No. 847,264. PATENTED MAR. 12, 1907.

F. E. STRASBURG.

PAPER BAG MACHINE.

APPLICATION FILED OCT. 8, 1906.

10 SHEETS—SHEET 1.

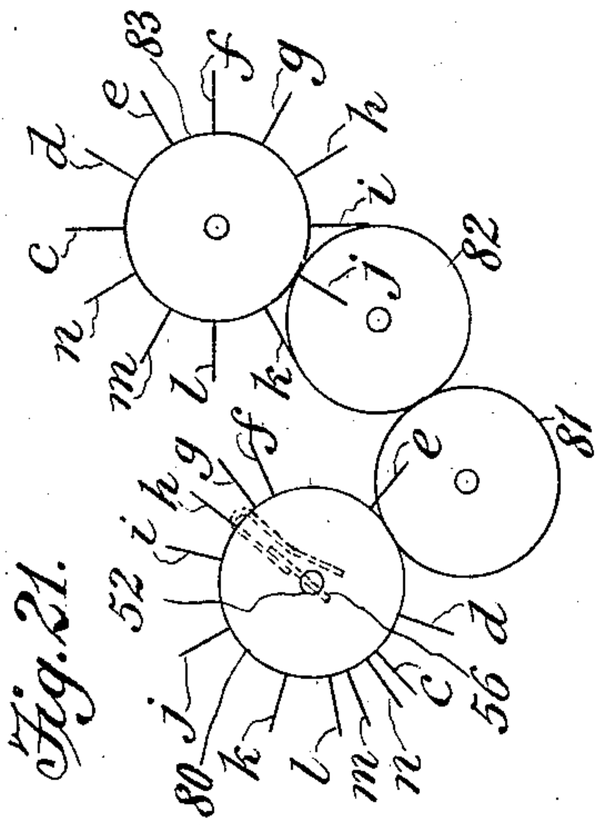

Fig. 21.

Fig. 1.

Witnesses:-

Chas. W. LaRue

A. E. Clark

Inventor:

Frederick E. Strasburg

By Wilbur McStone Atty.

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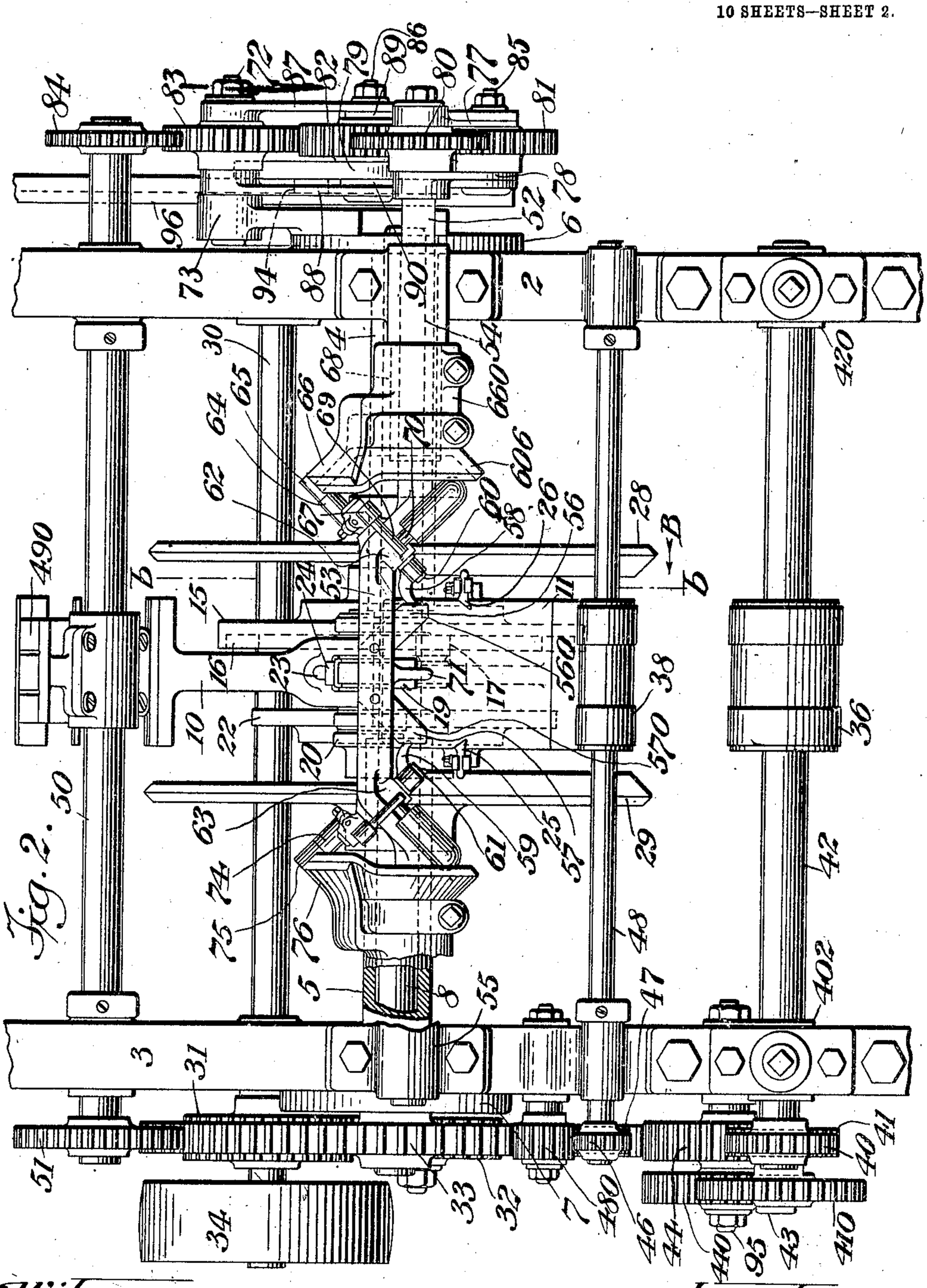

Fig. 2.

Witnesses:-

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By Wilbur M. Stone

Atty.

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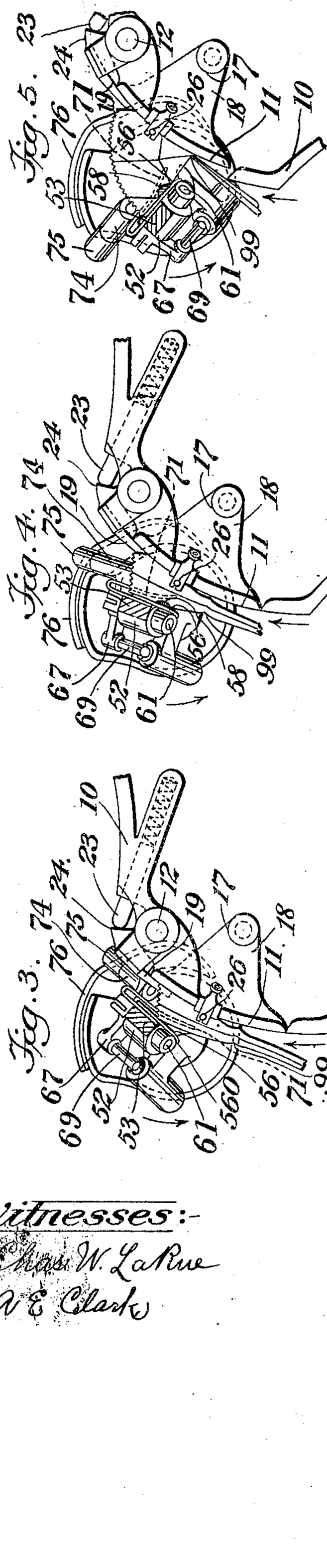

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A. E. Clark

Inventor;
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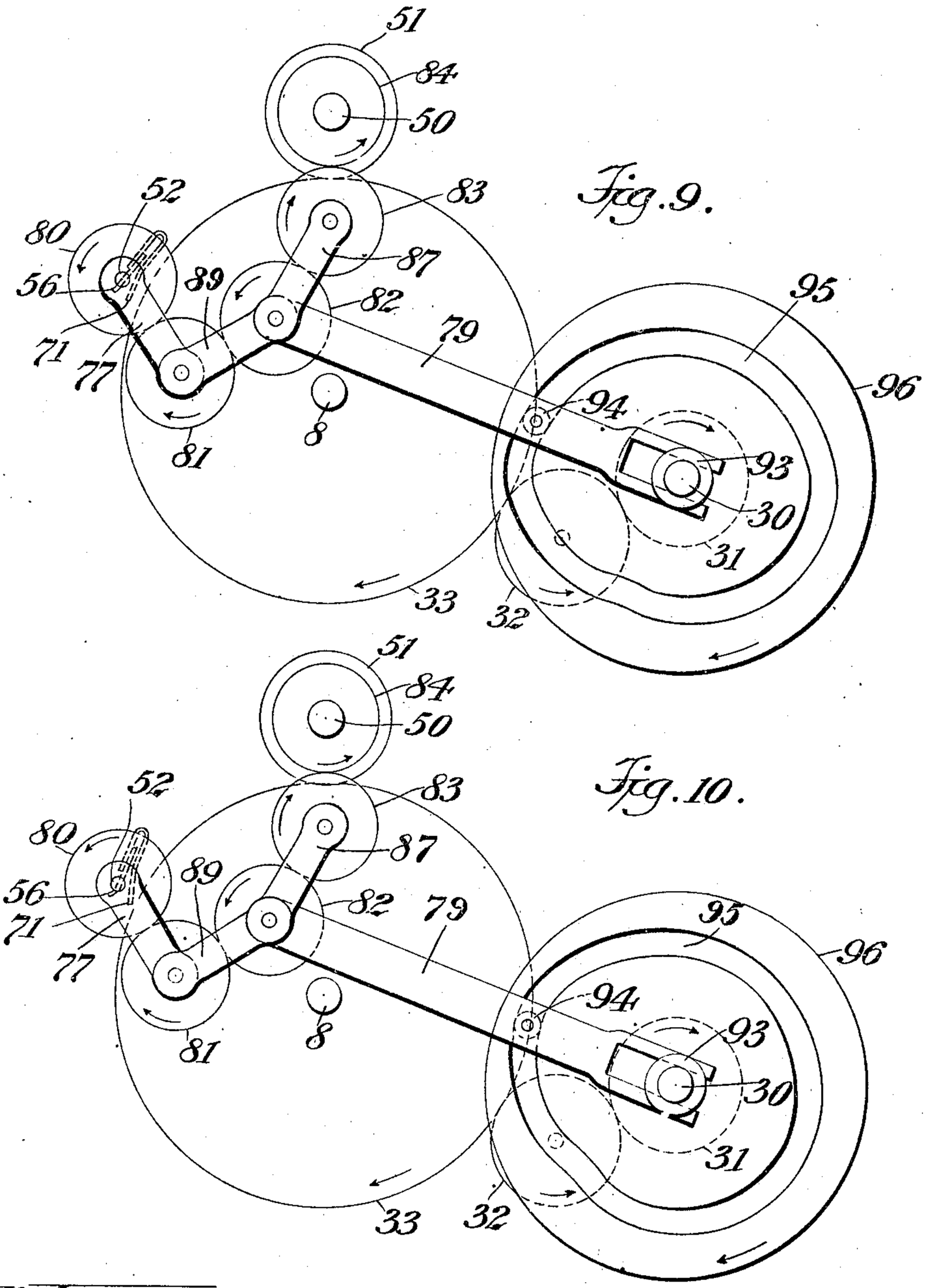

