May 10, 1949. H. D. LAWRIE 2,470,072

FOLDING MACHINE

Filed Oct. 18, 1946 5 Sheets-Sheet 1

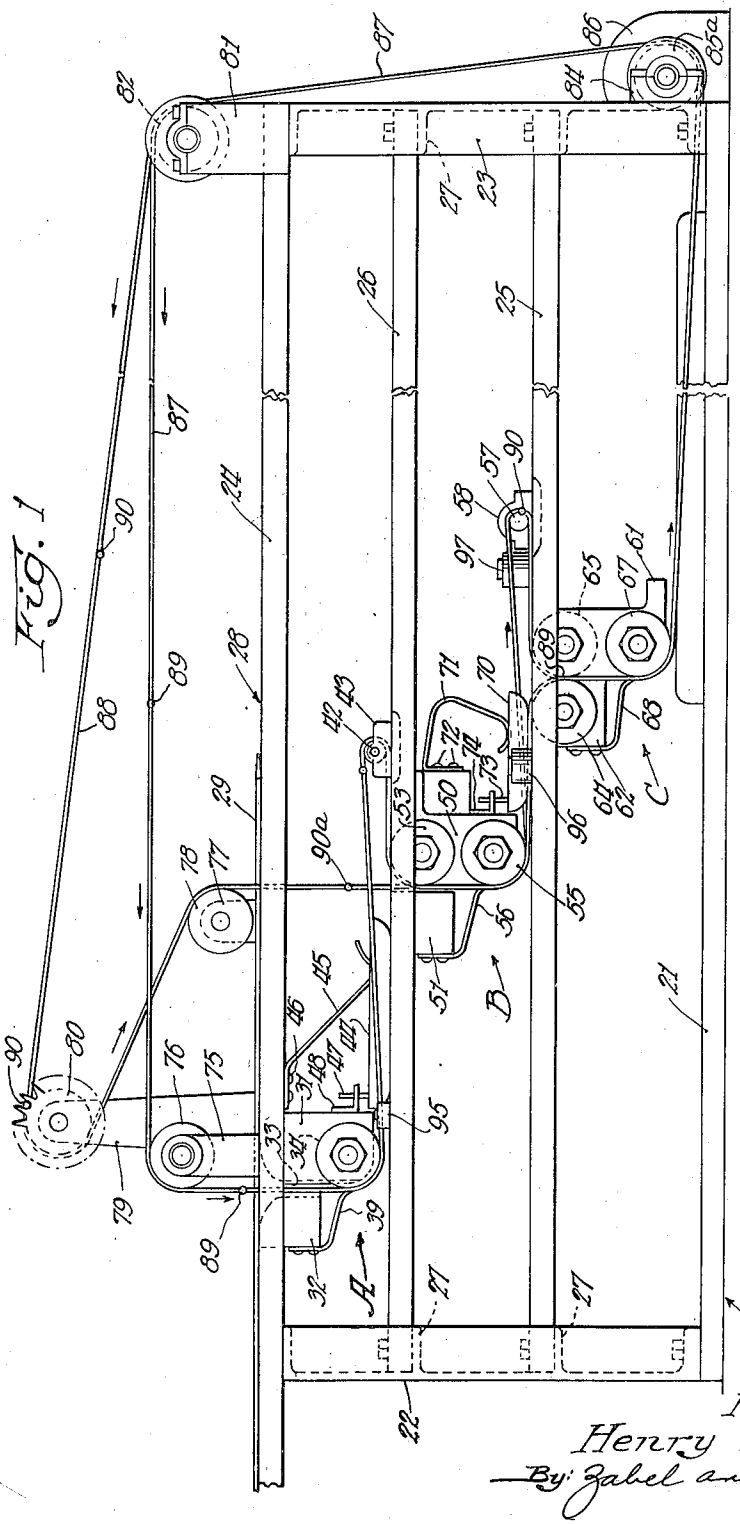


Fig. 1

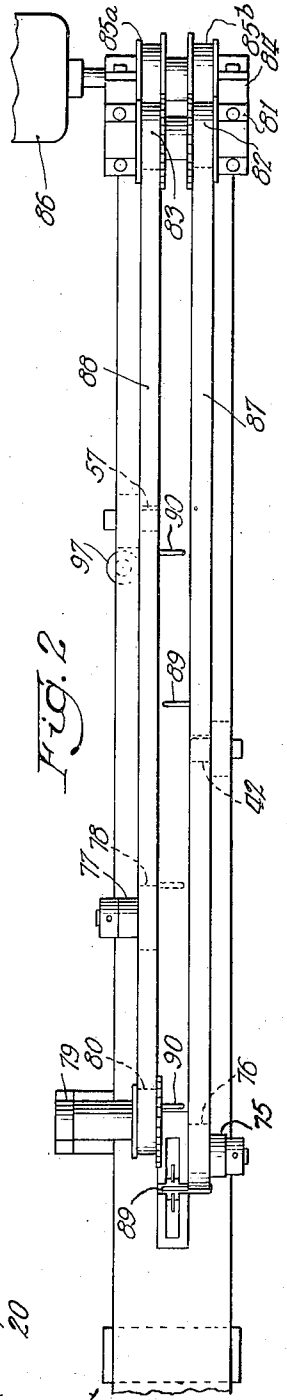


