

No. 709,503.

Patented Sept. 23, 1902.

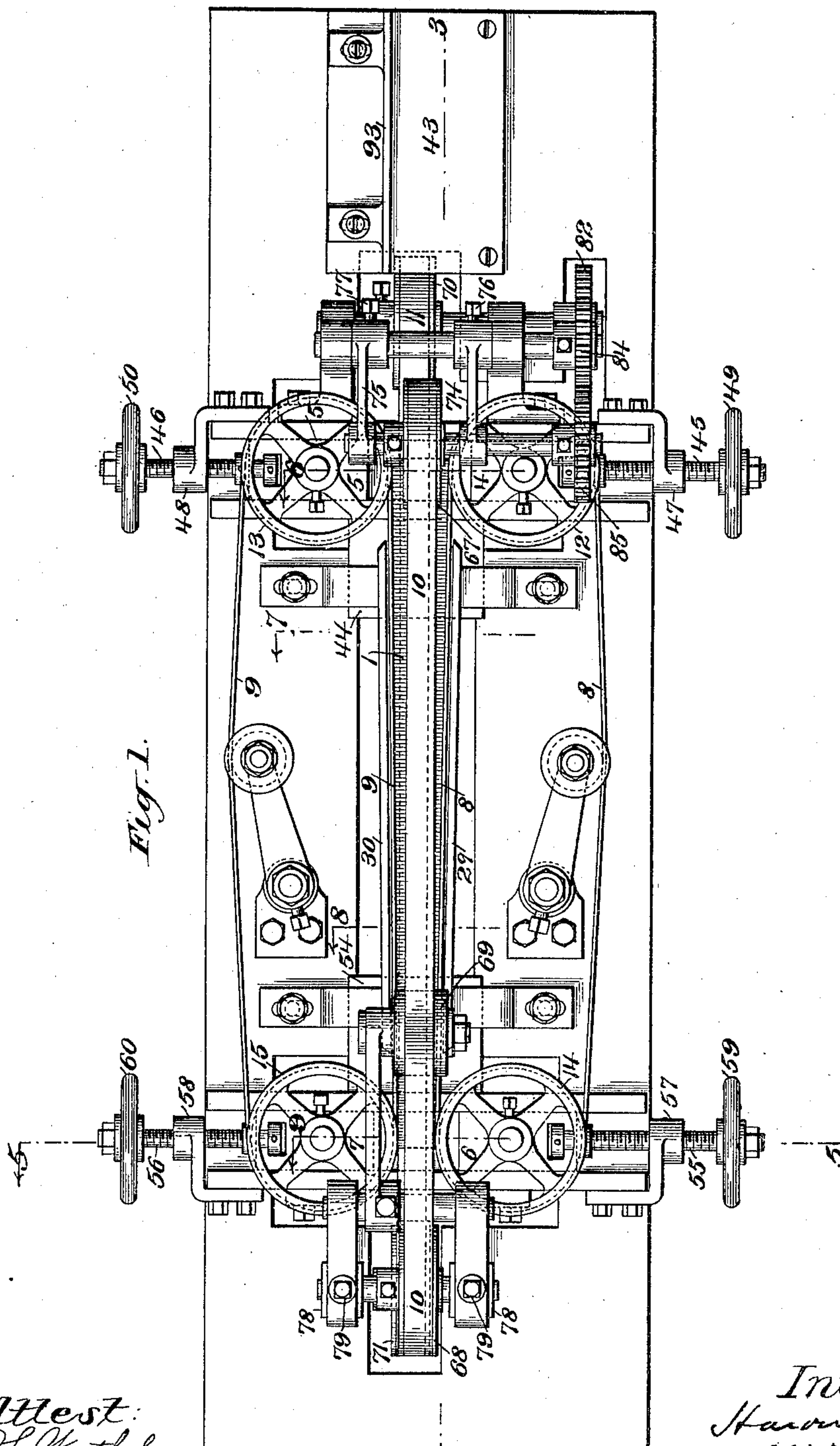
H. S. MUNSON.

MACHINE FOR REFOLDING PAPER TUBES.

(Application filed Aug. 4, 1898.)

(No Model.)

