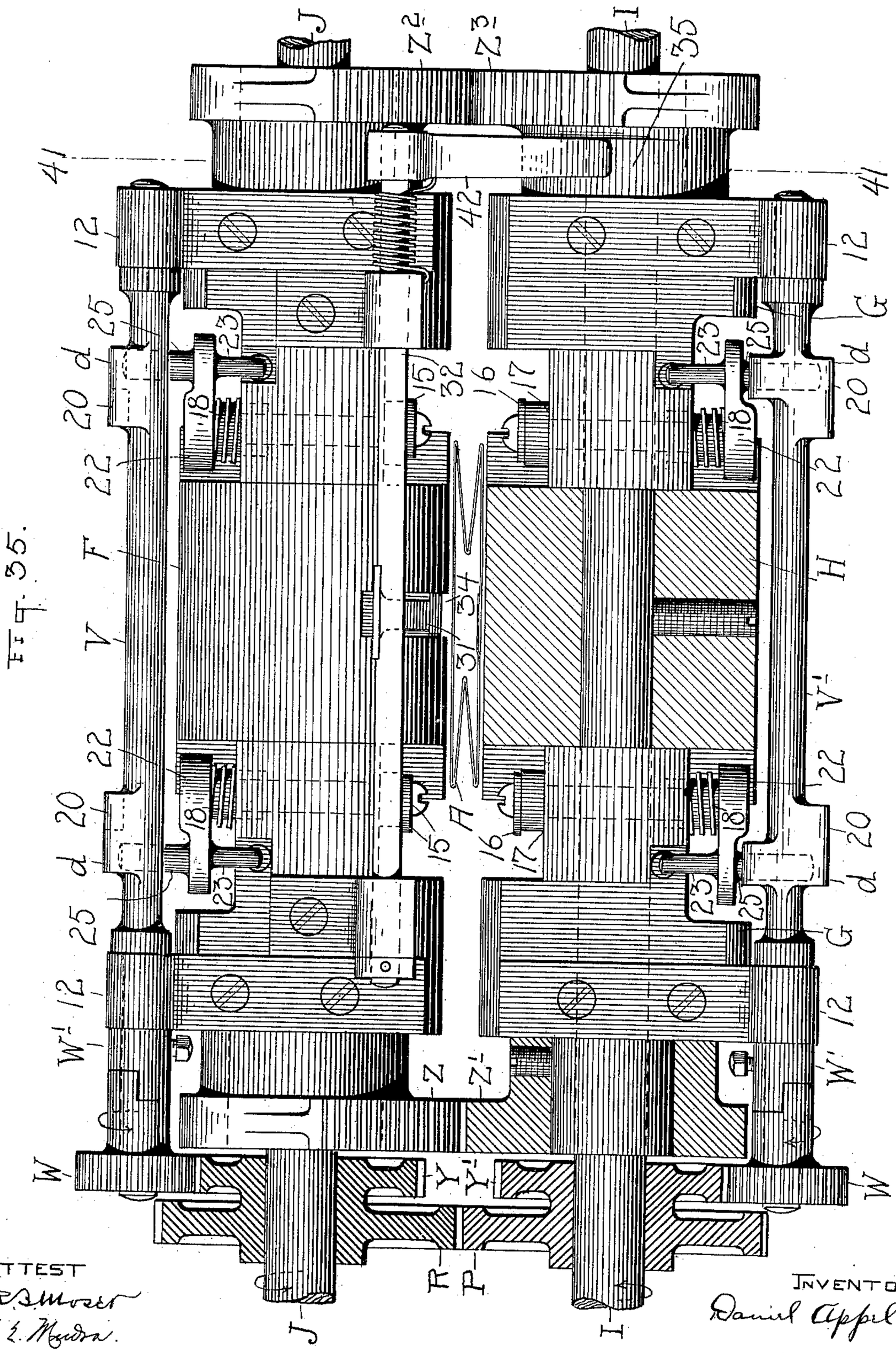


FIG. 35.

ATTEST
R. F. Moser
H. E. Mudra.

INVENTOR
Daniel Appel
BY H. T. Fisher ATTY

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 18.

Fig. 36.

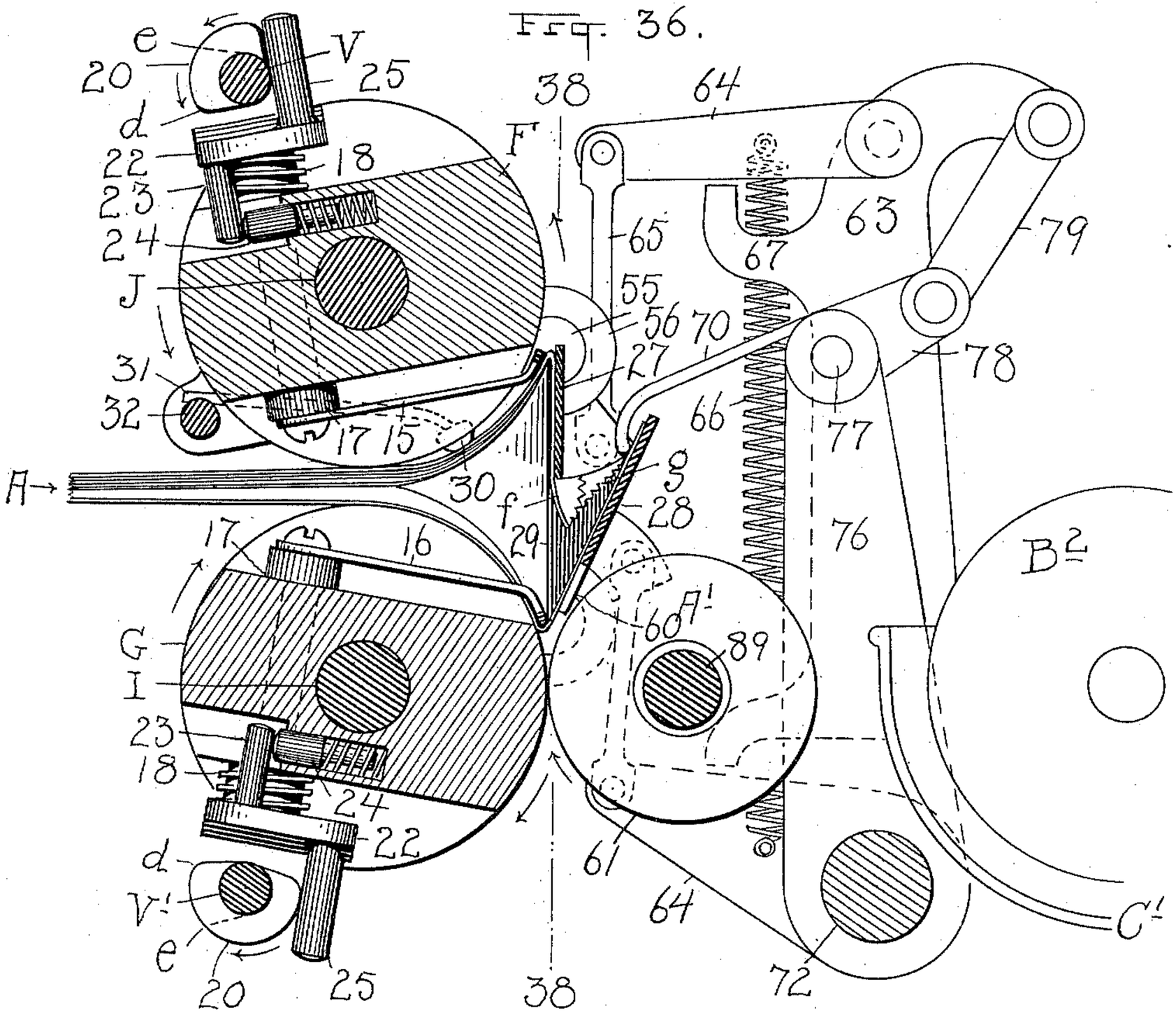
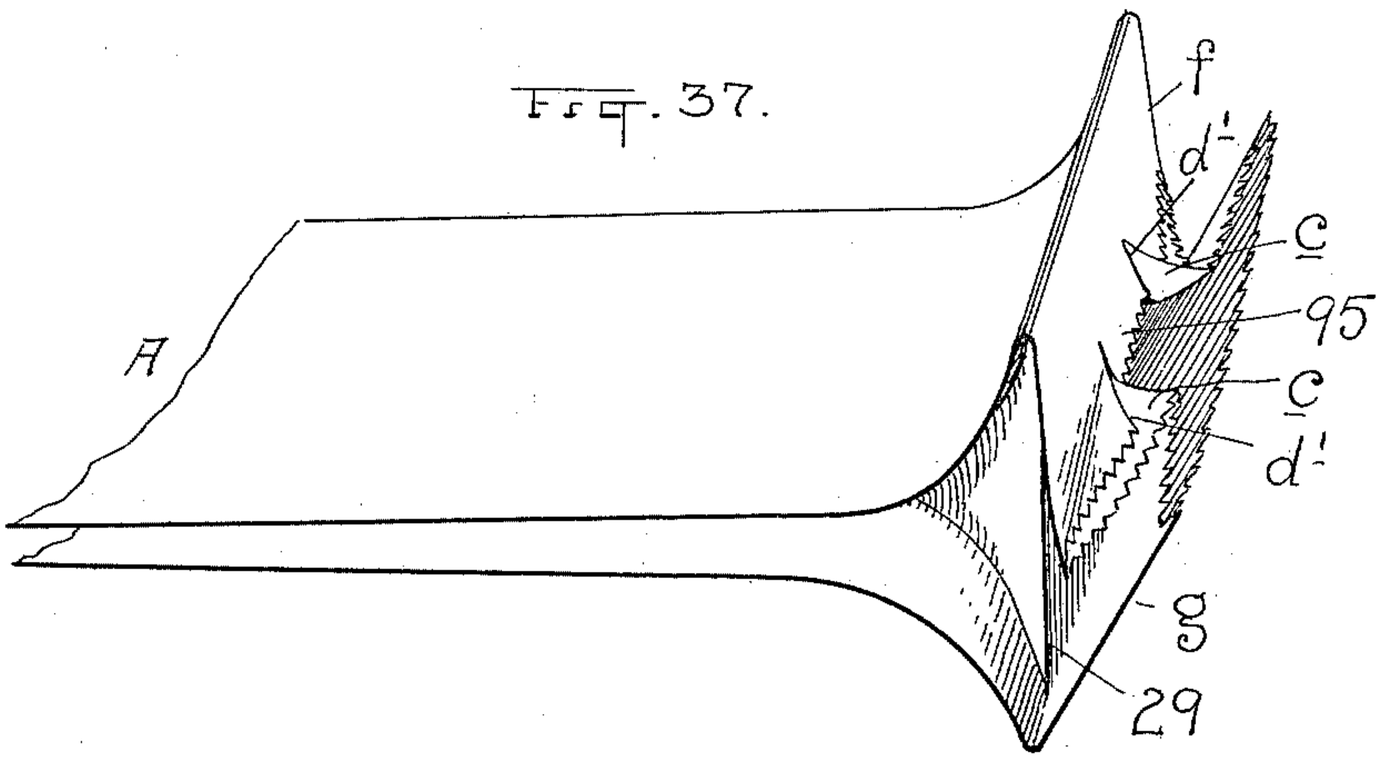


Fig. 37.



