No. 840,073. PATENTED JAN. 1, 1907.

W. A. LORENZ.

PAPER BAG MACHINE.

APPLICATION FILED AUG. 23, 1900.

6 SHEETS—SHEET 1.

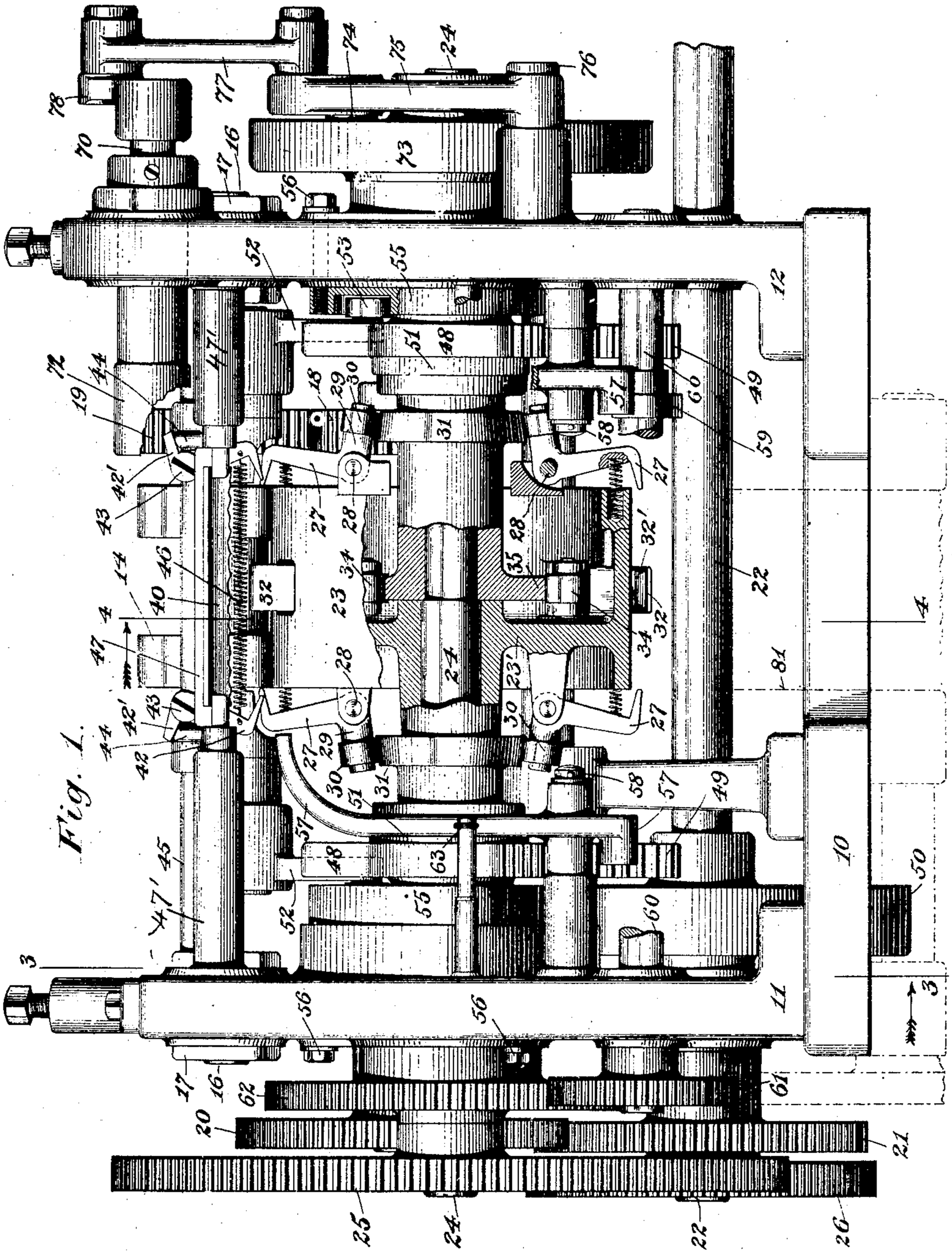

Fig. 1.

Witnesses:

Jas. Dangerfield.

Chas. F. Schmidt

Inventor:

William A. Lorenz

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6 SHEETS—SHEET 2.

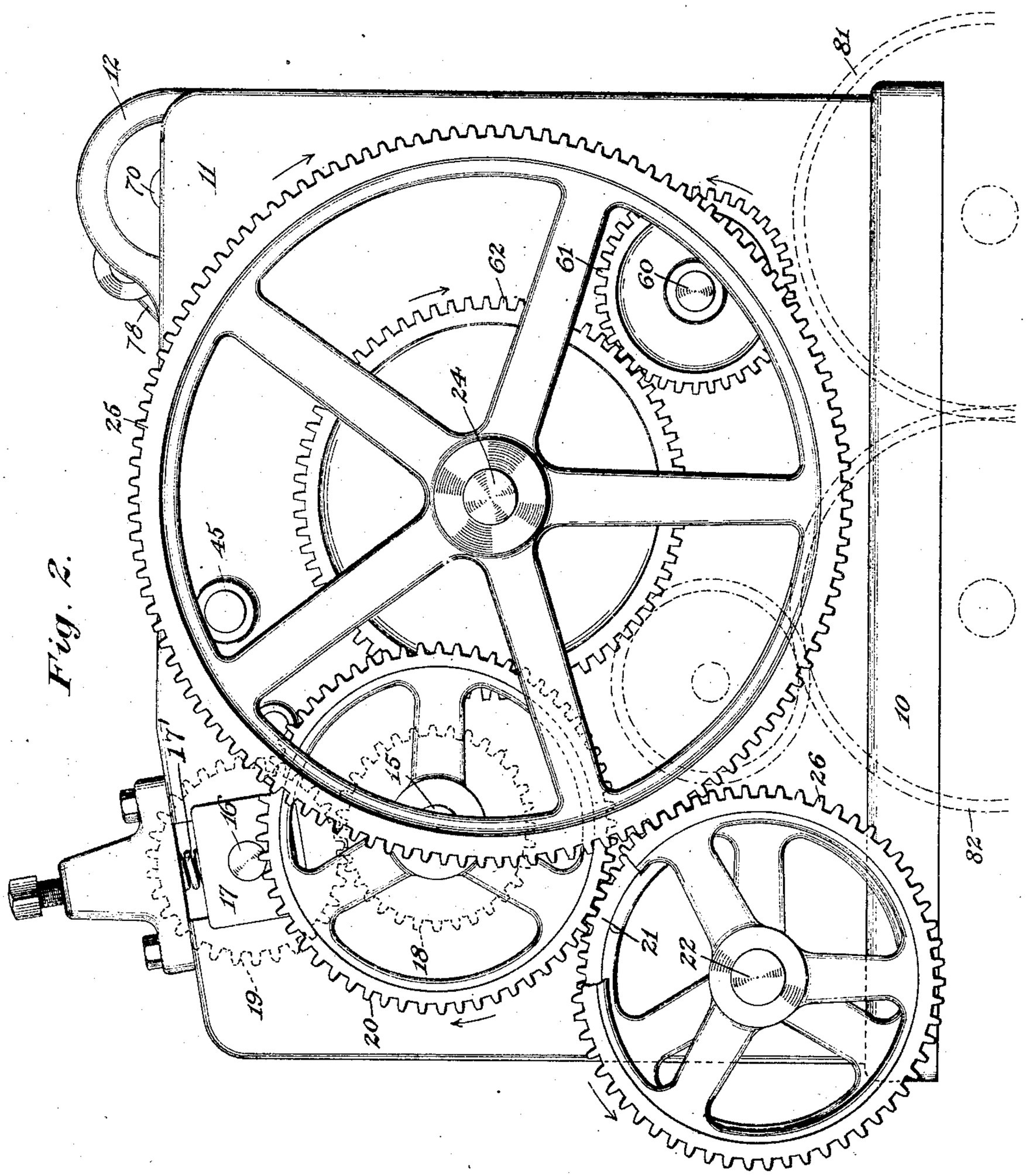

Fig. 2.