4 Sheets—Sheet 1.



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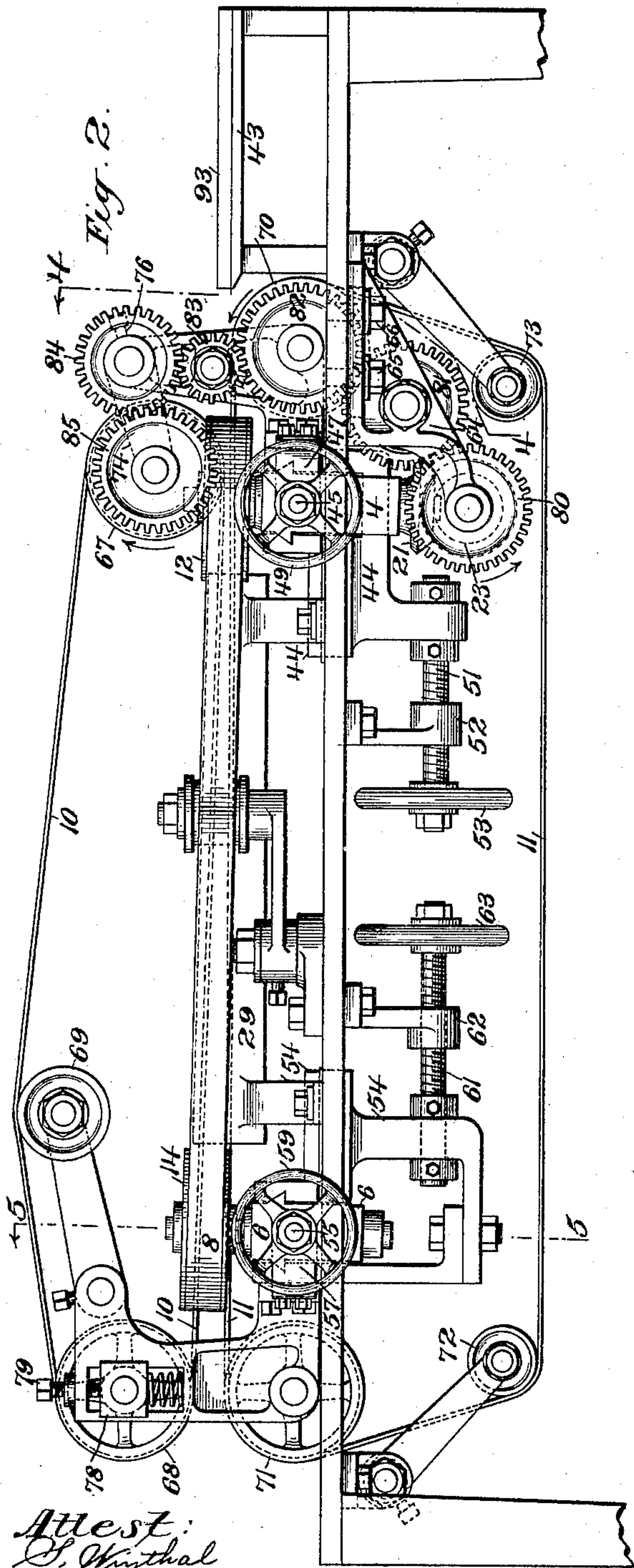
