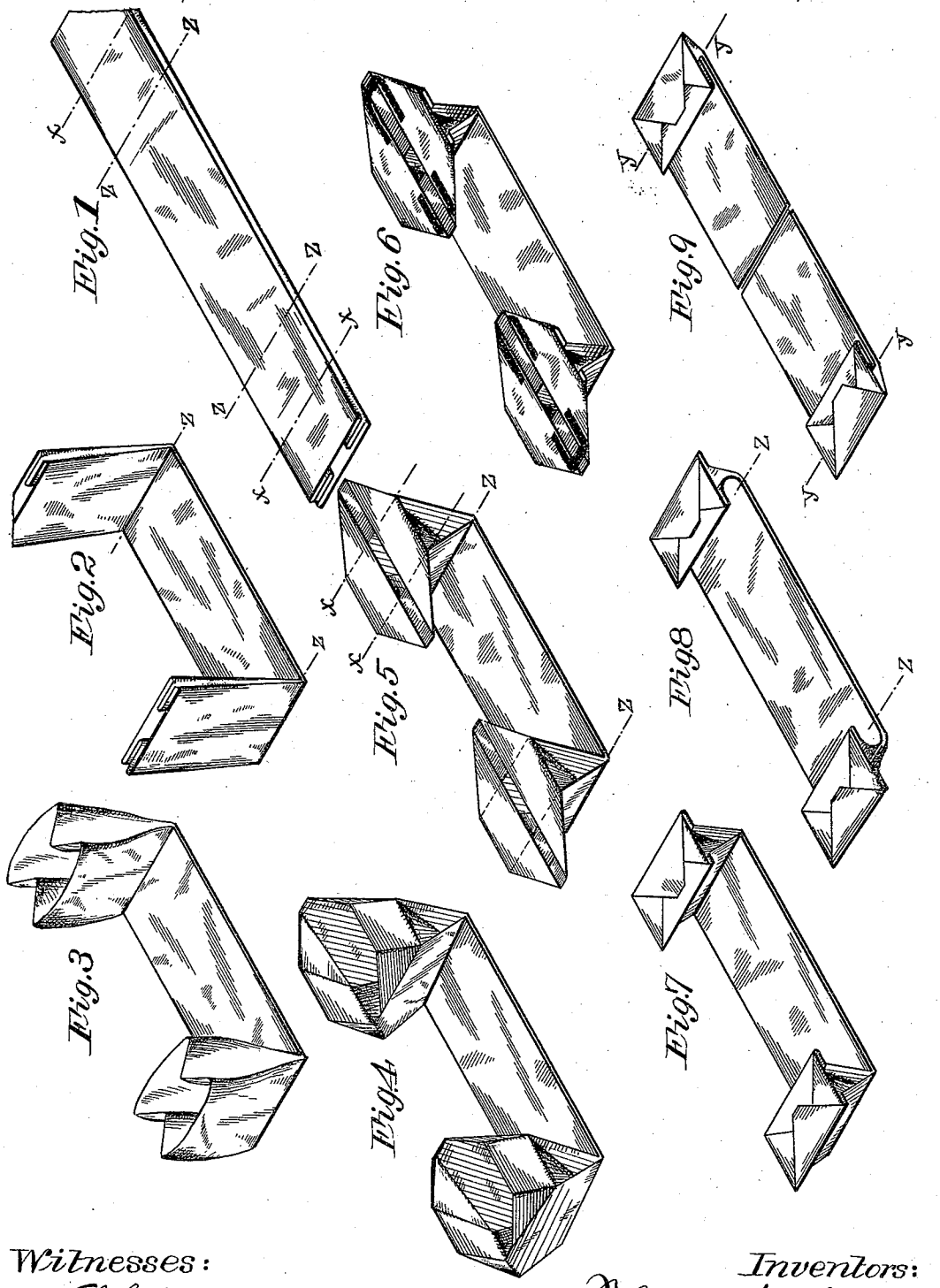
(No Model.) 10 Sheets—Sheet 1.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.



Witnesses:
W. H. Howiss.
H. Mallmer

Inventors:
William A. Lorenz
Edward E. Claussen

(No Model.) 10 Sheets—Sheet 2.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

