

No. 709,501.

Patented Sept. 23, 1902.

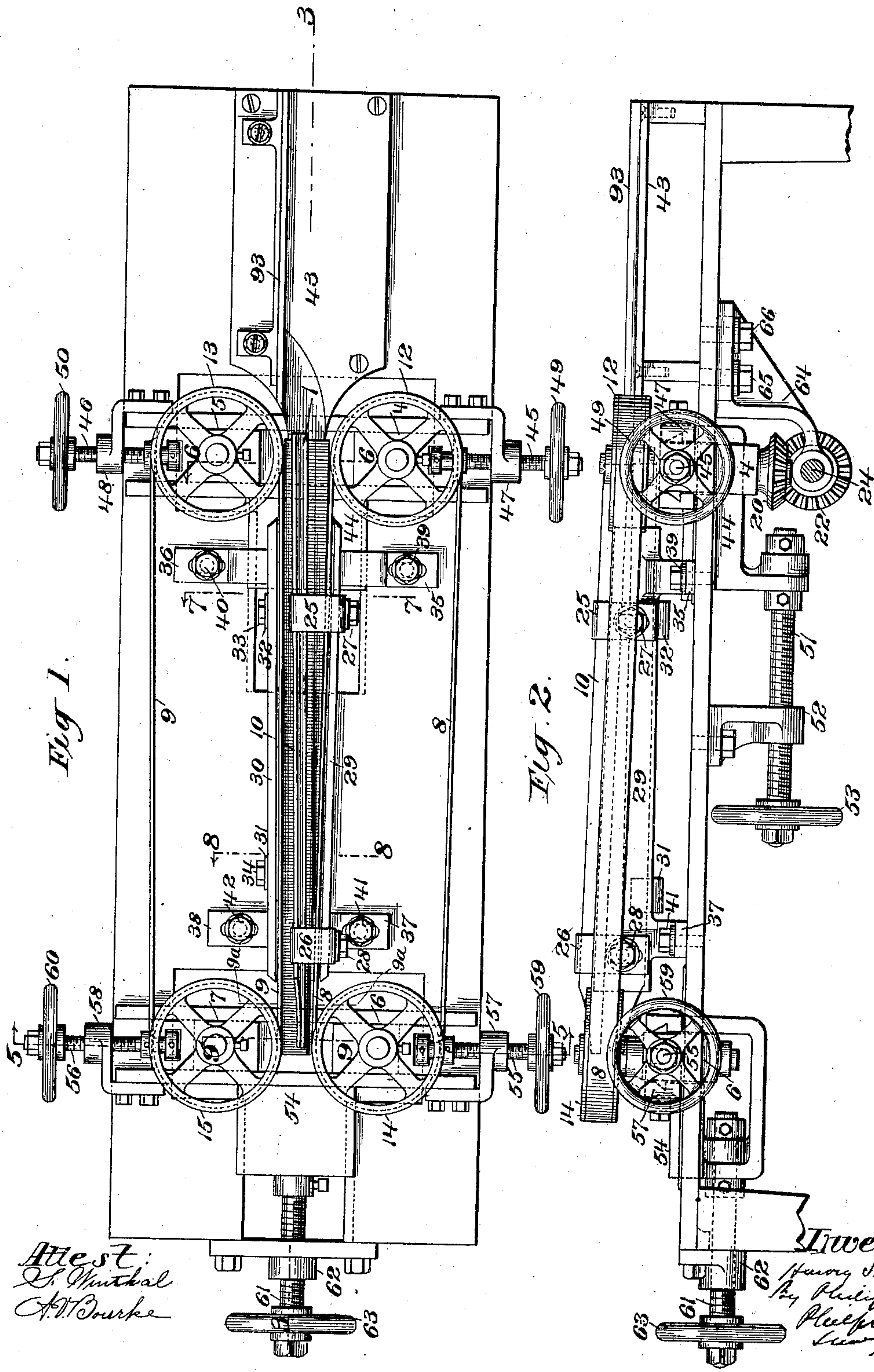
H. S. MUNSON.

MACHINE FOR REFOLDING PAPER TUBES.

(Application filed Aug. 4, 1898.)

(No Model.)