Attest
R. B. Moore
H. L. Medora.

Inventor
Daniel Appel

By H. T. Fisher Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 19.

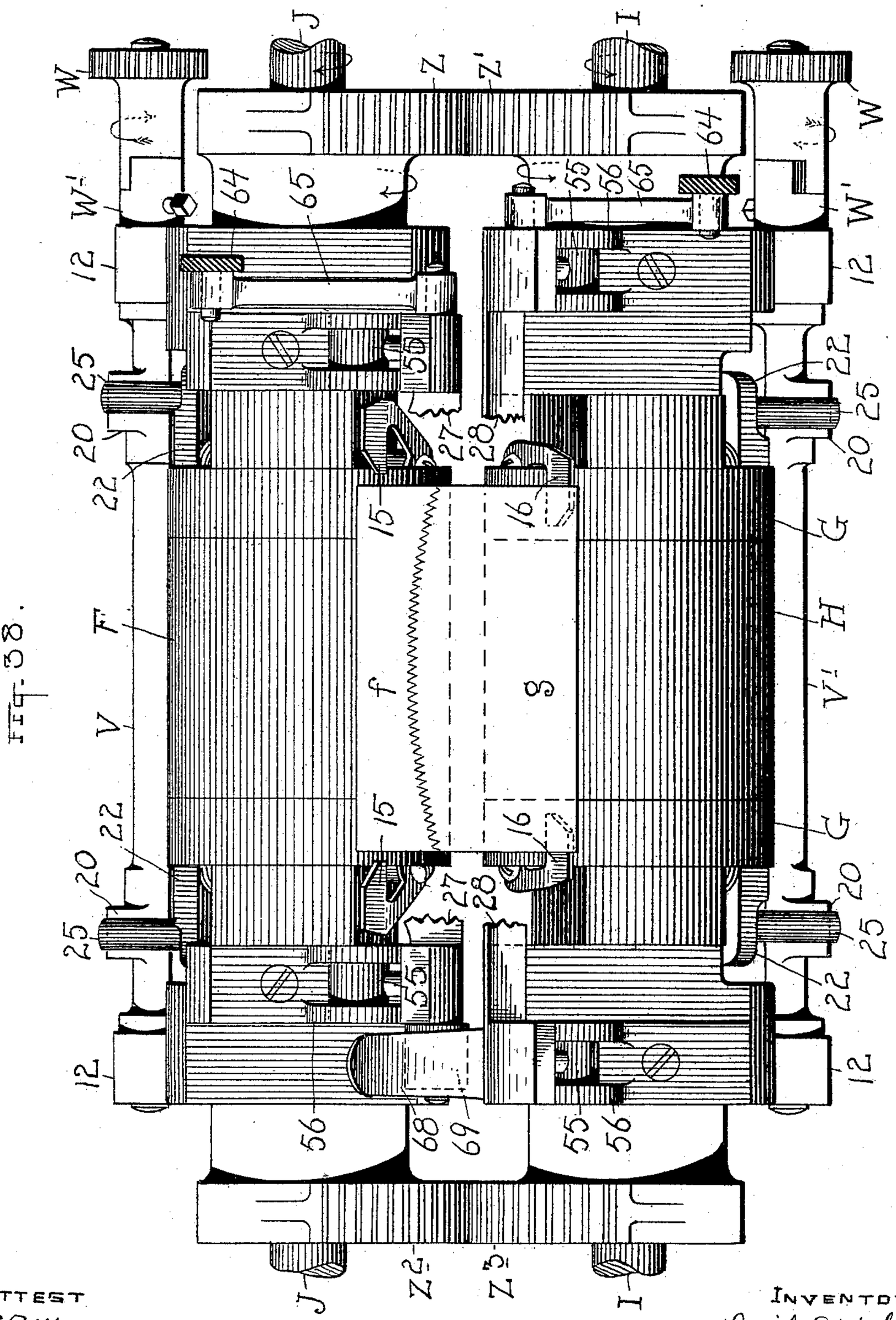


FIG. 38.

ATTEST
P. C. Mosser
H. E. Middaugh

INVENTOR
Daniel Appel
By H. T. Fisher ATTY

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 20.

Fig. 39.

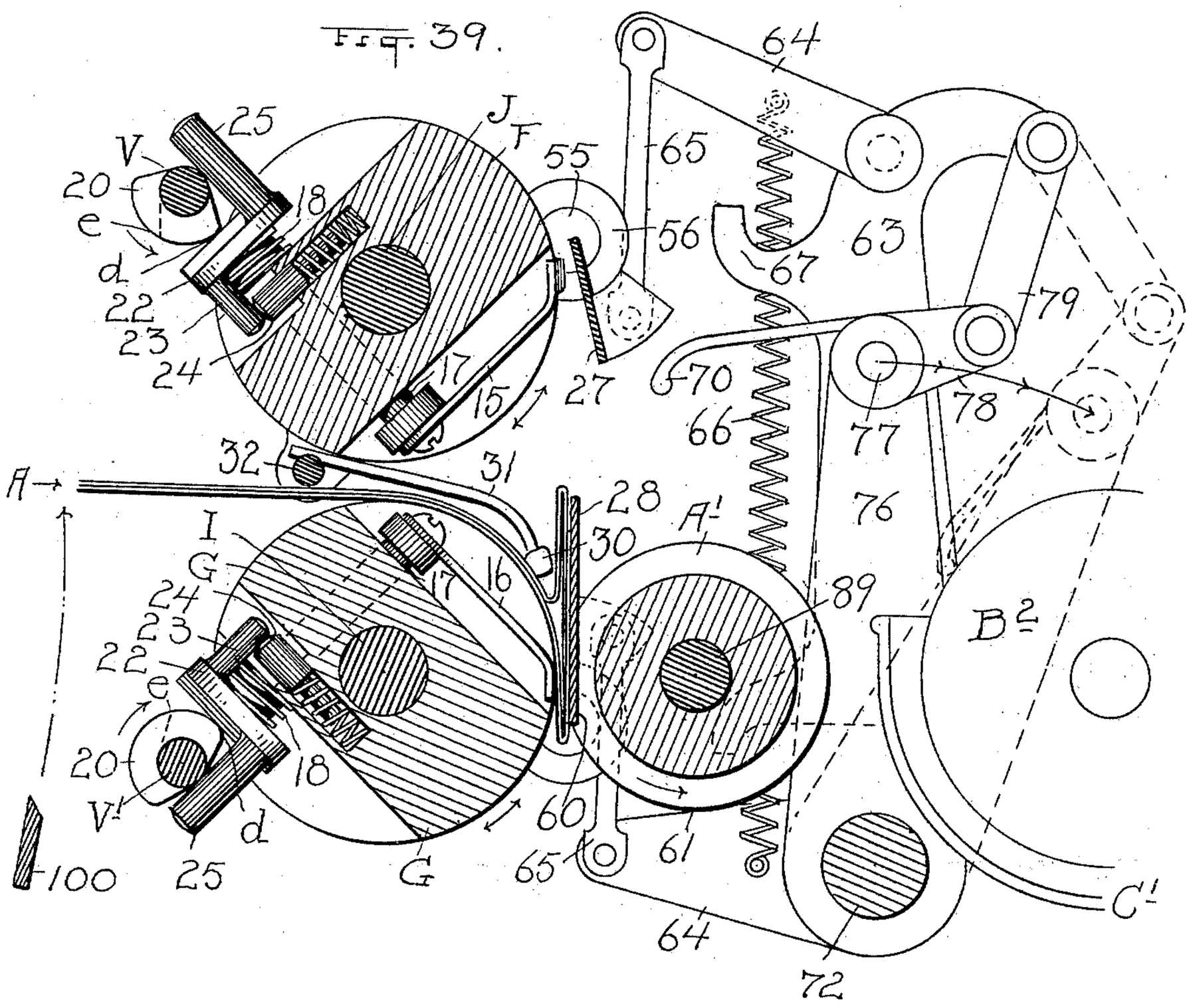
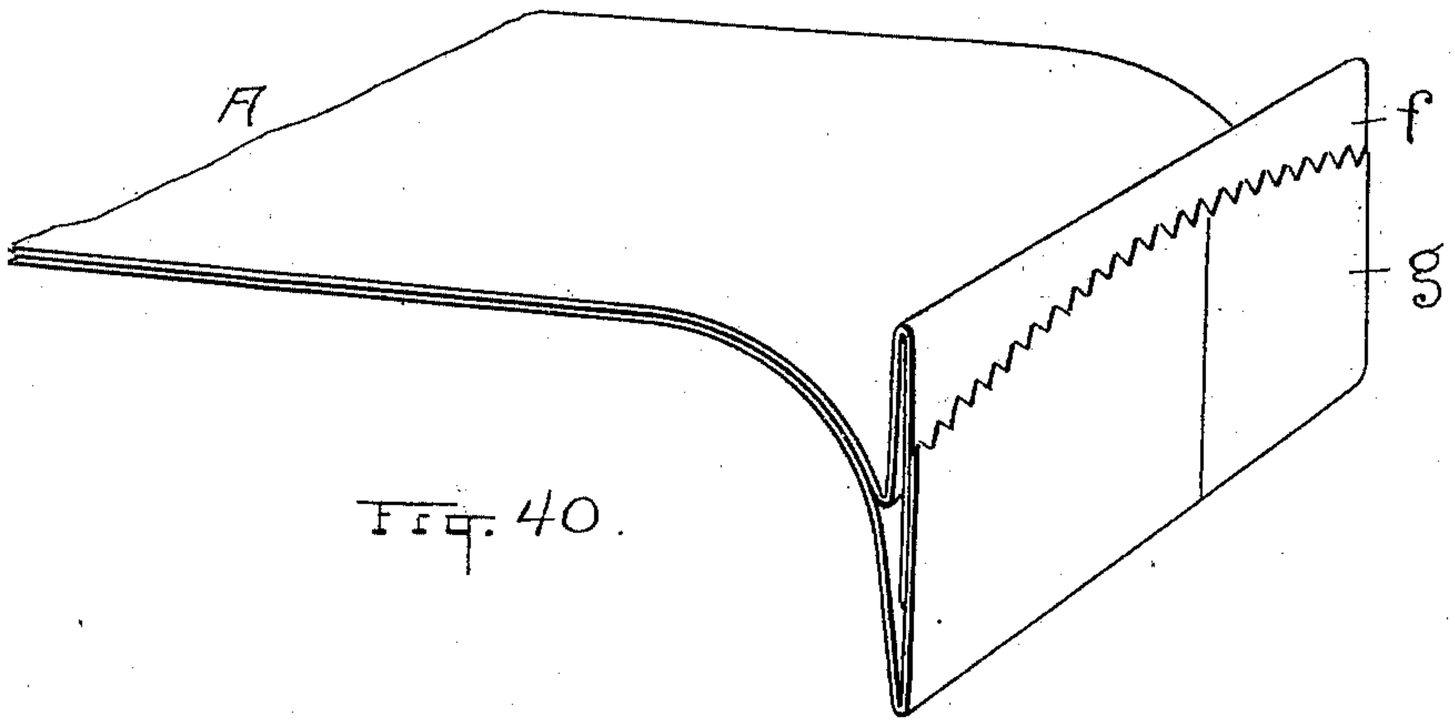


Fig. 40.