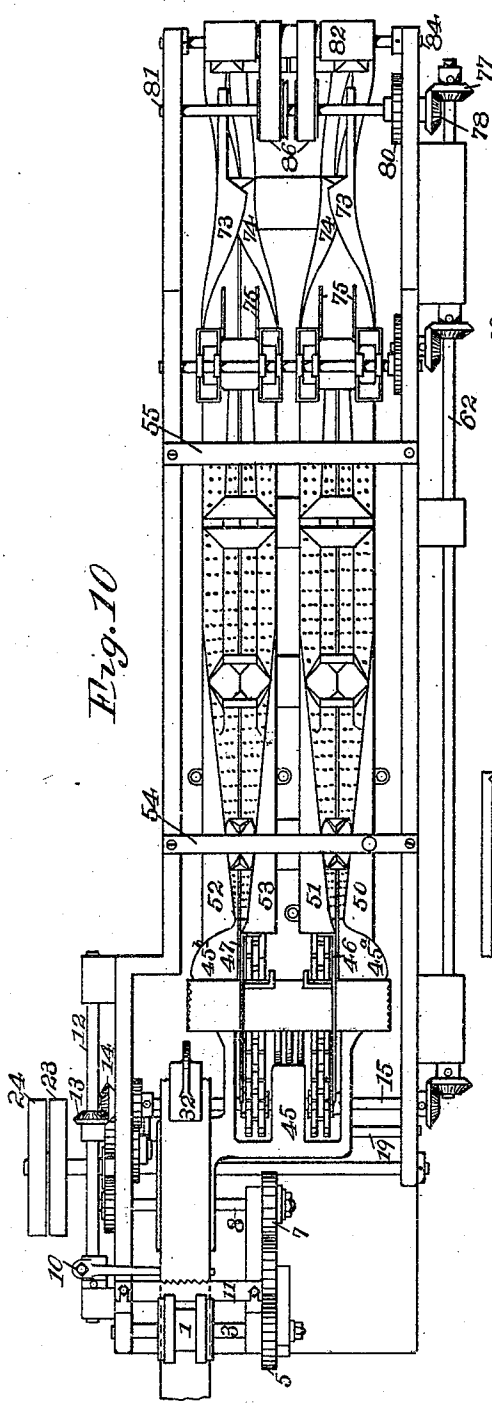


Fig. 10

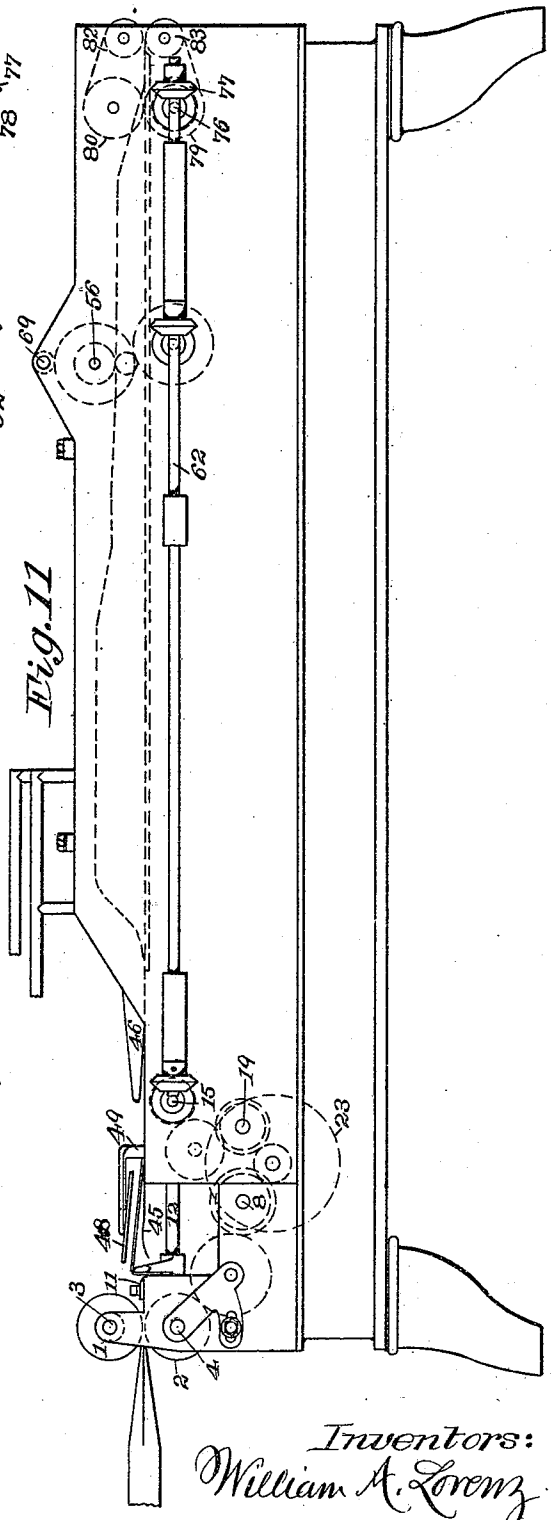


Fig. 11

Witnesses:
W. H. Howiss.
H. Mallmer

Inventors:
William A. Lorenz
Edward E. Claussen

(No Model.) 10 Sheets—Sheet 3.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

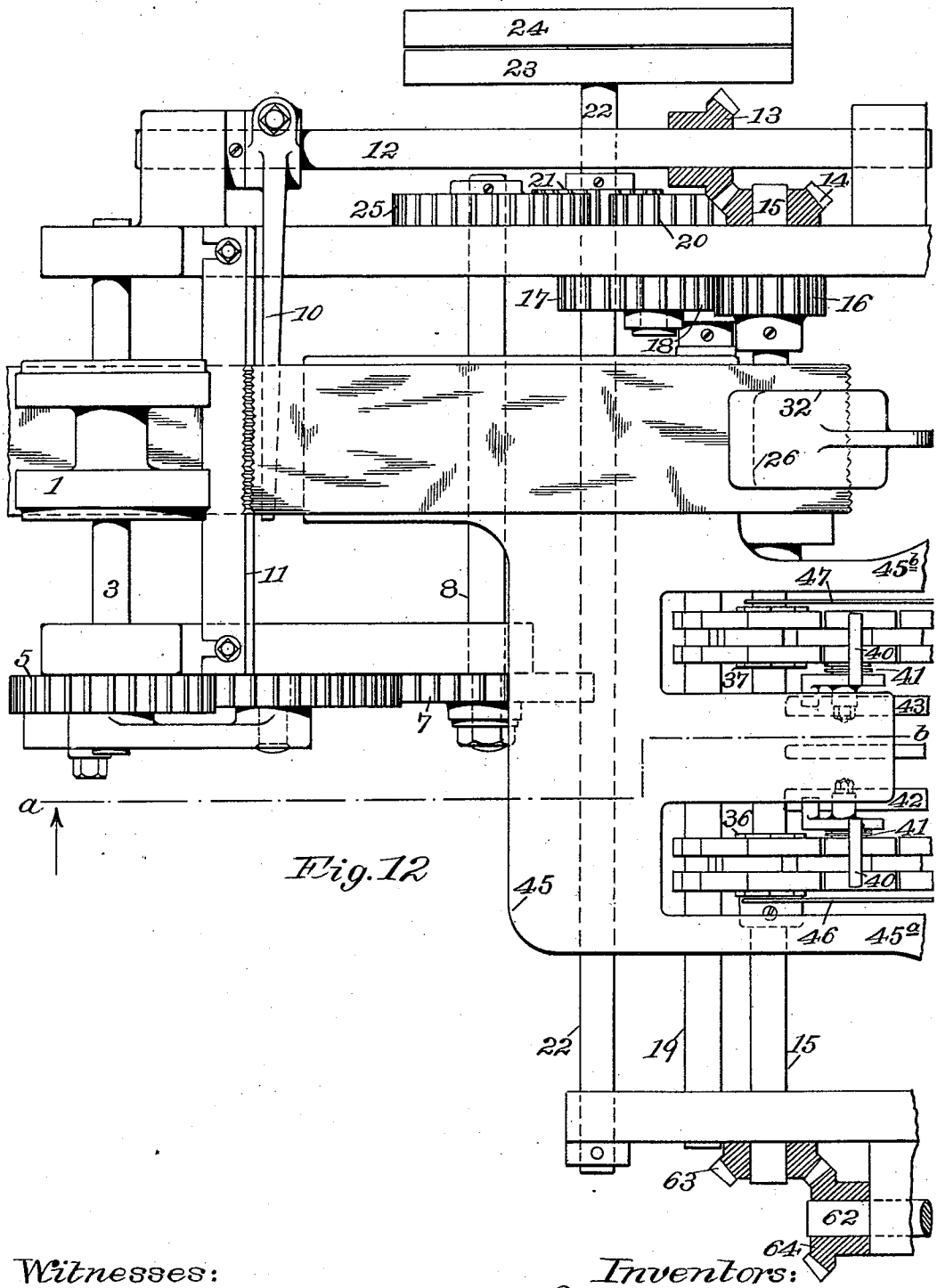


Fig. 12

Witnesses:
W. H. Honiss.
H. Mallner

Inventors:
William A. Lorenz
Edward E. Claussen

(No Model.) 10 Sheets—Sheet 4.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

