(No Model.)

5 Sheets—Sheet 1.

A. L. ADAMS & G. E. HAWES.

MACHINE FOR FOLDING AND WINDING STRIPS OF FLEXIBLE MATERIAL.

No. 594,586. Patented Nov. 30, 1897.

Fig. 1.

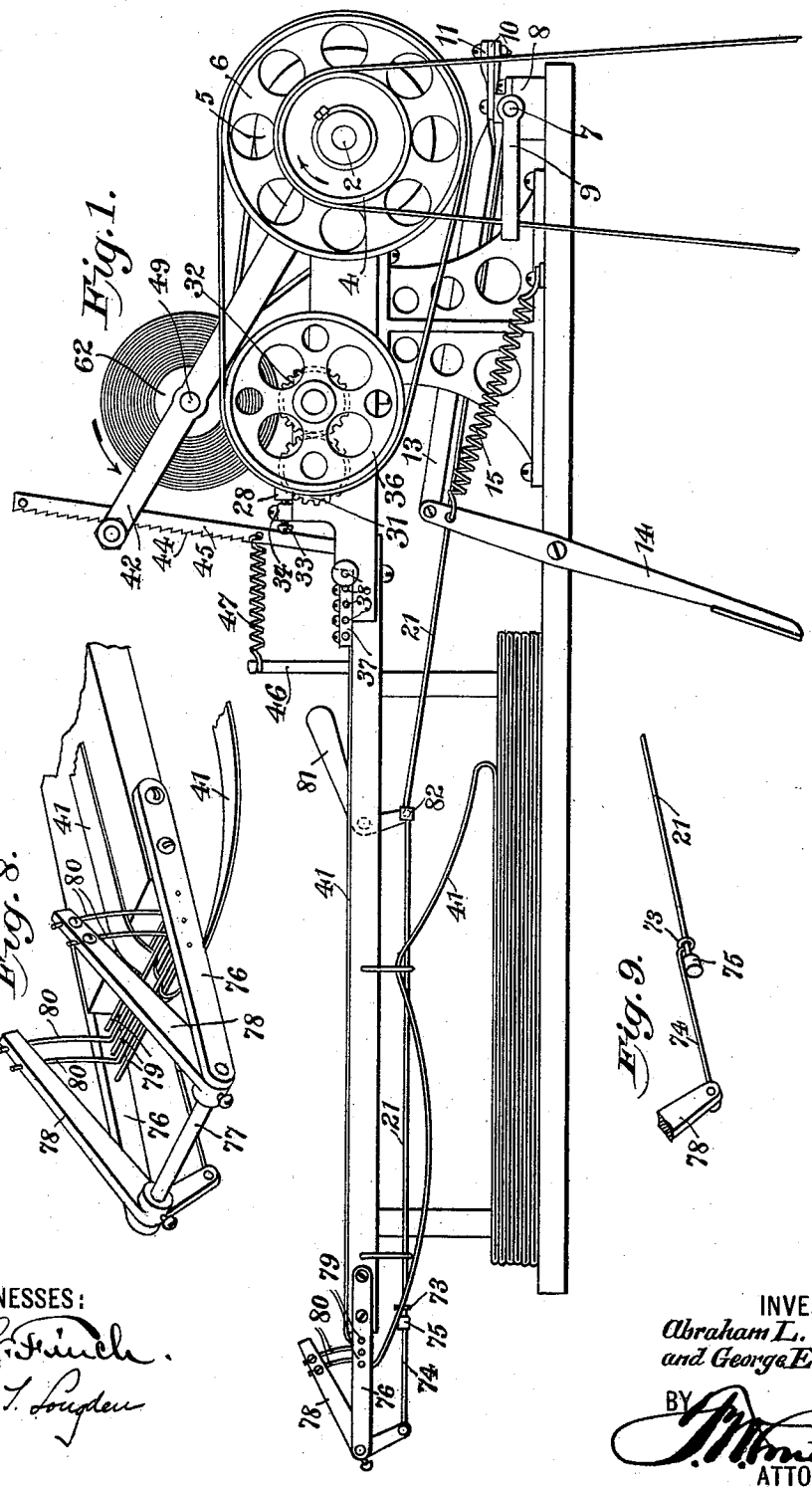

Fig. 8.

Fig. 9.

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Fig. 2.