Attest
R. B. Miller
H. L. Moodra.

Inventor.
Daniel Appel

By H. T. Fisher Atty.

No. 619,262.

Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.)

22 Sheets—Sheet 21.

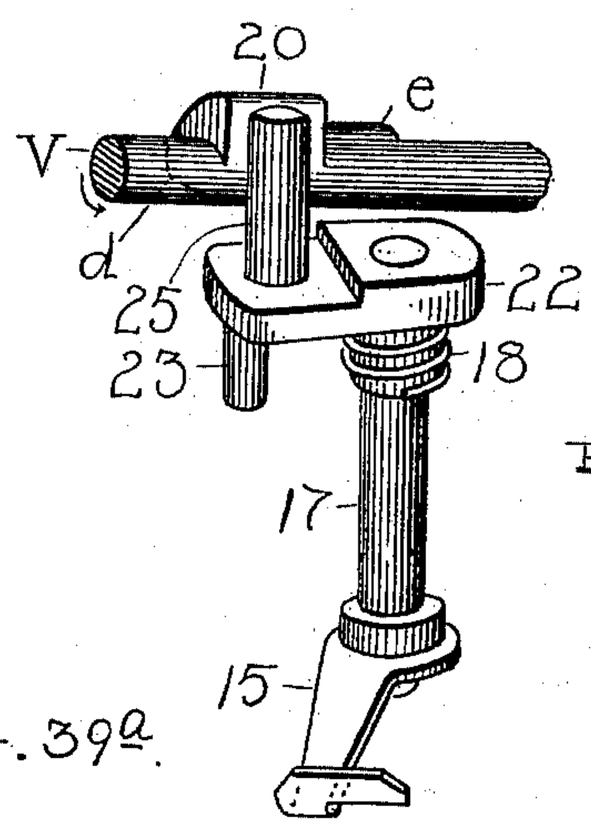


Fig. 39a.

Fig. 39e

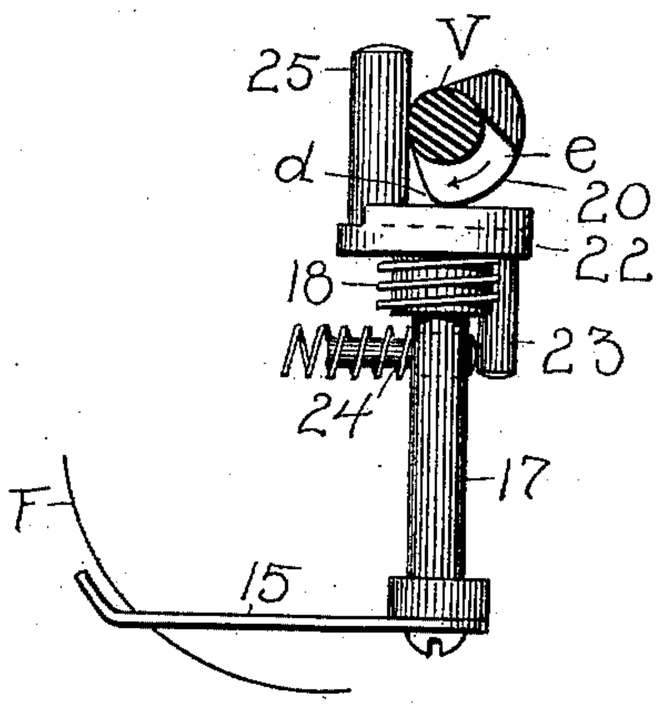


Fig. 39c

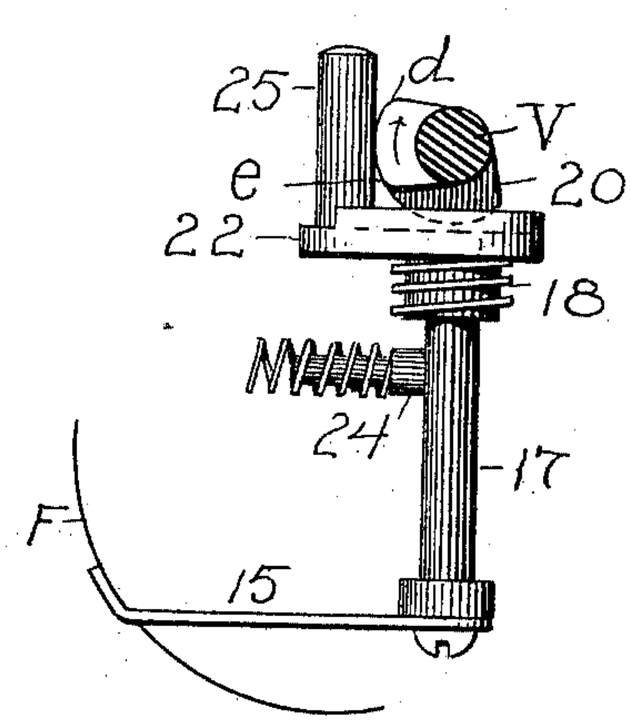


Fig. 39b

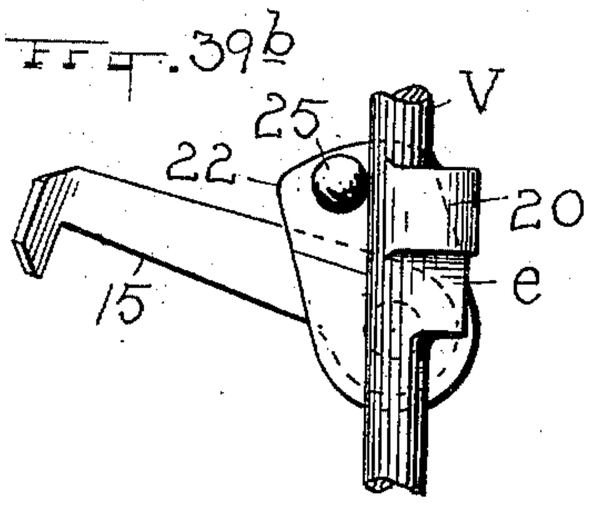
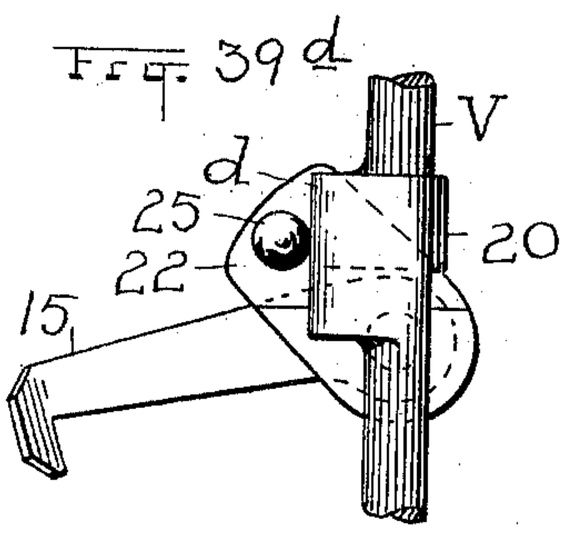


Fig. 39d



Attest

R. B. Moore.

H. L. Maydra.

Inventor

Daniel Appel

By H. J. Fisher Atty

No. 619,262. Patented Feb. 14, 1899.

D. APPEL.

PAPER BAG MACHINE.

(Application filed July 20, 1897.)

(No Model.) 22 Sheets—Sheet 22.