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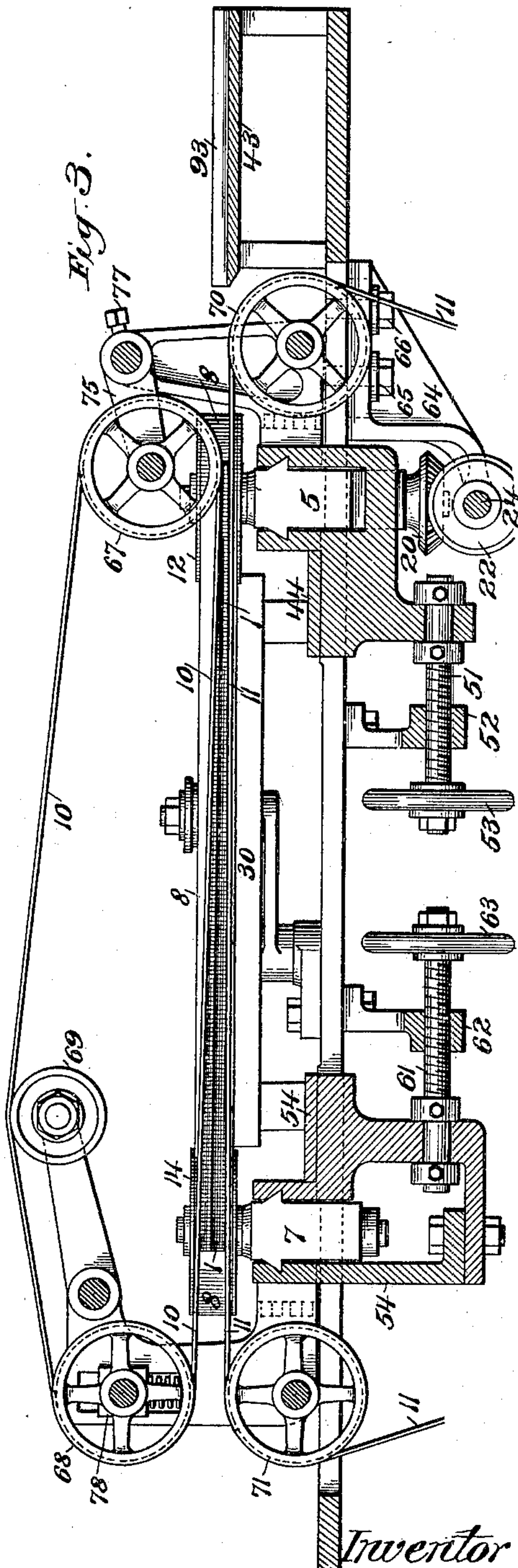
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