3 Sheets—Sheet 1.



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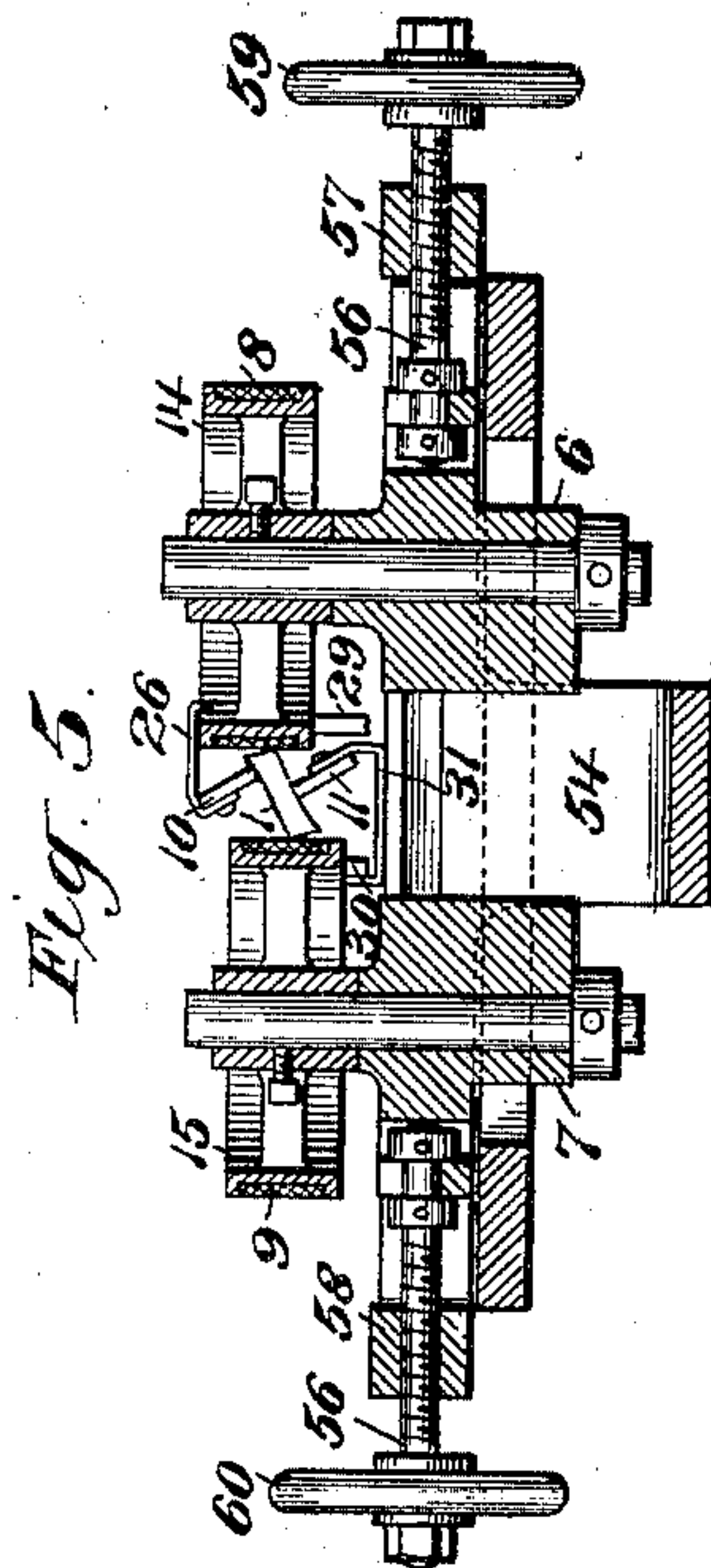
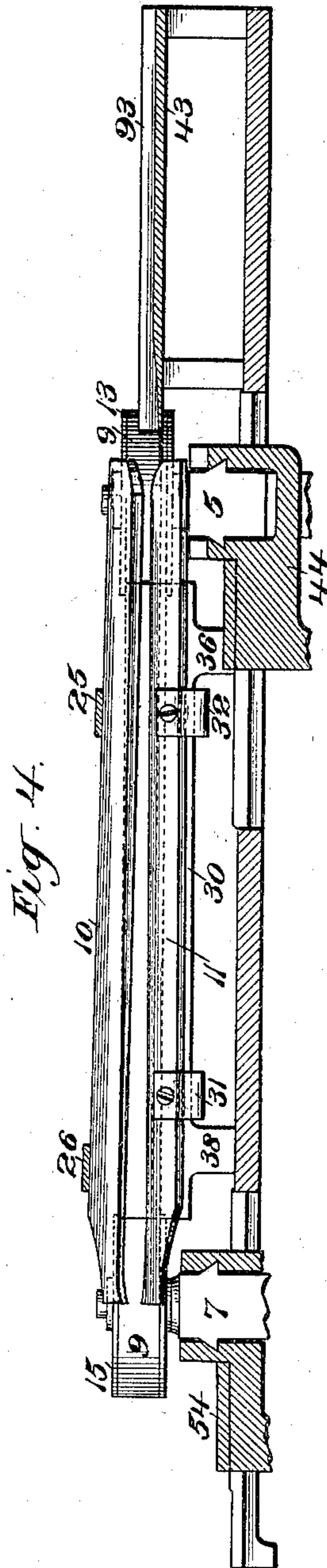
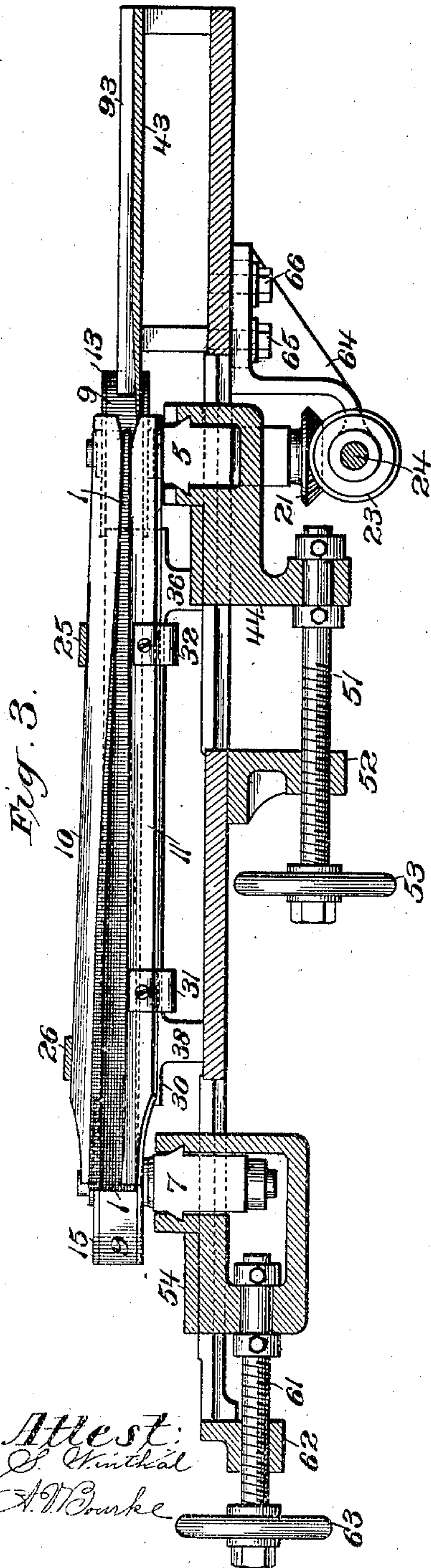
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3 Sheets—Sheet 2.