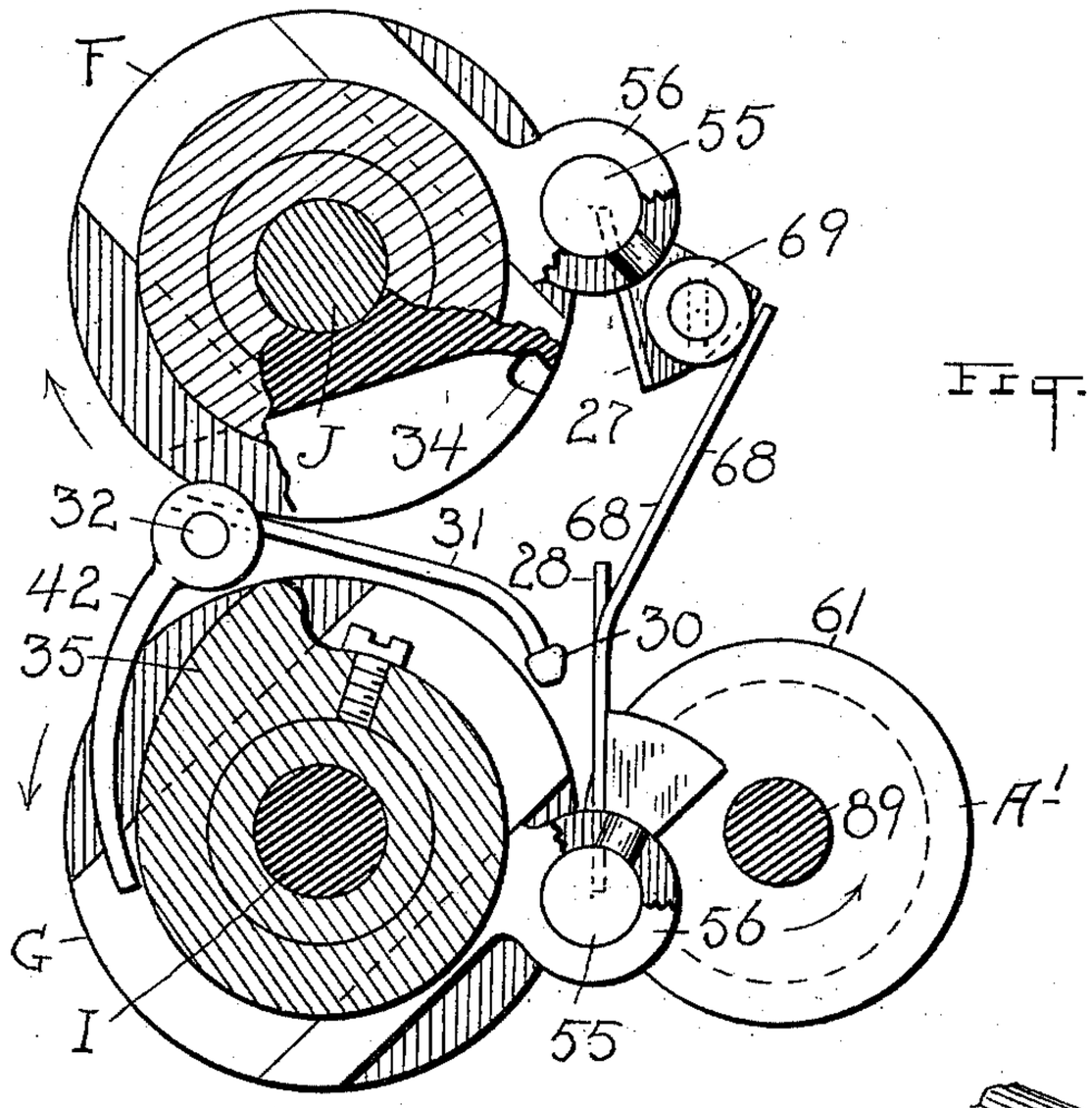


Fig. 41.

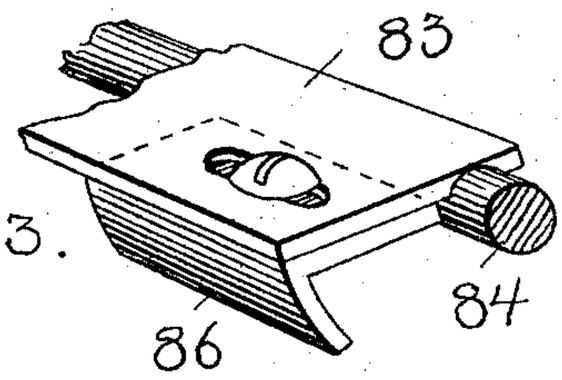
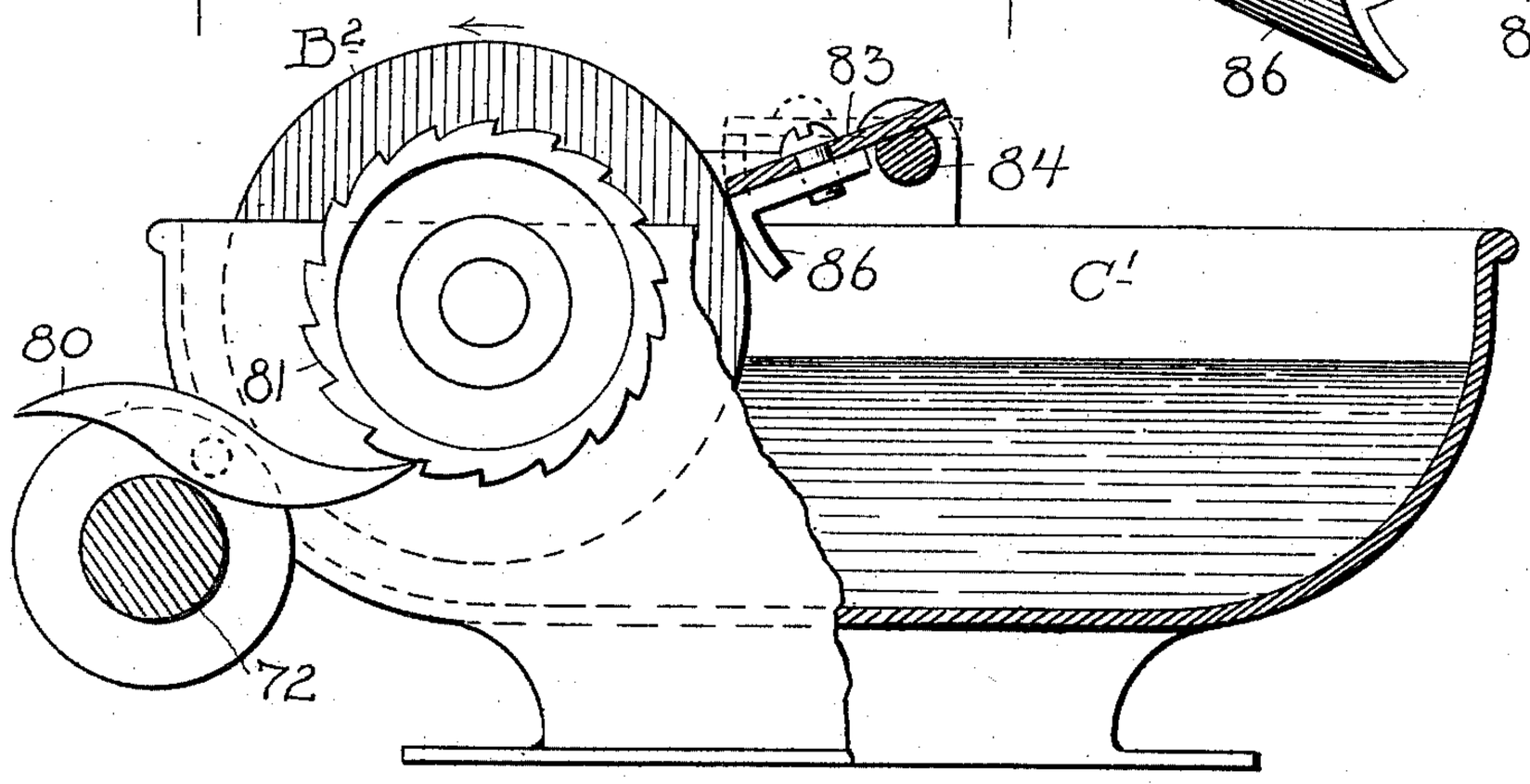


Fig. 43.

Fig. 42.



Attest
R. B. Moore
H. L. Medina

Inventor.
Daniel Appel.

By H. T. Fisher Atty

UNITED STATES PATENT OFFICE.

DANIEL APPEL, OF CLEVELAND, OHIO.

PAPER-BAG MACHINE.

SPECIFICATION forming part of Letters Patent No. 619,262, dated February 14, 1899.

Application filed July 20, 1897. Serial No. 645,230. (No model.)

To all whom it may concern:

Be it known that I, DANIEL APPEL, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Paper-Bag Machines; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to paper-bag machines; and the invention consists in a machine for making self-opening and non-collapsible square-bottom paper bags of the kind substantially as shown and described in an application filed by me on the 19th day of June, 1896, Serial No. 596,121.

In the accompanying drawings, Figure 1 is a plan elevation of my new and improved bag as it appears when delivered complete and ready for use by the present machine. Fig. 2 is a perspective view of the finished bag partly open, and Fig. 3 a longitudinal sectional elevation on line 3 3, Fig. 2, said views showing particularly the position and relation of the retired side ribs at the bottom of the bag. Fig. 4 is a perspective view of a bag fully open and showing the induced brace-lines which help to keep the bag distended toward and at its top. Fig. 5 is a cross-section of the bag, taken on line 5 5, Fig. 4, and disclosing the fold-lines inside the bottom. Fig. 6 is a side elevation of the bag and showing especially the bulging brace-lines on the plicated or narrow sides of the bag. Fig. 7 is a perspective view of a filled bag with the bottom developed or spread its full width, as occurs by filling; and Fig. 8 is a perspective view showing the bottom of a filled bag, as appears in Fig. 7. Fig. 9 shows the bag as a tube with the bottom opened out, but disclosing the lines on which it is formed in folding. Fig. 10 is a central longitudinal sectional elevation of the machine, showing only conspicuous parts here and there somewhat diagrammatically arranged and exhibiting the path of the paper from the original roll to the place of discharge of the finished product. Fig. 11 is a perspective elevation of the tube-former alone and independent of the other parts except the cutter-blades at its ends. Fig. 12 is a perspective view of the paper tube alone as it appears in its successive stages passing from the paper-roll to the point of severance as the bag is being finished and showing the gradual development of the paper into a plicated tube, the mechanism being omitted. Fig. 13 shows five assembled cross-sectional views taken at different points of the tube in Fig. 12, as shown by the arrows, and showing different stages of development. Fig. 14 is a plan view of the entire machine with the blank tube projecting from between the bottom-forming rolls to form the bottom of a bag. Fig. 15 is a side elevation of the full machine, and Fig. 16 is a detail view showing an arrangement of gearing which is partly obscured in Fig. 15. Fig. 17 is a side elevation of the full machine, looking at it from the opposite side of Fig. 15. Fig. 18 is an elevation of the paper-roll and the shaft and brake mechanism therefor and showing the roll as being placed in position. Fig. 19 is a plan view of Fig. 18 on line 19 19, looking down. Fig. 20 is an enlarged plan view of the machine up to the tube-cutting mechanism and showing all the mechanism that contributes to the forming of the plicated tube, the top and end of the said tube being broken away at its extremity to more clearly show the manner in which the tube feeds through the serrated cutter-plates, the top feed-roll being, however, removed. Fig. 21 is a central longitudinal sectional elevation of the part of the machine shown in Fig. 20 and taken on line 21 21, Fig. 20. Fig. 22 is a perspective of the serrated former, cutter-plates, and cutter-bar, looking in from the front. Fig. 23 is a bottom perspective of the cutter-bar and the cutting-plates fixed thereto. Fig. 24 is a cross-section, on the zigzag line 24 24, Fig. 21, of the rear end of the former and machine, where the paper is beginning to take on the tubular form. Fig. 25 is a cross-section of the former and the side-ply-guiding plates on line 25 25, Fig. 21; and Fig. 26 is a similar cross-section, but on the more advanced line 26 26, Fig. 21. Fig. 27 is a sectional elevation of the machine on line 27 27, Fig. 21, looking toward the front of the machine. Fig. 28 is a plan view of the machine forward of the cutters and looking down from a horizontal line corresponding substantially to 28 28, Fig. 29. Fig. 29 is a vertical cross-section of the machine on a line