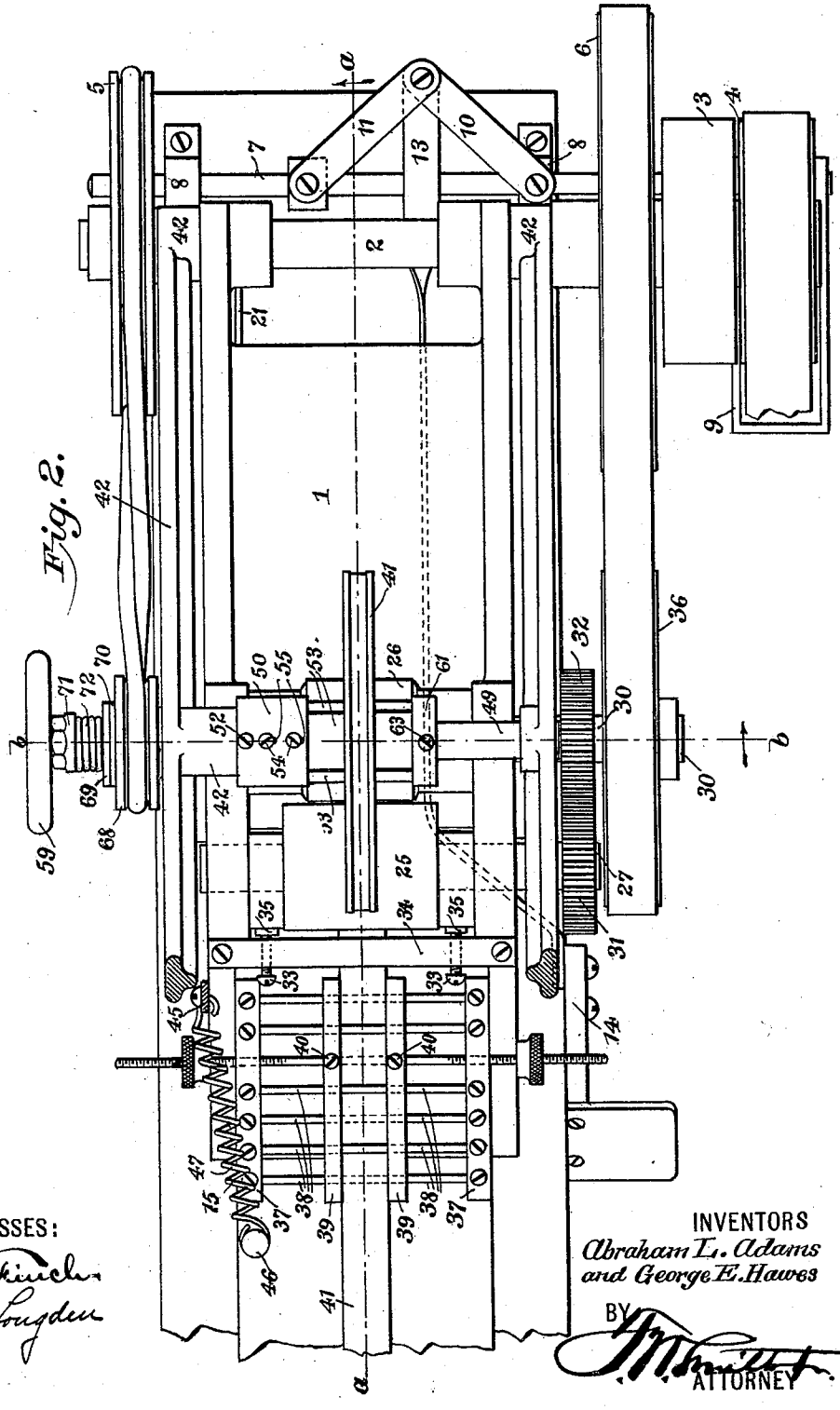

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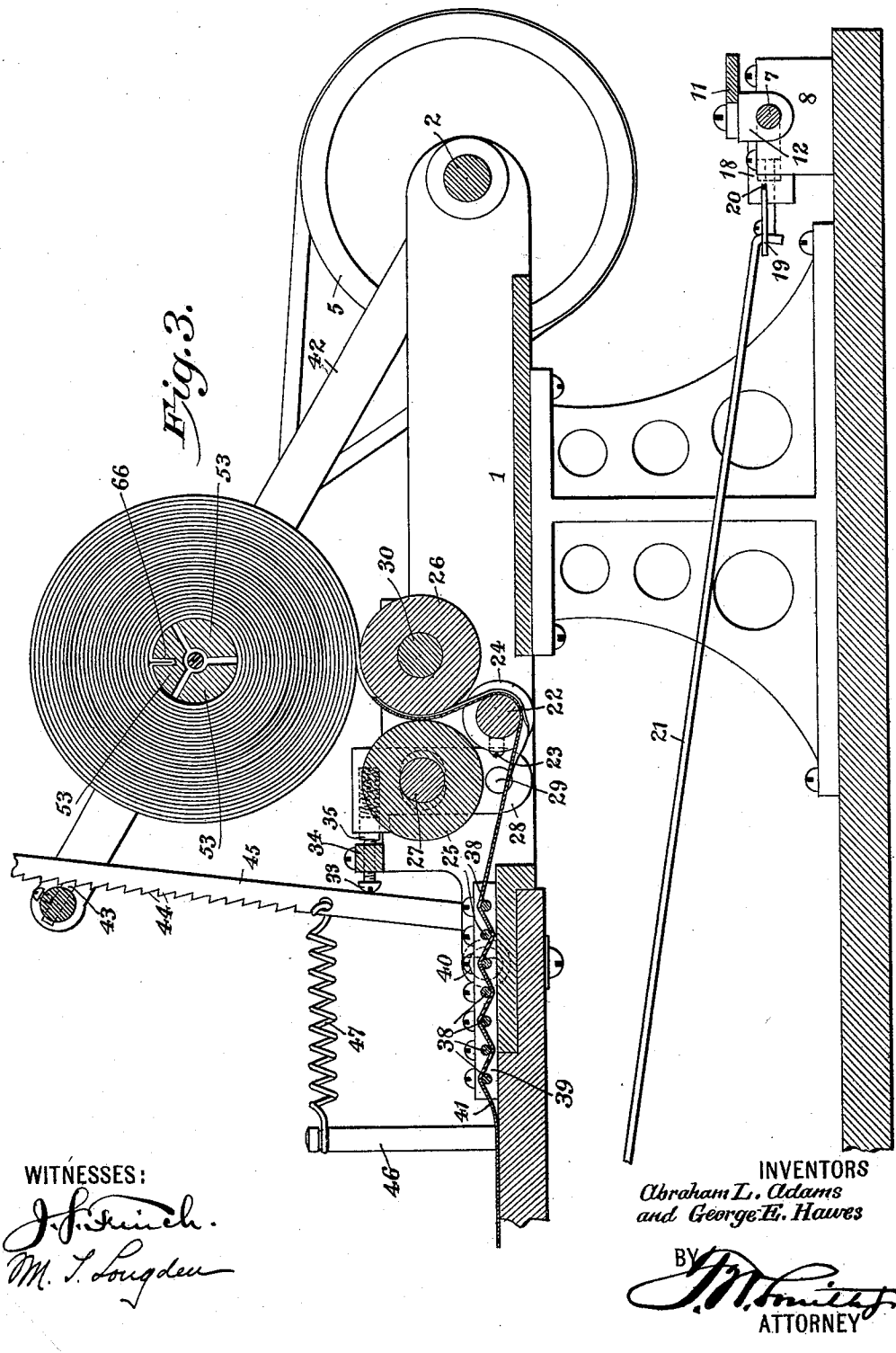
Fig. 3.



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(No Model.) 5 Sheets—Sheet 4.