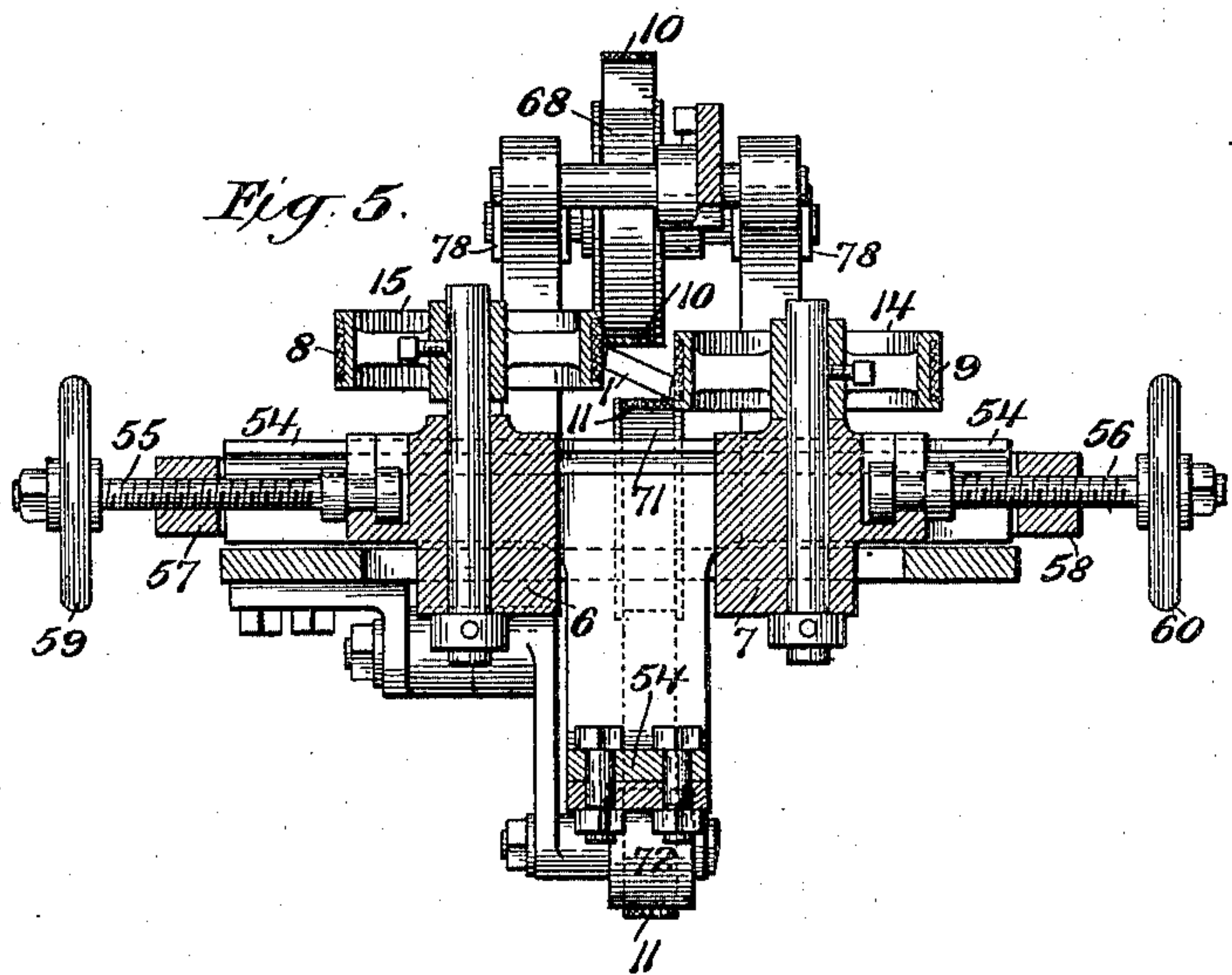
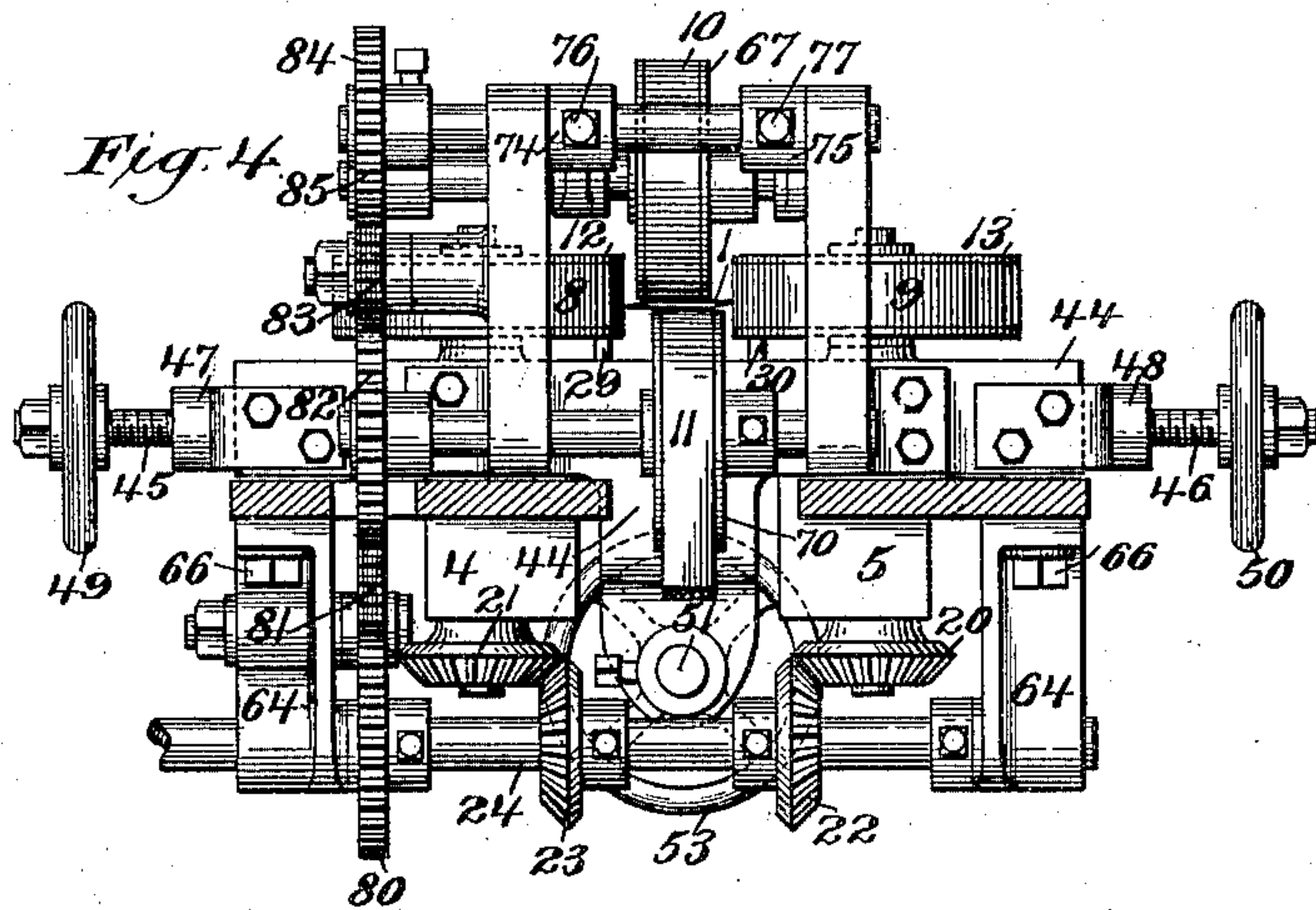
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4 Sheets—Sheet 3.