immediately in front of the bottom-forming rolls and looking into the mouth of the approaching plicated tube, the various parts being in the first position preparatory to forming the bottom folds of a bag. Fig. 29ª is a side elevation of the gear mechanism for driving the cam-shafts on the oscillating rolls. Fig. 30 is a perspective view of the end of the plicated tube as it appears when it enters between the forming-rolls and before the bag is severed from the tube. Fig. 31 is a cross-section of the bottom-forming rolls on lines 31 31, Fig. 29, the plicated tube being in position between them. This is the so-called "first" position in forming the bottom of the bag. Fig. 32 is a cross-section of the other end of the bottom-forming rolls on line 32 32, Figs. 28 and 29, and showing the manner in which the folding-plates are pivoted to their respective rolls. Fig. 33 is a cross-section of the same parts and on the same line substantially as Fig. 31, but with its operating parts in the second position of forming the bottom and with the bag in the advanced state seen in Fig. 34. Fig. 34 is a perspective view of a bag as it appears in the machine when the bottom is partially folded and showing a forming-finger in position as shown in connection with the bottom-forming roll, Fig. 33. Fig. 35 is a sectional elevation of the machine on the opposite side of the forming-rolls from Fig. 29 and looking forward to said rolls and showing the parts in Fig. 33 in full elevation. Fig. 36 is a cross-section of the forming-rolls and associated forming mechanism corresponding to Figs. 31 and 33, but with the said parts in the third position of bottom-forming and the bag in the more advanced state of completion seen separately in Fig. 37. Fig. 37 is a perspective view of the bag alone in the stage of development seen in Fig. 36 and with the inner bottom fold wiped in and in the act of being pasted and overlapped by the outer bottom fold. Fig. 38 is a sectional elevation of the machine on a line corresponding to 38 38, Fig. 36, showing the folding-plates removed to reveal the bottom of the bag and with the upper carrying-fingers withdrawn and the lower fingers still in position to carry the bag into the bite of the discharge-rolls. Fig. 39 is a cross-sectional view of the forming-rolls and other parts corresponding substantially to Fig. 33 and showing the fourth and last position of folding and with the bag, as seen in Fig. 40, being discharged as a completed product. Fig. 39ª is an elevation of the mechanism immediately connected with one of the gripping-fingers, and Fig. 39ᵇ is a plan view thereof. Figs. 39ᶜ and 39ᵈ are views of the same mechanism in a more advanced state; and Fig. 39ᵉ shows said parts when a movement has been completed, all of which is more particularly hereinafter described in connection with the operation of said parts. Fig. 40 is a perspective view of a completed bag as it is discharged by the discharge-rolls and shown in edge view, Fig. 39. Fig. 41 is a cross-section on line 41 41, Fig. 35, looking to the left and with the parts substantially in what is called the "fourth" or "last" position, corresponding to Fig. 39. Fig. 42 is an elevation, partly in section, of the bottom paste roller and pot and its associated parts; and Fig. 43 is a detail perspective of a section of the paste-regulator.

In the foregoing views the invention is illustrated according to the progress of the bag through the machine as nearly as possible to facilitate understanding and exhibit its successive stages of formation until completed and discharged. In this machine, which works from the paper-roll, the first essential work is to produce the plicated tube for making the bag, and it may be noticed here that the bag remains as a part of the tube until the bottom is practically completed and is not severed or detached at all into what is usually known as a "blank" and as is common in bag-making machines. It will also be noticed that the machine is one of exceptional compactness, a full-sized machine adapted to produce a bag eight to ten inches in length not occupying an area exceeding three feet wide by four feet long; yet this machine easily turns out a hundred and seventy-five complete bags per minute or about three per second. This serves to show that practically all the parts entering into the formation of the bag must be capable of exceedingly rapid and exact movements, and especially since by reason of the compactness of the machine some must act and get out of the way before others can do their part, all as will now be seen in a detailed examination of the machine. Furthermore, in order that the nature of the machine may be more clearly apprehended than would otherwise be practicable I have shown a number of views of the bag itself in one form and another in advance of the views of the machine, so that it may appear to begin with what the shape and style of the product of the machine really is and what the machine is intended to produce. These views may, however, be more profitably studied in detail at the close of the description.

Referring now to Fig. 10, Sheet 4, we are afforded a somewhat diagrammatic running view of the machine from end to end. In this view we have first the roll of paper A, supported and operating, as hereinafter fully described and disclosing the sheet of paper drawn between two guide-rolls 2 and 3 in contact with the paste wheel or disk 4 forward to and over the former B. (Seen in detail, Fig. 11.) The paste-wheel 4 applies the paste along the line of the longitudinal seam of the tube and is seen in plan, Fig. 14, where it is shown as running at the near edge of the paper before any folding begins. From this point and the roll 3 the paper is drawn always in a taut or stretched condition over the former B and thence on through the machine. The former B is so called by reason

of its importance in forming the plicated tube from which the bag is made. Hence the former B is set directly into the line of travel of the paper and with the paper enveloping the same as the tube is developed, substantially as seen in Figs. 10, 12, and 13.

The construction of the former is clearly seen in Fig. 11 and comprises the top and bottom plates *b* and *b'*, separated at their rear in the proportion relatively about as shown and gradually coming nearer together at their front until they leave only a comparatively narrow space for the plicated sides of the tube. A central web b^2 separates said plates, and at the rear end of the former the top plate, preferably, is provided with a reversely-inclined projecting portion b^3, over which the paper travels from the guide-roll 3, and at the angle of the bend between surfaces *b* and b^3 there is an upward and rearward extension b^4, preferably of the lower plate *b'*, and by which said parts are supported. Between the front ends of the two plates or sides *b* and *b'* are held the arms of two serrated paper-cutters, as hereinafter described. These details of the former B need not necessarily be observed, and any substantially similar construction of former, even if it were made in a single piece or one or more pieces and with different means of support, would be within the invention. The former thus constructed is supported rigidly in the line of travel of the paper by a suitable standard 5, Fig. 21, and as near the guide-roll 3 as practicable to economize space and facilitate operation.

Coöperating with the former in the production of the plicated tube are two upright arms or guide-standards 8. These standards 8 are fixed adjustably at their lower ends to the support 5 for the former and in this instance are inclined or bent outwardly from near their center to their top, so as to assume together approximately a V shape, the upper ends standing close to the sides of the head of the former relatively as seen in Figs. 10 and 24. The said standards have a depth of inclination equal at least to the width of the sides of the paper at this point, as clearly seen in Fig. 24, and they are essential in the formation of the tube in that they take out all the slack downward and give uniform tension to the paper before it enters upon the former as well as promoting a uniform movement of the paper over the former, so as to insure a perfectly-smooth tube when the paper enters between rollers C and D. The tops of the standards may be provided with small rollers or pulleys running in contact with the paper to reduce or prevent friction.

Beyond the standards 8, at the sides and bottom of the former B, are the flat-ply-developing plates 9 and the under plates 10 for bringing together the two sides of the tube, which unite to form the seam side of the bag and which are pasted together and produce the seam of the tube and bag in their overlapping portions. These plates 9 and 10 are preferably united in pairs and are located, respectively, just over and under the lower plate *b'* of the former, as seen in section, Figs. 26 and 27. The said plates, and particularly plates 9, are so shaped or arranged that they gradually extend inward from the head of the former B at a point corresponding substantially to 25 25, Fig. 21, and, as seen in Fig. 25, to the full depth of the ply at the other end, as seen in plan, Fig. 20. A singular effect of these plates 9 is that while they carry the paper gradually inward over the bottom plate of the former they induce the paper to curve inward under the upper plate *b* of the former B, substantially as seen in the succession of cross-sections of the tube, Fig. 13, and as seen also in Figs. 25 and 26. This effect is shown in the tube alone, Fig. 12, and in the cross-sections on the lines of the arrows *a* in Fig. 13, and the manner in which the lower plates 10 operate on the overlapping folds below is likewise disclosed in said sectional views, and the tube is made and pasted and finished ready to be severed when it passes feed-rolls C and D. As the former decreases in depth to its practically-closed extremity the ply-forming plates in like degree enter in to take up the surplus paper, and in this way the paper is kept stretched at all points and in all directions, and hence kept smooth and in good working condition.

The plates 9 and 10 are supported on the frame of the machine as may be found convenient and laterally adjustable on their supports in slots 11, as seen in Fig. 14, or in any suitable way.

The standard 5, Figs. 21 and 24, is made adjustable longitudinally on the base E of the machine, and the arms 8 are laterally adjustable on the standard 5, as seen in Fig. 24, by means of set-screws 11' or their equivalent.

Any suitable means of support and adjustment for the parts 5 and 8 may be adopted, and the said adjustments are intended to accommodate larger or smaller formers B, so as to make the same machine capable of producing bags of different but associated sizes by simply changing the former and making certain needed adjustments here and there as are provided for such changes and as will appear in a detailed examination of the machine. The ply and bottom plates 9 and 10 are adaptable to these changes.

This concludes the invention in so far as it relates to the production of the plicated tube, and the next direct step in the formation of the bag is the development of the bottom thereof. All intervening mechanism in the direct line of travel, and particularly that relating to the severing of the tube to cut off the bag, is best passed over now and will be considered in the order of its operation.

Referring then to Figs. 31, 33, 36, and 39, we see cross-sections of the bottom-forming rolls and other coöperating parts in four successive positions incident to the complete development of the bottom of the bag and serv-

ing also to illustrate the bag in the various stages of its development, as further shown in separate views on the same sheets of drawings. These several mechanical views are represented as looking in from the left of the machine and from the same position. In all these views, F represents the upper roll and G the lower roll or, more accurately, the two members or sections of the lower roll, the discharge-roll H dividing these sections, as will be hereinafter seen, and both rolls have a rotary oscillating motion in unison of just enough length to develop the bag-bottom. The roll H is referred to as one of the discharge-rolls and is fixed on shaft I, which carries lower roll G. The shaft I rotates continually in the same direction, and the upper roll-shaft J oscillates intermittently; but the forming-rolls F and G on both shafts oscillate together in exactly like degree and manner, as hereinafter described.

To rotate lower shaft I, the same is geared through to the main drive-shaft K of the machine by gears at the right, Figs. 16 and 29, and comprising gear L on the main shaft and two rigidly-connected gears M and N, side by side, on a stud or spindle projecting outward from the main frame of the machine, and the gear N, meshing with gear O, fixed on the shaft I. All these gears are of such size and relation as to give the requisite speed to the parts actuated by or through them.