Fig. 9.

Fig. 10.

Witnesses:-

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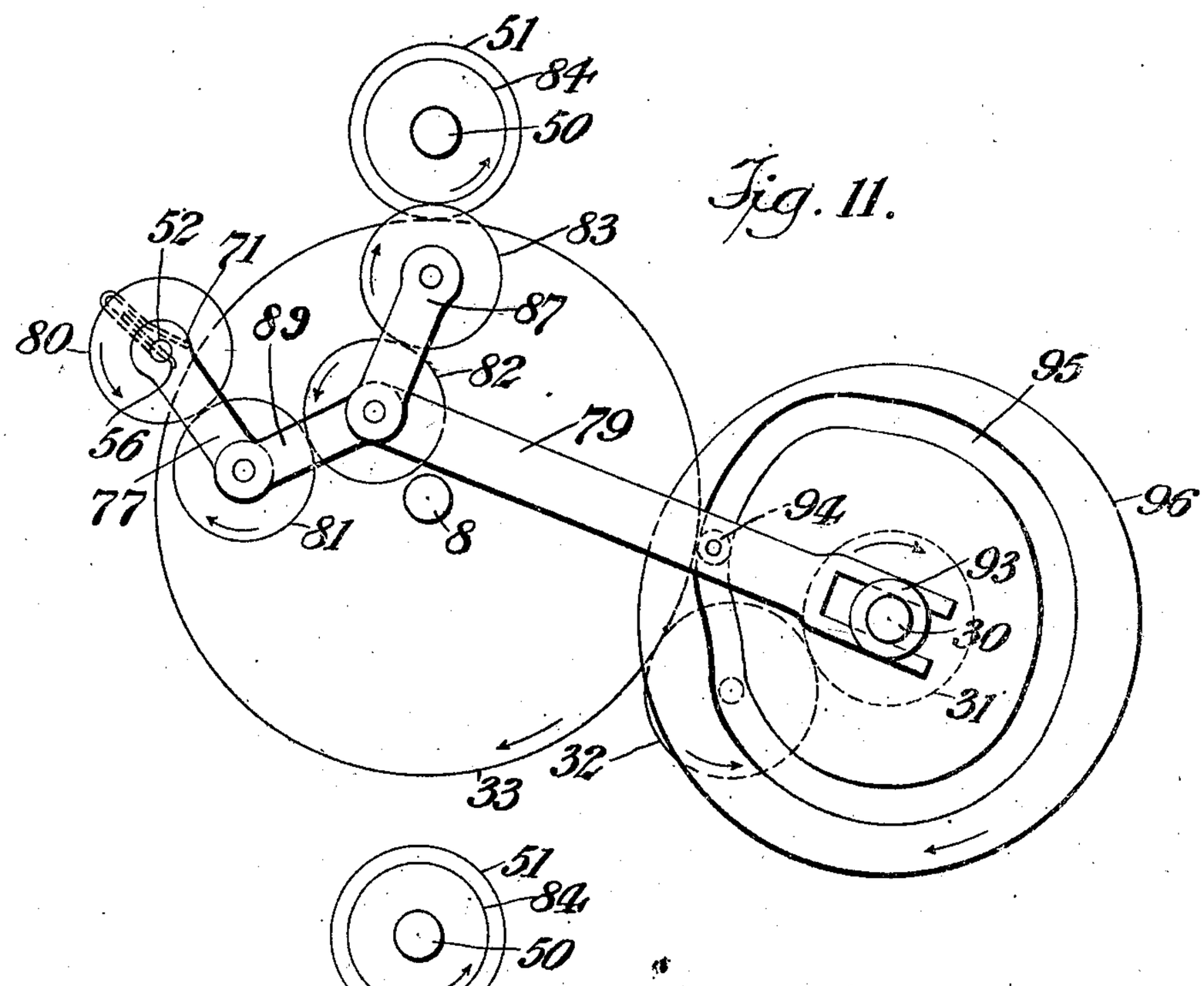

Fig. 11.

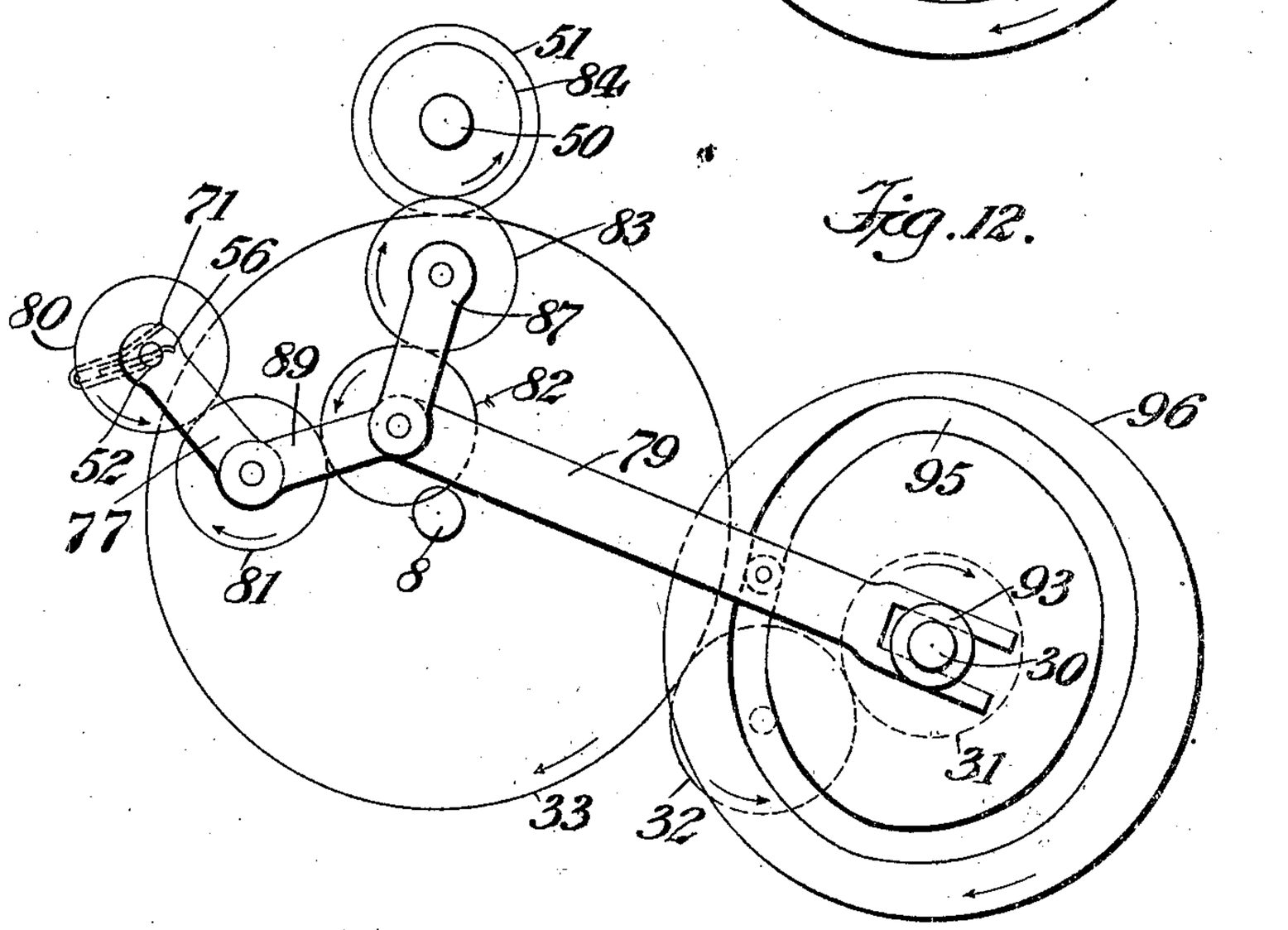

Fig. 12.

Witnesses:-

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10 SHEETS—SHEET 6.