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Fig. 6.

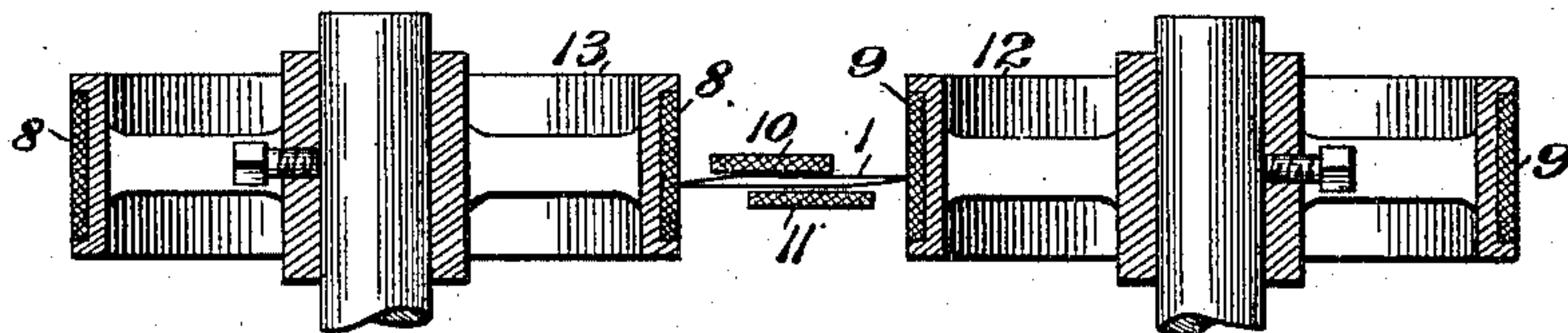


Fig. 7.