Inside of the main frame, Fig. 29, there is a gear P, free to rotate on lower roll-shaft I, meshing with a gear R, free to turn on upper roll-shaft J. This inner line of gear has to do especially with the actuation of the bag-gripping and bottom-distending fingers, while the line of gears L M N O is confined to the rotation of shaft I. It may also be understood here that the means for oscillating the rolls F and G are independent of these several gears and proceed initially from a cam on the inside of the hand or balance wheel S at the right, Fig. 29.

Now following up, first, the finger-actuating mechanism just referred to, we see in Figs. 29 and 38 two corresponding shafts V and V′, located at the top and the bottom, respectively, and supported at their ends in suitable bearings 12 on the rolls F and G. Each of these shafts has a pinion W, meshing with a gear Y and Y′ on shafts J and I. The said gears Y and Y′ are rigid with the gears R and P, respectively, and gears R Y are free on shaft J and gears P Y′ are free on shaft I. Now to rotate the four gears R Y and P Y′ continuously a train of gears is provided from shaft K and shown in Fig. 29ª. These gears comprise gear x on the drive-shaft actuating the line of gears, Fig. 29ª, to reach the gear P on shaft I. In this way a continuous rotation is imparted to gears Y and Y′, as above described. Then the shafts V and V′ will operate with an intermittent motion by reason of the oscillation of the rolls F and G, as will be seen farther on. It may be noted, in passing, that rolls F and G are oscillated together at exactly the same rate of speed by means of segmental gears Z, Z′, Z^2, and Z^3, rigid with the said rolls at their ends, Figs. 29 and 35. Thus the gears Z Z′ at the right in these views serve to actuate the lower right-hand section of roll G, and the gears Z^2 Z^3 at the left rotate the left-hand section of roll G, and power is transmitted through the upper shaft J and its segments.

The bag-gripping and bottom-distending fingers 15 and 16 are supported from and operate with the oscillating rolls F and G and have the shape as plainly shown on Sheet 21 of the drawings as well as in other views. Each finger is fixed rigidly on a spindle 17, set into the corresponding roll F or G, and said rolls are recessed where the ends of the spindles come to accommodate the fingers and other mechanism within their peripheries and where the said mechanism will not obstruct the operations of the machine. Now in order that said fingers may do their work and return promptly to starting position to work again several distinct movements thereof are necessary. To start with, the fingers should be open and out of the sides or plies of the tube, so that the paper tube may be fed or carried along at the speed of the machine without obstruction from the fingers. To this end the spindles 17 have a limited longitudinal movement, Fig. 31, so that when the fingers are engaged the spindles are drawn inward and are held in what is engaging position by a coiled spring 18 about the neck of the spindle at the outer end, and this spring is strong enough to hold the finger in operative engagement, as shown in second and third positions, Figs. 34 and 36. The extent of this axial movement of the spindles is shown by the slight space between the head of the spindle and rolls F and G, Fig. 31, which space is taken up when the fingers are in engagement.

The purpose of cam-shafts V V′ will now be apparent. Thus, as seen in Fig. 31, when the fingers are out of engagement the spindles 17 are depressed against springs 18 by cams 20 on said shafts, and as long as cam 20 occupies the position seen in Fig. 31 the fingers will be out and free. When the shaft is rotated away, the springs 18 will immediately assert themselves and engage the edges of the plies with a grip against the forming-rolls; but in addition to being held to or away from the rolls F and G the fingers 15 and 16 require also to be rotated into and out of the plies, according as they are to be free or to engage. When they are in, they engage the side plies at four points, corresponding exactly to the four corners of the bag-bottom and constituting those corners when the bottom is formed. The relation of the fingers to the bag-bottom when their work has just been finished is seen in front elevation, Fig. 38, where the upper fingers have that instant been withdrawn and the lower fingers are engaged only a mo-

ment longer to help deliver the bag safely in the bite of the discharge-rolls H and A'.

Fig. 36 shows the same relation of fingers as Fig. 38 and also the position of the other connected parts when this occurs. In this view the lower cam 20 is shown as somewhat larger or longer than the upper one, so as to hold the fingers 16 in engagement a little longer, as just described. In this view it will also be seen that the rotation of spindles 17 to throw the fingers 15 and 16 out of the plies occurs before the depression of the spindles and fingers by the cam, as seen in Fig. 31, and to effect this outward rotation of the spindles, each spindle is provided with a lever 22 at its outer end and a bearing pin or projection 23 on its inner side, which is engaged by a spring-pressed plug 24, socketed in the roller F or G, as the case may be. The plug 24 is in constant engagement with the projection 23 and exercises its greatest pressure at the instant that its finger 15 or 16 is to be released from the bag-bottom, so as to prevent a dragging or halting release. In this instant operation there must of course be a corresponding release of the finger-controlling mechanism by the cam 20, which for the time being counteracts spring and plug 24 and holds the finger in the ply of the tube. Said cam 20 has a flat portion to bear against pin 25 after reaction upon the cam by the spring-pressed plug 24, and slack is provided for in the movements of the cam-shaft to allow this reaction to occur, as hereinafter described. This reaction takes place as soon as the flattened side of the cam begins to present itself to the pin 25, when instantly with a click the cam is turned by the pressure of plug and spring 24, with its flat part against pin 25, which signalizes the withdrawal of the finger from the bag-bottom. Of course all the fingers are subject to a like action, and hence for convenience a single finger alone is described. To enable this quick action of the fingers to occur while pinion W is constantly in mesh, I sleeve the said pinion with its hub on the shaft V or V' and form the end of the hub with a shouldered offset to engage a similar shoulder on the sleeve W', fixed on the said shaft V or V'. Between these shoulders there is room to allow the shaft to rotate reversely and regardless of pinion W to throw the fingers out. Then being out, the parts go on as before.

When the four fingers are first engaged and the bottom has begun development, the rolls F and G and the other bottom-forming parts are in what is here considered as second position, Fig. 34, and the said rolls are rotating in the direction of the travel of the bag. Inasmuch as each set of fingers turns with its roll and the fingers engage the edge of the plies hard against the roll and have also a pushing effect by or through their straight forward edge it follows that there is no slipping of the paper, and the bottom is quickly brought to the distended form seen in Fig. 38. The distance of the rotary travel of the fingers is limited to the length of the transverse brace-rib 29 they develop in the sides of the bag and is something less than the fully-developed width of said sides, substantially as shown in Figs. 2 and 4. The rotary movement of rolls F and G continues after both sets of fingers 15 and 16 are withdrawn and the follower 30, fixed to the upper roll, Fig. 39, has tucked the upper broad side of the bag behind the bottom, and the bag is then well in the grip of the discharge-rolls. The follower 30 is at least as wide as the bag and is supported by an arm 31 from a transverse rod 32, Fig. 35, in bearings on the upper roll and engaged by a spring-coil to normally press the follower 30 inward into the recess 34, formed for it in the roll F, as seen in Fig. 41, where it is out of the way when not in use. Then to bring it into action I employ a cam 35, Figs. 35 and 41, which bears against an arm 42, rigid with rod 32, and this mechanism, together with the rotation of roll F, carrying rod 32, in coöperation with lower roll G, causes the follower to take the position and do the work seen in Fig. 39.

Now, referring again to the forming-rolls F and G, we find that said rolls have the requisite rotary oscillation imparted to them from a cam 48, located in this instance within the hand or fly wheel S, Figs. 15 and 28. A lever or arm 49 has a roller 50 working in this grooved cam, and at its other end said arm is clamped on the hub of a segmental gear 51, which is free to rotate on shaft I and meshes with a segment 52, fixed on shaft J. Thus an oscillatory movement of the requisite rotation is imparted from cam 48 to the upper roll, and from this roll oscillation is communicated to the lower sectional roll or sections of roll G through the segmental gears z', z^2, z^3, and z^4, respectively, as hereinbefore described.

When the cam-arm 49 is at its lowest or zero point, as seen best in Fig. 15, the parts generally are in first position, Fig. 31, and in which position the fingers 15 and 16 are rotated into the plies, but do not yet engage the paper against rolls F and G. Now as the cam 48 continues to rotate the arm 49 rides rapidly up the steep portion thereof, and the two rolls F and G are carried forward together, and by the time the roller reaches the apex or highest point of the cam the bottom of the bag is made and carried down into the bite of the discharge-rolls H and A', the lower fingers 16 retire, and the bag is discharged. As this discharge takes place the rolls F and G are rotated back by the retreating of the cam-arm to zero or starting point, Fig. 15, and the bottom-forming mechanism likewise resumes its primary position of readiness to resume operations. The successive positions from first to last in the production of the bag-bottom, as illustrated in Figs. 31, 33, 36, and 39, are taken so rapidly that the several steps are blended practically into one operation

and that so speedy that it is practically instantaneous. Thus in a general way we see how a bag is made by this machine. There are, however, a number of minor parts and combinations of parts and movements or operations which have not yet been explained and which are necessary to a complete understanding of the details of both mechanism and operation. Take cam-shafts V and V′, for example. These shafts act alike in the control of the fingers 15 and 16, respectively, through similar lines of intervening mechanism, already described. Said shafts are mounted in bearings 12 on the oscillating rolls F and G, so that when said rolls rotate in either direction said shafts go with them. Each shaft also has a pinion W, meshing with gear Y′ or Y, and these gears are rigid with gears P and R, respectively, which rotate continually in the same direction, as already described; but, as seen by the arrows, Figs. 29 and 33, gears P and R and V V′ travel reversely to the oscillation or movement of rolls F and G when the bag-bottom is being formed or developed. This oscillation occurs while the cam-arm 49 is mounting to the apex *a′* of the actuating-cam 48, and hence since shafts V and V′ are carried along with their rolls in this movement and are meshed through pinions W with gears traveling in the opposite direction the said shafts have a double speed imparted to them at this time, which tells on the cams 20 to operate the fingers 15 and 16, as will now appear. Thus in Fig. 31 we see the relation of the cam on, say, shaft V to the finger mechanism, and relatively it is the same on shaft V′, so that description of one will answer for both. Here we see that the portion of the cam from *d* to *e*, Fig. 39ª, is in position on the arm 22 of the spindle 17 to depress the finger 15 and keep it out of engagement with roll F and is bearing against pin 25 enough to carry the finger inward within the plies of the tube. This cam has come to this position from position in Fig. 39ª. When the second position is reached, Fig. 33, the rapidly-revolving shaft has carried cam 20 off spindle 17, so that finger 15 can engage the tube; but it has not yet left pin 25, and so the finger is kept within the ply relatively as in Fig. 31. A substantially similar relation of parts is seen in Fig. 39ᶜ. The next instant, however, cam 20 leaves pin 25 and the short plug and spring 24 bring pin 25 back against shaft V with a click into third position, Figs. 36 and 39ᵉ, thus throwing the fingers out of the plies. This action rotates the fingers 15 out relatively as seen in Figs. 39ª and 39ᵇ. Here the fingers remain while the cam 20 is traveling from the disengaging position 39ᶜ to the reëngaging position, substantially as seen in Fig. 31, to repeat the operation. When the cam-arm 49 reaches the apex *a′* of the cam, the oscillating rolls F and G have gone to the limit of their travel, and the parts are in the position relatively as shown in Fig. 39. By this time both sets of fingers are released and the finished bag is in the bite of the discharge-rolls. Now the rolls F and G begin to rotate back with the gears P and R and Y and Y′ and continue until the cam-arm 49 again reaches zero-point, Fig. 15. Hence in this reverse rotation cam-shafts V V′ do not rotate, because pinions R simply move in unison with their operating-gears and are not turned; but the instant the backward oscillation of the rolls ceases the cam-shafts and their cams are again rotated, as before, and the operation of the bottom-forming parts is repeated. All these movements and changes of position are of course very rapid, as they require to be to accomplish the rapid work of this machine, and of course the timing of the several movements must be exceedingly accurate and regular to obtain perfect work.