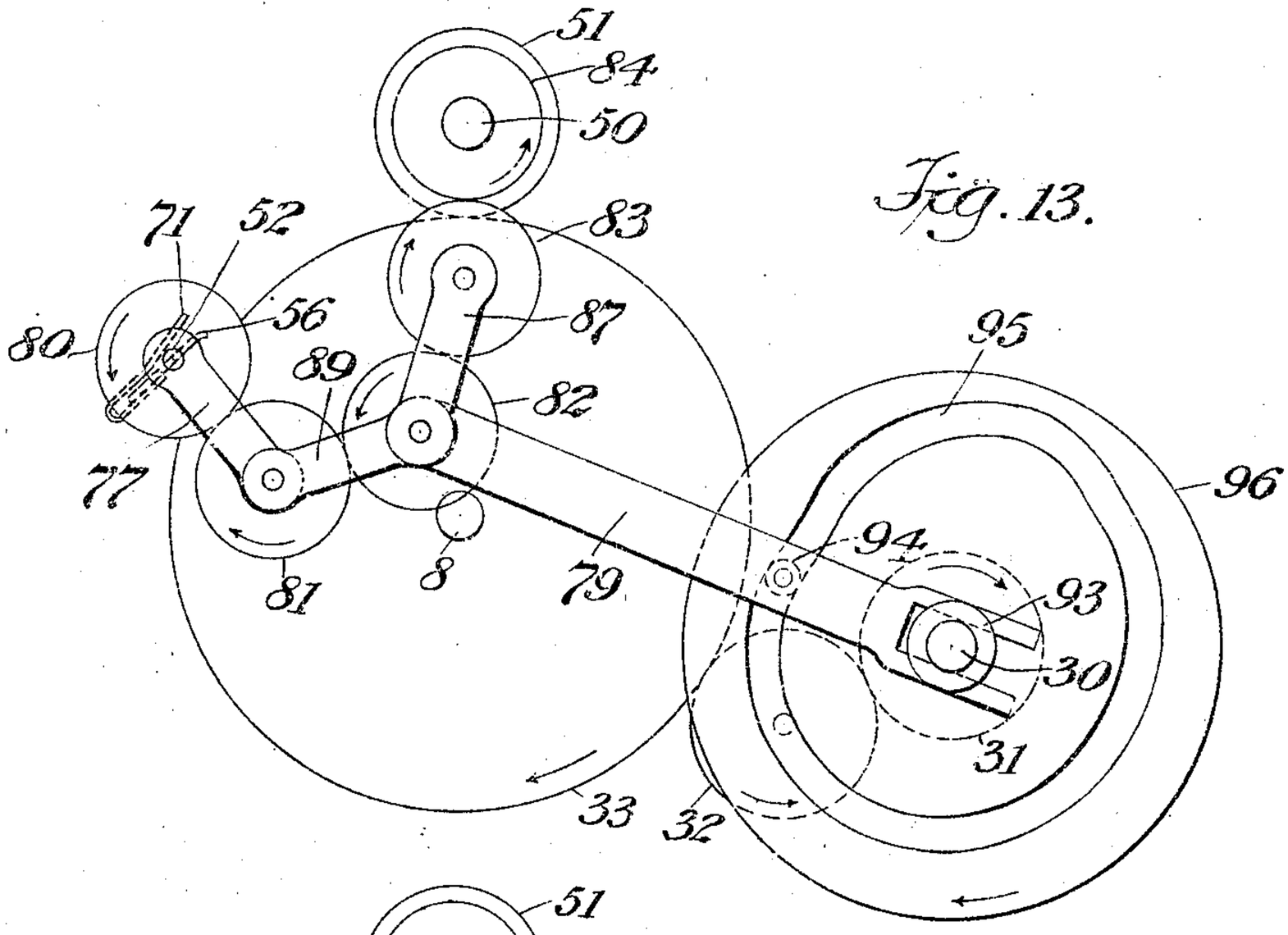

Fig. 13.

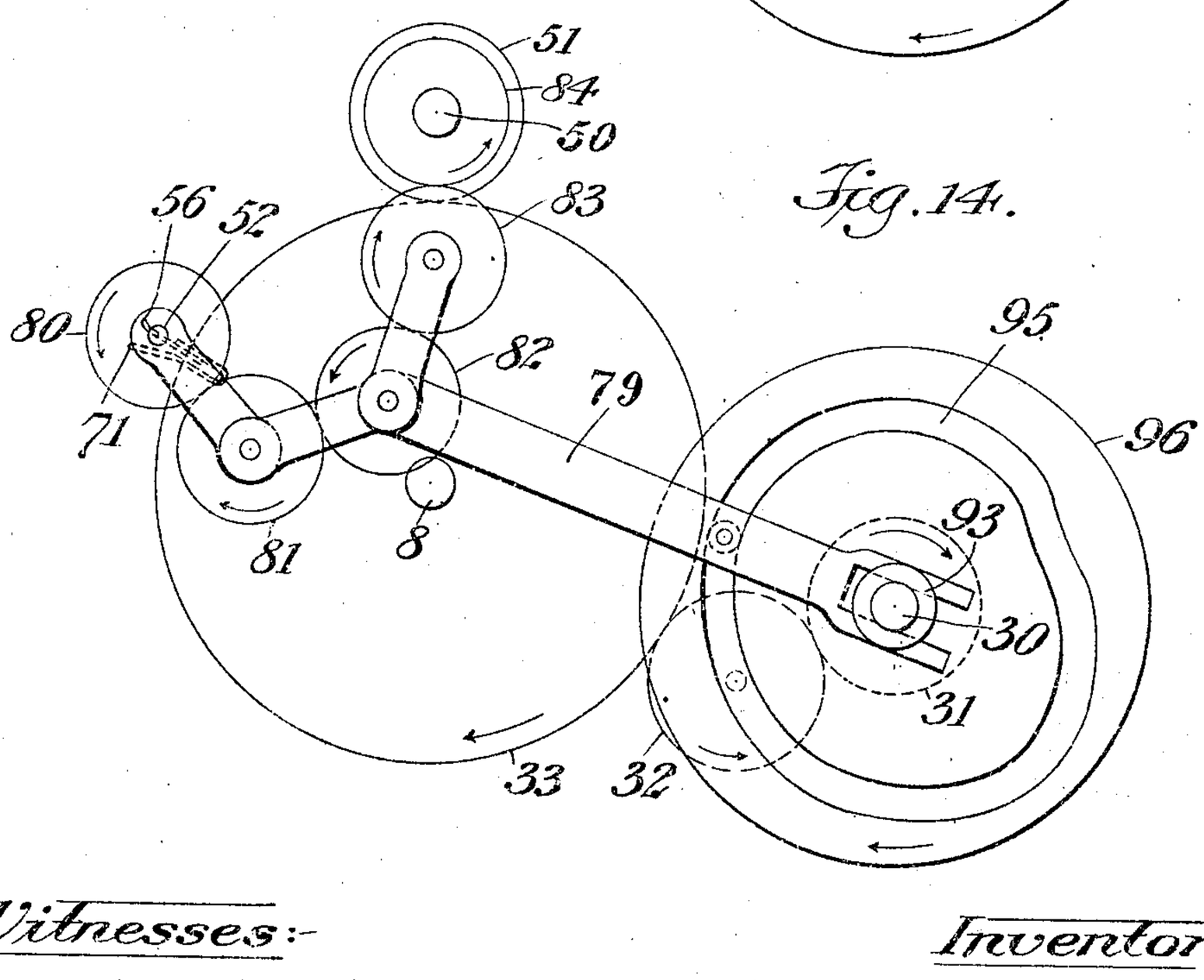

Fig. 14.

Witnesses:-

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10 SHEETS—SHEET 7.

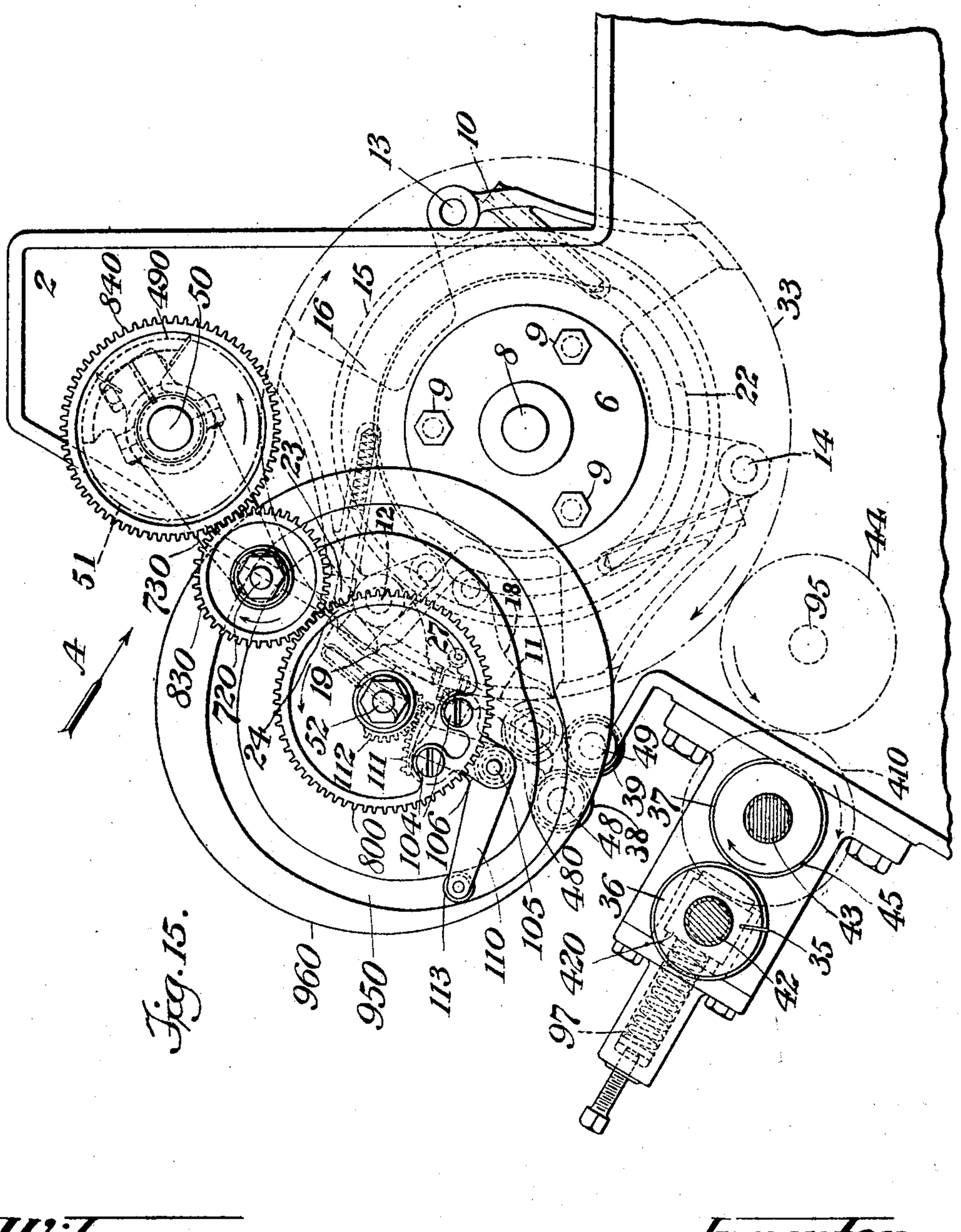

Fig. 15.