Fig. 13

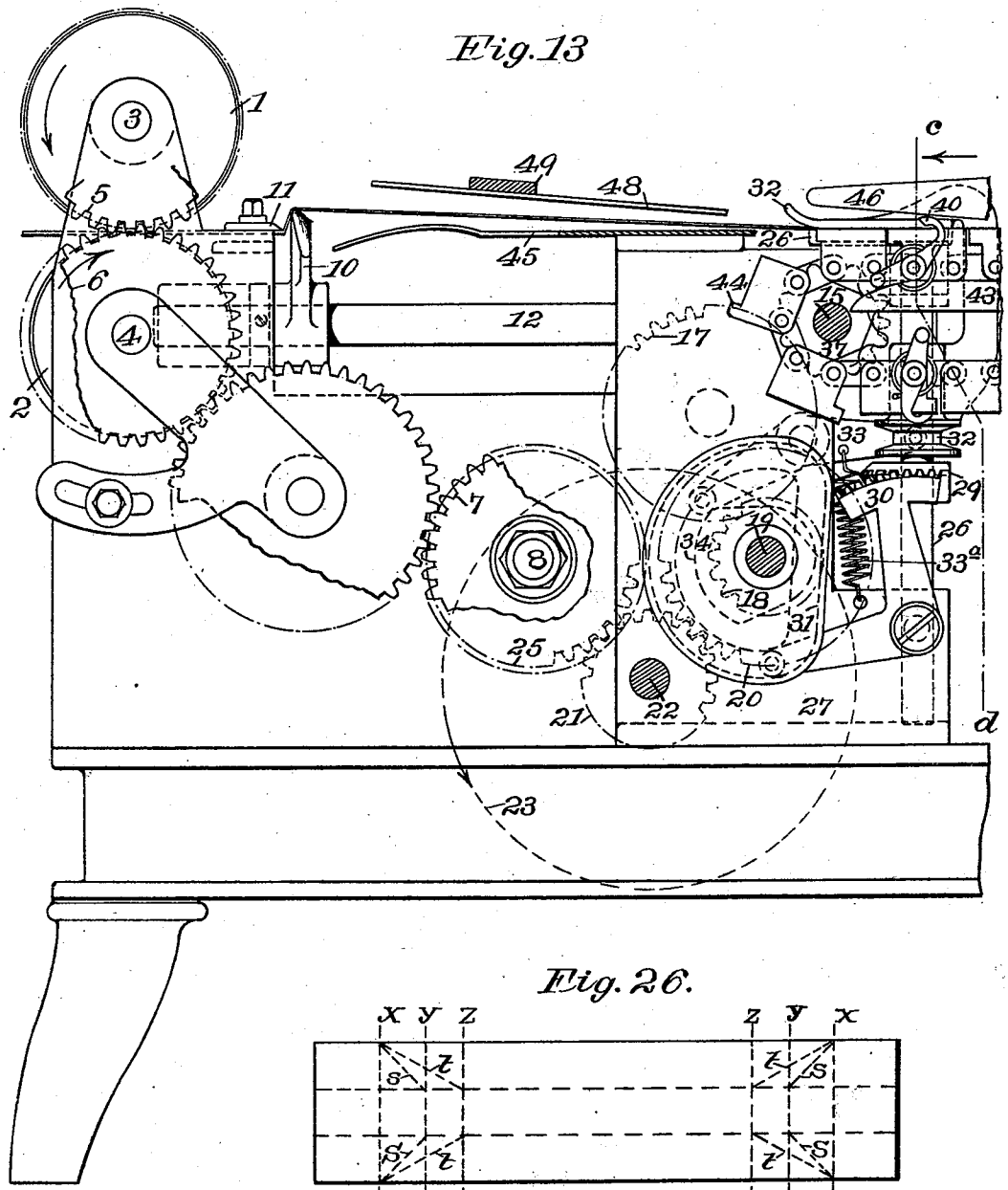


Fig. 26.

Witnesses:
W. H. Howiss.
H. Mallmer

Inventors:
William A. Lorenz
Edward E. Claussen.

(No Model.) 10 Sheets—Sheet 5.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

Fig. 14.

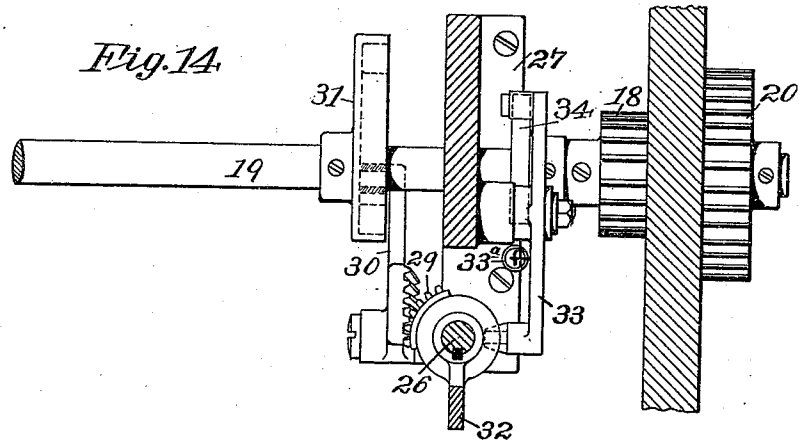
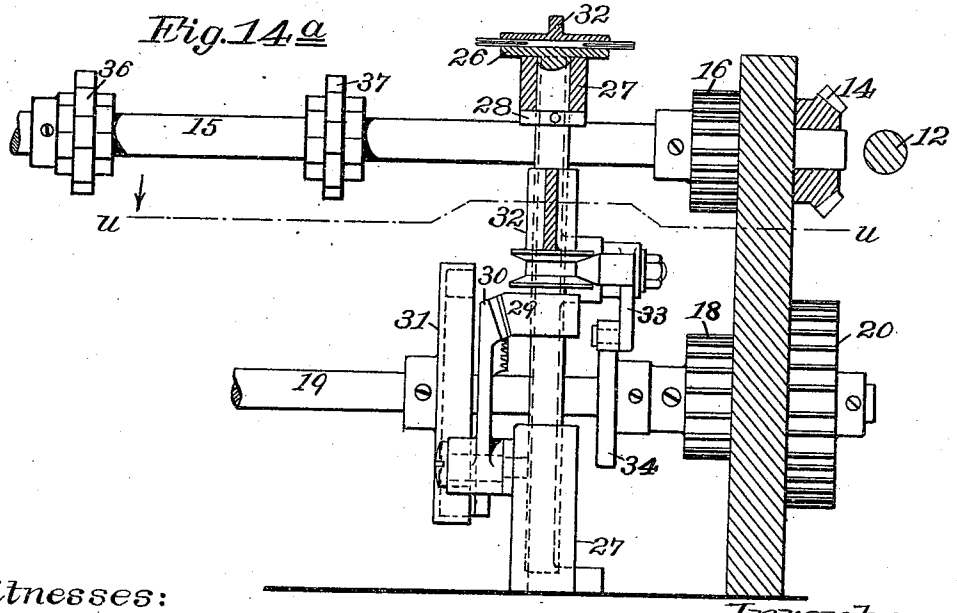


Fig. 14a.



Witnesses:

W. H. Louiss.

H. Mallmer

Inventors:

William A. Lorenz

Edward E. Claussen.

(No Model.) 10 Sheets—Sheet 6.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

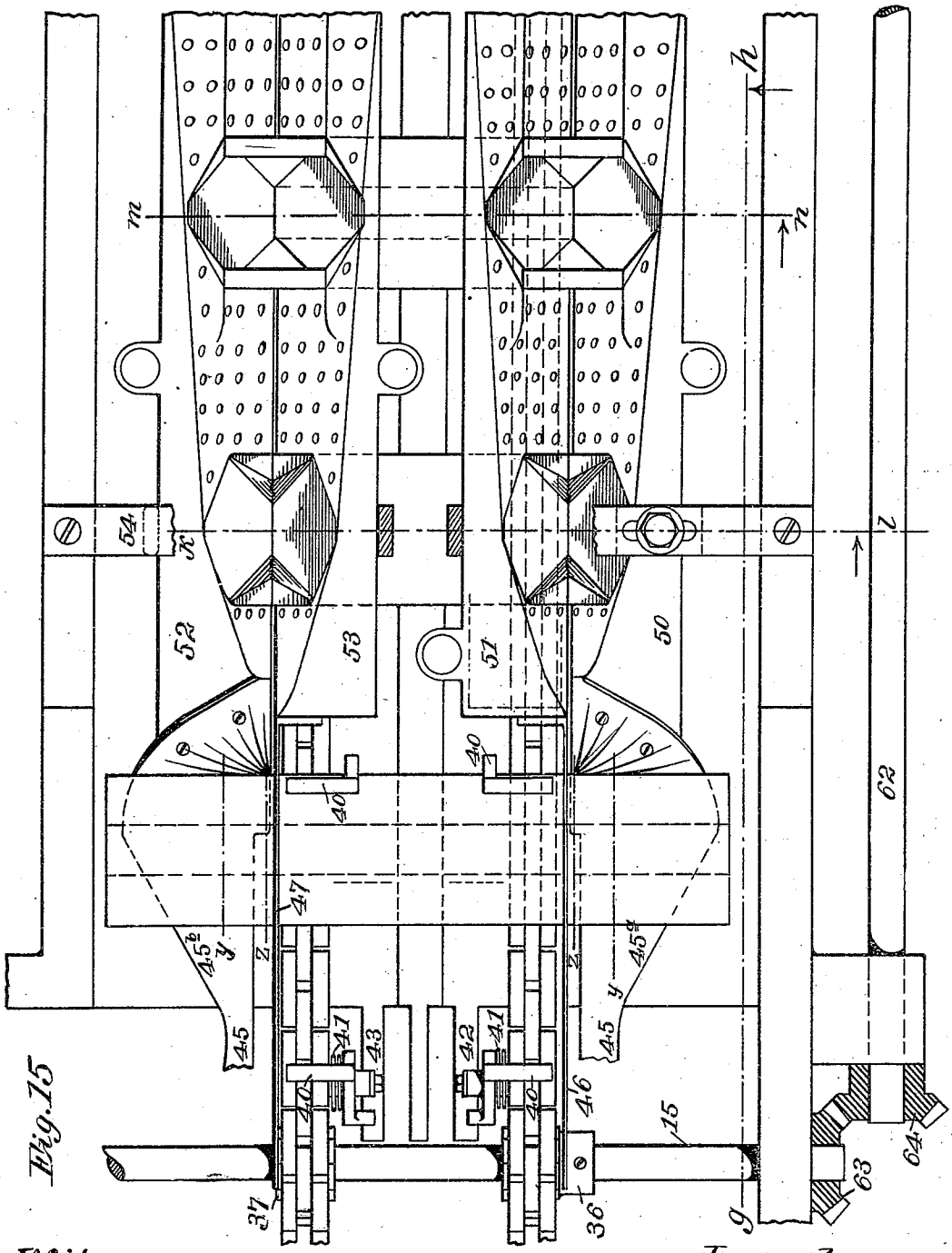


Fig. 15

Witnesses:
W. C. Hovius.
H. Mallmer

Inventors:
William A. Lorenz
Edward E. Claussen

(No Model.) 10 Sheets—Sheet 7.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