The two bottom-folding plates 27 and 28, hereinbefore mentioned, operate, in conjunction with fingers 15 and 16 and the follower 31, to produce the bag-bottom and are arranged to operate on the opposite side of the bottom from said fingers and follower. These plates are provided with trunnions 55, Figs. 32, 38, and 41, operating in bearings 56, fixed to rolls F and G, as seen in Fig. 32, and are shown here as long enough to extend beyond the edge of the bag at each side. Their function is successively and progressively shown in Figs. 31, 33, 36, and 39. In Fig. 33 they have been rotated into position to pinch the bottom laps of the bag with sufficient tightness to enable the fingers 15 and 16 to exert their spreading action on the sides of the tube to develop the bottom lines in the sides. This, among other things, means the development of the stiffening or strengthening transverse rib 29, which is naturally developed at the points of the fingers and will be retired from the edge of the bag according as these inwardly-extending parts of the fingers have more or less length. If desired, the rib can be formed practically without any retirement in the plicated sides. When this operation has been performed, the said plates separate and assume the relation, first, as seen in Fig. 36, leaving the bag-bottom as seen in Fig. 37, and next as seen in Fig. 39, where the plate 27 is shown as retired and plate 28 is backing the bottom against follower 30 and accompanying the bottom down between the discharge-rolls. To enable this to be done, plate 28 is formed with three so-called "fingers" 60, and the discharge-roll A′ is annularly recessed about its middle portion, Fig. 28, to accommodate the middle one of the three fingers 60, the other two fingers coming outside said roll A′ and the bag being engaged on its two annular bearing-surfaces 61. Hence when the bag is tucked by plate 28 and follower 30, as in Fig. 39, and is thoroughly in the bite of the discharge-rolls the oscillating rolls F and G reverse their movement, and plates 27 and 28

are carried back to starting position by the operation of said rolls, as seen substantially in Fig. 31.

To get the foregoing movements of plates 27 and 28, a simple lever-and-spring mechanism is employed, as seen in Figs. 31 and 39. This mechanism consists of suitable uprights 63, levers 64, pivoted thereon, and links 65, connecting said levers with the plates 27 and 28. A coiled-wire spring 66 connects levers 64 near their middle, and a stop-arm 67 limits the inward movement of each lever 64. These several parts, with the rotation of the rolls F and G, give to the plates 27 and 28 the operation desired. The pull of spring 66 is inward on both levers, and hence the stop-arms come into use to keep the plates apart to allow the paper tube to pass through when the parts are in first position, Fig. 31. Then as rolls F and G rotate apart at this side the position of said plates is quickly changed, first to second position, Fig. 33, and then to 36 and 39 as said rolls are carried farther around and the pivot-points of said plates farther apart.

In the foregoing movements of forming-plate 28 any tendency to work inward from the position seen in Fig. 41 is overcome, and said plate is prevented from coming on the inside of plate 27 when said plates approach each other in their operations by means of the flat projection or finger 68, Figs. 38 and 41, fixed on or at one end of the plate and bearing at its other end against a roller 69 on the corresponding end of the upper roll.

Incidental to the forming of the bottom of the bag is the pasting thereof, so that when the bottom is folded it will also be pasted and finished. This occurs automatically during the progress of folding by a special line of mechanism comprising a paster 70, Figs. 14 and 33, shown in one extreme of its position to take a supply of paste from roll B^2, Fig. 39, and in the other extreme to apply the paste to the bottom, Fig. 31. The travel of the paster is back and forth between these points, and the mechanism is constructed and timed to do its work at the right intervals. To this end I employ a rock-shaft 72, Figs. 17, 28, and 39, carrying a crank-arm 73, operated by an eccentric 74 on the main or drive shaft of the machine and connected by rod 75 with arm 73. An upright arm or lever 76 is fixed on rock-shaft 72 and carries the paster 70 at its top on a short bearing-rod 77 therefor, having a spring coiled about it, Fig. 14, to engage the paster and press it lightly to its work. An arm 78, rigid with rod 77, and a link 79 on post 63 serve to carry the paster to both positions when arm 76 is vibrated. The paster operates with a wiping movement, caused in part by its own movements and the movement of the bag under the operations, particularly, of folding-plate 28. It remains in position even after the shorter fold of the bottom has been withdrawn, as seen in Fig. 36.

It should be noticed that it is possible to get the bottom folds within the pinch of folding-plates 27 and 28, as in Fig. 33, only before the side formations of the bag by fingers 15 and 16 take place. After that occurs and the plicated sides are spread by transverse ribs 29 the stock of the short fold of the bottom is in a measure taken up and folded toward rib 29, as shown in Fig. 36, in position to be folded over by the outside lap, and the grip of the plates is necessarily released as to this fold.

In Fig. 42 we have an elevation, partly in section, of the paste-roll B^2 and paste-receptacle C'. The said roll B^2 is slowly rotated by a pawl 80, carred by a collar on rock-shaft 72, engaging ratchet-wheel 81 on said roll. The paste-regulating device consists of a regulating-plate 83, fastened on an adjustable shaft 84 and having a hand controlling-knob 85 at one end to fix the elevation of the plate at its edge in relation to roll B^2, so as to allow more or less paste to pass and even the same on the roll. Two laterally-adjustable shoes 86 are carried by this plate and have radially-curved surfaces close to the roll, serving to carry back any surplus paste raised by the roll. These shoes are set apart the width of the bag, so that paste may rise between them, but not beneath them. The depth of paste carried over by the roll is determined by the regulating-plate 83. Up to this time the bag is still in the tube, and it remains a part thereof until the entire bottom is formed and pasted and the bottom of the bag is engaged by rolls H and A' for discharge from the machine. The roll A' is purposely geared to travel at a greater speed than the normal travel of the paper tube A, so that when the bag is in the bite of discharge-rolls H A' the tube will be held tightly stretched from this point back to the feed-rolls C and D, and severance of the tube thereby be promoted. Roll A' is rotated continually in the same direction by gear 88, Fig. 28, on shaft 89, carrying said roll, and a gear 90 on shaft I, meshing with gear 88.

Now, referring to the bag-severing mechanism, we return to Fig. 10. Here we find that this mechanism is located just in advance of feed-rolls C and D. Across the machine, just over the paper tube A and just in front of rolls C and D, is the cutter-bar 92, Figs. 20, 21, 22, and 23. This bar is pivotally supported at its rear end on a separate adjustable frame on the main frame of the machine and temporarily locked at its front end by a cut-away disk 93 or any equivalent mechanism and carries three distinct cutter-plates projecting over its front edge and having serrated or saw-tooth edges to promote the severance of the tube. Two of these plates 94 are ailke in construction and function and are fixed on the bottom of the cutter-bar, with a space between them equal to the dovetail tongue 95 on the short bottom lap of the bag, Figs. 9 and 30.

In the formation of the bottom of the bag it is desirable to have the side plies at their

inner meeting edges folded back between the long and the short laps of the bottom on a triangular fold *c*, Fig. 37, and thus prevent all possible pin-holes or the like for fine material to creep out of the bottom. To enable this back folding to be done, the shorter lap of the bottom is made with two diagonal slits *d' d'*, which thereby produce the tongue 95. Then in lapping the bottom the adjacent sides of the side plies are drawn through these slits and the triangles *c* are folded and pasted down on the short lap *f*, with the longer lap *g* over all. The cutters 94 are therefore constructed with inner inclined edges *h*, corresponding in relation and length to slits *d'*, and the toothed cutting edge of these cutters corresponds to the edge of the short lap *f* outside these slits. Then to cut off what becomes the tongue 95 I employ a central cutter 97, which is set sufficiently above the side cutters 94 to enable them to do all their work, including the diagonal slits *d'*, before the cutter 97 comes into action. This is possible because the striker 100, Fig. 20, delivers a quick horizontal stroke from below. The inclined slits *d' d'* being formed, the paper comes at once into position to sever the tongue on cutter 97, and the work is done. However, before the cutters 94 and 97 can act the other two cutters 101 and 102 must do their work. These two cutters are arranged to come within the paper tube and have a neck or stem 99 reaching within the former B, Figs. 11, 20, and 21, to which they are so fixed as to rigidly support the said cutters in the relation to the other cutters about as seen in Figs. 21 and 22. The lip-cutter 101 is preferably slightly circular across its edge and is designed to cut the lower broad side of the tube. Cutter 102 is slightly higher and straight across, but somewhat retired from cutter 101, and is designed to sever the double side plies lying just beneath. Then still farther back and partly overlapping this cutter from the side are the cutters 94 and 97, above described, and which are outside the paper tube. The several cutters operate successively from below and sever the paper only on their own transverse lines regardless of what may be above or below, and yet the act of severing the tube on these several different lines is practically instantaneous and is produced by a single stroke of the striker. The feed-roll C has a depression or annular groove around its center to make room for the neck or stem 99 of the cutters 101 and 102, which project back and are fixed to the former B.

The mechanism for operating the striker is shown in plan, Fig. 14, and comprises a diagonally-set shaft 104, carrying a gear 105, meshing with and driven by a gear 106 on the main drive-shaft. The striker 100 is fixed to a disk or wheel 107 on shaft 104 and has a curved shank to bring it at right angles to plicated tube A and close to the cutters. The machine is so constructed and the striker is so arranged that it can describe a complete circle without encountering any other parts or in any wise obstructing their operations.