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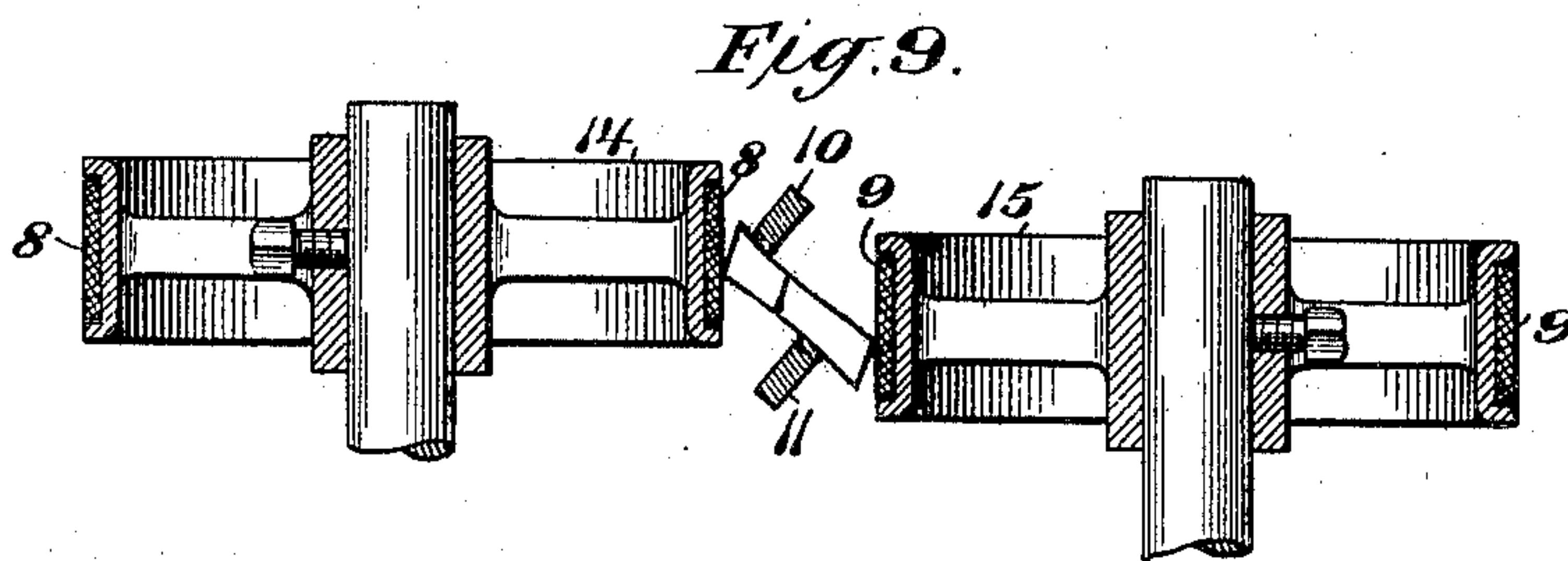
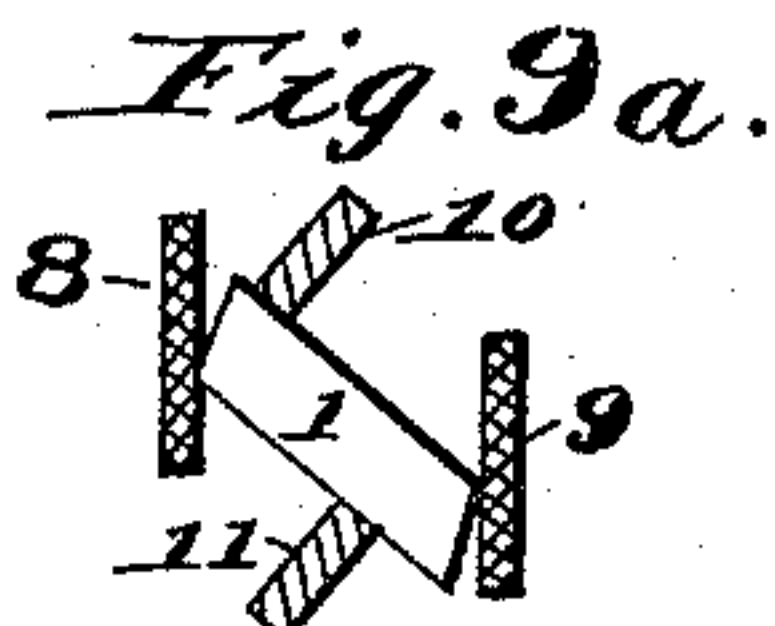
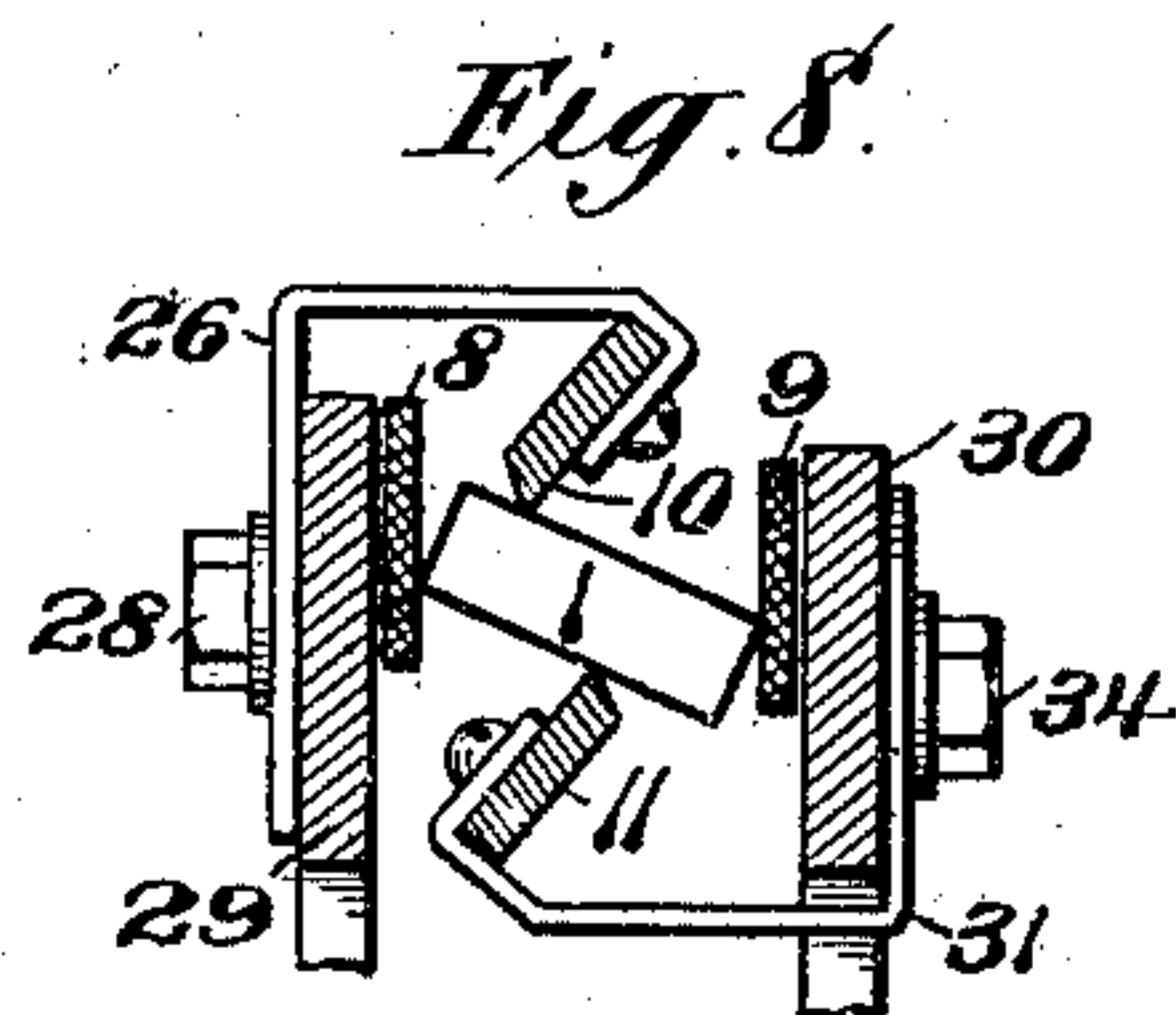