Fig. 2

Inventor:
Henry D. Lawrie
By: Zabel and Fritzbaugh
Attys

May 10, 1949. H. D. LAWRIE 2,470,072

FOLDING MACHINE

Filed Oct. 18, 1946 5 Sheets-Sheet 2

Fig. 4

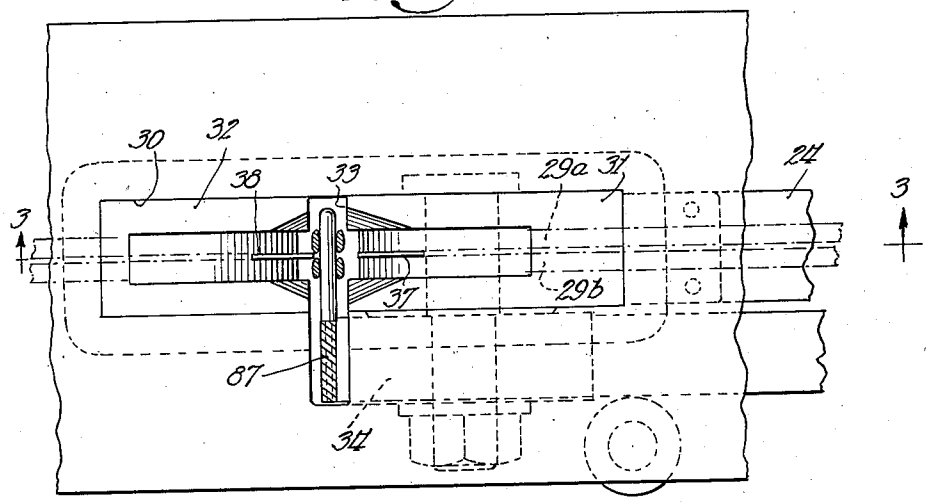


Fig. 3

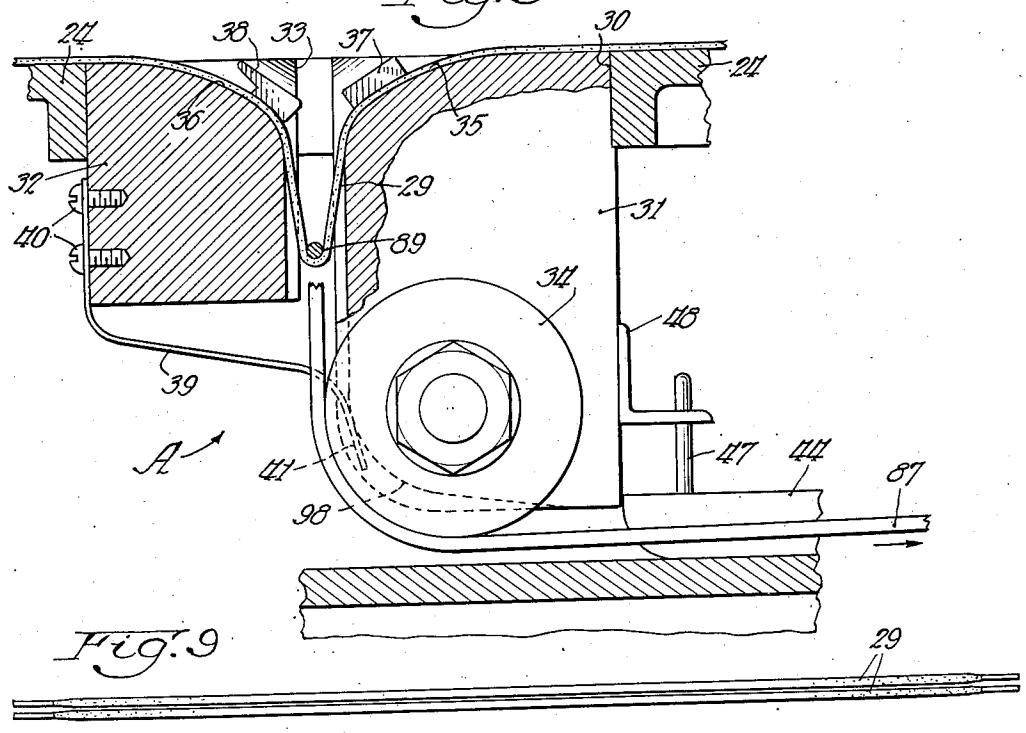


Fig. 9

Inventor:
Henry D. Lawrie
By: Zabel and Gritzbaugh
Attys.