Witnesses:

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Chas. F. Schmidt

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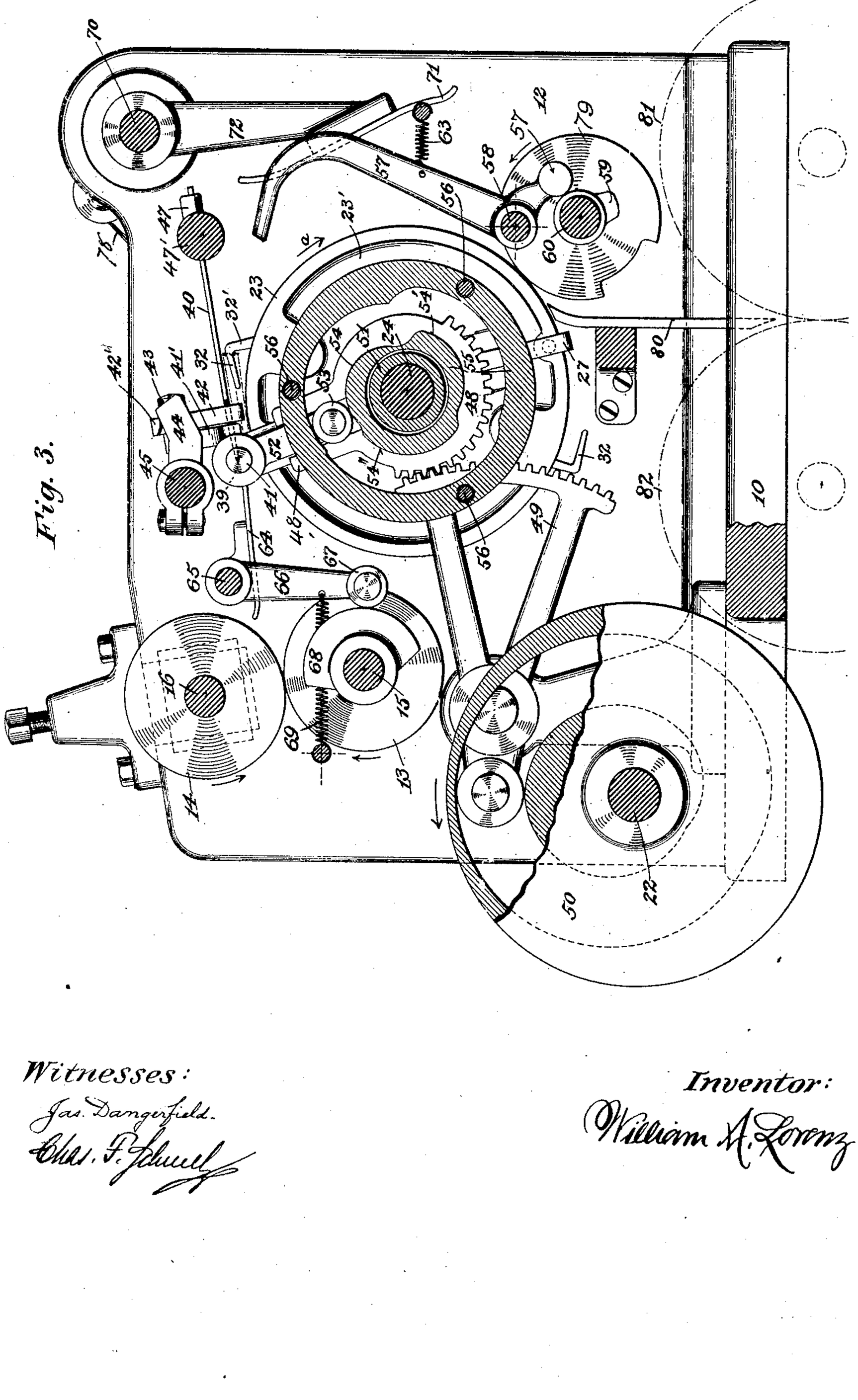
6 SHEETS—SHEET 3.

Fig. 3.



Witnesses:

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Chas. F. Schmeel

Inventor:

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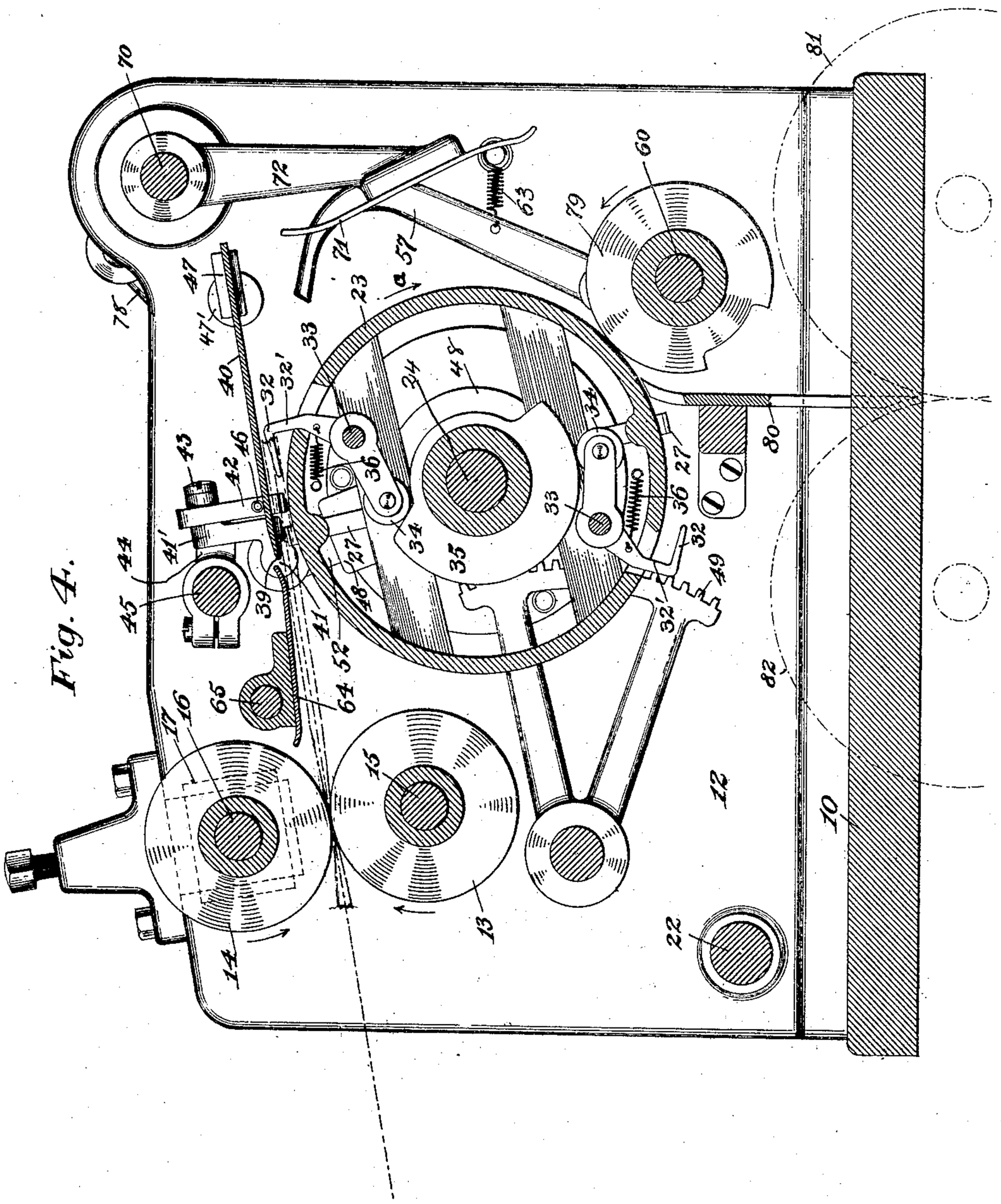
6 SHEETS—SHEET 4.