If it be desired to provide the bag with a string-hole, as is done in this case, I employ a device for puncturing the paper tube at regular intervals, according to the length of the bag, and in position to bring the hole near the edge of the longer side of the bag, as seen at *k*, Figs. 1, 2, and 3. The means for making this puncture are plainly seen in Fig. 27 and consist of a bevel-pointed punch 108, supported on an arm of the bell-crank lever 109, pivoted at its angle on the frame of the machine and operated at right intervals by a tappet-wheel 110 on the end of striker-shaft 104. A spring 111 keeps the lever-arm 109 out of operating position against a stop, and a projection *m* on the wheel 110, striking a projection *n* on the arm, causes the punch to descend and make the puncture. The paper displaced by the punch is allowed to adhere along one edge of the hole and is bent or folded back toward the top of the bag in the further operations of the machine.

Another important part of the invention is the means for controlling the tension of the roll of paper A, Figs. 18 and 19. These rolls are liable to be very heavy, making them difficult for one man to handle and place in position. Again, it is of the utmost importance that they should have uniform tension from the time the roll is started until it is exhausted. Assuming then that the roll has been brought to the machine in the usual way with the shaft 112 inserted and the cones adjusted thereto, I employ a box 113, adjustable in a pivoted support on a bracket 114, and a pinion 115 and hand-wheel 116 to operate the box laterally. The shaft can be laid in the box or bearing 113 from above and is reduced at its bearing portion, so as to present shoulders on both sides of the box, and these engage the shaft by the box to make the adjustment. At the other end the shaft has a pulley 117, adapted to rest in a wooden or like bearing 118, Fig. 18. This pulley-bearing is removably attached to a pivoted bolster 119, engaged by a spring-catch 120 to hold it securely in operating position, as seen in Figs. 18 and 19, where the roll is just being put into place.

In operation the same measure of friction is obtained on bearing 118 whether the roll is just started to unwind or is unwound practically down to the shaft, because the decreasing distance from the shaft at which unwinding occurs is compensated by the diminishing weight of the roll on the bearing, and experience has demonstrated that one equals or balances the other so nicely that a uniform tension of the paper to the machine is obtained. If the roll requires lateral adjustment to place it in exact alinement with the former, the pinion 115 can be operated for this purpose.

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

1. The tube-former consisting of fixed top and bottom plates and a downwardly-inclined rear portion over which the paper travels into the former, the former being of a size at its base equal to a cross-section of the developed tube, vertically-inclined and adjustable guide-posts at the sides of the base of the former, laterally-adjustable plates in the sides of the former, plates at the lower edges of the former to underfold the sides of the paper and means to draw the tube over the former, substantially as described.

2. The former having a cross-section at its base equal to the cross-section of the completed tube, the laterally-adjustable plates overlapping the top and bottom of the bottom plate of the former to produce the side plies and to underfold and lap the edges of the paper tube, and the inclined adjustable uprights at the head of the former and at the ends of said laterally-adjustable plates, substantially as described.

3. In a paper-bag machine, a set of rolls and gripping-fingers with parallel forming edges or surfaces carried by said rolls to engage the paper tube at four points and develop the bag-bottom, said fingers having spindles extending through said rolls, and actuating mechanism engaged with said spindles on the opposite side of the rolls from said fingers, substantially as described.

4. In a paper-bag machine, a set of oppositely-located bottom-forming rolls and a set of fingers on each roll with parallel edges for forming the cross-ribs of the bag, and to engage the plies of the paper tube against said rolls, and spindles through said rolls for the fingers and rotarily and axially movable, in combination with means at the opposite ends of said spindles to rotate said rolls while the said fingers are in engagement, substantially as described.

5. A set of bag-bottom-forming rolls, one above the other, two fingers on each of said rolls having their forward edge parallel with the forming-rolls and arranged to engage the paper tube when the corners of the bag-bottom are to be formed, means to oscillate said rolls simultaneously and means to actuate said fingers consisting of rotary oscillating spindles through said rolls at right angles to their axis, and mechanism at the outer extremities of said fingers to actuate the same, substantially as described.

6. The bottom-forming rolls and the tube-gripping fingers on said rolls having their forward edges parallel, spindles through said rolls to oscillate and depress said fingers against the rolls, and mechanism connected with the outer ends of said spindles to oscillate and axially move the same, and means to oscillate the rolls and thus spread the bottom of the bag while the fingers are engaged, substantially as described.

7. The bottom-forming rolls and means to oscillate said rolls, devices on each of said rolls to engage the corners of the bag-bottom and press the same against the rolls, and means to grip the edge of the bottom as the said devices are engaged to hold the corners of the bottom substantially as described.

8. The forming-rolls and the gripping devices thereon, having parallel engaging surfaces, in combination with folding-plates to fold the bottom laps of the bag, said plates arranged on the forming-rolls to lie flat against the sides of the bag-bottom, substantially as described.

9. The forming-rolls and the gripping-fingers, and plates carried by said rolls to engage and hold the bottom laps of the bag, substantially as described.

10. The forming-rolls and the fingers and the bottom-folding plates supported on said rolls, and means to throw said plates into position to grip the end of the plicated tube when said fingers are in engagement, substantially as described.

11. The oscillating forming-rolls and means carried by said rolls to develop the bag-bottom, said means comprising devices to engage the corners of the bottom and means to lap the bottom, substantially as described.

12. The forming-rolls and means to oscillate the same, and plates carried by said rolls to engage and lap the bottom folds, fingers to engage the corners of the bag-bottom, and separate actuating mechanism for said plates and fingers, said fingers and plates supported on said rolls, substantially as described.

13. The forming-rolls and the fingers and bottom-lapping plates carried thereby, and a paste-applying device for the bottom arranged to operate in conjunction with said plates, substantially as described.

14. The bottom-forming rolls and the plates to lap the bottom of the bag, and a follower to tuck behind the lower of said plates, substantially as described.

15. The bottom-forming rolls, means on said rolls to determine the four corners of the bottom and develop a transverse rib in each side of the bag between said corners, plates on said rolls to fold the bottom laps, and means to paste said laps while engaged by said plates, substantially as described.

16. A set of oscillating forming-rolls, devices on said rolls to enter the plies of the paper tube and engage the tube against said rolls, a set of bottom-lapping plates pivoted on said rolls and links connected with said plates to control their operations, substantially as described.

17. In a paper-bag machine, a set of oscillating forming-rolls and bottom-forming mechanism thereon and a set of rotating discharge-rolls, one of said discharge-rolls being on the same shaft as the lower oscillating roll, substantially as described.

18. The bottom-forming rolls and the bottom-folding mechanism carried thereby, means to oscillate said rolls and means to oscillate said bottom-folding mechanism, the discharge-rolls, and means to rotate said dis-

charge-rolls continually in the same direction, said sets of bottom-forming and discharge rolls arranged to coöperate, substantially as described.

19. The oscillating rolls and the bottom-forming devices carried thereby, one of said rolls being in sections, the feed-rolls for the paper tube and the discharge-rolls for the finished bag, one of said discharge-rolls located between the sections of the lower oscillating roll, substantially as described.

20. The feed-rolls of the paper tube and the bag-discharging rolls holding the bottom end of the tube, in combination with means between said sets of rolls to sever the bag from the tube, and the bottom-gripping mechanism arranged to feed the edge of the bottom between the discharge-rolls, substantially as described.

21. The bottom-forming rolls and the discharge-rolls arranged to carry the finished bag downward between them, and the mechanism carried by the said forming-rolls to feed the bag between the discharge-rolls, substantially as described.

22. A set of oscillating forming-rolls, fingers on said rolls to enter the plies of the paper tube and engage the tube against said rolls, a set of bottom-lapping plates pivoted on said rolls at one edge, separate links connected with the said plates and actuating mechanism connected with said links, substantially as described.

23. In a paper-bag machine, a pair of oscillating forming-rolls and a pair of discharge-rolls and mechanism to feed the bag downward between the discharge-rolls comprising a set of plates pivotally supported on the said forming-rolls and a follower coöperating with said plates, substantially as described.

24. The combination of the oscillating forming-rolls, the gripping-fingers thereon to engage the corners of the bag-bottom, the bottom-folding plates pivoted on said rolls and the link mechanism connected with said plates, and the follower secured to the upper of said rolls, substantially as described.

25. In a machine substantially as described, means for puncturing the paper tube to form a string-hole in a bag, consisting in means to stretch the said tube, the tube-former having a hole in its top, a tooth to enter said hole, an arm carrying the tooth and means to actuate said arm intermittently, substantially as described.

26. In a machine substantially as described, a shaft to carry the paper-roll having a bearing-wheel and a friction-bearing for said wheel, whereby a uniform tension is maintained on the paper taken from the roll, substantially as described.

27. The paper-roll shaft having a bearing-wheel fixed thereto, a wooden bearing for said wheel and a pivoted support therefor, substantially as described.

28. The paper-roll shaft, a bearing-wheel on said shaft and a friction-bearing for said wheel, and a bearing for the opposite end of said shaft, substantially as described.

29. In a paper-bag machine, a paste-receiver, a paste-roll in said receiver, an adjustable paste-regulating plate and adjustable cleaning-shoes carried by said plate and having adjustable curved bearing-surfaces, substantially as described.

30. The oscillating bottom-forming rolls and the bottom-forming mechanism thereon, the lower of said rolls consisting of two sections and a set of discharge-rolls for the finished bag, one of which is located between said lower forming-roll sections, substantially as described.

31. The oscillating forming-rolls and the bottom-forming fingers and plates pivotally supported thereon, mechanism to actuate said fingers comprising a cam-shaft and cams, spindles carrying said fingers extending through said rolls and rotated by said cams, spring bearing against said spindles, and discharge-rolls, substantially as described.

32. A paper-bag machine comprising a former to make the paper tube, a set of tube-feeding rolls, a set of bottom-forming rolls, fingers on said forming-rolls to develop the four corners of the bag-bottom and plates to lap the bottom, means to apply paste to the bottom laps, cutters to sever the bag, and rolls to carry away the finished bag, substantially as described.

33. In a paper-bag machine, a set of fingers to develop the four corners of the bag-bottom and the brace-ribs between said corners, a set of plates to grip the bottom laps together when the fingers spread the bottom, means to carry and operate said fingers and plates and means to sever the bag from the tube and means to discharge the finished bag, substantially as described.

34. In a paper-bag machine, cutters to sever the paper tube and to slit the tube and means to strike the tube against the cutters, substantially as described.

35. In a paper-bag machine, a set of cutters to sever the paper tube transversely, and one or more cutting edges to slit the tube at an inclination to its serrated edge, and mechanism to bring the tube into cutting and slitting relation, substantially as described.

36. In a paper-bag machine, the combined tube severing and slitting cutters, in combination with a striker to force the tube into severing relation with said cutters, substantially as described.

Witness my hand to the foregoing specification this 16th day of July, 1897.

DANIEL APPEL.

Witnesses:
H. T. FISHER,
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