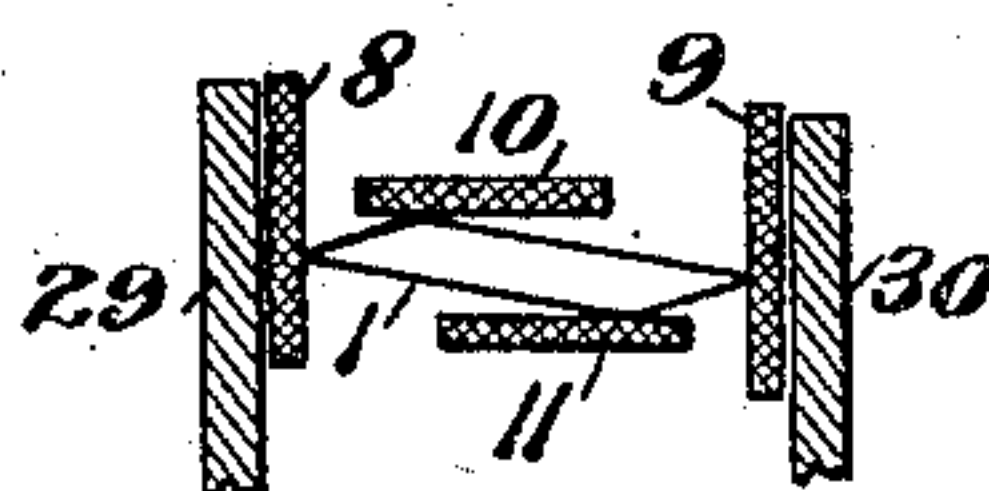


Fig. 8.

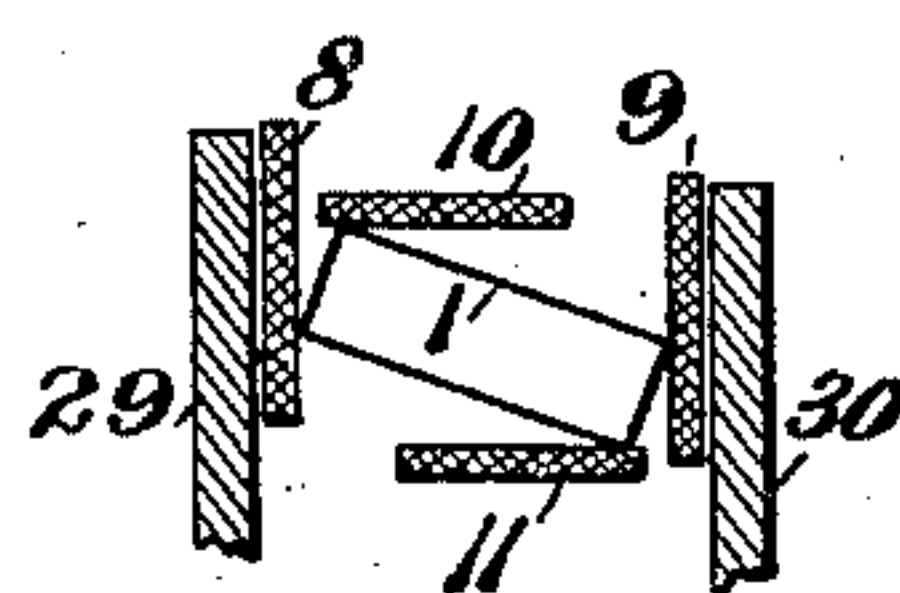
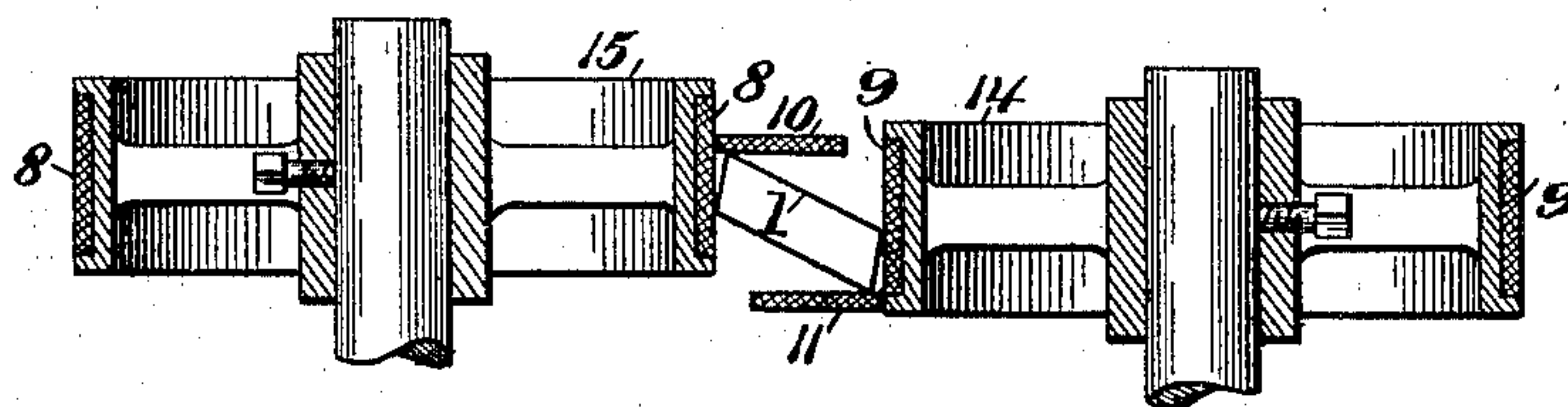


Fig. 9.