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Fig. 4.

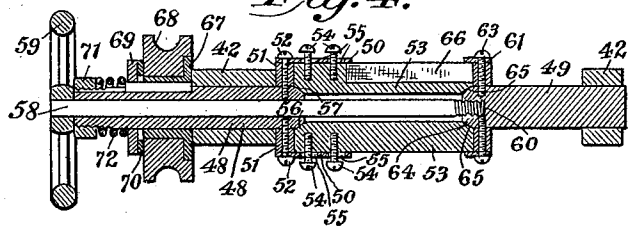

Fig. 6.

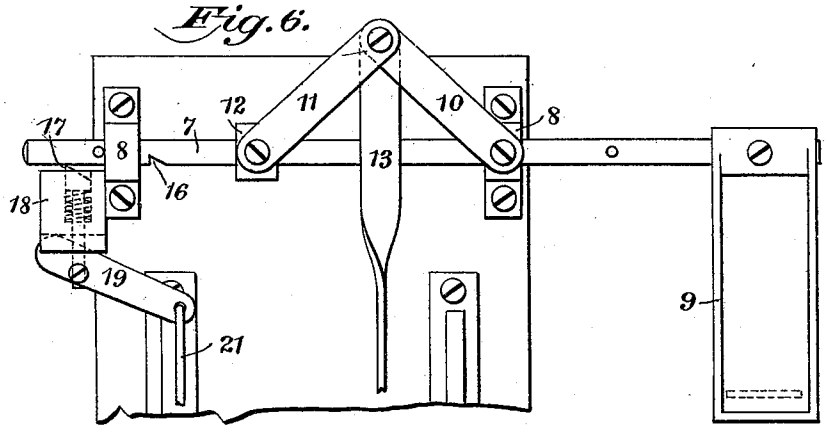

Fig. 5.

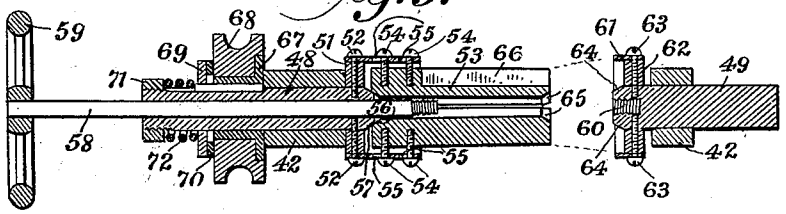

Fig. 7.