Fig. 4.



Witnesses:

Jas. Dangerfield.

Chas. F. Shuell

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W. A. LORENZ.

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6 SHEETS—SHEET 5.

Fig. 5.

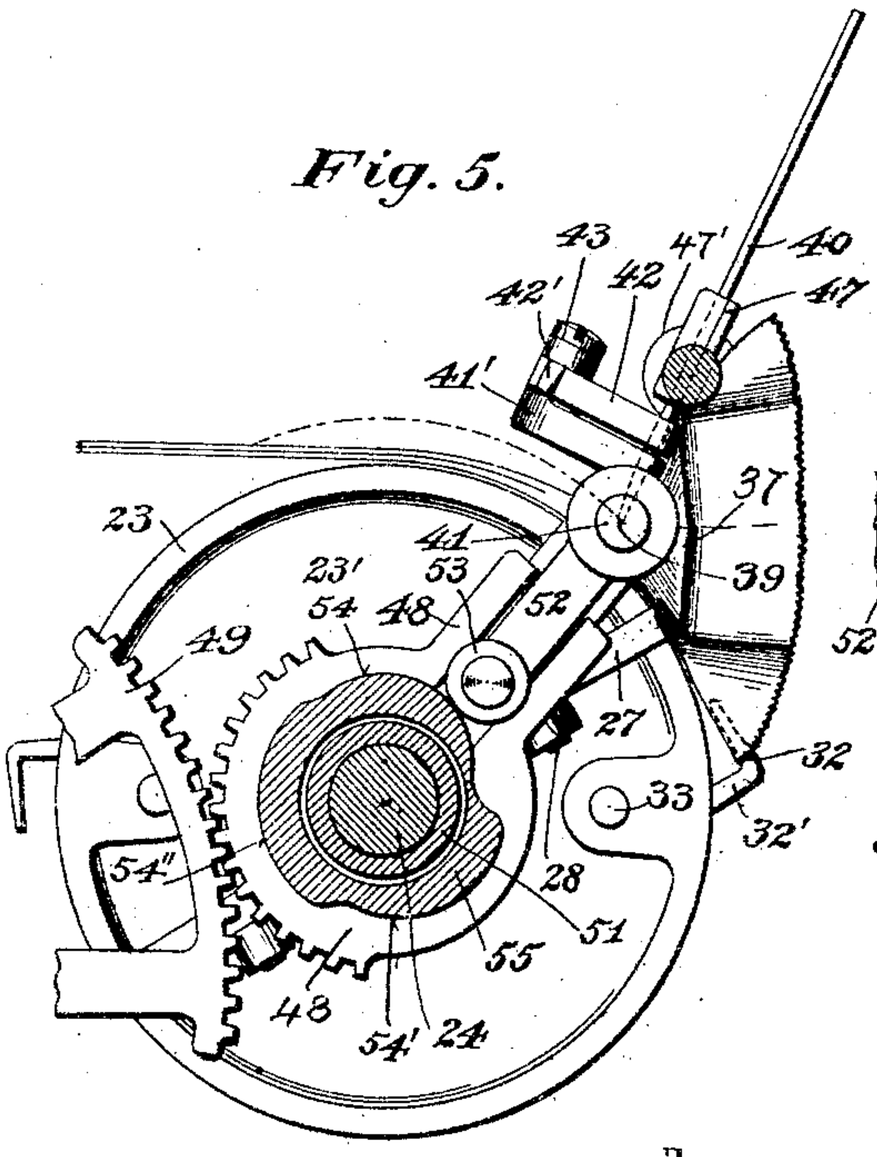


Fig. 6.

Fig. 7.

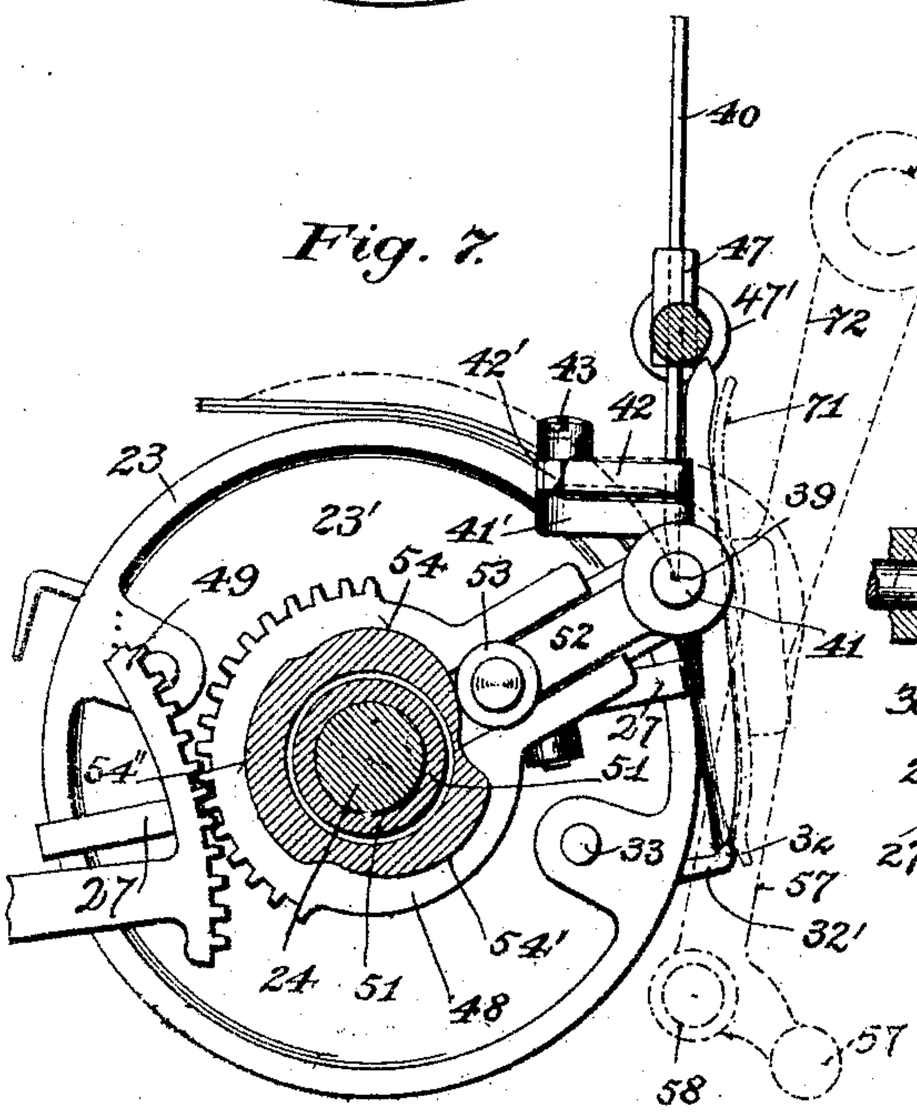
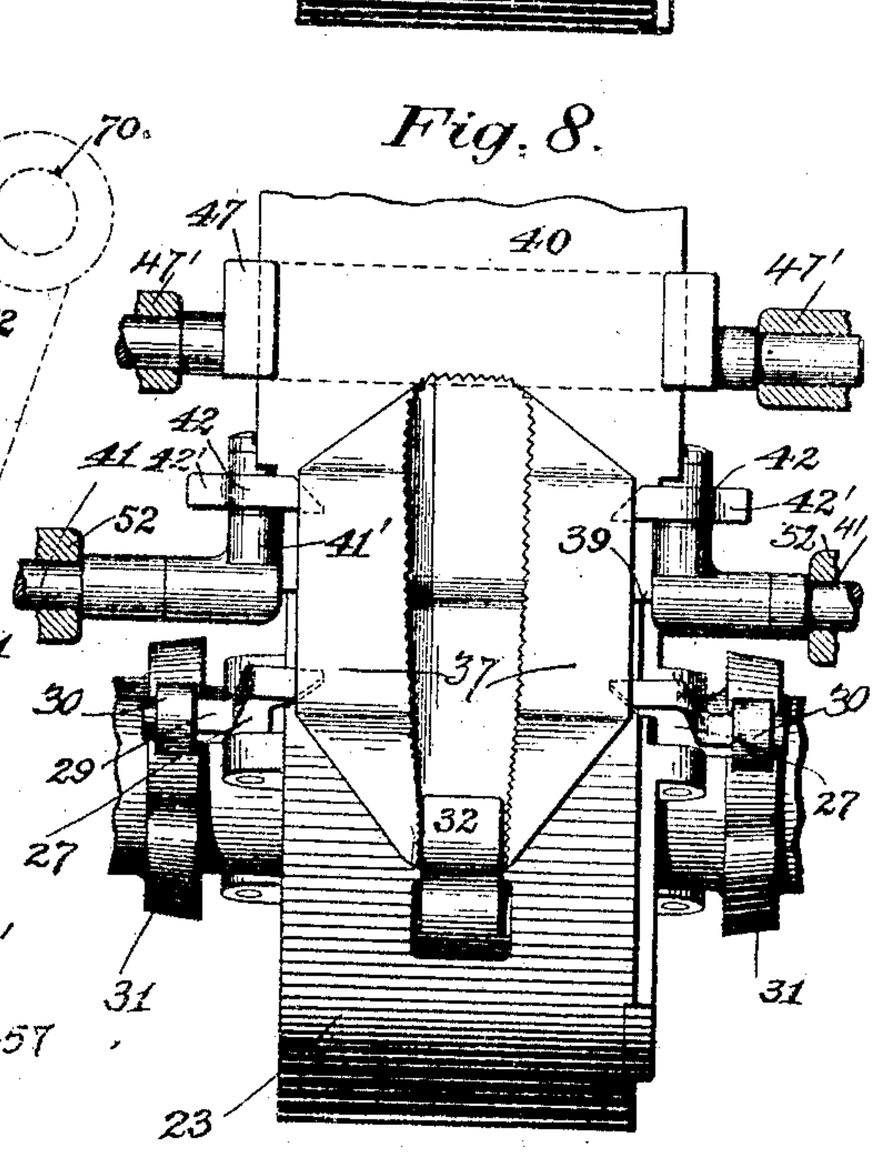