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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. 709,503, dated September 23, 1902.

Application filed August 4, 1898. Serial No. 687,701. (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 herein-after 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 planes of travel gradually contract from their receiving to their delivering ends and of a pair of opposed guiding-belts gradually separating from the entrance to the exit point in the other direction, whereby the space in which the tube is compelled to travel is so gradually contracted widthwise and expanded in the opposite direction as to cause the line of its travel to be so changed that the combined strains thus imparted to the tube force it from the flat tubular condition in which it is formed and cause it to assume a hollow or outspread tubular 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, when 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 line 3 of Fig. 1, a paper-box tube being shown as undergoing the operation of being refolded. Fig. 4 is a cross-sectional elevation taken on the section-line 4 of Fig. 2 as seen looking in the direction of its attached arrow, which is that of the travel of the tube through the mechanisms. 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 that of the travel of the tube through the machine. Figs. 6, 7, 8, and 9 are enlarged cross-sectional elevations taken, respectively, on the section-lines 6 7 8 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 and top and bottom guiding-belts 10 11, all of which belts, though preferably of leather, may be of any material so long as they are strong and durable and preferably so heavy that when stretched they will form stable bounds between which the paper tube will be carried onward without forcing them apart to modify their action upon the tube; but lighter belts may be used when held in place by suitable bearers, as will hereinafter appear. The 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.) The 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 it will be observed that the pulleys 14 and 15 revolve in different horizontal planes, the plane in which pulley 15 revolves being somewhat above that in which pulleys 12 and 13 revolve. All of these belt-carrying pulleys may 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 between the pulleys 12 and 13 are at a distance equal to the width of the outspread or flat tube, while the distance between the bearing-points of the pulleys 14 15 or at the exit-point of the tube is a distance 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 runs 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 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 now arrange longitudinally between the belts 8 9 guiding-belts 10 11 (they may be twisted)—that is to say, running guiding-belts that bear on the top and bottom plies of the tube throughout the length of its travel through

the machine, or substantially so—in such manner as to provide suitable bearings in constantly-differing planes and properly support and hold the tube to the action of the belts 8 9 and cause a complete refolding of the tube and also prevent buckling, and these guiding-belts 10 11 are so mounted and run that although they bear considerably upon the tube at its entrance end the dimensions of their bearing parts are quickly reduced, so as to become substantially a point by reason of the shape so speedily given to the tube to produce such bearing or contact. These continuous guiding-belts 10 11 thus form the top and bottom guides, and they are stretched throughout the machine so as to suitably bear on the upper and lower parts of the tube being refolded. They are preferably caused to run flatwise through the machine, though they may be twisted, as before stated and as will be hereinafter explained. They have the advantage of forming an open entrance for the reception of the tube end, because they spread away from each other at that point in turning over their carrying-pulleys. They generally present throughout their length a constantly and progressively widening pathway for the tube, against which belts the upper and lower angles of the tube bear, except at the entrance-point, where in the collapsed condition of the tube they provide a more extended widthwise bearing for the tube. In addition to their constant and progressive separation from the entrance to the exit end of the machine the carrying-pulleys for these belts 10 11, preferably flanged, are set in different vertical planes, or so that the upper guiding-belt 10 will run at one side of the common central point between the belt-carrying pulleys 12 13 and 14 15, and the lower guiding-belt 11 will run at the opposite side of said central point or midway between the belts 8 9 and each follow true courses through the machine, the carrying-belts 8 9, respectively, approaching these guiding-belts 10 11, so that at the exit end of the machine, as shown, the belt 8 bears against the edge of the belt 10 and the belt 9 or its carrying-pulley bears against the belt 11. The upper belt 10 runs over a pulley 67 at the entrance end of the machine, traverses through the machine between the belts 8 and 9 to the pulley 68, from which it returns over an adjustable tightening-drum 69 to said pulley 67. The lower belt 11 runs over a pulley 70 at the entrance end and travels through the machine between the belts 8 9 to a pulley 71, around which it returns over tightening-pulleys 72 73 to the pulley 70. The pulley 67 is hung in arms 74 75 at the entrance end, whereby it may be adjusted vertically, suitable set-screws 76 77 fixing its adjustment, and the pulley 68 at the exit end of the machine is mounted upon spring-seated boxes 78, controlled by a set-screw 79, whereby the requisite pressure of the belt 10 it carries is exerted upon the upper edge of the tube and its adjustment to suit the dimensions thereof