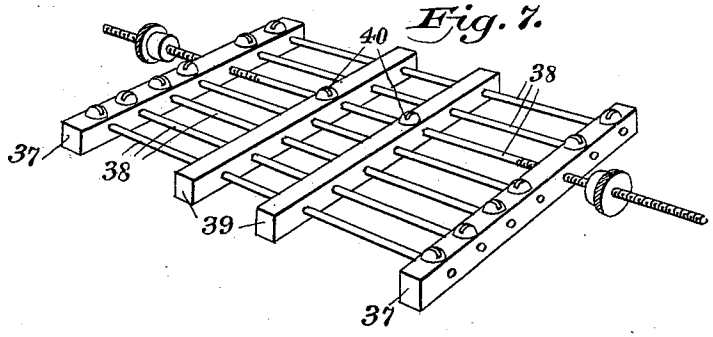

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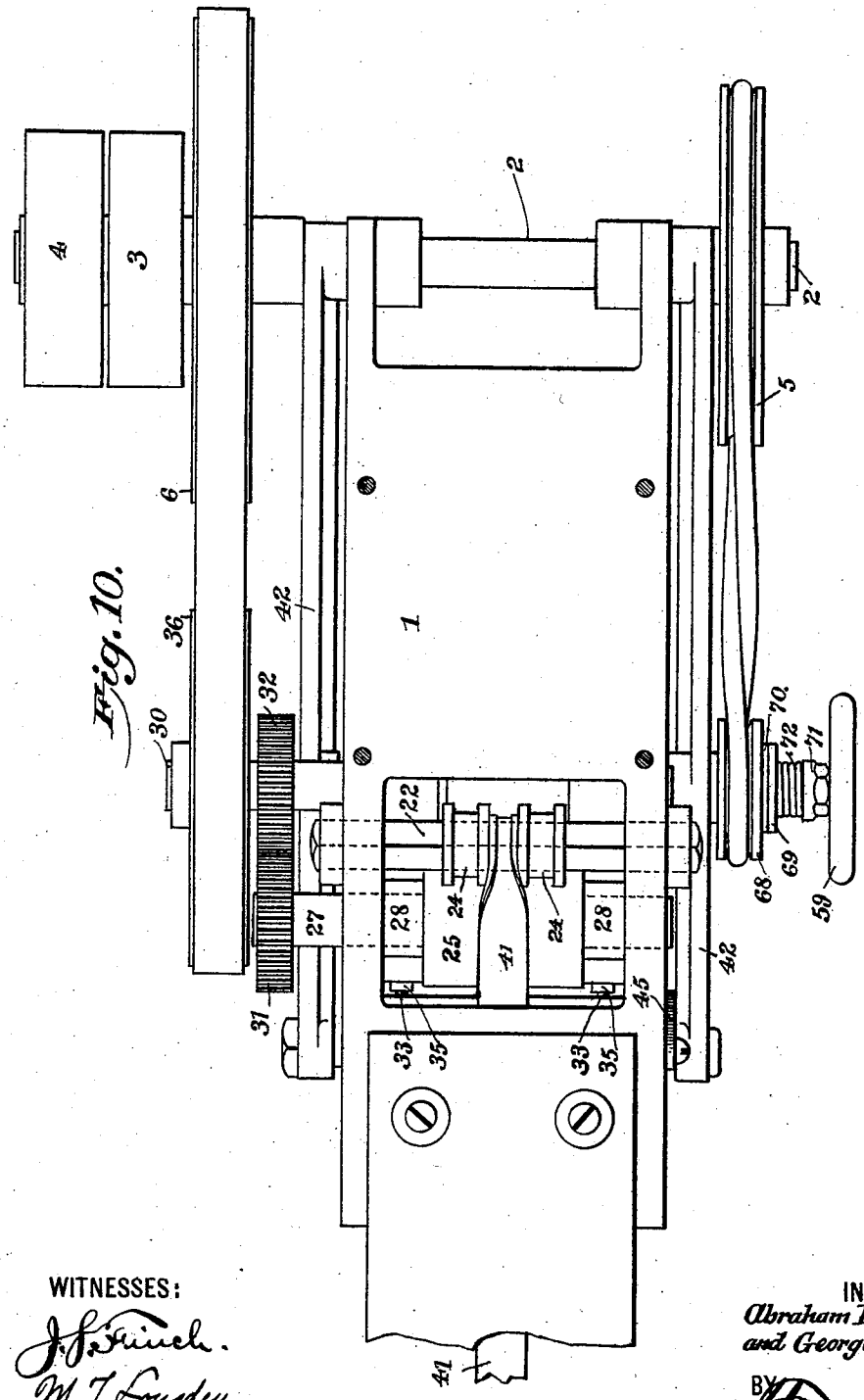
Fig. 10.