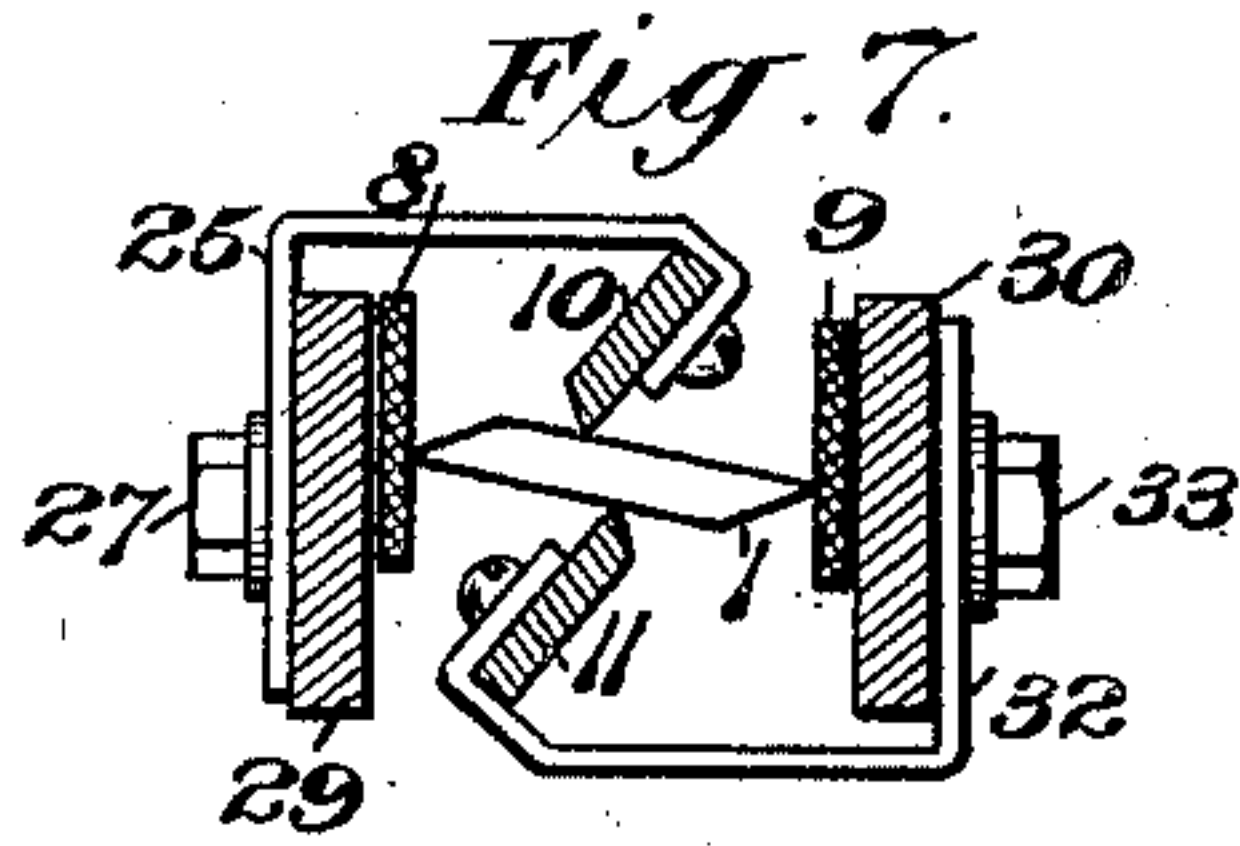
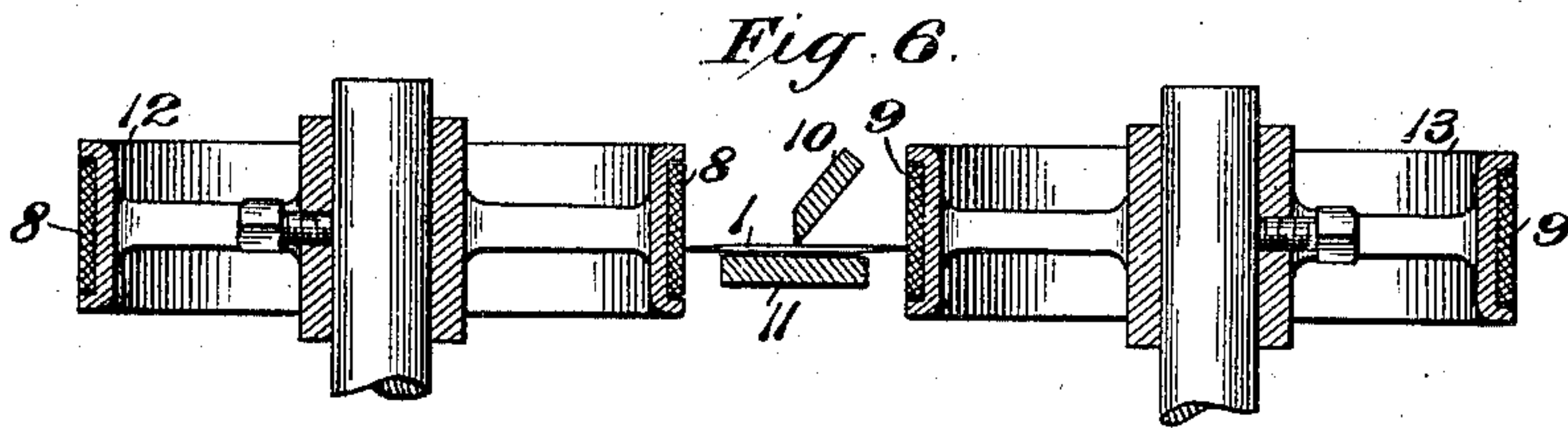
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(Application filed Aug. 4, 1898.)