Witnesses:

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10 SHEETS—SHEET 8.

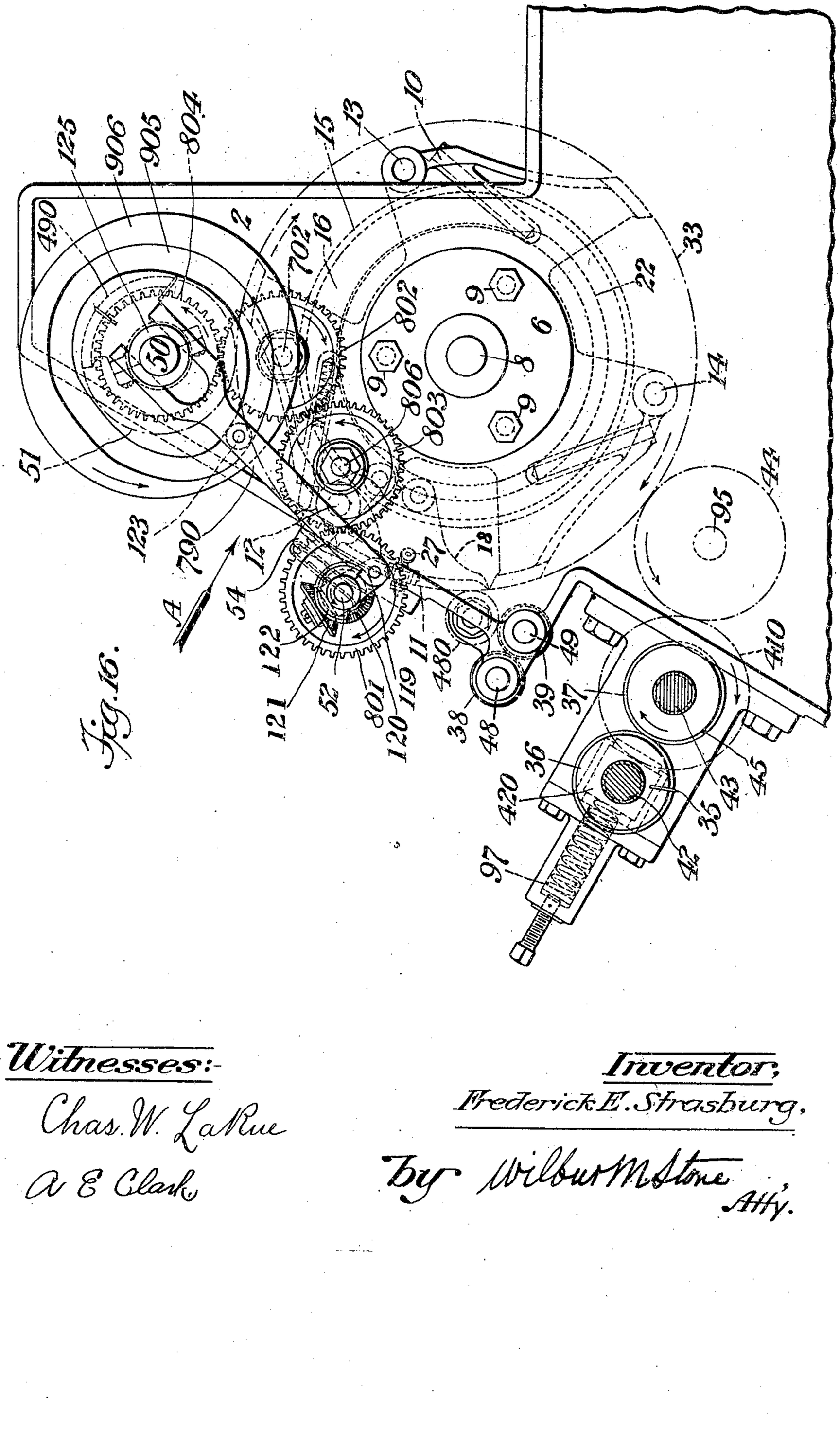

Fig. 16.

Witnesses:-

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by Wilbur M. Stone Atty.

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PAPER BAG MACHINE.

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10 SHEETS—SHEET 9.

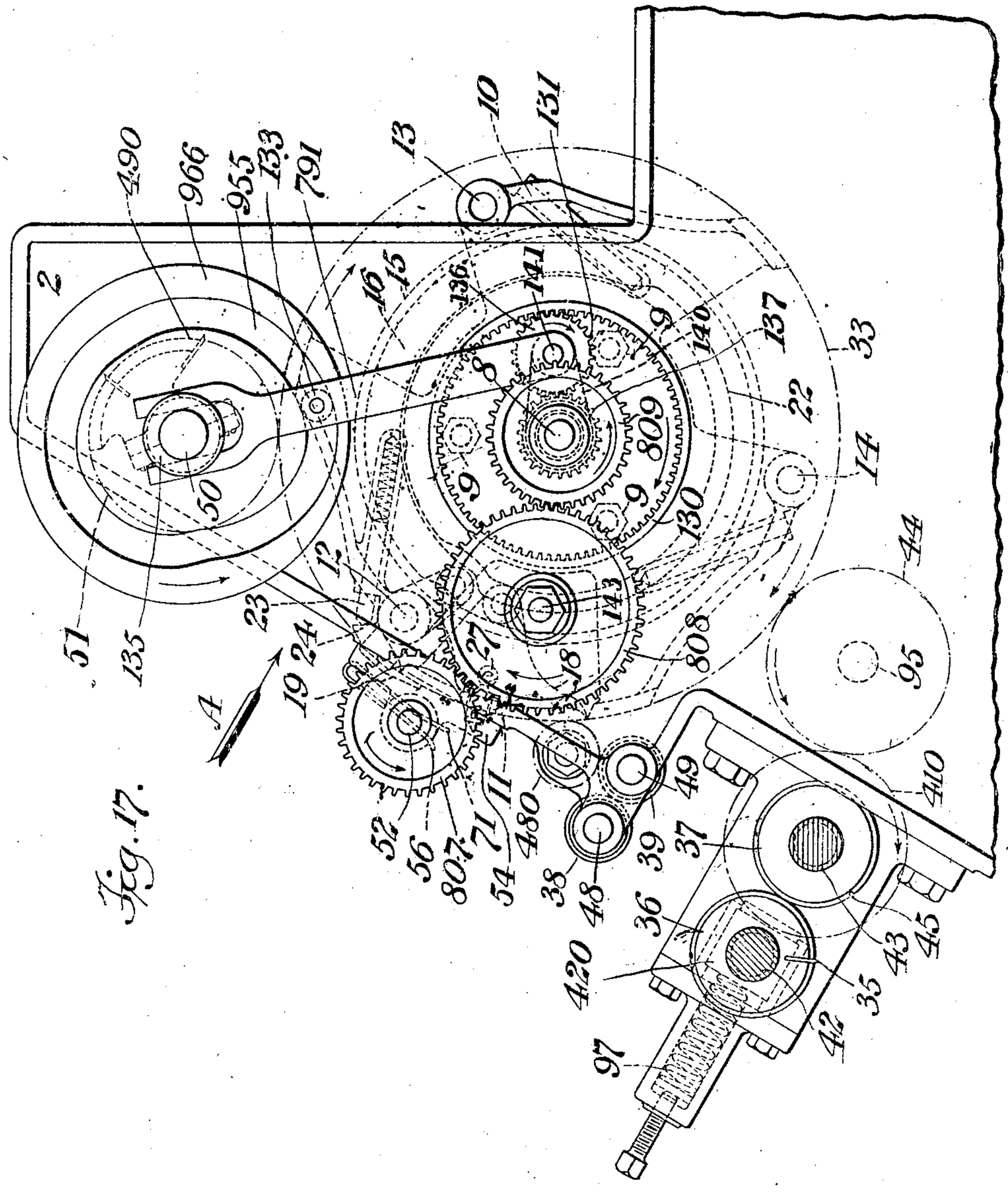

Fig. 17.

Witnesses:-

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No. 847,264. PATENTED MAR. 12, 1907.

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PAPER BAG MACHINE.

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10 SHEETS—SHEET 10.

Fig. 20.