Fig. 8.



Witnesses:

Jas. Dangerfield.

Chas. D. Schmeltz

Inventor:

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No. 840,073.

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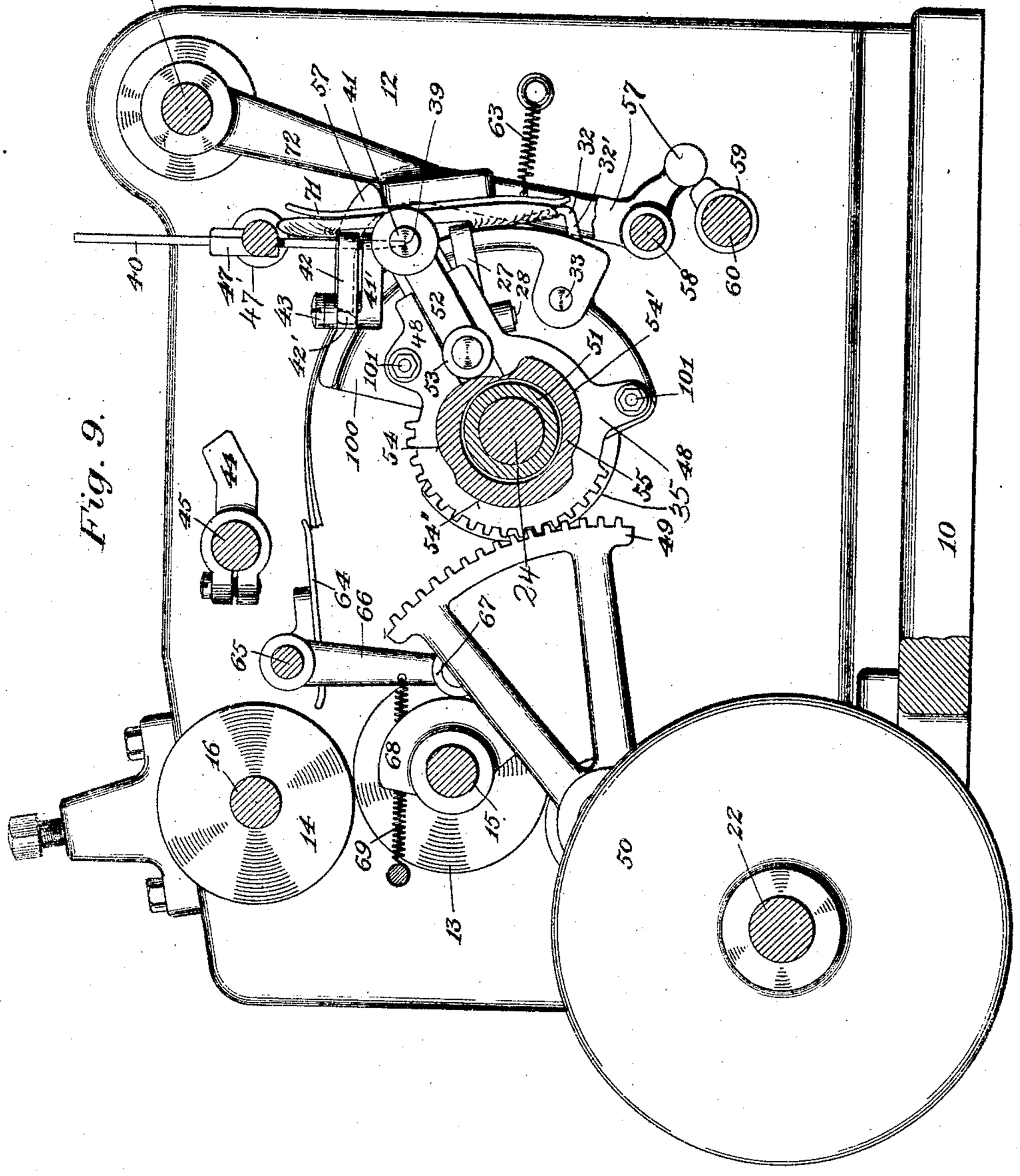
PAPER BAG MACHINE.

APPLICATION FILED AUG. 23, 1900.

6 SHEETS—SHEET 6.

Fig. 9.



Witnesses:

Jas. Dangerfield.

Chas. F. Schmelz

Inventor:

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UNITED STATES PATENT OFFICE.

WILLIAM A. LORENZ, OF HARTFORD, CONNECTICUT, ASSIGNOR TO UNION PAPER BAG MACHINE COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PAPER-BAG MACHINE.

No. 840,073. Specification of Letters Patent. Patented Jan. 1, 1907.

Application filed August 23, 1900. Serial No. 27,864.

To all whom it may concern:

Be it known that I, WILLIAM A. LORENZ, a citizen 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 invention relates to paper-bag machines, and particularly to that class thereof wherein square-bottomed bags are formed from tucked or bellows-sided tubing.

The invention comprises what is technically known as the "diamond-folding" section of a paper-bag machine, receiving the bellows-sided blanks from any suitable blank-forming mechanism, folding the well-known diamond folds therein, and passing the diamond-folded blank on to any preferred mechanism for completing the bag by pasting and cross-folding the end flaps of the diamond.

The general object of the present invention is to provide improved devices having an improved mode of operation upon the blank whereby the unfolding of the bellows side tucks and their refolding into the triangular and diamond folds is accomplished in a more natural, certain, rapid, and accurate manner than heretofore.