(No Model.)

3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

HARVEY S. MUNSON, OF NEW HAVEN, CONNECTICUT.

MACHINE FOR REFOLDING PAPER TUBES.

SPECIFICATION forming part of Letters Patent No. 709,501, dated September 23, 1902.

Application filed August 4, 1898. Serial No. 687,699. (No model.)

To all whom it may concern:

Be it known that I, HARVEY S. MUNSON, a citizen of the United States, residing at New Haven, county of New Haven, and State of Connecticut, have invented certain new and useful Improvements in Machines for Refolding Paper Tubes, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to render supple or limp the defined lines upon which a flat blank must be bent to form it into a hollow tube that is to receive and act as the container for contents, as a slide, entered into it. Two of these lines of folding are necessarily doubled in the act of forming the flat tube by folding inwardly its sides and uniting them, while the remaining two defined lines for folding remain in their primary or unfolded condition. Primarily said unfolded or defined lines are rendered limp or supple by bending or folding them sufficiently to bring the flat tube up into hollow form, and incidentally this necessarily opens up or refolds the once-folded lines. This operation of opening up or bending the tube upon its folding-lines is called "refolding," and it is accomplished by the present improvements in a machine embodying this invention in a most simple and effective structure, the several novel features whereof are too fully hereinafter described and claimed to need preliminary explanation, except to say that the essential characteristics of the mechanisms are a pair of side carrying-belts whose relative planes of travel gradually approach each other from their receiving to their delivering points and of opposed guides whose planes of direction are such that their bearing-faces gradually separate from their receiving to their delivering points, whereby the space within which the tube is compelled to travel is gradually contracted in one direction, as widthwise, and expanded in the other and exerts strains upon the tube that cause its plies to move laterally upon its folding-lines and gradually transform it from a flat or collapsed condition, in which it is formed, into a hollow or distended one, from which it may reassume or be collapsed into

its flat tubular condition, it having thus been so folded and refolded upon its folding-lines that the same will readily bend when the tube or short sections of a long tube are to assume a hollow tubular form in practical use, at which time they must readily move on their fold-lines while being worked either by hand manipulation or a packing-machine during the operation of filling them as containers with their contents.