May 10, 1949. H. D. LAWRIE 2,470,072

FOLDING MACHINE

Filed Oct. 18, 1946 5 Sheets-Sheet 3

Fig. 6

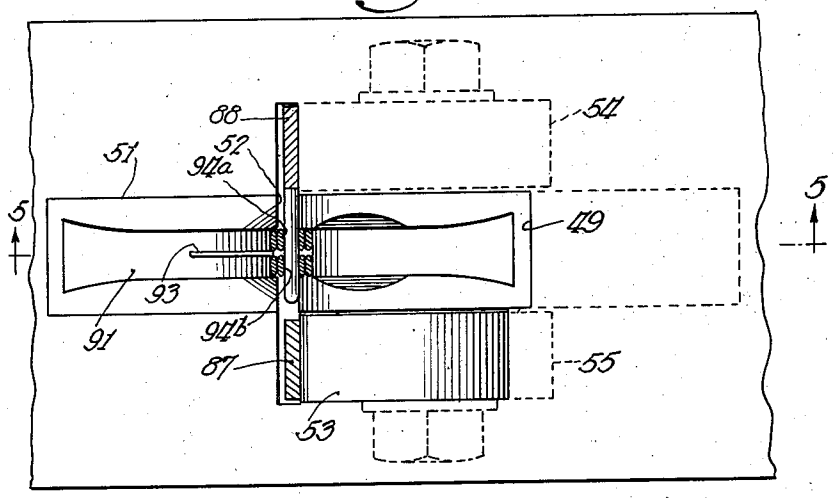
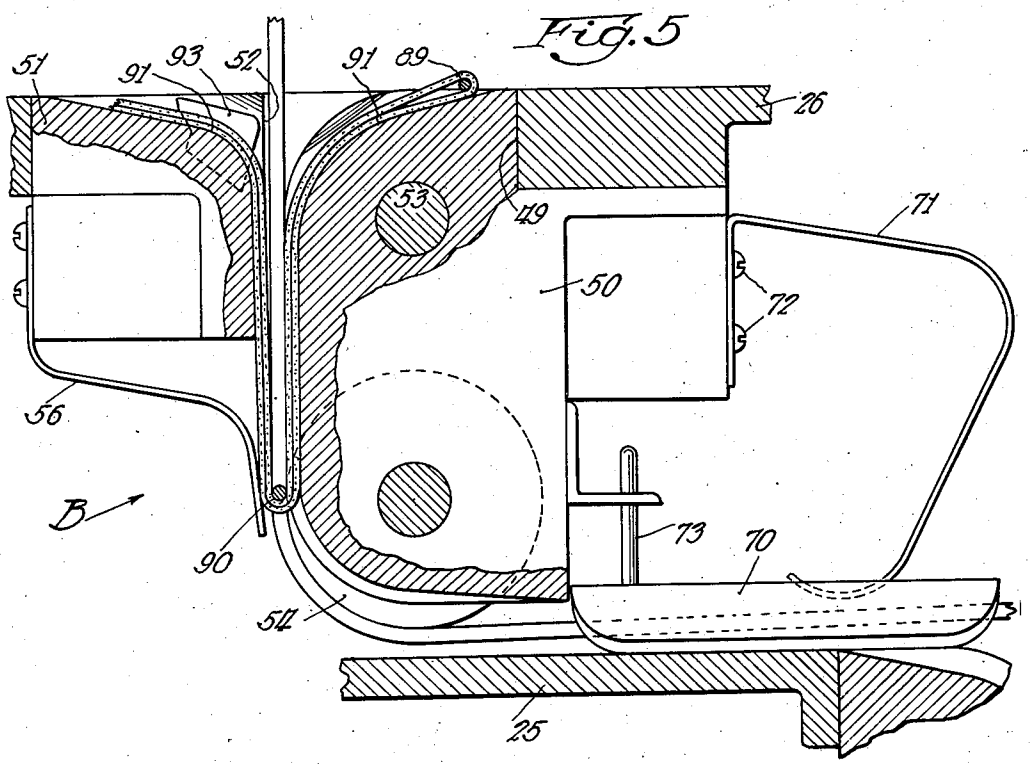