An important feature of this invention is that whereby the blanks are carried in a rotary path while the blank-folding mechanism is carried back and forth in an oscillatory path, having its approximate center of oscillation situated within the rotary path of the blank-support, whereby the blank-folding mechanism may be carried in coactive relation to the blank and its folding-bed throughout a very considerable angle of their respective rotary and oscillatory movements, thereby giving more time for the blank-folding operation and also permitting the blank-folding mechanism to return in the most direct line and with the least amount of necessary movement to its coactive relation to the succeeding blank. Means extraneous to the blank-support are provided for operating the parts of the blank-folding mechanism as it is carried forward and back. Thus the blank-support travels forward continuously with the successive blanks, while the blank-folding mechanism, mounted and driven in practical independence of the blank-support, oscillates forward and back in close and extended coactive relation to the succeeding blanks. In this way a single set of blank-folding mechanism may be employed to great advantage in connection with a mulple blank-support or folding-bed carrying a plurality of blanks.

Another feature of the invention consists in mounting the blank-folding means for rising-and-falling movement away from and toward the surface of the blank-support, thus facilitating the engagement of the folding means with the blank prior to the folding operations. This capacity for rising-and-falling movement is also utilized in connection with the folding operation itself, the folding means being carried away from the surface of the blank-support as it is being turned backwardly, so as to open the tucked sides of the tube far enough to develop the outer margins of the inner triangular folds at an early stage in the turning movement of the folding means. (See Figures 5 and 6.) These triangular folds are formed from portions of the tucked side plies, which by the act of their conversion into the triangular folds are unfolded from their tucked-in position and refolded on new lines. This unfolding of these portions of the tucked sides and the refolding into the triangular folds constitute an important and critical step in the procedure of manufacturing this kind of paper-bag with the rapidity and accuracy required for commercial success. The present machine contains two factors which contribute in an important degree to the success of this critical step: First, the front end of the blank is held in an elevated position above the surface of the folding-bed, and, secondly, the triangular folds are defined at an early stage of the turning-back movement in the front end of the upper ply. These two factors coöperate to avoid wide angular distention of the front ends of the top and bottom plies during the time that the triangular folds are being defined, thus relieving the side folds from undue strain while they are being converted into those triangular folds.

Further features of the present invention reside in the construction and arrangement of the diamond-folding mechanism, whereby

folding means is mounted for oscillation upon an axis to which is imparted the described forward-and back and rising-and-falling movements.

In the drawings accompanying this specification, and in which similar characters designate similar parts, Fig. 1 is a front view of my improved machine. Fig. 2 is a side view of the same, illustrating the manner in which the several shafts are connected by gearing. Fig. 3 is a sectional side view on line 3 3 of Fig. 1. Fig. 4 is a section on line 4 4, Fig. 1. Fig. 5 is a partial view corresponding to Fig. 3, showing the parts in the position where the inner triangular folds have been approximately outlined. Fig. 6 is a front view of the same, Fig. 7 is a view corresponding to Fig. 5, showing the carrier and blank-folding mechanism at the end of the working stroke of the latter with the diamond flattened down. Fig. 8 is a front view of the same, and Fig. 9 is a side view of the machine, incorporating a modification of the blank-support.

In the drawings, 10 designates the bed-plate, to which are secured two upright side frames in which the several coöperating shafts for driving the various devices are supported. Suitable means are provided for feeding blanks or bellows-sided tubing into the machine, such means consisting in the present instance of suitable feed-rollers 13 and 14, mounted on shafts 15 and 16, respectively, the latter being journaled in boxes 17, movably held in the side frames and acted upon by suitable springs 17′. (See Fig. 2.) The feed-rollers are geared together by means of gears 18 and 19, mounted on said shafts between the side frames 11 and 12, and said feed-rollers are driven by a gear 20, mounted on the lower roll-shaft and obtaining motion from a similar gear 21, mounted upon a shaft 22, which constitutes the main driving-shaft of the machine and to which power may be applied from any convenient source. From the feed-rollers the blank or tube is conducted to a suitable blank-support, serving as a folding-bed and as a means for carrying the blank forward during the bottom or diamond forming operation. Connected for coöperation with the blank-support is a blank-folding means adapted to engage the upper ply of the tube or blank and turn it back, the blank-support and blank-folding means coacting to open out the end of the blank and form the diamond. The blank-support is of the rotary type and consists, substantially, of a cylinder 23, mounted upon a shaft 24, which receives rotary movement through a gear 25, secured thereto and in engagement with a gear 26, mounted upon the main driving-shaft 22.

The tuck-holders 27 are journaled at 28 on opposite sides of the blank-support and serve to hold to the lower surface of the blank-support those portions of the lower ply of the blank which are not to be folded back, the front angular edges serving to define the extent to which the said lower ply is folded back to form the inner triangular folds. The lower ends 29 of these tuck-holders are preferably provided with cam-rollers 30, which engage with stationary cams 31, the peripheries of which are shaped to open and close the tuck-holders at the proper times. The blank-support 23 is provided with a front diamond-holder 32, which is journaled at 33 in the web 23′ of the blank-support and carries a roll 34, engaging with the cam 35 under the pressure of a spring 36, the cam and spring serving to open and close the said holder at suitable times. The blank-engaging portion of the front holder is adapted to engage with the blank at a substantial distance above the surface of the bed, thus relieving the front end of the blank from the strains which would result from holding the end of the lower ply of the blank down upon the surface of the blank-support during the formation of the innner triangular folds, and thereby facilitating the easy formation of those folds without losing control of the flap, Figs. 5 and 6.

The blank-folding mechanism is mounted for oscillation in a curved path the center of which is within the rotary path of the folding-bed, the folding means being mounted upon arms 48, which are journaled upon the hubs 51. A blank-folding member or plate 40, which directly engages with the blank and has a defining edge 39 for defining the so-called "primary transverse cross-fold line" of the blank, is provided at its opposite sides with brackets having trunnions 41, which are journaled in the carriers 52, the axes of the trunnions being substantially in alinement with the defining edge 39. The plate 40 is provided with means for engaging the side edges of the upper ply of the blank at the portions which are to form the upper and outer corners of the inner triangular folds of the blank. Those means consist of the box-holders 42, which are pivoted by means of the screws 43, upon the extensions 41′ of the trunnion-brackets, the outer L-shaped ends of the box-holders being carried, by means of the spring 46, into the side tucks of the blank below the plate 40 as the parts move forward from the blank-receiving position shown in Fig. 3. The box-holders are opened to receive the blank by means of the abutments 44, which are secured to a fixed shaft or bar 45 and collide with the arms 42′ of the box-holders as the latter are carried back toward the position shown in Figs. 1 and 3. The outer end of the plate 40 slides in a guide or swivel 47, which is pivotally supported upon the side frames.

The oscillatory movements of the blank-folding mechanism are effected by mea a cam 50 on the shaft 22, the cam serv ng o

oscillate the sector-gears 49, which engage with a segmental gear appurtenant to the arms 48, thereby imparting to those arms an oscillatory movement on the hubs 51 and also in coaction with the guide 47 imparting to the folding-plate 40 an oscillatory movement upon its trunnions 41. The extent of these oscillatory movements of the arms 48 and of the plate 40 may be seen by comparison of Figs. 4 and 7.