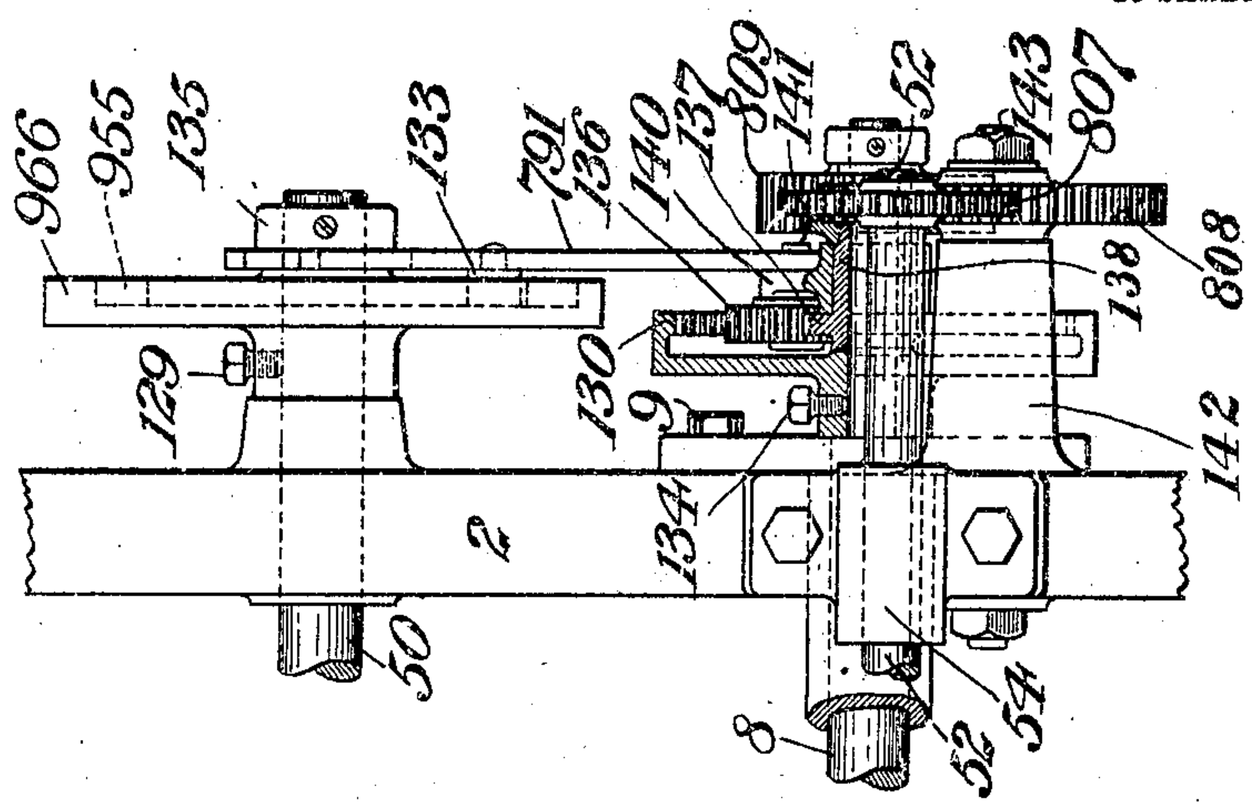


Fig. 19.

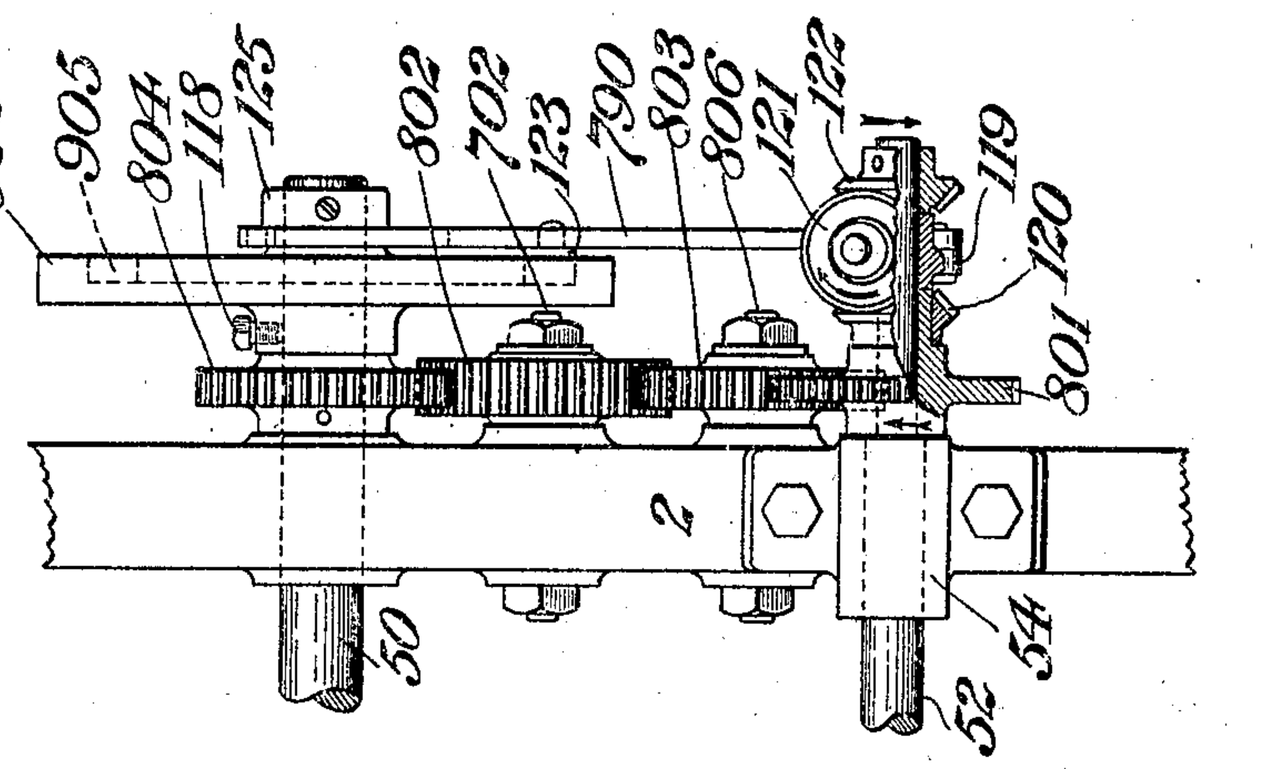
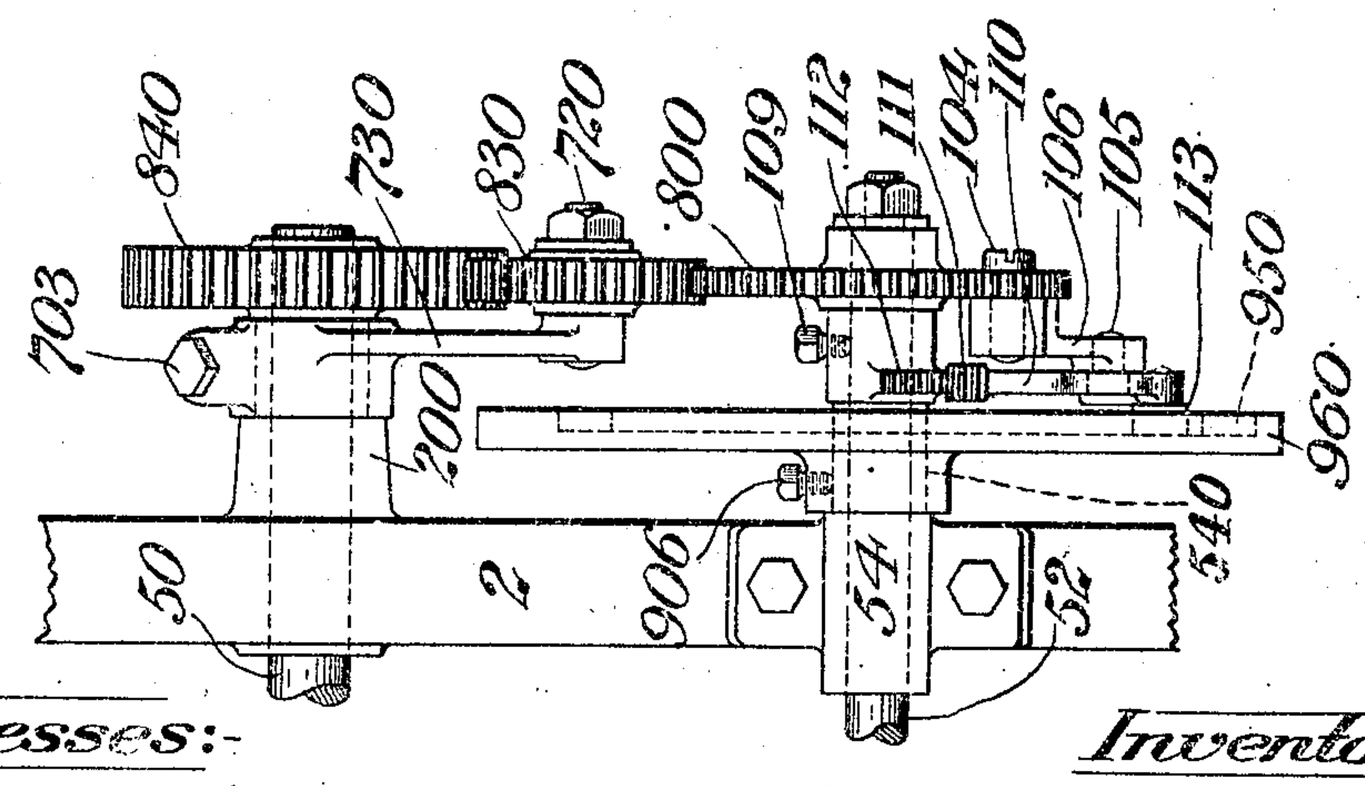


Fig. 18.



Witnesses:-

Chas. W. LaRue

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Inventor:

Frederick E. Strasburg.

By Wilbur M. Stone Atty.

UNITED STATES PATENT OFFICE.

FREDERICK E. STRASBURG, OF RUMFORD FALLS, MAINE, ASSIGNOR TO CONTINENTAL PAPER BAG COMPANY, OF RUMFORD FALLS, MAINE, A CORPORATION OF MAINE.

PAPER-BAG MACHINE.

No. 847,264. Specification of Letters Patent. Patented March 12, 1907.

Application filed October 8, 1906. Serial No. 337,971.

To all whom it may concern:

Be it known that I, FREDERICK E. STRASBURG, a citizen of the United States, residing at Rumford Falls, in the county of Oxford and State of Maine, have invented certain new and useful Improvements in Paper-Bag Machines, of which the following description and claims constitute the specification and which are illustrated by the accompanying drawings.