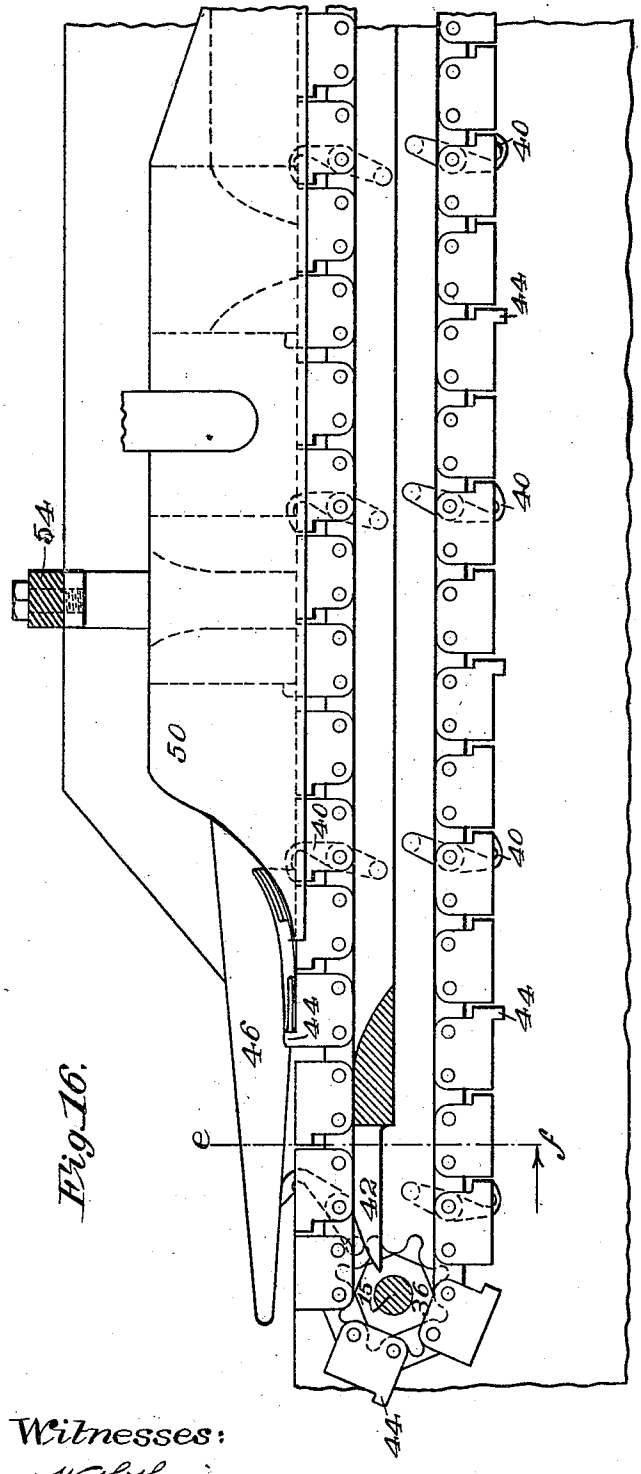


Fig. 16.

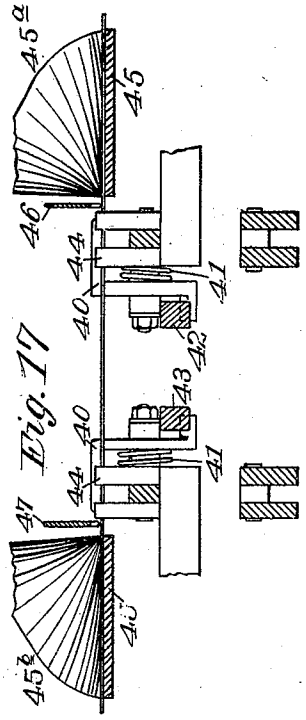


Fig. 17.

Witnesses:
W. H. Bonniss.
H. Mallner

Inventors:
William A. Lorenz.
Edward E. Claussen.

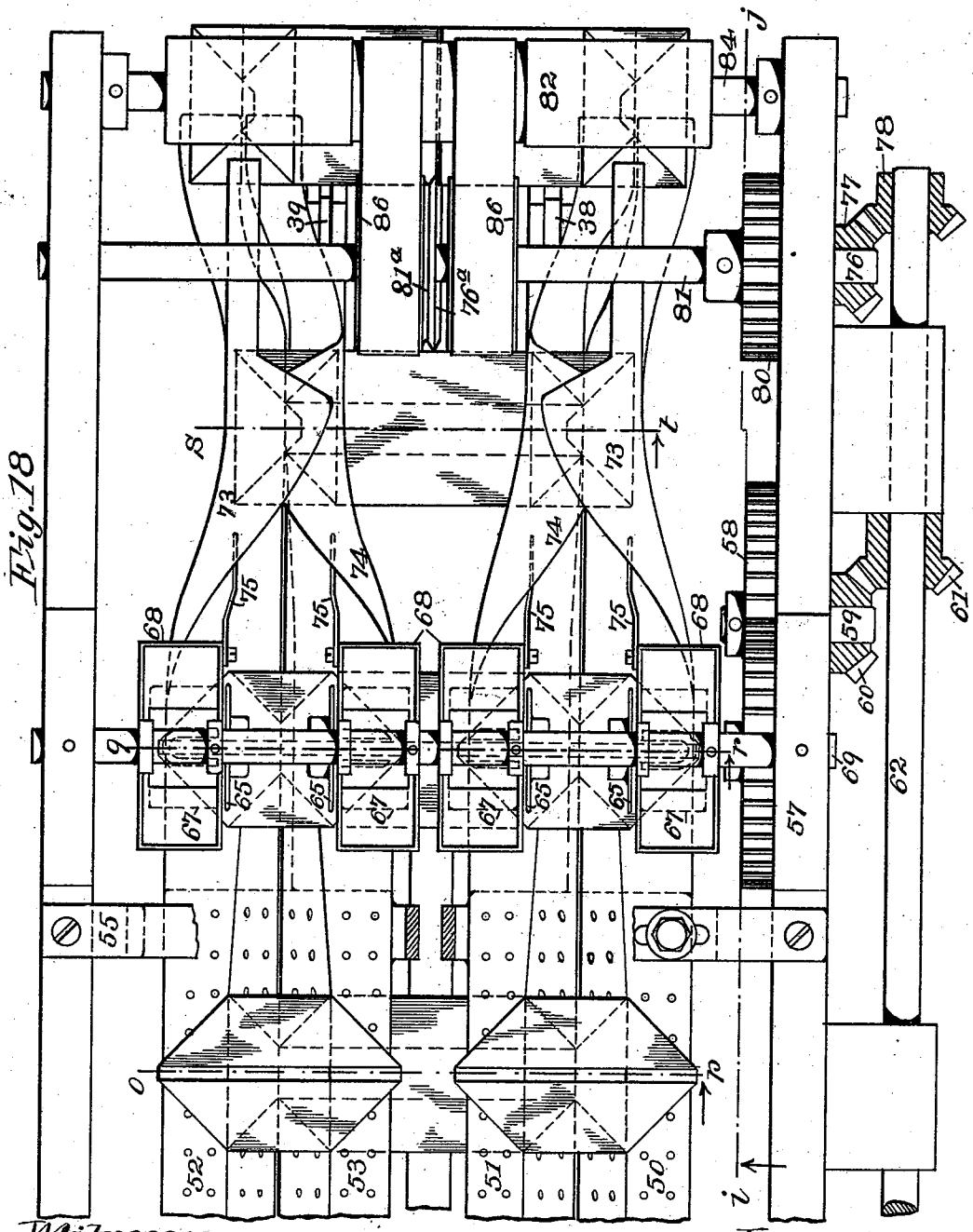
(No Model.) 10 Sheets—Sheet 8.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