Fig. 5



Inventor:
Henry D. Lawrie
By: Zabel and Fritzhaugh
Attys.

May 10, 1949. H. D. LAWRIE 2,470,072

FOLDING MACHINE

Filed Oct. 18, 1946 5 Sheets-Sheet 4

Fig. 8

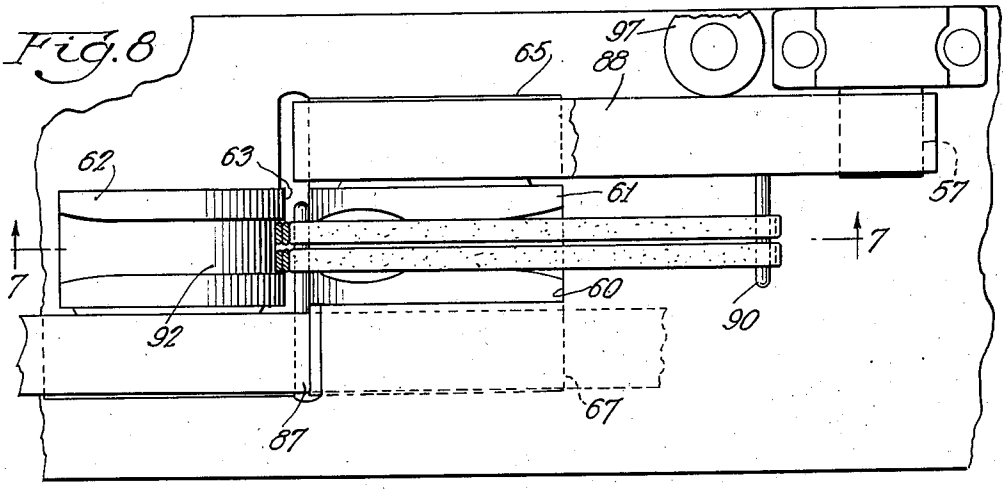
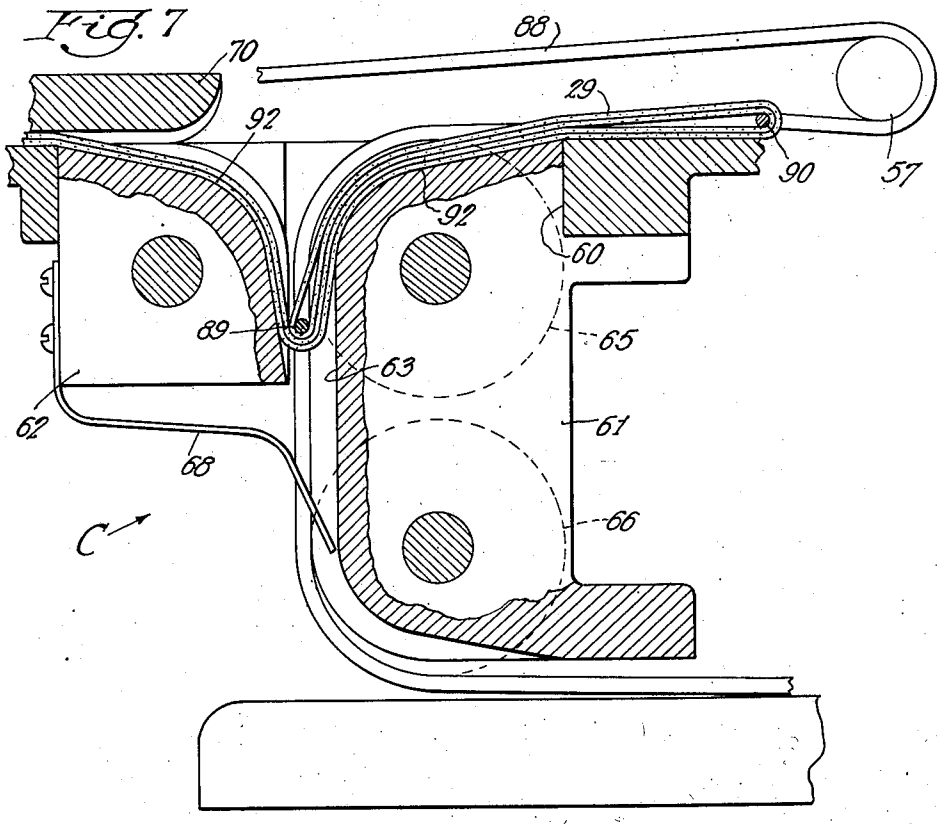