This machine automatically opens out a tucked-paper tube into a diamond form, and thus participates in manufacturing continuous tucked-paper tubing into square-bottom paper bags like those of Reissue Letters Patent No. 10,083, granted April 11, 1882, upon the application of Mark L. Deering, and in so doing does an important part of the work which has long been done by the machine of the Claussen patent, No. 598,497, of February 8, 1898.

The drawings which accompany this specification exhibit my invention as applied to such rotary folding mechanism below the paper as that shown in the Claussen patent; but those drawings exhibit rotary folding mechanism above the paper, which differs materially in construction and in mode of operation from the oscillating folding mechanism above the paper which is shown in the Claussen patent, and those drawings also show four alternative forms of differential mechanisms connected with the rotary folding mechanism above the paper, each of which four forms of differential mechanism differs materially in construction and mode of operation from everything shown in the Claussen patent, and likewise differs, as I believe, from everything shown anywhere in the prior art of paper-bag machinery.

Though the descriptive part of this specification primarily attends to the particular mechanism shown in the accompanying drawings, my invention, as defined in sundry of my claims, may include combinations in which the folding mechanism below the paper differs materially from the particular rotary folding mechanism below the paper, which is shown in the Claussen patent and is also shown in the drawings which accompany this specification.

When I speak of folding mechanism "below" the paper and of folding mechanism "above" the paper, I do not mean that the paper is always horizontal and that the folding mechanism below the paper is directly between it and the earth, while the folding mechanism above the paper is directly between it and the sky, for the paper may pass through the machine diagonally or vertically instead of horizontally. When I speak of the folding mechanism below the paper, I mean to include the folding-beds, upon one of which one ply of a tucked-paper tube is gripped and held, and by the folding mechanism above the paper I mean that mechanism which grips the other ply of the tucked-paper tube and turns and folds it back upon itself.

In the drawings which accompany this specification, Figure 1 is a side elevation of a part of a paper-bag machine, which part includes the rotary folding mechanism below the paper of the Claussen patent and includes my new rotary folding mechanism above the paper. Fig. 2 is a plan view of the machinery of Fig. 1 looking in downward diagonal direction of the arrow A of Fig. 1. Figs. 3 to 8, inclusive, are a series of sectional side elevations taken on line *b b* of Fig. 2 and looking in the direction of the arrow B in that figure and showing successive positions of the folding mechanism below the paper, and of the folding mechanism above the paper in my machine without showing the means by which those folding mechanisms are respectively rotated. Figs. 9 to 14, inclusive, are diagrammatic side elevations showing successive positions of one form of mechanism for imparting varying rotation to the folding mechanism above the paper. The positions shown in Figs. 9 to 14, inclusive, of that operating mechanism correspond with the positions shown in Figs. 3 to 8, inclusive, of the rotary folding mechanism operated upon thereby. Figs. 15, 16, and 17 are side elevations, otherwise similar to Fig. 1, which show three other mechanisms for imparting the desired variable rotation to the folding mechanism above the paper. Figs. 18, 19, and 20 are partial front elevations of the mechanisms of Figs. 15, 16, and 17 looking in the direction of the arrow A in those figures respectively. The three mechanisms shown in Figs. 15, 16, and 17, respectively, are included in this specification and

the accompanying drawings as showing three separate equivalents of the mechanism shown in Figs. 9, 10, 11, 12, 13, and 14 for imparting the necessary variable rotation to the folding mechanism above the paper. Fig. 21 is a diagrammatic side elevation illustrating the relative positions of gears 80 and 83 during one complete rotation of each of them.

In the accompanying drawings the numerals 2 and 3 indicate the two sides of the frame, upon which are mounted the various parts of moving machinery shown in the drawings. In sleeves 4 5, inreaching from side frames 2 3, respectively, is journaled the conveyer-shaft 8. Sleeves 4 5 are provided with flanged heads 6 7, respectively, through which, by means of bolts 9, said sleeves may be secured to their respective side frames. Fixed to shaft 8, about midway between frames 2 3, is the rotary conveyer 10.

Pivotally supported by the rotary conveyer are one or more carriers or folding-beds, as 11. In the present drawings places are provided in conveyer 10 for three such folding-beds, but for convenience only one is shown. Said folding-bed 11 is pivoted at 12 in conveyer 10, and said conveyer is provided with pivots 13 14 for the other two folding-beds. Folding-bed 11 may be caused to oscillate on pivot 12 toward and away from axis 8 during its rotation about said axis on conveyer 10 by the fixed cam 15, which is mounted on the sleeve 4 and has a cam-groove 16 for engagement with roll 17, carried by inwardly-reaching projection 18 of folding-bed 11. Said folding-bed 11 is provided with the front clip 19, pivoted coaxially therewith at 12. Said front clip may be actuated in proper time by means of arm 20, inwardly reaching from pivot-shaft 12, and to which shaft said arm and front clip 19 are fixed. Said arm 20 has pivotally mounted on the inner end thereof cam-roll 21 for engagement with the periphery of cam 22. Said cam 22 is fixed to the inward end of sleeve 5. Cam-roll 21 may be urged to coaction with said cam and front clip 19 to its work of gripping the forward end of the lower ply of the bag-blank to the folding-bed by the impinging of spring-actuated plunger 23 in conveyer 10 against heel 24 of front clip 19. Folding-bed 11 is also provided with the side clips 25 26, pivoted in suitable brackets thereon. Said side clips have the cam-rolls, as 27, for engagement with cams 28 29, fixed to sleeves 4 5, respectively.

The machine is provided with main shaft 30, to which is fixed gear 31 adjacent to frame 3. Said gear 31, through intermediate gear 32, drives gear 33 on conveyer-shaft 8. Gear 33 has a diameter three times greater than that of gear 31, whereby shaft 30 is caused to make three revolutions for each revolution of shaft 8. Power may be communicated to the machine by means of pulley 34 on main shaft 30.

The machine is also provided with the blank-feeding rolls 36 37 and 38 39. Rolls 36 37 are geared together to rotate at equal surface speeds by means of gears 40 41, respectively, affixed to the respective roll-shafts 42 43. Said rolls each have a circumference equal to a bag-blank length and are driven to make three revolutions for each revolution of conveyer 10 by the following train of gearing: Gear 44 on stud 95 meshes with conveyer-gear 33, and turning on the same stud and fast to gear 44 is gear 440, meshing with gear 410 on shaft 43 of roll 37. Roll-shaft 42 may be mounted in slidable boxes 402 420 and said boxes urged downwardly to hold roll 36 to its work by springs, as 97. Roll 36 may be provided with a creaser-blade 35 for coaction with a creaser-groove 45 in roll 37 for forming a crease in the bag-blank on the line of the main transverse fold. Feed-rolls 38 39 are geared together by gears 46 47, fixed to roll-shafts 48 49, respectively. Lower gear 47 is driven from conveyer-gear 33 through intermediate gear 480, whereby said rolls are caused to revolve at a surface speed equal to the surface speed of the folding-beds.

The machine is also provided with the creasing and pasting wheel 490 for forming the creases on which to fold over the front and rear flaps of the diamond to finish the bag-bottom and for applying paste to secure these flaps in place. This creasing and pasting wheel is fixed to shaft 50, and to said shaft is also fixed gear 51 for engagement with conveyer-gear 33, whereby wheel 490 is driven at the same surface speed as the folding-beds.

On shaft 52, supported for revolution in brackets 54 55, upstanding from side frames 2 3, respectively, is carried means coöperating with the successive folding-beds for opening out the forward end of the bag-blanks and folding them down into the well-known diamond form. Said shaft 52 in its middle portion at 53 is shown of rectangular form and somewhat offset from its axis of revolution. Fixed to said middle rectangular portion 53 are blades 56 57 for engagement with side clips 58 59, respectively, to grip the upper plies of the side tucks of the bag-blank to turn over these upper plies in forming the diamond fold. Said blades 56 57 have their ends bent backwardly at 560 570, respectively, to allow free access of the upper ply of the bag-blank thereunder and over front hook 71. Side clips 58 59 are pivotally supported on shafts 60 61, mounted for oscillation in opposite sides and adjacent to the path of the bag-blank on the folding-bed. Said shafts 60 61 preferably lie in one plane and each at an angle of about forty-five degrees with shaft 52.

Shaft 60 is provided at that end thereof opposite side clip 58 with a cam-roll arm 64, bearing cam-roll 65, for engagement with cam 66. Bearing 54 is provided with an inwardly-reaching sleeve 68, to which said cam 66 is fixed. Roll-arm 64 has a portion 67 projecting axially opposite thereto and in which is fixed pin 69 for engagement with spring-actuated plunger 70 and by which means side clip 58 is urged to its work and roll 65 to engagement with cam 66. For convenience of adjustment cam 66 may comprise two members 606 660, each provided with clamping means for securing said members to sleeve 68. Side clip 59 is mounted similarly to side clip 58 and is actuated by cam-arm 74, carrying roll 75 in engagement with cam 76, all similar to the corresponding parts just described for actuating side-clip 58, except that the operating means for side clip 59 are of the opposite hand to those for side clip 58. Attached to the middle portion 53 of shaft 52 is front finger 71 for engagement with the upper ply of the forward end of the bag-blank.

Shaft 52 and the mechanism carried thereon are caused to rotate in coaction with the successive folding-beds by means of differential mechanism, which I will now describe. On shaft 52 and for convenience at the right-hand end thereof, Fig. 2, is fixed gear 80. Said gear is driven through two floating gears 81 82 by gear 83. In the present instance said gear 83 is mounted on fixed stud 72, supported in bracket 73, bolted by two of bolts 9 to flange 6 of sleeve 4. For convenience gear 83 meshes with and is driven by gear 84 on creaser-shaft 50. As shaft 50 makes three rotations for each revolution of conveyer 10 and as gears 80 and 84 are equal gears, shaft 52 will also make three rotations for each revolution of conveyer 10 and one rotation for each passing folding-bed on that conveyer. Shaft 52 could be driven from any of several sources of power other than shaft 50 and which driving would in all ways serve the present purpose, provided that the gears were proportioned to cause shaft 52 to make one complete rotation for each passing of a folding-bed, and provided said transmission was made through means which are shiftable and thereby adapted to vary the speed of the shaft 52.