The carriers which support the trunnions 41 of the plate 40 consist in the present instance of slides 52, which are mounted for sliding movement upon the arms 48 in a substantial radial direction with reference to the center of oscillation of those arms. The inner ends of the sliding carriers 52 engage with the cam 54, preferably by means of rollers 53, whereby a rising-and-falling movement from and toward the surface of the blank-support is imparted to the blank-folding means. This rising-and-falling movement of the blank-folding means performs two important functions—first, to facilitate the proper engagement of the folding instrumentalities with the blank when in position shown in Fig 3, the blank-folding means being then elevated a substantial distance above the surface of the blank-support, and, second, to enable the tucked sides of the blank to be separated a substantial distance at the time of forming or outlining the inner triangular folds, as represented in Figs. 5 and 6, thus enabling them to be formed at an early stage in the turning movement of the folding means, while the front ends of the plies, and especially the side plies, are free from strain. As shown in Figs. 5 and 6, these triangular folds are in this machine safely defined by the time the upper ply of the blank is turned to a position substantially perpendicular to the surface of the folding-bed, and hence before the front end of the blank is distended far enough to draw its side edges together. After those triangular folds are safely defined or outlined the aforesaid side edges are drawn toward each other by the lengthwise distention of the front end of the blank due to the continued backward turning movement of the folding-plate, during which time the cams 55 move the carriers inwardly, and thus carry the blank-folding plate toward the surface of the blank-support, thereby facilitating the formation and flattening of the diamond, as shown in Figs. 7 and 8. Thus the path of movement of the blank-folding plate 40 is a composition or resultant of the three individual movements imparted to it—namely, its oscillatory movement upon its trunnions 41, its oscillatory movement with the arms 48 forward and back in the general direction of travel of the blank-support, and its rising-and-falling-movement with the carrier-slides 52 away from and toward the center of oscillation of the arms 48. The path of movement of the defining edge 39 of the plate which results from the arrangement described is represented in Figs. 5 and 7 by a curved dot-and-dash line. That path may, however, be varied to any desired extent by suitably timing and proportioning the cam 50 and the cam 55. It is frequently desirable thus to vary the path of movement of the blank-folding plate, and particularly the path of movement of the defining edge thereof, in order to adapt the machine to the manipulation of different kinds of thicknesses of paper or to suit changes in the characteristics of the same paper due to changes in the humidity of the atmosphere. Means are herein provided for enabling these changes to be quickly made. The cams 55 are provided with three different working faces, (herein designated as 54, 54′, and 54″,) either of which may be brought into working relation to the carrier-slides 52 merely by loosening or removing the screws 56 and then turning the cams 55, so as to bring the desired cam-face into operative position, in which it is again held by the screws 56. This change is quickly made and enables the path of movement of the blank-folding member to be selectedly varied with relation to the path of travel of the blank. It will be understood that the paths of movement of the box-holders in the construction shown are similar to that of the plate 40.

To aid in flattening the diamond, the drop-plate 71 is employed, which is mounted on an arm 72, secured to the shaft 70, which is journaled in the side frames and is operated by the cam 73, mounted on the shaft 24. The cam 73 engages, preferably by means of a roller 74, with a lever 75, journaled at 76 on the side frame 12 and having its free end connected by a link 77 with the crank-arm 78 appurtenant to the drop-plate shaft 70. After the diamond has thus been flattened by the drop-plate the blank is carried beneath the presser-roll 79 on the shaft 60, after which the delivery-plate 80 deflects the blank from the blank-support and delivers it to other devices, which may include a paster-roll and flap-folding devices, as 81 82, which transform the blank into the completed bag.

As a means for operating the box-holders 42 to release the blank toward the conclusion of the diamond-folding operation arms 57 are employed, which are pivoted on the studs 58 and are moved into the pathway of the arms 42′ of the box-holders by means of a cam 59 upon the shaft 50, which is driven from the carrier-shaft 24 by means of gears 61 and 62, a spring 63 serving to withdraw the arm 57 from its operative position and to hold it into contact with the cam 59.

As a means for guiding the incoming blank from the rolls 13 and 14 to and between the folding-plate 40 and the blank-support when the latter are at the position shown at Fig. 3

I preferably employ a guide-plate 64, which is mounted upon the shaft 65, to which a rocking movement is imparted from the lever 66 and roll 67 from the cam 68, mounted upon the shaft 15, a spring 69 serving to keep the roller in engagement with the cam. In this way the guide-plate 64 serves to compress the front end of the blank and guide it safely into proper position between the blank-folding plate 40 and the blank-support, after which the guide-plate 64 is lifted, so as to allow the blank to return to its distended position, which it does by virtue of the resiliency of its bellows side folds. This distension of the blank carries its top ply against the under side of the plate 40, which being in its raised position allows the side plies to be distended, and thus facilitates the easy and certain entrance of the box-holders 42 between the side plies of the blank.

In Fig. 9 is shown a modified arrangement of my improved machine, in which an oscillatory blank-support is shown in place of the rotary support previously described. The blank-support 100 is directly connected to the arms 48 by bolts, so that as the arms 48 are oscillated by their operating-sectors 49 the support will be carried back and forth by the arms, the operation of the carrier-slides 52 in the arms 48 being as hereinbefore described.

The mode of operation of my improved machine is as follows: Bellows-sided tubing is drawn into the machine by the feed-rolls 13 and 14 and guided by the guide-plate 64 between the blank-folding member 40 and the blank-support 23, as shown in Fig. 3, so that the tuck-holders 27 and the front diamond-holder 32 will engage the lower ply of the blank. At the same time the box-holders 42 swing into the side tucks and grip the outer edges of the upper ply of the blank against the under side of the folding-plate 40. During this time the blank-support and the folding means travel forward in the direction of the arrow *a* in register with the blank. As this forward movement continues the folding-plate 40 is carried forward to the position shown in Fig. 5, at which position the folding-plate 40 is away from the blank-support far enough to stretch out the tucked sides of the tube between them, thus defining at least approximately the outer margins of the inner triangular folds, this separation of the plate 40 from the blank-support being effected by the cams 55. By this arrangement it will be observed that the turning-back means, comprising the member 40 and the box-holders 42, are rotated about a center of rotation lying a substantial distance from the surface of the folding-bed, so that the front end of the upper ply is turned back about the line in the upper ply as an axis, which is called the "primary transverse crease-line" of the diamond, while said line lies at a substantial distance above the lower ply. The engaging means formed by the box-holders and the coöperating portions of the member 40 thus serve to carry the portion of the upper ply gripped by them through a path concave toward the folding-bed such that the primary transverse crease-line of the upper ply is lifted from the lower ply of the blank at the time of defining the margins of the inside triangular folds of the diamond. This feature of manipulation tends to materially reduce the formation of disruptive strains in the paper and insures more uniform and accurate folding of the blanks than is had when the plies are not separated in the manner described. In this way the blank is opened out into what is substantially a flat-bottomed box, the four corners of which are practically defined by the box-holders 42 and the tuck-holders 27, while those portions of the box which are above those corners are in substantially free condition, after which the continued swinging movement of the plate 40, in connection with its falling movement toward the surface of the blank-support, serve to draw the side edges of the box-like form toward each other into the well-known flattened diamond form shown in Figs. 7 and 8. At the position shown in Fig. 7 the diamond is still further flattened by means of the drop-plate 71. The arms 57 are thrown inwardly by the cams 59 to release the box-holders from the blank, and the latter is drawn forward under the drop-plate 51, which then moves more closely to the blank-carrier, thereby flattening the diamond more completely. The blank then passes under the roll 79, after which the front holder and the tuck-holders release the blank, which is then delivered to the flap-folding devices, which may be carried by the rollers indicated by dot-and-dash lines 81 and 82.

It will be observed that the blank-folding member 40, which is guided at one end by the swivel-guide 47, pivoted to the stationary framework of the machine, is supported at the other end by a pair of trunnions 41, attached to brackets secured to the plate 40. These trunnions are pivotally supported on the ends of the slides 52, sliding in the arms 48. These slides constitute supporting means to which the blank-folding member 40 is pivoted, which means are movable transversely of and also with the blank-carrier by the cams acting on the slides 52 and the sector-gearing for turning the arms 48 about their fixed hubs.

I claim as my invention—

1. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, having in combination a rotary folding-bed, carriers oscillating about a center situated within the rotary path of the bed, turning-back means moved by said carriers through an oscillatory path above the rotary path of

the bed and means for operating said turning-back means on said carriers to engage and turn back the upper ply of a blank as the blank travels with the bed.

2. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, having in combination a rotary folding-bed, a carrier oscillating about a center situated within the rotary path of the bed, turning-back means engaged by said carrier and moved through an oscillatory path above the rotary path of the bed, and means for operating said turning-back means to engage and turn back the upper ply of a blank as the blank travels with the bed.

3. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, having in combination a rotary folding-bed, oscillating arms pivoted within the rotary path of the bed, turning-back means moved by said arms through an oscillatory path above the rotary path of the bed and means for operating said turning-back means on the arms to engage and turn back the upper ply of a blank as the blank travels with the bed.

4. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, having in combination a shaft, a rotary folding-bed supported thereby, arms one at each side of the folding-bed each journaled around said shaft, means for continuously rotating said folding-bed, means for oscillating said arms about the shaft, means for causing a blank to advance with the bed, and means carried by the arms for engaging and turning back the upper ply of said blank.

5. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks including in combination, a continuously-rotating shaft, a rotary folding-bed secured thereto, an arm at each end of the bed having a portion surrounding the shaft, a second shaft geared to the first shaft, a cam member actuated by said second shaft, connections between the said cam member and said arms for oscillating the latter about the first-mentioned shaft, and means carried by said arms for engaging and turning back the upper ply of a blank advanced by the folding-bed.

6. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, including in combination, a rotating shaft, a blank-support mounted on said shaft and turning with it, said support having a series of folding-beds arranged at intervals about the shaft, an arm at each end of the support having a portion surrounding the shaft, means carried by the arms for engaging and turning back the upper ply of a bag-blank and means for turning the arms about the shaft with the support while said turning means operate upon a blank carried by one of said beds and then turning the arms in the opposite direction to bring the turning means carried by them into operative relation with the blank carried by a succeeding bed.

7. In a bag-machine, means for forming diamond folds on bellows-sided blanks, having in combination a rotary folding-bed, oscillating arms pivoted concentrically with the bed, mechanism moved by said arms through an oscillatory path above the rotary path of the bed, and means for operating said mechanism on said arms, to engage and open the blank during its movement with the bed.

8. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating arms pivoted within the rotary path of the bed, folding mechanism pivotally supported on said arms and means for oscillating said folding mechanism relative to said arms.

9. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating carrier-arms moving on a center of oscillation situated within the rotary path of the bed, devices mounted for oscillation upon the said arms, and means for operating said devices on the arms to engage and open the blank during their movement with the bed.

10. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating carrier-arms moving on a center of oscillation situated within the rotary path of the bed, devices mounted for oscillation on the said carriers, said devices including means for engaging the upper ply of the blank, means for swinging the carrier-arms forward in the direction of travel of the blank, and means for turning the said devices backwardly to fold the diamond as the carrier-arms are thus moved forward.

11. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating carrier-arms supported for oscillation upon an axis situated within the rotary path of the bed, holders coöperating with the said bed, to hold the lower ply of the blank thereon, and folding devices mounted for oscillation upon the said carrier-arms, including holders for engaging the upper ply of the blank, means for moving the carrier-arms forward in the direction of travel of the folding-bed, and means for turning the said folding devices backwardly to form the diamond.

12. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating arms moved about a center of oscillation located within the rotary path of the bed, folding mechanism moved by said arms through an oscillating path above the rotary path of the bed, and yield-

ing side grippers having a capacity for lateral movement to engage and disengage the blanks, cam mechanism operating on said side grippers to engage and disengage the blanks, as they oscillate over the rotary folding-bed, and means for actuating the folding mechanism to open the blank.

13. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks including in combination, a rotary folding-bed, a carrier mounted for oscillation about a center situated within the rotary path of the bed, a member pivoted to said carrier and having a fold-defining edge, means for holding the upper ply of the blank against said edge, means for oscillating said carrier and means for oscillating said member relative to said carrier.

14. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, including a folding-bed, turning-back mechanism including a transverse-fold-defining member mounted for oscillation upon an axial support, said axial support, means for causing a continuous advancement of the folding-bed, and means for reciprocating the said axial support back and forth lengthwise of the path of travel of the bed.

15. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, including a folding-bed, a transverse-fold-defining member mounted for oscillation upon an axial support substantially in alinement with the fold-defining portion of said member, said axial support, means for holding the upper ply of the blank against said edge, means for causing a continuous advancement of the folding-bed, and means for reciprocating the said axial support back and forth lengthwise of the path of travel of the bed.

16. In a bag-machine, mechanism for forming diamond-folded blanks from bellows-sided tubes, having in combination a rotating folding-bed provided with means for holding the lower bellows folds of a tube, oscillating arms pivoted within the path of the rotating bed, means carried by the oscillating arms, for defining the cross-fold of the diamond, holders also carried by the said arms for engaging the upper bellows folds of a tube, means for oscillating said holders and fold-defining means on an axis carried by said arms, and means for moving said axis and the parts supported thereby toward and away from the folding-bed.

17. In a bag-machine, mechanism for forming diamond folds on bellows-sided bag-blanks, including a movable blank-support having a folding-bed upon which the diamond is flattened, means for securing the lower ply of the bag-blank thereto, turning-back mechanism including a member having a cross-fold-defining edge, and means for moving said member so that said edge travels, during the diamond-folding operation, at substantially the same speed as that of the surface of the blank-support and through a predetermined path which is substantially similar to the path traveled by the portion of the blank secured to said support, said paths being separated by a substantial distance during the time of defining the outer margins of the inner triangular folds.

18. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, including a movable blank-support having a folding-bed, means for securing the lower ply of the bag-blank thereto, turning-back mechanism including a blank-folding member having a cross-fold-defining edge, means for moving said member so that said edge travels, during the diamond-folding operation, at substantially the same speed as that of the surface of the blank-support, and through a predetermined path which is substantially parallel to the path traveled by the portion of the blank secured to said support, said paths being separated by a substantial distance during the time of defining the outer margins of the inner triangular folds, and for turning said member relative to said edge at an axis while the edge is traveling along said predetermined path.

19. The combination, with a traveling blank-support having a folding-bed and tuck-holders, of a blank-folding member having a defining edge and box-holders, and mounted for oscillation on a movable axis which is substantially in alinement with said defining edge, means for swinging said member upon said axis during the diamond-folding operation, and means for moving the said defining edge and axis toward and away from a position, which at the time of defining the outer margins of the inside triangular folds is at a substantial distance from the blank-supporting surface of the blank-support.

20. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, having in combination a movable blank-support, turning-back mechanism including a movable blank-folding member having a defining edge and mounted for oscillation upon a movable axis, means for oscillating the blank-folding member upon its axis, and means for moving the said axis through different paths so that the defining edge is carried generally with the blank-support during the folding operation, but at different distances therefrom during the formation of the inside triangular folds.

21. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating arms pivoted within the rotary path of the bed, folding mechanism pivotally supported on said arms to turn relatively thereto about an axis above the rotary path of the bed, and means for oscillat-

ing said folding mechanism relative to said arms.

22. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, having in combination a folding-bed, means for securing the lower ply of a bag-blank thereto, movable means for engaging the end of the upper ply of the blank to turn it back about its primary transverse crease-line, and operating means therefor, arranged to move the engaging means relative to the folding-bed through such a path concave toward the folding-bed, that the portion of the upper ply in which the crease-line is formed is lifted from the lower ply at the time of defining the margins of the inside triangular folds.

23. The combination, with a movable blank-support having tuck-holders, of a movable blank-folding plate having a defining edge, box-holders, a guide mounted for oscillation around a fixed axis and provided with guiding-ways for the folding-plate, and means extraneous to the blank-support for moving the defining edge in a path which is a substantial distance away from the surface of the support during the formation of the inside triangular folds.

24. The combination with a blank-support having tuck-holders, of a blank-folding plate having a defining edge, box-holders, a movable plate-carrier supporting the plate substantially in alinement with the defining edge, means for moving said edge in a path which is away from the surface of the blank-support during the formation of the inner triangular folds, and means for guiding the outer end of said plate.

25. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, having in combination a rotary folding-bed, oscillating arms pivoted within the rotary path of the bed, turning-back means moved by said arms through an oscillatory path above the rotary path of the bed, means for moving said turning-back means toward and away from the bed, and means for operating said turning-back means on said arms to engage and turn back the upper ply of a blank as the blank moves with the bed.

26. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating arms pivoted within the rotary path of the bed, pivotal supports for folding mechanism carried on said arms, means for reciprocating said pivotal supports so that they approach and recede from the path of the bed, folding mechanism connected to said pivotal supports so as to oscillate thereon in forming the diamond, and means for oscillating said folding mechanism relative to said arms.

27. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating arms pivoted within the path of the rotary bed, trunnion-supports mounted on the oscillating arms and movable thereon toward and away from their center of oscillation, trunnions mounted on said supports, means secured to said trunnions for defining the cross-fold and turning back the upper ply of a blank, and means for oscillating the arms, reciprocating the trunnion-supports, and oscillating the trunnions, whereby the cross-fold defining and turning-back means is operated in coaction with the bed.

28. In a bag-machine, mechanism for forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed, oscillating arms pivoted within the path of the rotary bed, slides carried by the oscillating arms and movable thereon toward and away from the center of oscillation, trunnions mounted on said slides, means secured to said trunnions for defining the cross-fold and turning back the upper ply of a blank, and means for oscillating the arms, reciprocating the slides and oscillating the trunnions, whereby the cross-fold defining and turning-back means is operated in coaction with the bed.

29. The combination with a blank-support having tuck-holders and mounted for continuous rotation, of a blank-folding plate having a defining edge, box-holders, a carrier on which the folding-plate is mounted for oscillation, and means for reciprocating the said plate-carrier back and forth in the general direction of travel of the blank-support, and also toward and from the surface of the blank-support.

30. The combination with a rotary blank-support having tuck-holders, of a blank-folding plate having a defining edge, box-holders, arms mounted for oscillation upon an axis substantially in alinement with the axis of the blank-support, plate-carriers mounted on said arms for radial movement toward and from the said axis, and having the said blank-folding plate mounted for oscillation thereon, means independent of the blank-support for oscillating the said arms, and means for moving the said plate-carriers radially.

31. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks including in combination a folding-bed, blank-folding mechanism including a transverse-fold-defining member mounted for oscillation upon an axis substantially in alinement with the fold-defining portion of said member, means for causing a continuous advancement of the folding-bed, means for reciprocating the said axis back and forth lengthwise of the path of travel of the bed, and means for moving the said axis toward and from the folding-bed as said axis is reciprocated, and means for oscillating said member as said axis is reciprocated.

32. The combination with a movable blank-carrier and means for securing a blank thereto, of a blank-folding member and box-holders, supporting means on which said member and holders are mounted for oscillation, said supporting means being mounted for movement toward and from and also in the direction of travel of the blank-carrier, and means independent of the blank-carrier for oscillating the blank-folding member and box-holders during the blank-folding operation.

33. The combination with a movable blank-carrier and means for securing a blank thereto, of supports mounted for movement in the general direction of travel of the blank-carrier and also transversely to that direction, a blank-folding member and box-holders mounted for swinging movement upon the supports, said folding member having a defining edge, means for moving the supports to carry said defining edge toward and from the surface of the blank-carrier, means for advancing the said supports in the direction of travel of the blank-carrier during the blank-folding operation and means for oscillating the blank-folding member and box-holders on said supports during the blank-folding operation.

34. The combination with a movable blank-carrier having tuck-holders, and with a blank-folding member having box-holders, of supporting means by which said member is pivotally supported, and movable transversely of, and also with the blank-carrier throughout the diamond-folding operation.

35. In a bag-machine, mechanism for forming diamond-folded blanks from bellows-folded tubes, having in combination a rotating folding-bed provided with devices for holding the lower ply of the blank, oscillating arms pivoted within the rotary path of the bed, folding means carried by said arms, means for oscillating the arms, and means for imparting the necessary movements to the folding means carried by said arms.

36. In a bag-machine, mechanism for forming diamond-folded blanks from bellows-folded tubes, having in combination a rotating folding-bed provided with devices for holding the lower ply of the blank, oscillating arms pivoted within the path of the rotating bed, folding means carried by said arms and moving therewith at times in the direction of movement of the bed and at times in the opposite direction, means for causing the folding means to move also toward and away from the path of the bed, and means for oscillating the said folding means on an axis carried by the arms.

37. In a bag-machine, mechanism for forming diamond-folded blanks from bellows-sided tubes, having in combination a rotating folding-bed provided with means for holding the lower bellows-folds of the tube, oscillating arms pivoted within the path of the rotating bed, means carried by the oscillating arms for defining the cross-fold of the diamond, holders also carried by the said arms for engaging the upper bellows-folds of a tube, means for oscillating said holders and fold-defining means on an axis carried by said arms, and means for moving said axis and the parts supported thereby toward and away from the folding-bed.

38. The combination, with a rotary blank-support having tuck-holders, of a movable blank-folding plate having a defining edge, box-holders, means for slidably guiding the outer end of said plate, and means extraneous to the blank-support for moving said defining edge in unison with the support during a portion of its folding movement.

39. The combination, with a rotary blank-support having tuck-holders, of a movable blank-folding plate having a defining edge, box-holders, means for supporting the said plate for oscillation upon an axis substantially in alinement with the defining edge, means extraneous to the blank-support for moving the said edge in unison with the support during a portion of its folding movement, and means for slidably guiding the outer end of said plate.

40. The combination with a rotary blank-support having tuck-holders, of a blank-folding plate having a defining edge, box-holders, a movable plate-carrier supporting the plate substantially in alinement with the defining edge, a guide for the outer end of the plate, and means operable independently of the blank-support for moving the said plate-carrier approximately in unison with the blank-support during the formation of the inner triangular folds.

41. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks, including in combination a framework, a rotating blank-support mounted in said framework, a carrier oscillating about a center situated within the rotary path of the blank-support, means for engaging and turning back the upper ply of a blank as the blank travels with the support, said means being pivotally connected to said framework above said path and to said carrier.

42. In a bag-machine, mechanism for forming diamond folds on bellows-sided blanks including in combination a framework, a rotary blank-support mounted in said framework, a carrier oscillating about a center situated within the rotary path of the blank-support, means for engaging and turning back the upper ply of a blank as the blank travels with the support, said means being pivotally connected to said carrier, and means slidingly and pivotally connecting the engaging and turning-back means to said framework.

43. In a bag-machine, mechanism for

forming diamond folds on bellows-folded blanks, having in combination a rotary folding-bed having a front diamond-holder adapted to hold the lower ply of the blank at a position elevated above the bed during the formation of the diamond, oscillating arms pivoted within the rotary path of the bed, folding means moved by said arms through an oscillatory path above the rotary path of the bed, and means for operating said folding means to engage and open the blank during their movement with the bed.

44. The combination with a rotatable blank-support, of means for turning back the upper ply of a bag-blank to form diamond folds, and a diamond-holder carried by the blank-support, and having its blank-engaging portion at a substantial distance from the surface of the blank-support while engaging the blank.

45. In a bag-machine, the combination with a blank-support pivoted to carry the blank in a curved path, of means for holding and transporting a bag-blank thereon, including a device moving in conjunction with the support for engaging the end of the lower ply of the blank at a position above the surface of the blank-support, and means for engaging and turning back the upper ply of said blank.

46. In a paper-bag machine, mechanism for forming diamond folds on bellows-sided bag-blanks, having in combination a folding-bed, means for turning back the upper ply of the blank to form the diamond folds, and a holder for engaging the flap end of the bag-blank to control its position relative to the bed, said holder having its blank-engaging portion at a substantial distance above the surface of the blank-support during the folding operation.

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