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UNITED STATES PATENT OFFICE.

ABRAHAM L. ADAMS AND GEORGE E. HAWES, OF BRIDGEPORT, CONNECTICUT.

MACHINE FOR FOLDING AND WINDING STRIPS OF FLEXIBLE MATERIAL.

SPECIFICATION forming part of Letters Patent No. 594,586, dated November 30, 1897.

Application filed January 20, 1897. Serial No. 619,994. (No model.)

To all whom it may concern:

Be it known that we, ABRAHAM L. ADAMS and GEORGE E. HAWES, citizens of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Machines for Automatically Folding and Winding Strips of Flexible Material; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to certain improvements in machines for automatically folding and winding strips of flexible material, and is an improvement upon the machine shown and described in our pending application, Serial No. 598,227, filed July 6, 1896; and it consists in certain details of construction and combination of elements hereinafter further set forth and then specifically designated by the claims.

The object of the present invention is to provide a machine which will fold or wind any width of strip and in which the parts may be so adjusted and arranged that the folding may be performed upon one edge only, or, if desired, the depths of the folds of the two edges may vary, while at the same time the strip is so guided and held at such a tension that the winding operation is performed with great facility.

A still further object of our improvement is to provide a stop-motion which shall be automatically operated by the strip itself, so that when the latter has been nearly used up and passed through the folding and winding devices the machine will come to a stop, thereby enabling the operator to neatly join the end of a succeeding strip to the rear end of the preceding strip, so that in effect an endless strip may be passed through the machine.

In the accompanying drawings, which form a part of this application, Figure 1 is a side elevation of our improved machine; Fig. 2, a plan view; Fig. 3, a section at the line *a a* of Fig. 2; Fig. 4, a detail sectional elevation of the winding-drum at the line *b b* of Fig. 2; Fig. 5, a view similar to Fig. 4, but showing the winding-drum collapsed; Fig. 6, a detail broken plan view of the bed of the machine, showing particularly the mechanism whereby the machine is started and stopped; Fig. 7, a detail perspective of the combined guide and tension device; Fig. 8, a detail broken perspective showing the appliances which operate in connection with the strip for automatically stopping the machine; Fig. 9, a detail broken perspective of a portion of the rod which connects such mechanism with the belt-shifting appliance, and Fig. 10 a bottom plan view of the machine.

Similar numbers of reference denote like parts in the several figures of the drawings.

In our pending application above referred to we showed and described permanent appliances for folding a certain width of strips, and it was impossible to vary the width of such strips without the substitution of another set of rollers; also, the folding devices comprised a roll having in its periphery a series of annular grooves and another roll having corresponding peripheral collars which fit within such grooves, so that when the strip was led between these rolls the edges would be bent at right angles to the body of the strip, the latter being then deflected against a round surface, so as to cause the edges to lie flat against the body of the strip. Our present improvement contemplates the complete folding of the edges of the strip in an entirely different manner, which will permit of the adjustment of the folding devices, so as to accommodate different widths of the strips, which improvement we will now describe.

1 is the bed of the machine; 2, the power-shaft, having mounted on one extremity tight and loose pulleys 3 4, respectively. 5 6 are pulleys mounted on said shaft on opposite sides of the bed.

7 is a rod held within boxes 8, secured upon the bed, said rod being capable of a free sliding movement and having secured to one extremity an ordinary belt-shifter 9.

10 11 are toggles, the former pivoted to one of the boxes, while the toggle 11 is pivoted to a block 12, rigidly secured to the rod 7.

13 is a link, one end of which is pivoted to the toggles at the point where the latter are pivoted together, the other extremity of such link being pivoted to a hand-lever 14, which is within reach of the operator, so that it will

be clear that when this hand-lever is operated to straighten the toggles the belt will be shifted from the loose pulley upon the tight pulley for the obvious purpose of starting the machine. 15 is a coil-spring whose extremities are connected to the bed and the upper end of the lever 14 in such manner as to normally throw the toggles into the position shown in Figs. 2 and 6. This belt-shifter construction is quite ordinary and forms no part of our invention proper, and it is merely described in order that no confusion may arise as to the operation of the structure illustrated in the drawings.

16 is a notch in the rod 7, and 17 is a spring-actuated latch supported in any ordinary way within a housing 18, secured to the bed, which latch will engage with said notch when the toggles have been straightened out in the manner hereinbefore described for the purpose of holding the belt upon the tight pulley.

19 is a link-bar, to which the spindle of the latch is pivoted, the outer end of said bar extending within a groove 20 in the housing 18 (see Fig. 3) and bearing against said housing.

21 is a light wire rod loosely secured to the inner end of the link 19, said rod having connection with certain appliances, hereinafter to be described, whereby the latch 17 may be withdrawn from the notch 16, thus enabling the spring 15 to shift the belt onto the loose pulley.