Pivoted on shaft 52 on opposite sides of gear 80 are arms 77 78, in the free ends of which is supported gear 81 for revolution in mesh with gear 80. Pivoted on stud 72 on each side of gear 83 are arms 87 88, in the free ends of which is supported gear 82 for revolution in mesh with gear 83. For retaining gears 81 82 in mesh studs 85 86 thereof, respectively, are linked together by arms 89 90. Gear 82 may be made to oscillate about stud 72 and in mesh with gear 83 and gear 81 to oscillate about shaft 52 in mesh with gear 80 on one side and gear 82 on the other side to accelerate or retard the rotation of gear 80 and shaft 52 by means of cam-arm 79, one end of which is pivoted to stud 86 of gear 82 and the other end of which bifurcated at 91 to slide back and forth on shaft 30. For convenience said bifurcated end 91 is arranged to slide on a rectangular block 92 and in which block shaft 30 rotates. Said block 92 and arm 79 are held in alinement by means of collar 93, fast on shaft 30. Arm 79 may be caused to reciprocate to move floating gears 81 82 by the engagement of roll 94 on arm 79 with cam-groove 95 of cam 96 on said shaft 30. By disposing cam 96 at some convenient position in some other part of the machine and by a slight modification of the cam-path 95 of said cam arm 79 may be connected to stud 85 to oscillate the floating gears with equal efficiency with the arrangement illustrated in the present drawings. By means of floating gears 81 82, arm 79, and cam 96 gear 80 and shaft 52 may be driven at a variable rotary speed in an anticlockwise direction from the uniform rotation in a clockwise direction of gear 83 to cause shaft 52 and the mechanism carried thereon to harmoniously coact with any given folding-bed on canveyer 10 to open out the forward end of the bag-blank and fold it down into the diamond fold and then to cause said shaft 52 and the mechanism carried thereon to continue their rotation in an anticlockwise direction back to their initial positions ready to coact with the next succeeding folding-bed on conveyer 10, and so on continuously.

The successive steps in the variable rotation of gear 80 relative to the successive steps in the uniform rotation of gear 83 may be followed in the diagrammatic view of Fig. 21. Therein positions *c c* of said gears, respectively, correspond with the position of blades 56 57 when the bag-blank is being delivered under said blades preparatory to the formation of the diamold fold, Fig. 3. From position *c* to position *e* gear 80 rotates at an increasing speed, while gear 83 revolves at a uniform speed from position *c* to position *e* thereof. Positions *e e* of said gears in Fig. 21 correspond approximately with the positions of those gears in Fig. 5. From position *e* to position *g* gear 80 rotates at a decreasing speed. (See Fig. 7.) Gear 80 now increases its speed from position *g* to position *j*, (approximately the position of Fig. 8.) From position *j* gear 80 rotates at a decreasing speed through positions *h i*, &c., to its original position *c*.

Referring now to Figs. 15 and 18, I have therein illustrated equivalent differential mechanism for rotating at the desired variable speed shaft 52 and the mechanism thereon. In said Figs. 15 and 18 gear 800, mounted to turn freely on shaft 52, is driven in an anticlockwise direction at a uniform speed to

make one revolution for each passing of a folding-bed on the conveyer 10. For convenience gear 800 is shown as driven from gear 840, fixed on creaser-shaft 50, said gears being of equal diameter through intermediate gear 830. Intermediate gear 830 turns freely on stud 720, fixed in arm 730, and which arm is clamped, by means of bolt 703, to projecting sleeve 200 of side frame 2. On shaft 52, adjacent to gear 800, segment-gear 112 is secured by means of set-screw 109. Arm 110 is pivoted to turn freely on stud 105 in bracket 106. Said bracket is attached, by means of screws 104, to gear 800 for revolution therewith at a uniform speed. Said arm 110 has formed thereon segment-gear 111 for engagement with segment-gear 112 on shaft 52. The other member of said arm 110 carries roll 113 for engagement with groove 950 of cam 960. Said cam 960 is fixed on sleeve 540, projecting outwardly from box 54 of shaft 52 by means of set-screw 906. If now as gear 800 revolves at a uniform speed on shaft 52 arm 110, carried on said gear to be held against rotation on pivot 105, its segment-gear 111, in mesh with segment-gear 112, fast on shaft 52, will hold said segment-gear 112 and shaft 52 against rotation relative to gear 800 and will cause shaft 52 to rotate in unison with gear 800; but as arm 110 has its roll 113 in engagement with groove 950 of fixed cam 960 said arm as it is carried around by gear 800 will be oscillated back and forth on its pivot 105, and its segment-gear 111, in mesh with segment-gear 112, will cause said segment-gear and shaft 52 to oscillate about the axis of said shaft relative to gear 800. As roll 113 is moved toward shaft 52, said shaft will be caused to rotate faster than gear 800, and as said roll is moved away from shaft 52 said shaft will be caused to rotate slower than gear 800. Thereby variable rotary motion is imparted to shaft 52 and the mechanism carried thereon from the uniform rotary motion of gear 800. Also the contour of cam-groove 950 is such that the folding mechanism on shaft 52 is caused to rotate at a speed so varied within each revolution as to suitably time said folding mechanism with each successive folding-bed on the rotary carrier 10 in the formation of the diamond fold of a bag-blank.

In Figs. 16 and 19 I have illustrated another equivalent differential mechanism for rotating at the desired variable speed shaft 52 and the mechanism thereon. Therein gear 801, mounted to turn freely on shaft 52, is driven in a clockwise direction at a uniform speed to make one revolution for each passing of a folding-bed on conveyer 10. For convenience gear 801 is shown as driven from gear 804 on creaser-shaft 50, said gears being of equal diameter, through intermediate gears 802 803. Said intermediate gears turn freely on studs 702 806, respectively projecting from frame 2. For clearness of illustration the mechanism on shaft 52 in Fig. 19 is shown partly in section. To the hub of the gear 801, turning freely on shaft 52, is fixed bevel-gear 120, meshing with bevel-gear 121, pivoted to turn freely on rock-arm 119, turning freely on shaft 52. Bevel-gear 121 meshes on that side opposite bevel-gear 120, with bevel-gear 122 fixed on shaft 52. Bevel-gears 120 and 122 are of equal diameter and coaxial. By this train of three bevel-gears rotary movement may be transmitted to shaft 52 from gear 801, but in the opposite direction to the movement of that gear. Fixed on shaft 50 by set-screw 118 is cam 906, having cam-groove 905 for engagement with roll 123 of arm 790. Said arm 790 is pivoted at its lower end to rock-arm 119 and at is upper end is bifurcated for sliding engagement with shaft 50. Said arm is maintained in operative position on shaft 50 by collar 125. If now shaft 50 be rotated in an anticlockwise direction and rock-arm 119 and bevel-gear 121 thereon be held against turning about shaft 52, said shaft will be caused to rotate at the same speed as gear 801, but in the opposite direction; but as arm 790 has its roll 123 in engagement with groove 905 of cam 906 arm 790 will rock arm 119 and transmitting bevel-gear 121 thereon to cause bevel-gear 122 and shaft 52 to rotate faster than bevel-gear 120 when arm 790 is moved toward shaft 50 and slower when arm 790 is moved away from said shaft. Thereby variable rotary motion is imparted to shaft 52 and the mechanism carried thereon from the uniform rotary motion of gear 801. Also the contour of cam-groove 905 is such that the folding mechanism on shaft 52 is caused to rotate at a speed so varied within each revolution as to suitably time said folding mechanism with each folding-bed on the conveyer 10 in the formation of the diamond fold of a bag-blank.

In Figs. 17 and 20 I have illustrated still another equivalent differential mechanism for rotating at the desired variable speed shaft 52 and the mechanism thereon. Therein internal gear 130 is secured by set-screw 134 to an outwardly-extending portion of shaft 8. For clearness of illustration the mechanism on said shaft is shown partly in section in Fig. 20. Internal gear 130 actuates gear 137 through planetary idle gear 136, which is in mesh with both gears 130 and 137. Said gear 137 is mounted to turn freely on shaft 8, coaxial with internal gear 130. As shaft 8 is actuated at one-third the rotation speed desired in shaft 52, internal gear 130 is of three times the diameter of gear 137. On the outer end of sleeve 138 of gear 137 is fixed gear 809 for revolution therewith. Planetary transmitting-gear 136 is mounted for free rotation on stud 141 of rock-arm 140. The hub of said rock-arm encircles sleeve 138

of gear 137 and turns freely thereon. Arm 140 and transmitting-gear 136 thereon may be shifted in a circular path about the axis of shaft 8 by means of arm 791, bearing roll 133 in engagement with groove 955 of cam 966. Said cam 966 is mounted on shaft 50 and is secured thereto by set-screw 129. Said shaft 50 is geared to revolve at a constant speed three times as fast as shaft 8. Arm 791 is connected to rock-arm 140 by means of pivot-pin 141, and said arm is bifurcated at its upper end for sliding engagement with shaft 50 and is maintained in operative position on shaft 50 by collar 135. Motion is transmitted from gear 809 to equal gear 807, fast on shaft 52, through idle gear 808, turning freely on stud 143 in hub 142 of frame 2. If now shaft 8 be rotated in a clockwise direction and rock-arm 140, carrying planetary idle gear 136, be restrained against turning about shaft 8 as an axis, internal gear 130 will drive gear 137 through idle gear 136 in an anticlockwise direction at a constant speed relative to internal gear 130, but in the ratio of three to one to said internal gear. Then through gear 809 on sleeve 138 of gear 137, idle gear 808, and gear 807 on shaft 52 said shaft will also be driven at a constant speed of rotation equal to that of gear 137; but as arm 791 has its roll 133 in engagement with groove 955 of cam 966 arm 791 will rock arm 140 and idle gear 136 thereon to cause gear 137 to rotate relatively faster than internal gear 130 when arm 791 is moved toward shaft 50 and relatively slower when arm 791 is moved away from said shaft. Thereby through the train of gears 809, 808, and 807 variable rotary motion is imparted to shaft 52 from the uniform rotary motion of internal gear 130. Also the contour of cam-groove 955 is such that the folding mechanism on shaft 52 is caused to rotate at a speed so varied within each revolution as to suitably time said folding mechanism with each folding-bed on the conveyer 10 in the formation of the diamond fold of a bag-blank. The internal gear mechanism of Figs. 18 and 20 is mounted on shaft 8 for convenience only and can as well be mounted on shaft 52 or elsewhere, provided that the ratios of the gears be such as to produce the desired number of revolutions of shaft 52.