is accomplished. These upper and lower belts are driven from a toothed wheel 80 on the driving-shaft 24 through intermediates 81, 82, 83, 84, and 85, the shaft of the pulley 70 carrying the intermediate 82, and the shaft of the pulley 67 carrying the intermediate 85, and the pulleys 71-78 being propelled by the belts 10 and 11.

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, are 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 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 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 when 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 compensating movement of the pulley 68 through its spring-seated bearings will serve for all sizes of tubes to be refolded; but a suitable adjustment through its screws 79 will be adequate. At the entrance end the guide-belt 10 may be adjusted to vertically suit the thickness of the box-tube material operated upon by means of its arms 75, which are movable and provided with screws 77, by which they can be fixed in any desired position.

It is preferable to mount the side carrying-belt pulley 15 in a plane higher than its companions supporting the side carrying-belts, for the reason that in such an arrangement the opening-up movement of the tube is the more smoothly accomplished with less liability to smudging the freshly-printed edge or otherwise marring the surface of the tube operated upon; but it will be readily apparent that such pulley 15 may be rotated in the same horizontal plane as its companion 14, in which case the tube undergoing treatment will travel slightly over the surface of the belt 8.

It has been explained why the bearers 29 30 are advantageous in this machine, especially where the belts are thin, as they may be with such bearers. It will therefore be understood that where the top and bottom guides are provided in the form of belts 10 11 the same active force exerted by the tube undergoing refolding will tend to distort these belts 10 11 and injuriously modify their action. It is therefore to be understood that these belts may be provided with similar bearers as those marked 29 30 used in connection with the belts 8 9.

What is claimed is—

1. A paper-tube-refolding mechanism comprising side belts whose planes of travel gradually approach from their receiving to their delivering points, and opposed top and bottom belts whose planes of travel 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 on 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, substantially as described.

2. A paper-tube-refolding mechanism comprising side belts whose planes of travel gradually approach from their receiving to their delivering points and which diverge edgewise, and opposed top and bottom belts the planes of whose 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 and expanded in the other, and one edge of the tube is moved out of the plane in which the other edge travels, and strains are exerted on the tube that cause its plies to move laterally on its folding-lines and transform it from a flat or collapsed condition into a hollow or distended one, substantially as described.

3. A paper-tube-refolding mechanism comprising side belts whose planes of travel gradually approach from their receiving to their delivering points, opposed top and bottom belts the planes of whose 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 and expanded in the other, and strains are exerted upon the tube that cause its plies to move laterally on its folding-lines and transform it from a flat or collapsed condition into a hollow or distended one, and bearers holding one or both sets of belts to duty against distortion, substantially as described.

4. A paper-tube-refolding mechanism comprising side belts whose planes of travel gradually approach from their receiving to their delivering points, opposed top and bottom belts, the planes of whose bearing-faces gradually separate from their receiving to their delivering points, and an elastic bearing for the carrying-pulley for the delivery end of the top belt, substantially as described.

5. A paper-tube-refolding mechanism comprising side belts whose planes of travel gradually approach from their receiving to their delivering points, opposed top and bottom belts, the planes of whose bearing-faces gradually separate from their receiving to their delivering points, and adjustable arms for supporting the carrying-pulley for the receiving end of the top belt whereby the space for the tube between the pulleys of the top and bottom belt at the entrance-point may be adjusted, substantially as described.

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.