In the accompanying drawings, which represent a machine capable of practically carrying this invention into use, Figure 1 is a plan or top view of such machine. Fig. 2 is a side elevation thereof. Fig. 3 is a longitudinal sectional elevation thereof on the section-line 3 of Fig. 1, a paper-box tube being shown as undergoing the operation of being refolded. Fig. 4 is a like longitudinal sectional elevation on the line 3 of Fig. 1, no tube being shown as undergoing the folding operation. Fig. 5 is a cross-sectional elevation taken on the line 5 of Fig. 1 as seen looking in the direction of its attached arrow, which is contrary to that of the travel of the tube through the machine. Figs. 6, 7, 8, 9^a, and 9 are enlarged cross-sectional elevations taken, respectively, on the section-lines 6 7 8 9^a 9 of Fig. 1 as seen looking in the direction of the arrows connected with said lines, which is that of the travel of the tube through the machine, whereby the various forms assumed by the tube as it is operated upon and undergoing refolding are rendered perspicuous.

The principal mechanisms are a pair of side carrying-belts 8 9, which, though preferably of leather, may be of any material so long as they are strong and durable enough to form when stretched stable bounds between which the paper tube will be carried onward without forcing them apart sufficiently to modify their refolding action upon the tube; but lighter belts may be used when held in place by suitable bearers, as will hereinafter appear. These belts 8 9 are led about and driven by pairs of pulleys 12 13 and 14 15, which pulleys are preferably flanged to better hold the belts in place. (See Figs. 6 and 9.) These pulleys 12 13 are mounted fast upon spindles that are respectively provided with miter-gears 20 21, that mesh with companion miter-

gears 22 23, carried by the driving-shaft 24, and this gearing drives the belt-pulleys 14 15, which are idlers, through the belts 8 9.

From Fig. 6 it will be observed that the pulleys 12 13 have a common horizontal plane of motion, and from Figs. 5 and 9 (view seen in the opposite direction) it will be observed that the pulleys 14 and 15 revolve in separate horizontal planes, the plane in which pulley 15 revolves being in common with that in which the pulleys 12 and 13 revolve. All of these belt-carrying pulleys may, however, run in common planes, as will hereinafter appear in an explanation of modifications of the mechanisms.

By comparing Fig. 6 with Fig. 9 it will further be observed that the belt-pulleys 14 15 are set nearer together than are the pulleys 12 13, or, in other words, the bearing-points of the carrying-belts between the pulleys 12 and 13 (the tube-entrance) are at a distance apart substantially equal to the width of the outspread or flat tube, while the distance between the bearing-points of the carrying-belts between the pulleys 14 15 (the exit of the tube) are at a distance apart equal to that of the outside bearing edges of the tube when in the opened-up or hollow tubular form which is its refolding degree of outward spread.

When the flattened tube is entered between the belts 8 9, its border edges or outer folds engage these belts at about equal points widthwise thereof, and since the belt 9 moves horizontally the edge of the tube bearing upon it is carried horizontally by it through the machine; but as the belt 8 runs obliquely it results that the edge of the tube which is carried by the belt 8 is constantly and progressively lifted, or, in other words, that the opposite edges or outer folds of the tube are progressively moved toward each other by being caused to travel or advance in planes constantly converging and because of the belts 8 9 progressively diverging edgewise or in planes parallel, or substantially so, with the axes of the supporting-rolls as the exit end is approached it follows that the top and bottom plies of the flat tube are constantly and progressively moved away from each other concertedly with the like movement of the sides of the tube toward each other, by which combined movements of its component walls the flattened condition of said tube, as seen in Fig. 6, is gradually changed to that of an open tube, as seen in Fig. 9, which transformation in being accomplished forces the component sides, top, and bottom of the tube to move with respect to each other upon the defined folding-lines whereon a flat blank is doubled to form the tube and whereby said lines are folded and unfolded or refolded, and thus are so worked as to soften their resistance or cause them to become supple or limp. In order to govern the opening up of this flat tube and cause its top and bottom plies to aid the operation, or, in other words, always secure precision in this operation, I

arrange longitudinally between the belts 8 9 stationary guides 10 11 (they may be twisted) or sectional equivalents thereof—that is to say, guides that bear throughout the length of the travel of the box-tube, or substantially so—in such manner as to provide suitable bearing-points in differing planes to properly support the tube to the action of the belts while preventing buckling, and these guides have their bearings preferably diminished to narrow dimensions or edges. The upper guide 10 is preferably narrow-faced throughout, though its last bearing may be of considerable substance and flatly bear upon a considerable portion of the top of the tube. It may also, as shown, be bent inward from its plane near that point to aid a substantial refolding of the upper corner at that time. The lower guide 11 is preferably flat and somewhat wide at the entrance-point for the tube and may droop somewhat, to not only afford a substantial support for the tube, which is flat at that point, but aid in its entry to the belts, and generally throughout its extent this guide presents a narrow bearing-face to the box-tube, though it may at its terminal end be of considerable substance, so as to flatly bear upon a considerable portion of the under side of the tube. It may also, as shown, be bent inward from its plane near that point, and thus insure that the adjacent doubled edge or lower corner of the same shall be sufficiently bent for a distance inward from this corner and compel its double edge to receive a substantial fold. Any suitable means for sustaining these guides in place may be used, that shown as convenient and suitable being the carrying-elbows 25 and 26 for the guide 10, secured by set-screws 27 28 to the bearer 29, and the carrying-elbows 31 32 for the guide 11, secured by set-screws 33 34 to the bearer 30. These guides are preferably made adjustable by means of slots in their elbows, that embrace their fastening set-screws. These bearers 29 30 are usefully and preferably provided to prevent any undue sagging or buckling of the belts, and they are set edgewise or in substantial parallelism with and along the outer sides of the belts 8 9 and are held in place by elbow-brackets 35 36 and 37 38, having elongated sockets, whereby they may be adjustably held by retaining-screws 39 40 41 42.