22 is a shaft supported at its ends within the sides of the frame, it being immaterial whether this shaft is journaled so as to revolve or whether it is stationary, although we prefer that it should be journaled so as to revolve in order to reduce the friction to a minimum while the strip is being folded, as will be hereinafter explained. Rigidly secured upon this shaft by means of set-screws 23 (one only being shown) are plain collars 24. (See Figs. 3 and 10.) Immediately above the shaft 22 are ironing-rolls 25 26, the former being mounted upon a shaft 27, which is journaled within a frame 28, pivoted, by means of a rod 29 at its lower extremity, between the sides of the machine-frame, while the roll 26 is supported on a shaft 30, journaled between the sides of the machine-frame. The outer extremities of the shafts 27 30 project through the sides of the machine-frame and are provided with intermeshing spur-gears 31 32, the opening in the frame through which the shaft 27 projects being slightly elongated to permit of a slight swinging movement of the frame 28. Set-screws 33, driven through blocks 34, supported on the machine-frame, bear directly against spring-backed pins 35, carried at opposite sides of the upper portion of the frame 28, so that the movement of said frame will be resilient, while at the same time by operating the screws 33 the roll 25 may be caused to bear with more or less force against the roll 26. On the extreme end of the shaft 30, immediately beyond the gear 32, is a pulley 36, which is belted up to the pulley 6, whereby motion may be communicated to these ironing-rolls.

The collars 24 are so adjusted that the distance between them is exactly equal to the width of the folded strip, and it will be observed that the latter is led around the shaft 22 immediately between the ironing-rollers, so that it will be clear that the latter will draw the strip. The width of the unfolded strip is greater than the distance between the collars by the combined width of the folds themselves, and as the strip is drawn along by the ironing-rollers the edges will be automatically creased and folded by the action of the inner faces of the collars, the deflection of such folded strip causing the folded edges to lie flat down against the bottom of the strip, so that they will be in proper position before they are subjected to the ironing operation. It is, however, necessary that the unfolded strip should be delivered to the folding-collars at a suitable tension and should be guided in a straight line with respect to the space between such collars, and we have therefore provided a combined guide and tension device, which we will now describe. Our combined guide and tension plate comprises side bars 37 and a series of stiff wires 38, whose extreme ends are secured within said bars, the wires being arranged at suitable distances apart. 39 are parallel bars through which these wires pass loosely, so that said bars may be readily moved toward or away from each other upon the wires, and 40 are set-screws carried by these bars, by means of which the latter may be rigidly secured to any one of the wires. The distance between these bars 39 when properly adjusted for use must be exactly equal to the width of the unfolded strip, while at the same time said bars must be so adjusted and held by the set-screws 40 that the vertical plane which extends lengthwise and exactly midway between the bars 39 must be coincident with the vertical plane which intersects the shaft 22 crosswise and exactly midway between the inner edges of the collars 24. This relative adjustment and arrangement of the collars 24 and guide-bars 39 is of course desirable and proper only in instances where the strip is to be folded so that the flaps of the folded portions shall be precisely the same width, and it will be clear that should it become necessary to fold a strip on one edge only this may readily be accomplished by making the proper relative adjustments of these collars and bars.

41 is the strip of cloth or other material which is interwoven with as many of the wires 38 as may be found necessary in order to give the proper tension, and right in this connection we desire to say that while we are of course aware that this manner of obtaining the tension is not broadly new, and we have no desire to be understood as making any generic claim for the same, still as a part of our specific device in connection with the adjustable guide-bars this tension device be-

comes quite an important feature of our improvement and upon which we shall hereinafter base one or more claims.

After the strip has been folded and ironed it is delivered to certain appliances which operate to wind the strip into coil form suitable for commercial use, and these appliances we will now describe.

42 is a frame loosely supported at one end around the shaft 2, so as to be capable of a free vertical swinging movement, a pawl 43 being secured to the other end of the frame and adapted to engage with ratchet-teeth 44 in a lever 45, which latter is pivoted at its lower extremity to the frame of the machine.

46 is a post which rises from the bed of the machine, and 47 is a coil-spring, whose extremities are connected, respectively, to said post and to the lever 45, the function of this spring being to normally throw said lever toward the pawl 43, so that the lever will yield resiliently as the frame 42 is elevated to permit the pawl to engage with succeeding ratchet-teeth.

48 49 are separate head-blocks, which are supported and journaled within the frame 42 at opposite sides in such manner as to be capable of revolution.

50 is a keeper-ring secured to the inner end of the block 48 by means of a collar 51, interposed between said ring and block, and screws 52, driven through the ring and collar into the block.