Fig. 18



Witnesses:

W. H. Homiss.

H. Mallmer

Inventors:

William A. Lorenz

Edward E. Claussen

(No Model.) 10 Sheets—Sheet 9.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

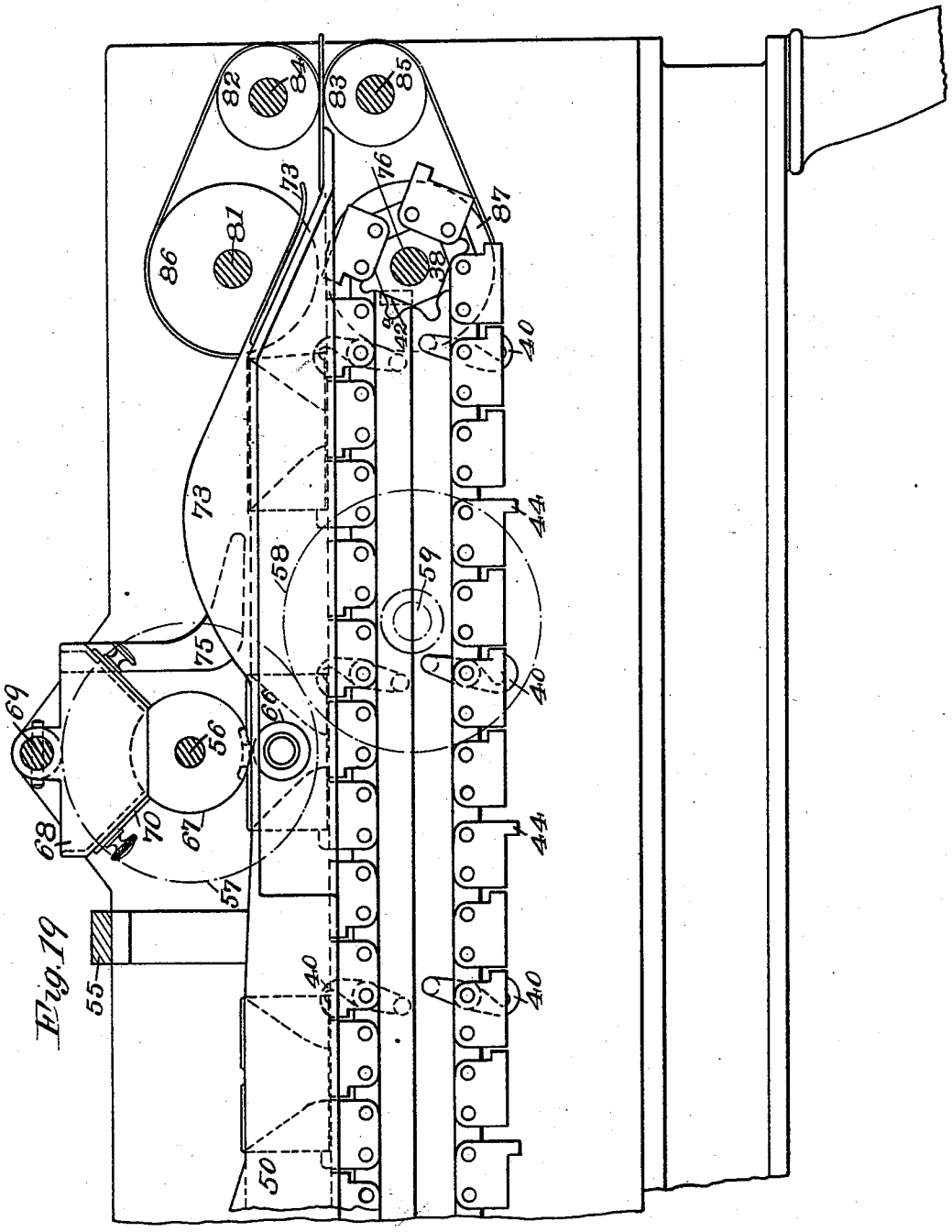


Fig. 19

Witnesses:
W. H. Louiss.
H. Mallmer

Inventors:
William A. Lorenz
Edward E. Claussen

(No Model.) 10 Sheets—Sheet 10.

W. A. LORENZ & E. E. CLAUSSEN.

PAPER BAG MACHINE.

No. 553,652. Patented Jan. 28, 1896.

Fig. 20

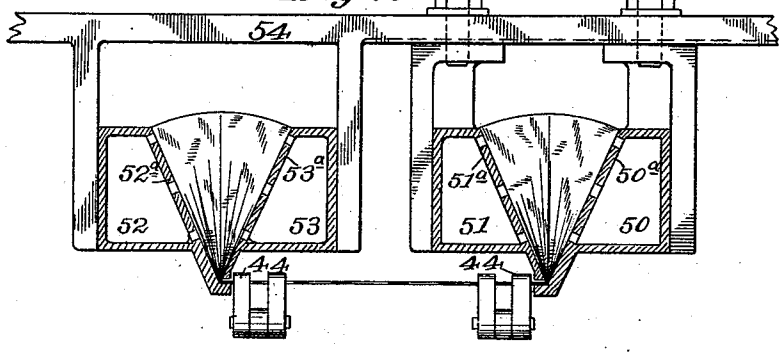


Fig. 21

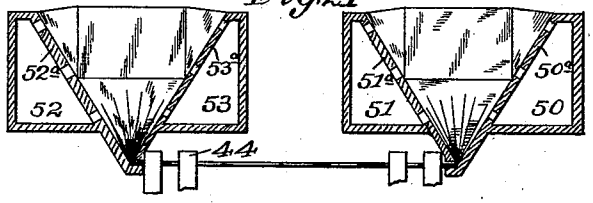


Fig. 22

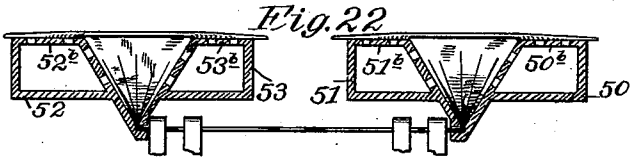


Fig. 23

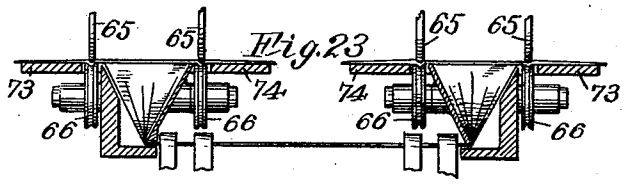


Fig. 24

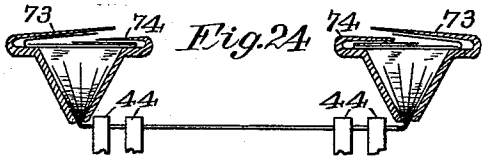


Fig. 25

Witnesses:
W. H. Honiss.
H. Mallmer

Inventors:
William A. Lorenz
Edward E. Claussen

UNITED STATES PATENT OFFICE.