There are also still other equivalent means for so combining the folding mechanism below the paper with the rotary folding mechanism above the paper as to enable those mechanisms to harmoniously coöperate to make the diamond fold in a paper-bag blank. The four forms of combining mechanism which are particularly described in this specification are selected as typical of all equivalent means for accomplishing that result.

I will now describe the operation of my present machine when it includes the particular operating mechanism shown in Figs. 9 to 14 of the drawings.

A section of tucked paper tubing of suitable length for a bag-blank is presented to the bite of rolls 36 37, Figs. 1 and 2, creasers 35 45 being at such distance from said bite as to form later the crease for the main traverse fold of the bag-bottom at the proper distance from the leading end of said bag-blank. The machine is then started and the bag-blank is fed forwardly and upwardly between said rolls 36 37. A crease 99 is formed across said blank by creasers 35 45 and the forward end of the bag-blank delivered into the bite of rolls 38 39. Rolls 38 39 revolve at a surface speed equal to the surface speed of the folding-bed and somewhat faster than the surface speed of rolls 36 37, thereby causing the bag-blank to be drawn out from rolls 36 37, or roll 36 may be lifted to release the blank at the proper time by some suitable means. (Not shown.) The bag-blank is then delivered onto the contiguous folding-bed, as 11, and with the forward end of the lower ply of said blank under front clip 19. Thereupon front clip 19 grips said forward end of the lower ply of the blank to the forward end of the folding-bed and side clips 25 26 grip the lower plies of the respective side tucks to the sides respectively of the folding-bed, Fig. 3. At this time shaft 52 in its anticlockwise rotation has reached the position of Fig. 3, and the upper ply of the mouth of the bag-blank passes under blades 56 57 and over front fingers 71. Also floating gears 81 82 and their actuating mechanism are in the positions of Fig. 9. The folding-bed now advancing in a clockwise direction from the position of Fig. 3 to that of Fig. 4 carries the upper ply of the bag-blank well up onto front finger 71, and the continued rotation of shaft 52 carries side clip-rolls 65 75 onto the high parts of their respective fixed cams 66 76, whereby side clips 58 59 grip the upper plies of the respective side tucks to fingers 56 57 respectively. Fig. 4.

Floating gears 81 82 and their actuating mechanism are now in the positions of Fig. 10. Roll 94 in groove 95 of cam 96 now passes from the high part of said groove to the position of Fig. 11, whereby arm 79 is retracted toward shaft 30 and gear 82 is caused to roll in an anticlockwise direction on gear 83 against the direction of rotation thereof, thereby increasing the speed of rotation of gear 82, and gear 81 is caused to rotate in a clockwise direction on gear 82 against the direction of rotation thereof, thereby increasing the speed of rotation of gear 81 over that of gear 82; but gear 81 is also caused to roll in an anticlockwise direction on gear 80 in the same direction as the

rotation thereof, thereby imparting to said gear 80 a speed of rotation less than that of gear 81. The resultant of these two increased speeds and one decreased speed is an increased speed of gear 80 over that of driving-gear 83, whereby shaft 52 and the mechanism carried thereon are caused to rotate from the position of Fig. 4 to that of Fig. 5 at an increasing speed to properly coact with the folding-bed to open out the forward end of the bag-blank on the transverse line of crease 99, Fig. 5. Also roll 17 of folding-bed 11 now passes to a low part of groove 16 in cam 15, whereby said folding-bed is swung inwardly on pivot 12 of carrier 10 to maintain the proper distance between the folding-bed and shaft 52 in the opening out of the bag-blank, Fig. 5. Arm 79 still continuing its retractive movement from the position of Fig. 11 to that of Fig. 12 and at an increased speed, as will be observed from the contour of groove 95 of cam 96, shaft 52 will continue its anticlockwise rotation and at a still increasing speed from the position of Fig. 5 to that of Fig. 6. This still increasing speed of rotation of shaft 52 from the position of Fig. 5 to that of Fig. 6 is required to enable the mechanism of said shaft 52 to properly coact with the folding-bed to complete the diamond fold.

Directly succeeding the position of Fig. 5 side clip-rolls 65 75 run off the high parts of their respective fixed cams 66 76, whereby side clips 58 59 are caused to release their grip on the side tucks respectively of the bag-blank. The folding-bed is then swung outwardly to its original position, and the now diamond-folded bag-blank is released from engagement with the mechanism of shaft 52, Fig. 6.

From the position of Fig. 12 to that of Fig. 13 arm 79 stands substantially still, as roll 94 is then traveling in an approximately concentric portion of groove 95 of cam 96, and shaft 52, therefore, rotates at an approximately uniform speed from the position of Fig. 6 to that of Fig. 7. At this later position the diamond-folded blank passes out of engagement with the mechanism of shaft 52. From the position of Fig. 7 the bag-blank is carried on under the creaser and paster-wheel 490 and thence to any suitable flap-folding mechanism. (Not shown.) At the same time arm 79 reverses its direction of travel and from the position of Fig. 13 to nearly that of Fig. 14 moves slowly outwardly from shaft 30, and thereby slows down the speed of rotation of shaft 52 to allow the mechanism carried thereby to turn over opposite the depressed portion 100 of carrier 10 without interference, Fig. 8. From the position of Fig. 14 arm 79 remains substantially at rest for a short time and then continues its outward movement, decreasing the speed of rotation of shaft 52 until that shaft returns to its initial position of Fig. 3 to repeat its operation on another bag-blank.

I claim—

1. The combination of a moving folding-bed which is provided with devices to hold the lower ply of a tucked paper tube thereon; a rotary folding mechanism, opposite to the moving folding-bed, and provided with devices to grip thereto the upper ply of the tucked paper tube; and differential mechanism, connected with the rotary folding mechanism, and adapted to impart thereto a series of rotations, each of which gradually varies in speed during different parts thereof, but is identical in aggregate time with one cycle of movement of the moving folding-bed, or with some divisor of that cycle; all coöperating to unfold a tucked paper tube, and to refold it into a paper-bag blank of a diamond form.

2. The combination of a moving conveyer; an oscillating folding-bed pivoted to the conveyer, and provided with devices to hold the lower ply of a tucked paper tube thereon; a rotary folding mechanism opposite to the moving conveyer; and provided with devices to grip thereto the upper ply of the tucked paper tube; and differential mechanism, connected with the rotary folding mechanism, and adapted to impart thereto a series of rotations, each of which gradually varies in speed during different parts thereof, but is identical in aggregate time with one cycle of movement of the moving conveyer, or with some divisor of that cycle; all coöperating to unfold a tucked paper tube, and to refold it into a paper-bag blank of a diamond form.

3. The combination of a rotary folding-bed, which is provided with devices to hold the lower ply of a tucked paper bag thereon; a rotary folding mechanism opposite to the rotary folding-bed, and provided with devices to grip thereto the upper ply of the tucked paper tube; and differential mechanism, connected with the rotary folding mechanism, and adapted to impart thereto a series of rotations, each of which gradually varies in speed during different parts thereof, but is identical in aggregate time with one rotation of the folding-bed, or with some divisor of that rotation; all coöperating to unfold a tucked paper tube, and to refold it into a paper-bag blank of a diamond form.

4. The combination of a rotary conveyer; an oscillating folding-bed pivoted to the conveyer, and provided with devices to hold the lower ply of a tucked paper tube thereon; a rotary folding mechanism opposite to the rotary conveyer and provided with devices to grip thereto the upper ply of the tucked paper tube; and differential mechanism, connected with the rotary folding mechanism, and adapted to impart thereto a series of rotations, each of which gradually varies in speed during different parts thereof, but is

identical in aggregate time with one rotation of the rotary conveyer, or with some divisor of that rotation; all coöperating to unfold a tucked paper tube, and to refold it into a paper-bag blank of a diamond form.

5. The combination of a rotary folding-bed which is provided with devices to hold the lower ply of the tucked paper tube thereon; a rotary folding mechanism opposite to the rotary folding-bed and provided with devices to grip thereto the upper ply of the tucked paper tube; and differential mechanism connected with the rotary folding mechanism and consisting of two floating gears, and links to retain those gears in mesh, and means to so move those floating gears as to vary the speed of the rotary folding mechanism relatively to the speed of the rotary folding-bed; all coöperating to unfold a tucked paper tube, and to refold it into a paper-bag blank of a diamond form.

6. The combination of a rotary conveyer; an oscillating folding-bed pivoted to the conveyer and provided with devices to hold the lower ply of a tucked paper tube thereon; a rotary folding mechanism opposite to the rotary conveyer and provided with devices to grip thereto the upper ply of the tucked paper tube; and differential mechanism, connected with the rotary folding mechanism, and consisting of two floating gears, and links to retain those gears in mesh, and means to so move those floating gears as to vary the speed of the rotary folding mechanism relatively to the speed of the rotary folding-bed; all coöperating to unfold a tucked paper tube, and to refold it into a paper-bag blank of a diamond form.

FREDERICK E. STRASBURG.

Witnesses:

JOHN P. SHEPHERD,

CHARLES L. BROWN.