53 are fingers whose inner ends extend within the ring 50 and are attached to the latter by means of screws 54, which pass through elongated slots 55 in the ring into the fingers themselves. These screws are merely driven into the fingers to a depth sufficient to permit the heads of the screws to project beyond the outer surface of the ring a slight distance, so that when the fingers are not supported in the manner presently to be described said fingers will drop or collapse until their movement is arrested by the striking of the screw-heads against the body of the ring, as shown at Fig. 5, the elongated slots 55 readily permitting this movement. The fingers are interiorly beveled or chamfered at their rear extremities, as shown at 56, and the forward end of the block 48 is correspondingly beveled, as seen at 57, this beveled part of the block being always in engagement with the beveled portion of the fingers for the purpose presently to be explained.

The block 48 is tubular, and the spindle 58 passes freely through this block and is provided at its free end with a hand-wheel 59. The inner end of this spindle is threaded and takes within a thread in a socket 60, formed within the inner face of the block 49. Around the inner end of the block 49 is a keeper-ring 61, which is secured in position by means of a collar 62, which is placed around the block, and screws 63, driven through said ring and collar into the block itself.

Presupposing the parts to be in the position shown at Fig. 4, it will be clear that if the hand-wheel 59 be operated so as to withdraw the spindle 58 from the block 49 the latter may then be readily retracted, whereupon the fingers 53 will collapse, as shown at Fig. 5. It should be stated, however, that the inner end of the block 49 is beveled, as seen at 64, and that the tips of the fingers are interiorly beveled at their inner ends, as seen at 65, so that when the parts are in the position as shown at Fig. 4, the fingers will be supported in their distended position upon the beveled portions of the two blocks 48 49. The parts are restored to the position shown at Fig. 4 by simply pushing the block 49 inward, whereupon its beveled end will strike the beveled portions 65 of the fingers and cause the latter to distend until they rest firmly upon the block, and then the spindle is operated to drive its threaded end within the block 49 and thus securely lock the parts together. The outer surfaces of these fingers 53 are curved so as to present as a whole in cross-section a circle, as seen at Fig. 3, and these fingers constitute the drum on which the folded strip is wound, and for this purpose a slit 66 is formed in one of the fingers, within which slit the end of the strip may be forced, so as to attach the same in order that a proper winding may be insured.

When it becomes necessary to take off a coil of the folded strip, the block 49 is withdrawn in the manner hereinbefore described and the fingers allowed to collapse, whereupon the coil may be readily removed without any danger of distortion; also, a coil may be placed upon the collapsed drum and secured in position by the distention of the fingers, so that the free end of the coiled strip may be secured to another strip and the coil wound into larger form. As the coil increases in diameter during the winding operation it will of course rest by gravity against the roll 26, and the frame 42 will be gradually elevated thereby, and will be successively locked in its elevated positions by means of the pawl 43 and ratchet 44. Of course the winding must not be performed at a rate faster than the rate at which the folded strip is delivered from the rolls 25 26, and therefore we have provided the usual means whereby the winding may be properly performed, which means we will describe, although it is specifically the same as the corresponding means set forth in our pending application referred to.

A shouldered collar 67 is secured around the block 48, and mounted around this collar and bearing against the same by friction only is a loose pulley 68.

69 is a ring around the block 48 and capable of a movement lengthwise thereof, and 70 is a washer of leather or other suitable material interposed between said ring and the side of the pulley 68.

71 is a nut on the outer end of the block 48, and 72 is a coil-spring around the block

and bearing against said nut and against the ring 69, so that a pressure is brought to bear against the pulley 68, whereby the latter may be bound with friction against the collar 67.

A belt connects the pulleys 5 68, and when the winding-drum has a tendency to take up a greater length of the folded strip than is proper the pulley 68 will simply slip without causing such drum to revolve.

The rod 21, hereinbefore referred to, extends beneath the bed to the front of the machine and is properly supported within suitable hangers, the rear end of such rod extending through an eye 73 at one end of a link 74, the extremity of said rod being provided with a head 75 to prevent disengagement from the link, while at the same time said rod may have a free lengthwise movement through said eye.

76 is an extension from the bed, within which is supported a rock-shaft 77, to which are secured at the sides thereof L-levers 78. These levers, in connection with the rock-shaft, form in reality a "bell-crank" lever, and we will make use of this term in the further description of our improvement.

79 are cross-wires which extend horizontally from side to side of the extension 76, and 80 are parallel U-shaped wires which depend from the inner ends of the bell-crank and are adapted to pass freely between the cross-wires 79. The free end of the link 74 is pivoted to the lower leg of the bell-crank, so that it will be clear that when the upper leg of the bell-crank drops down the lower leg will operate to retract the link 74 in a direction away from the machine proper, whereby the latch 17 will be withdrawn from the notch 16, for the purpose hereinbefore set forth.