WILLIAM A. LORENZ AND EDWARD E. CLAUSSEN, OF HARTFORD, CONNECTICUT, ASSIGNORS TO ALBERT H. WALKER, TRUSTEE, OF SAME PLACE.

PAPER-BAG MACHINE.

SPECIFICATION forming part of Letters Patent No. 553,652, dated January 28, 1896.

Application filed May 5, 1894. Serial No. 510,186. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM A. LORENZ and EDWARD E. CLAUSSEN, citizens of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Paper-Bag Machines, of which the following is a full, clear, and exact specification.

This is a new and improved machine for automatically manufacturing square-bottomed paper bags from tucked-paper tubing in a manner substantially in accordance with the process set forth in our application for Letters Patent of the United States, executed and filed contemporaneously herewith.

It consists in devices which sever from a continuous tucked-paper tube a blank sufficiently long to make two bags, and which turn that severed blank in its own plane at a right angle to its former position and transfer it laterally to a traveling linked carrier, by which it is gripped at equal distances from its ends, leaving a suitable length projecting from each side of the carrier to form a bag-bottom. In this position it is carried along in suitable relation to suction-formers, which first turn up the ends of the blank at right angles to its middle reach and then spread open those ends into the diamond form. Other improved devices then paste, crease, and fold down the end flaps of the diamond.

An important feature of this invention is the arrangement of means whereby the triangular folds in the bellows sides of the blank are not reduced to their final proportions until after the bottom folding is completed, thus allowing greater freedom of movement to the paper in the formation of those folds.

Reference is made to the accompanying drawings, in which—

Figures 1 to 9, inclusive, are isometric views of a blank in the different stages of its folding operation as performed by the machine of our present invention. Fig. 1 represents the blank of tucked tubing. Fig. 2 shows the ends turned up at right angles to the body of the blank. Fig. 3 shows the plies slightly drawn apart, and Fig. 4 shows them about half folded. In Fig. 5 the bottom plies are folded into the diamond form, and in Fig. 6 the side plies of the tube above the bottom are shown partially closed together. In Fig. 7 the bottom flaps are shown folded down, thus completing the bag-bottoms. Fig. 8 shows the blank partly flattened down, the side plies being brought nearly together, and in Fig. 9 the blank is shown quite flattened and cut apart into two completed bags. Figs. 10 and 11 are respectively a plan view and a side view of our machine. Fig. 12 is a plan view, drawn to enlarged scale, of the left-hand end of the machine of Fig. 10, showing the devices for cutting off and transferring the blanks to the carriers. Fig. 13 is a side view in section taken on the line *a b* of Fig. 12. Fig. 14 is a plan view, partly in section, taken on the line *u u* of Fig. 14ª, of the parts which operate the transferring device. Fig. 14ª is an end view, partly in section, taken on the line *c d* of Fig. 13, and shows the construction and relation of the transferring mechanism. Fig. 15 is a plan view of the middle portion of the machine of Fig. 10, and Fig. 16 is a side view, partly in section, on the line *g h* of Fig. 15. Fig. 17 is a sectional end view taken on the line *e f* of Fig. 16. Fig. 18 is a plan view of the right-hand end portion of the machine of Fig. 10, and Fig. 19 is a sectional end view taken on the line *i j* of Fig. 18. Figs. 20, 21, 22, 23, and 24 are end sectional views of the formers and are taken on the lines *k l* and *m n* of Fig. 15 and on lines *o p*, *q r*, and *s t*, respectively, of Fig. 18. These views are made looking toward the right in Figs. 15 and 18. For greater clearness the above section-lines are supposed not to pass through the blanks or the carrier-links. Fig. 25 is an edge view of the pair of completed bags as they emerge from the rolls, shown at the extreme right of Fig. 18 after being cut apart. Fig 26 is a plan view of a length of tubing such as is employed in this machine, showing the relative position of the fold-lines made therein by the operation of this machine.

The tucked-paper tubing for this machine may be made by any of the well-known devices now used for that purpose, and is drawn into the machine by the drawing-rolls 1 and 2, fixed on the shaft 3 and 4, and driven by the gears 5 and 6, respectively. Suitable motion

is derived from the change-gear 7 on the shaft 8 by means of an intermediate gear carried on a yoke in the usual manner and adapted to be swung into contact with the different sizes of change-gears required to feed the different lengths of tubing for various sizes of bags. The lengths of tubing are severed by a rotating striker-arm 10 and a knife 11, as shown in Fig 13, when a slack has been formed in the tube, as hereinafter explained. The knife is adjustably clamped on the frame of the machine and the striker is adjustably clamped on the rotating shaft 12, they being left adjustable to suit the different lenghts of blanks. The shaft 12 has fixed upon it the bevel-gear 13, which meshes with the bevel-gear 14 on the shaft 15. That shaft has fixed upon it the gear 16, which is driven through the intermediate gear 17 by the pinion 18 on the cam-shaft 19. That cam-shaft has fixed upon it the gear 20, which is driven by the pinion 21 on the pulley-shaft 22, and that shaft is driven by means of a belt upon the tight and loose pulleys 23 and 24. The pinion 21 also meshes with and drives the gear 25 on the change-gear shaft, for imparting motion to the drawing-rolls.

The gripping and transferring devices are best seen in Figs. 13, 14, and 14^a. A gripping-table 26 has its stem journaled in the bracket 27 with its lower end abutting against the bottom of its hole, and is kept from rising by a a collar 28. The sector bevel-gear 29 is fixed upon the stem of the table and meshes with the cam-arm sector 30, which also engages with the cam 31 on the shaft 19, that cam being of a suitable form to cause the table to oscillate through an angle of about ninety degrees. The gripper 32 is fitted to slide longitudinally upon the stem of the table 26 and is made to turn with that table by means of the spline shown in Fig. 14. An annular groove is formed in the gripper, in which is fitted one end of the lifting-lever 33, the opposite end of that lever being held by its spring 33^a into engagement with its cam 34 on the shaft 19. The function of that cam and spring is to raise and lower the gripper 32 at suitable times for gripping and releasing the bag-blanks.

The mechanism for carrying the blanks through the machine consists of two endless linked carriers which travel side by side, carried by the sprocket-wheels 36 and 37 on the shaft 15, and by the sprocket-wheels 38 and 39, respectively, on the shaft 76. Those carriers are composed of a series of blocks linked together, some of which, at suitable intervals in the chain, are provided with grippers 40 pivoted thereon. One end of each of the grippers is adapted to lie upon the top of its block so as to grip a bag-blank thereto by the action of the spring 41, and the other end of the gripper is adapted to be engaged by the cam-pieces 42 and 43 for opening and closing the grippers at the proper time for receiving the blanks, and by the cross-arm 42^a (best seen in Fig. 19) for releasing those blanks. These grippers are so arranged upon the carriers as to travel side by side in pairs. At a suitable distance back from each of these pairs of grippers are located the lugs 44, for the purpose of insuring correct and square register of the blanks upon the carriers.

The lower plate 45 (best shown in Fig. 10) is attached to the frame of the machine and extends from beneath the cutting-off position of the blank to the beginning of the suction-formers, and is adapted to support and guide the blanks as they are transferred from the knife to those formers. The forwardly-extending wings 45^a 45^b of the plate 45 are curved upwardly, as best shown in Fig. 17, and serve to turn the end portions of the blank up at a right angle with the body thereof, while the defining-plates 46 47, attached to the formers, extend over the blank and define the transverse lines on which those upward folds are made. A guard-plate 48, supported by the arm 49, serves to prevent the blank from being thrown too high by the striker-arm.