As thus far described, assuming the machine to have been built for the treatment of a given size of box-tube, as a standard cigarette-box tube, its operation will be readily understood.

For convenience, although it is non-essential, a feeding-table 43, with an adjustable guiding-ledge 93, is provided, and one after another of long and flat box-tubes, suitable to be cut up into short containers, is entered between the belts 8 9 and the guides 10 11, as in Fig. 6. The leading end of this tube, very slightly pressed open by the act of introducing it, is frictionally seized by contact

of the belts with its opposite folded edges, and thus caused to take up the movement of the belts. It is carried by them continuously and progressively onward and is regularly compressed or narrowed up widthwise, so that the opposite sides and top and bottom plies move in opposite directions, each connected side and ply bending on the outermost folded corner as contracting-fulcrums, and each such side and ply bending on one of the remaining folded corners as an enlarging-fulcrum. As this movement proceeds the tube is caused to assume a rhomboidal form, as in Fig. 7, then becomes rectangular, as in Fig. 8, then moving still further assumes a rhomboidal form beyond the rectangular, this conversion of the transverse form of it taking up the shapes intermediate those illustrated, and thus the flat tube of Fig. 6 is opened out by its walls moving upon its lines of fold until its connecting-folds are moved from an inward-folded condition into an obtuse-angled fold, and its unfolded lines are moved from the flat or unfolded condition and folded or bent into the acute-angled fold shown in Fig. 9. The tube thus treated has all of its folding-lines brought into that supple, limp, or "refolded" condition suiting them for convenient manipulation in forming them into containers for contents and loading them therewith. Paper tubes of this character are now extensively made in varying sizes, the refolding of which various-sized tubes is provided for in this machine as follows: The spindles of the belt-pulleys 12 13 have their bearings in boxes 4 5, that are capable of moving laterally by means of sliders that bear in facing ways cut in a sliding carrier-block 44. These boxes 4 5 are respectively provided with adjusting-screws 45 46, having their inner ends connected rotatively to said boxes and having their threaded shanks turning, respectively, in threaded nuts 47 48, fixed to the bed-plate and bearing at their outer ends, respectively, hand operating-wheels 49 50. The carrier-block 44 slides longitudinally on ways provided for it at each side of a recess in the bed-plate, being provided with an adjusting-screw 51, rotatively connected with the block 44, the threaded shank of said screw turning in a threaded nut 52, that is fast to the bed-plate and provided at its outer end with a hand operating-wheel 53. The spindles of the belt-pulleys 14 15 have their bearings in boxes 6 7, that are capable of moving laterally by means of sliders that bear in facing ways cut in a sliding carrier-block 54. These boxes 6 7 are respectively provided with adjusting-screws 55 56, having their inner ends connected rotatively to said boxes and having their threaded shanks turning, respectively, in threaded nuts 57 58, fixed to the bed-plate, and bearing at their outer ends, respectively, hand operating-wheels 59 60. The carrier-block 54 slides longitudinally on ways provided for it at each side of a recess in the bed-plate, being provided with

an actuating-screw 61, rotatively connected with the block 54, the threaded shank of said screw turning in a threaded nut 62, that is fast to the bed-plate, and being provided at its outer end with a hand operating-wheel 63. When, therefore, it is desirable or necessary to adjust the band-pulleys 12 13 or 14 15 to or from each other, this may be accomplished by suitably turning the hand-wheels 49 50 or 59 60, and when this companion set of belt-pulleys 12 13 is to be adjusted bodily to or from the companion set of belt-pulleys 14 15 this is readily effected by suitably turning the hand-wheels 53 62, one or both. One such adjustment only is necessary, except where a very long tube is to be treated, when it may be desirable to make both adjustments. If, however, the carrier-block 44 is to be adjustable, the bracket 64 will also be appropriately adjusted by its slotted bearing and holding-screws 65 66, provided for that purpose.

The belt-pulleys 12 13 14 15 are made fast to their spindles by holding-screws, as shown, and may, if desired, be adjusted longitudinally thereon.

Where the bearing-surfaces of the belts are plain, it is essential that longitudinal guides shall be provided, and these guides preferably extend to form longitudinal bearings equal, or nearly so, to the longitudinal bearings afforded by the belts 8 9. Although these top and bottom guides are shown herein as stationary guides 10 and 11, it will be understood that the invention as claimed herein is not limited to the use of stationary guides. In my application, Serial No. 687,701, filed August 4, 1898, I have shown guides in the form of moving belts. If they are of an extent which includes or extends beyond the point of narrowest dimensions between the belts 8 9 where they pass around the pulleys 12 13, it is preferable to curve their outer ends outwardly, as shown, thus shaping them to form inclined facing inner surfaces that will constitute wedge-like directors acting to guide the tube to its appropriate position between the belts 8 9 where it enters between them.

A feeding-table 43 has been described as useful for aiding the entrance of the tube into this refolding device; but from the modified guides described in the preceding paragraph it is apparent that such a table is not essential, and whether or not said modified guides are used it would still be apparent that a feeding-table may be dispensed with, since it is possible without it to enter the tubes into the refolding device with great speed. Where, however, the feeding-table is used, it has been found in practical use that its front end must be inclined, so as to admit the downward expansion or bulging of the tube end to take place without throwing the tube out of proper relation to the belts 8 9, which bulging or downward expansion of the tube is caused the moment the edges

of the tube impinge between the belts and become slightly expanded at the forward end, which so bellies it as to require this compensating space in the table where the front end
5 of the tube rests, while rearwardly thereof said table may be flat where the collapsed part of the tube rests.