The strip 41 as it is led through the machine passes directly over the cross-wires 79, and the U-shaped wires 80 rest upon such strip and are prevented from dropping through the cross-wires only by the resistance afforded by the strip itself, and it will therefore be readily understood that when the end of the strip has been reached and the latter is withdrawn from between the cross-wires and the wires 80 the upper portion of the bell-crank will then drop by gravity, thus withdrawing the latch 17 from the notch 16 and causing the machine to come to a state of rest. This enables the operator, as before stated, to join a succeeding strip to the rear end of the preceding strip for the purposes hereinbefore set forth, and, furthermore, it relieves the operator from any anxiety as to the withdrawal of the strip from the folding devices and the consequent entanglement of such strip during the winding operation.

A dog 81 is pivoted at the side of the bed, the lower extremity of the dog being pivotally connected to a block 82, which latter is secured to the wire rod 21, so that the operator may at any time by depressing this dog cause the machine to stop independent of the operation of the bell-crank lever at the rear of the machine, because it will be borne in mind that the rod will slip freely through the eye 73.

The holding of the winding-drum and coiled strip by means of the pawl 43 and ratchet-lever 45 not only relieves the drum from undue vibration, but also conveniently holds the drum in elevation while the coiled strip is being removed.

It is of course immaterial whether the shape of the shaft 22 is round or angular in cross-section or whether such shaft revolves or not, since in any instance the strip will be properly creased and the folded edges laid down prior to their passage between the ironing-rollers, and we have therefore shown these two styles of shaft in Figs. 3 and 10, respectively.

We have shown and described our improvement as adapted for folding and winding a single strip; but of course these parts may be duplicated, so as to provide a series of such devices, and we therefore do not wish to limit ourselves to the use of but a single set of the same.

Our improvement is exceedingly useful for the purpose of merely winding a strip, whether the same has folded edges or not, for the combined tension and guide will hold and deliver the strip properly, so that the coils will be wound perfectly true, and therefore we do not wish to be limited to the use of this combined tension and guide in connection with the folding devices.

It will thus be clear that our present improvement differs materially from the construction shown and described in our pending application referred to in that the latter contemplates the use of collars which coöperate with annular grooves for the purpose of creasing and folding the strip, whereas the gist of our present invention rests in the broad idea of providing collars at a distance apart equal to the width of the folded strip and in delivering the unfolded strip at a tension between these collars and then deflecting the folded strip at a tension at an abrupt angle to the plane in which it was originally delivered between the collars, so that such folded strip will closely hug the shaft, which constitutes the surface against which the folding is effected.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a machine of the character described, the combination of the shaft against which the folding is effected, the collars mounted on said shaft and separated by a distance equal to the width of the folded strip, means for delivering the strip at a tension between said collars, and means for deflecting the folded strip at a tension around said shaft whereby the latter is closely hugged by said strip, substantially as set forth.

2. In a machine of the character described,

the combination of the shaft against which the folding is effected, the folding-collars mounted on said shaft and separated by a distance equal to the width of the folded strip, means for delivering the unfolded strip between said collars, and means for drawing the strip between the collars and snugly around said shaft, whereby the edges are folded and caused to lie flat against the body of the strip, substantially as set forth.

3. In a machine of the character described, the combination of the shaft, the collars secured thereon at a distance apart equal to the width of the folded strip, means for delivering the unfolded strip between said collars at a tension, and a pair of ironing-rolls through which the folded strip is passed, the location of such rolls with respect to said shaft being such that the folded strip will be deflected and caused to closely hug said shaft, substantially as set forth.

4. In a machine of the character described, the combination of the shaft, the adjustable collars secured thereon, the combined tension and guide device supported on the bed of the machine and whereby the strip is delivered at a proper tension and in the proper direction with respect to said collars, and the ironing-rolls through which the folded strip is passed, said rolls being capable of drawing the strip between the folding-collars and snugly against said shaft, substantially as set forth.

5. The combination of the frame which supports the winding devices, the head-blocks supported within said frame one of said blocks being tubular and the other block provided at its inner end with a threaded socket, while the inner ends of both blocks are beveled, the keeper-rings secured to the inner ends of each block, the fingers interiorly beveled at both ends and loosely connected at their bases to the keeper-ring attached to the tubular block and whereby said fingers may be capable of distention or contraction, and the spindle threaded at its inner end to engage with said threaded socket, substantially as set forth.

6. The combination of the extension from the bed supporting cross-wires over which the strip is delivered, the rock-shaft journaled within such extension at the end thereof and beyond said wires, the cranks secured at opposite ends of said rock-shaft and carrying U-shaped wires which are adapted to pass between said cross-wires when said cranks are lowered, one of said cranks having a depending portion whereby a bell-crank is formed, the belt-shifting appliances, and the rod connected to the depending portion of said bell-crank and to said appliances, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

ABRAHAM L. ADAMS.
GEORGE E. HAWES.

Witnesses:
F. W. SMITH, Jr.,
M. T. LONGDEN.