Each of the formers of this machine is separated into two parts to allow the blanks to pass through between them, and therefore consists of the pair 50 51 and the pair 52 53. Their form and position with relation to each other and to the carriers are best shown in Figs. 20 to 24, inclusive. They are suspended from and supported by the bridges 54 and 55, which are supported at their ends upon the side frames of the machine. The adjoining inner walls 50^a, 51^a, 52^a, and 53^a of the members of each pair, against which the blanks are drawn in contact, are substantially vertical at the left-hand ends of the formers and are gradually inclined apart at the tops toward, the section-lines *k l* of Fig. 15, as shown in the section Fig. 20. That angular divergence is increased until nearly to the position of the blank shown at the section-line *m n* in Fig. 15, when the angle of those walls is substantially as shown in Fig. 21. To the right of the position of the section-line *o p* in Fig. 18 the angle formed by the two walls becomes more acute, as in Figs. 23 and 24. The adjoining lower edges of the walls 50 51 and of the walls 52 53 are separated far enough to allow of the passage between them of the body of the blanks, as shown in Figs. 20 to 24. The space on the outer sides of each of those walls is inclosed for a portion of its length by outer walls, which with the inclined walls form chambers within which is maintained a suitable partial vacuum by means of any well-known air-exhausting mechanism connected with the supply-pipes shown in Fig. 11. The length of those air-chambers is best indicated in Fig. 10 by the perforations shown therein.

The upper walls 50^b, 51^b, 52^b, and 53^b spring from the planes of the inclined walls 50^a, 51^a, 52^a, and 53^a, respectively, at a point about half-way between the positions of the blanks shown at *k l* and *m n* in Fig. 15, merging

gradually into horizontal positions at the line *m n* of the same figure, as shown in section in Fig. 22. The walls 50^a, 51^a, 52^a, and 53^a are perforated with air-holes leading to the suction-chambers, and the function of these walls is to regulate the extent to which the plies of the blank are to be separated by the action of the "suction." The upper walls 50^b, 51^b, 52^b, and 53^b are similarly perforated, and their function is to support the end flaps of the diamond folds of the blank as those flaps are drawn down by the suction. From the line *o p* to the line *q r* of Fig. 18 the angle between the inclined walls becomes more acute by the narrowing of the space between their upper edges, as shown by comparison of Figs. 22 and 23. The horizontal walls 50^b, 51^b, 52^b and 53^b are thereby correspondingly widened so as to afford a support for the diamond on both sides of its flap-fold lines, while those lines are being creased and while paste is applied to the blank.

The devices for creasing, pasting, and folding down the end flaps of the diamond are best shown in Figs. 18, 19, and 23. A shaft 56 is journaled in the frame of the machine, and has fixed upon it the gear 57, which receives its motion by means of the gear 58, shaft 59, bevel-gears 60 61, shaft 62 and bevel-gears 63 and 64 from the shaft 15, the proportions of the connecting-gearing being such that the two shafts 15 and 56 rotate at equal speeds. Upon the shaft 56 and in suitable relation to the path of the bag-blank are fixed the four creasing-wheels 65 which co-operate with four grooved wheels 66 journaled on the formers, to crease the blanks at the lines on which the end flaps are to be folded. These creasing-wheels are best shown in Fig. 23. The shaft 56 has also fixed upon it four paster-wheels 67, provided with grooves in their peripheries suitable for depositing paste upon the four respective flaps of the blank, as indicated in Fig. 6. The upper segments of the paster-rolls pass through the bottom of the paste-boxes 68, which are supported by the rod 69 fixed in the frames. The peripheries of the paster-rolls are scraped clear of paste by the scrapers 70, leaving the grooves full of paste, which is thus deposited in the desired lines upon the blanks.

Each pair of formers, as 50 51, is provided with the fixed curved wings 73 and 74, which, as the blank is carried from the position *q r* to that of *s t* in Fig. 18, serve to turn over the flaps from their position shown in Fig. 23 to that shown in Fig. 24. The bottom defining-plates 75 serve to define the square bottom of the bag and insure more accurate folding of the flaps upon the crease-lines. From the position of the line *s t*, as seen in Fig. 18, the spaces between the two pairs of formers diverge and their upper walls and wings are inclined downward, as shown in Fig. 19, so as to flatten down the blank to the form shown in Fig. 25.

The upper reaches of the carriers for the blanks are supported by a shelf-like extension of the frame, (best seen in Fig. 17,) which extends from the sprocket-wheels 36 37 to the sprockets 38 39 upon the shaft 76. That shaft is positively driven by the shaft 62 by means of the bevel-gears 77 and 78. The gear 79 is fixed on the shaft 76 and meshes with the gear 80 fixed on the shaft 81. Fixed upon the shafts 76 and 81 are a pair of cutters 76^a 81^a, by which the bags are cut apart as they pass through.

The rolls 82 and 83 on the shafts 84 85 respectively are adapted to flatten and press the folds of the bags, and they are driven from the pulley 86 and 87 on the shafts 81 and 76 by means of belts, which also serve to carry the bags to those rolls after they are released from the carriers.

The operation of this machine is as follows: The tucked-paper tubing is drawn from a suitable former, such as that partially represented at the left-hand end of Fig. 11, by the drawing-rolls 1 and 2, is passed under the knife 11 between the plates 45 and 48, and is seized between the table and its gripper 32. As the front end of the tube is thus arrested, a slack is formed therein between the gripper and the drawing-rolls, as shown in Fig. 13, at which time the striker-arm operates to sever the blank from the tube, which operation by means of the slack produces blanks with much cleaner cut edges than would result if the tube were to be stretched taut at the moment of severance. The severed blank, still clamped upon the table, is next transferred to one of the pairs of linked carriers by the operation of the cam 31 and connections, by which the table 26 is turned upon its bearings about ninety degrees, thus carrying the middle reach of the blank upon the carriers. The gripper is now raised from the table by the action of its cam 34, thus releasing the blank as it is carried forward by the lugs 44 on the chain. As soon as the blank has thus been brought into register by the lugs, it is seized at its leading edge by a pair of the grippers 40 and is carried forward beneath the defining-plates 46 47. The end portions of the blank which projects beyond the defining-plates are next turned up against those plates substantially at right angles to the body of the blank, as shown in Fig. 2, by means of the curved wings 45^a 45^b of the plate 45. The upturned ends of the blank are next carried between their respective formers and become subject to the action of the suction by which their plies are drawn apart, as shown in Figs. 3, 4, 20 and 21. Continuing, the end flaps are drawn down upon the top surfaces of the formers, as shown in Fig. 22, completing the diamond form, as seen in Fig. 5. Passing between the creasing-wheels the blanks are creased at the lines *x x* of Fig. 1 and have paste applied upon the flaps, as shown in Fig. 6. Passing by the curved wings 73 74 the

flaps are folded by those wings, the defining-plates 75 serving to prevent the diamond from being folded beyond the crease-lines.

At the position *o p* of Fig. 18 the blanks are of the form shown in Fig. 5, with the triangular side folds extending from the line *z* to the lines *x* in the latter figure. As the blanks are carried along from that position the two plies of its tucked sides are brought toward each other, thus altering the form of the blanks, as shown in Fig. 6, and after passing the position of the lines *s t* in Fig. 18 the bags are still further collapsed into the form shown in Figs. 8 and 9 by reason of the relation of the longitudinal spaces between the members of the two pairs of formers, which here diverge, as shown in Fig. 18, thus extending the central flattened reach of the blank from the lines *z z* to the lines *y y* and reducing the side triangular folds to their right-angled proportions, thereby enabling the bags to be collapsed. They are cut apart in passing through the shearing-rolls 76^a 81^a, are released from the grippers 40, and are delivered by the belts to a suitable table or to a drying-machine, the bottoms being pressed flat in passing between the rolls 82 and 83.

An important feature in this machine and one which differentiates it from all others in the art so far as known to us is the arrangement whereby the bottom folds are completed and pasted down before the side triangular folds are reduced to their final proportions. All previous machines of this class known to us have separated the side tucks of the blank only as far as the lines *y y* of Fig. 26, and have formed the right-angled triangular folds in their final proportions either before or simultaneously with the bottom folds of the bag. In this invention the plies which ultimately form those triangular folds are left open and slack while the bottom folds are being made, and the formation of those folds is therefore free from outside distorting influences.