In the general arrangement shown one of the belt-carrying pulleys at the delivery end
10 of the machine runs in a higher plane than its companion, wherefrom it results that the belt it carries progressively rises or separates vertically with respect to its companion. These belts might run in the same horizontal
15 planes and the guides be suitably and progressively separated to cause the tube to so move horizontally as to accomplish its refolding, and although this operation would cause at least one folded edge to move over the face
20 of the belt still that operation would be practical with most grades of goods, and especially such as have their ornamental exterior surfaces so decorated as to have such a folded edge practically free from any ink.

25 Although in their relation to the other parts of this machine the belts 8 9 travel in vertical planes, it will be apparent from a slight consideration that these belts may run more or less obliquely.

30 It has been said that the bearers 29 30 are advantageous in maintaining the proper stretched condition of the belts 8 9, whereby the lateral pressure exerted by them is so maintained as to produce a uniform refold-
35 ing action upon the tube. The said bearers accomplish this action of the belts by maintaining their true alinement and preventing any twisting, buckling, or springing outward of them, and while the structure of them
40 shown is a simple and desirable one they might have the form of idlers, pins, or stays of any form, against which the belts bear at suitable or necessary points to accomplish the object stated.

45 Preferably the refolding devices will be arranged so that the tube will be open to an extent that will expand it beyond the rectangular cross-sectional form, though its expansion to or nearly to that shape is all that is essential
50 to be performed by tube-refolding machines. It may be stated, however, that when the tube is opened up to the rectangular shape, as in Fig. 8, or even if carried to the rhomboidal form, as in Fig. 9, at the exit of it from the
55 machines the guides 10 11 at that point may be, as shown, so shaped as to bend the tube sides inwardly far enough to overfold the corners, if desired.

What is claimed is—

60 1. A paper-tube-refolding mechanism comprising side carrying-belts, whose planes of travel gradually approach from their receiving to their delivering points, and opposed guides, the planes of whose bearing-faces
65 gradually separate from their receiving to their delivering points, whereby the space within which the tube is compelled to travel

is gradually contracted in one direction and expanded in the other, and strains are exerted upon the tube that cause its plies to move
70 laterally upon its folding-lines and transform it from a flat or collapsed condition, into a hollow or distended one, substantially as described.

2. A paper-tube-refolding mechanism com-
75 prising side carrying-belts, whose planes of travel gradually approach from their receiving to their delivering points and which diverge edgewise, and opposed guides, the planes of whose bearing-faces gradually separate from their receiving to their delivering
80 points, whereby the space in which the tube is compelled to travel is gradually contracted in one direction as widthwise and expanded in the other direction, and one edge of the
85 tube is moved out of the plane in which the other edge travels and strains are exerted upon it that cause its plies to move laterally upon its folding-lines and transform it from
90 a flat or collapsed condition, into a hollow or distended one, substantially as described.

3. A paper-tube-refolding mechanism comprising side carrying-belts, whose planes of travel gradually approach from their receiving to their delivering points, opposed guides,
95 the planes of whose bearing-faces gradually separate from their receiving to their delivering points, whereby the space in which the tube is compelled to travel is gradually contracted in one direction and expanded in the
100 other and strains are exerted upon the tube that cause its plies to move laterally upon its folding-lines and transform it from a flat or collapsed condition, into a hollow or distended one, and bearers holding the belts to duty
105 against distortion, substantially as described.

4. A paper-tube-refolding mechanism comprising side carrying-belts, whose planes of travel gradually approach from their receiving to their delivering points, and opposed
110 guides the planes of whose bearing-faces gradually separate from their receiving to their delivering points, whereby the space in which the tube is compelled to travel is gradually contracted in one direction as width-
115 wise and expanded in the other direction, and strains are exerted upon the tube that cause its plies to move laterally upon its folding-lines and transform it from a flat or collapsed condition, into a hollow or distended one,
120 one or both of said guides being provided with inward extensions at their delivering ends to impart an extra bend to the innermost foldings, substantially as described.

5. A paper-tube-refolding mechanism hav-
125 ing side carrying-belts whose relative planes of travel gradually approach from their receiving to their delivering points, and opposed longitudinal guides whereby the tube is directed, said guides having outwardly-inclined
130 ends to direct the tube to the belts, substantially as described.

6. In a paper-tube-refolding mechanism in which the tube is contracted widthwise be-

tween propelling-surfaces, a feeding-table having an inclined front end to admit of downward expansion or bulge of the tube, substantially as described.

5 7. In a paper-tube-refolding mechanism, the combination with pulleys 12, 14 and 13, 15 and side carrying-belts supported thereby, of means for adjusting said pulleys to move the opposed faces of the belts toward or from each
10 other, substantially as described.

8. In a paper-tube-refolding mechanism, the combination with pulleys 12, 14 and 13, 15, side carrying-belts supported thereby, and opposed guides, of means for adjusting said
15 pulleys to move the opposed faces of the belts toward or from each other and for adjusting

said guides toward or from each other, substantially as described.

9. In a paper-tube-refolding mechanism, the combination with pulleys 12, 14 and 13, 15, 20 side carrying-belts supported thereby and bearers for the belts, of means for adjusting said pulleys and bearers to move the opposed faces of the belts toward or from each other, substantially as described. 25

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HARVEY S. MUNSON.

Witnesses:

E. G. THOMPSON,
G. M. BORST.