In Fig. 26 the lines *y y* indicate the ultimate location of the primary transverse fold-line characteristic of all paper bags of this class, and upon which the blank or the upper plies thereof are ordinarily folded as the first step toward making the diamond and bottom folds; but in the present instance we open the top and bottom plies and the side tucks of the blank to a distance substantially beyond this ultimate location *y y* of the primary transverse fold-line, to or toward the lines *z z*, as indicated also in Figs. 2 and 5, and in Figs. 20, 21, 22, 23 and 24. The latter figure represents a section taken on the line *s t* of Fig. 18, at which location in the latter figure the plan view of a paper-bag blank appears. From this position *s t* of the blank it is carried toward the right in Fig. 18, and the location of the transverse fold-line is changed from its temporary or preliminary location *z z* to its ultimate or permanent location *y y* by means of the engaging surfaces of the formers, which diverge from the position *s t* and smooth out the upper ply of the blank, as indicated in Fig. 8, until that blank arrives at the rollers 82 and 83, at which point the blank is fully extended so that it will lie down flat. This flattened condition of the blank is not possible until the preliminary transverse fold-line is carried to its ultimate or permanent position *y y*, for the reason that the triangular side folds cannot be folded against the bottom of the bag until they are reduced to their right-angular proportions, as fully set forth in the specifications accompanying our application for a process patent above referred to. The transverse fold-line determines the position of the apexes of the triangular folds, and when that line has been transferred to the position *y y*, which is at a distance from the plane *x x* of the bag bottom equal to the depth of the side tucks, or equal to one-half the distance between the two lines *x x* of Fig. 5, the triangular folds may lie flat against the bag bottom because in that position their apexes coincide with the respective bottoms of the bellows side plies of the blank.

Another important improvement over previous machines of this class is in the means herein employed for carrying a double blank forward, and for folding its two ends simultaneously. Hitherto only single blanks have been folded by being drawn along in contact with a suction former. The constant tendency of the suction in these "side-draft" systems is to cause the blanks to hug the formers, thus drawing the ends back and tending to form the bottoms out of square with the bodies of the blanks. In the arrangement of this invention the carrying means operates as a "central draft" between the two equal retarding influences of the double formers upon the ends of the blank.

Referring to the plan view of the entire machine shown in Fig. 10, it will be seen that the general direction of travel of the tube and of the blank-carriers is the same, the blanks after severance being turned at right angles in order that they may be passed on in the same general direction as before. By this arrangement we are enabled to design the machine in convenient rectangular form with its shafts and principal motions parallel to each other. We thus avoid many objectionable features incident to the more obvious plan of arranging the tube-forming section at right angles to the blank-carrying section, in the form of an **L**, which not only requires more space, but is much more difficult to adjust and maintain in proper connection.

That arrangement of the formers whereby the ends of the blanks are turned up at right angles to their bodies is not an essential feature of this invention, inasmuch as those formers would operate with equally good results if the apexes of the **V**-walls faced toward each other and thus formed the bottoms in a plane at right angles to instead of parallel

with the general plane of the bodies of the blanks. In such an arrangement, however, the completed bag would be in the form of a T, and it would be necessary to turn the bottoms down upon the bodies for convenience in packing. Therefore we prefer to form the bottoms at once in a position parallel with the bodies. Furthermore, thus having the two bottoms in the same plane we are enabled to mount the two sets of creasing and pasting wheels upon the same shaft.

For greater clearness the blanks are herein represented as having considerable space between them on the formers, thus leaving many of the air-holes uncovered, which in practice would make it more difficult to maintain a suitable vacuum in the chambers. The blanks may, however, be caused to follow each other more closely, so as to keep nearly all of the holes covered, by increasing the relative speed of the mechanism which cuts off and feeds the blanks to the formers, and by adding suitable pasting surfaces on the pasting-wheels.

We claim as our invention—

1. In combination with means for feeding a paper tube longitudinally, and for severing the blanks therefrom, and with a carrier adapted to carry the severed blanks in a direction substantially parallel with the general direction of the tube before severance, a transferring device adapted to clamp the blank before it is severed, and after severance to turn it substantially at right angles and transfer it to the carrier in a position transverse to the direction of travel thereof.

2. In combination with tube forming and feeding devices, and with means for severing blanks from the tube thus formed, a carrier adapted to travel in the same general direction as the tube, and a transferring device adapted to receive the end of the tube, to clamp and hold it during severance, and to transfer the severed blank to the carrier in a position transverse to the general direction of travel thereof, substantially as described.

3. The combination of a carrier provided with a gripper, and adapted to carry a bag blank in a direction transverse to its length, a defining plate, and a curved wing adapted to fold the end of the blank up at an angle to its body on the line determined by the position of the defining plate, as the blank is carried along by the carrier, substantially as described.

4. The combination of a pair of linked carriers provided with grippers arranged to travel side by side in pairs, and provided also with corresponding lugs 44, arranged and operating to register a bag blank upon the carrier and to grip it when so registered, substantially as described.

5. Means for forming the primary transverse folds in a double bag blank, consisting of a pair of linked carriers provided with grippers and registering lugs adapted to travel side by side in pairs, a pair of defining plates for defining the location of the transverse fold lines, and a pair of curved wings adapted to turn up the end of the blank at an angle to its body upon the lines defined by the plates, substantially as described.

6. The herein described former consisting of two parts adapted to co-operate in forming the diamond and final folds of a passing blank, having between them a longitudinal space which is adapted to allow the plies of the blank to be separated to a distance substantially beyond the ultimate location of the characteristic primary transverse fold line, and adapted to reduce that primary fold line to its ultimate position after the diamond folds are completed, substantially as described.

7. The herein described former for making diamond folds in bellows sided bags blanks, consisting of the V walls 50^a, 51^a, separated at their apex by a longitudinal space for the passage of the bag blank, the walls 50^b, 51^b, springing from and joining the walls 50^a, 51^a, at a distance from their apex substantially greater than the depth of the side tucks of the blanks to be folded, for the purpose specified.

8. The herein described former for making diamond folds in bellows sided blanks, consisting of the V walls 50^a, 51^a, separated at their apex by a longitudinal space for the passage of the bag blank, the walls 50^b, 51^b, springing from and joining the walls 50^a, 51^a, at a distance from their apex substantially greater than the depth of the side tucks of the blank to be folded, with air chambers adjoining those walls, in which a partial vacuum is maintained, the walls being provided with a series of perforations leading to the respective air chambers, substantially as described.

9. Means for folding a double ended bag blank, consisting of linked carriers provided with grippers and adapted to carry a double blank in a direction transverse to its length, curved wings adapted to turn the ends of the blank up at substantially right angles with the body thereof, and the oppositely disposed pairs of formers, between the members of which the upturned ends of the blank are carried, the formers being provided with air chambers and perforations in which a partial vacuum is maintained, substantially as described.

10. In combination with means for carrying a bag blank, the herein described former consisting of two parts adapted to form the diamond fold in the blank by separating the principal plies thereof to a distance from the plane of the intended bottom substantially beyond the ultimate location of the characteristic transverse fold line, having a longitudinal space between the formers for the passage of the blank adapted to determine the temporary transverse line of fold thereof, and adapted to subsequently diverge from the line of travel of the carrier for the purpose of reducing the transverse fold line to its ultimate position, substantially as described.

11. In combination with a carrier adapted

to carry a double-length bag blank in a transverse direction, two pairs of formers adapted to form the diamond and final folds upon the opposite end of the blank, the members of each pair being separated by a longitudinal space for the passage of the blank, those spaces being arranged at a distance apart substantially less than that between the ultimate locations of the characteristic transverse fold lines of the double-length blank, then diverging from the point where the diamond folds are completed, for the purpose of reducing the transverse fold lines to their ultimate locations, substantially as described.

WILLIAM A. LORENZ.
EDWARD E. CLAUSSEN.

Witnesses:
W. H. HONISS,
H. MALLNER.