Fig. 7



Inventor:
Henry D. Lawrie
By: Zabel and Fitzhugh
Attys

May 10, 1949. H. D. LAWRIE 2,470,072

FOLDING MACHINE

Filed Oct. 18, 1946 5 Sheets-Sheet 5

Fig. 10

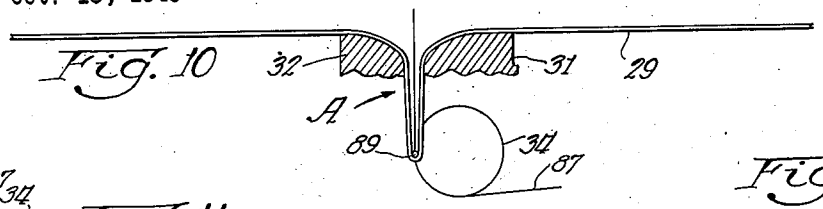


Fig. 11

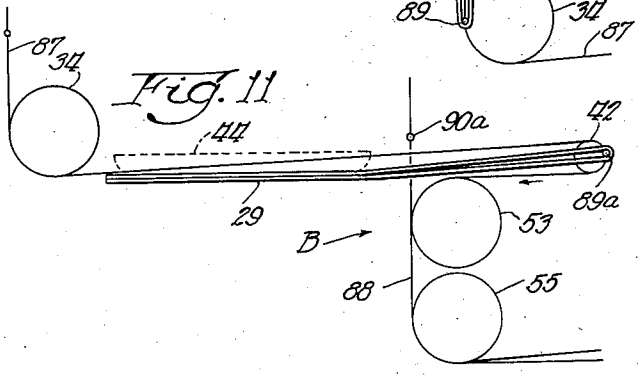


Fig. 12

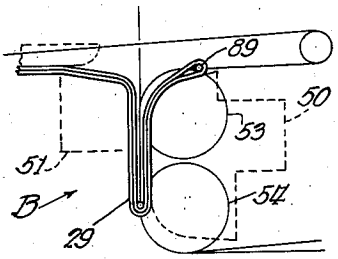


Fig. 13

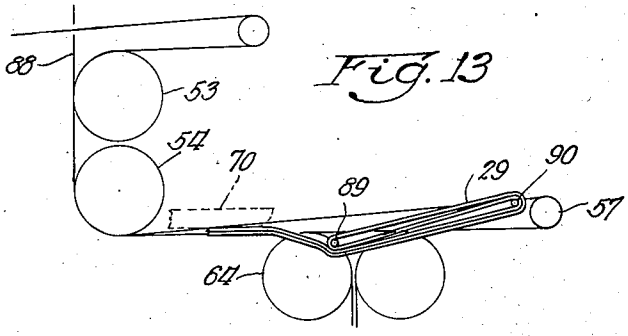


Fig. 14

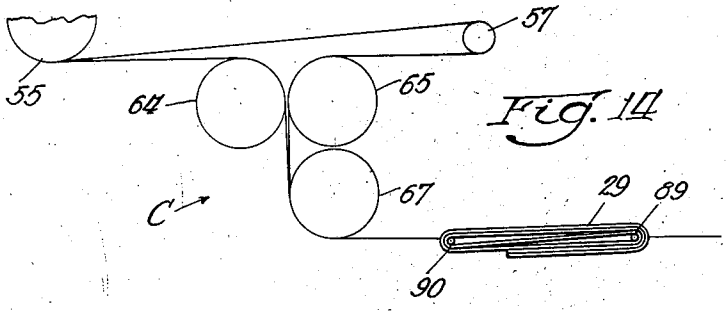
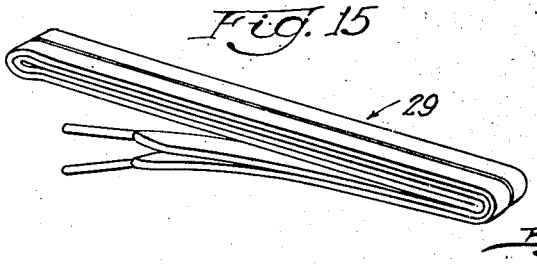


Fig. 15



Inventor:
Henry D. Lawrie
By: Zachel and Fitzpatrick
Attys.

Patented May 10, 1949 2,470,072

UNITED STATES PATENT OFFICE

2,470,072

FOLDING MACHINE

Henry D. Lawrie, Wilmette, Ill.

Application October 18, 1946, Serial No. 704,101

4 Claims. (Cl. 270—70)

1

The present invention is concerned with a machine for folding shoelaces and the like into condition for wrapping. Shoelaces are normally paired and then folded into a size of approximately four and one-half inches in length. A piece of paper is then wrapped and glued about the central portions of the laces thus folded. In this form the laces are then in condition for marketing.

The present invention relates particularly to a device for folding the paired laces though it is applicable for folding products other than shoelaces such, for example, as ribbon and string, particularly in the form commonly sold as gift wrapping materials.

As an object of the invention it is intended to provide a device capable of folding shoelaces and the like under assembly line conditions, with a minimum of manual operations. The paired laces or the like are fed into the present machine at one end and are discharged at the other end neatly folded into form for wrapping and marketing. This is all accomplished as a continuous operation with a plurality of paired laces progressing through the machine at one time.

The foregoing constitute some of the principal objects of the present invention, others of which will become apparent from the following description and the drawings, in which

Fig. 1 is a more or less diagrammatic side elevational view of a folding machine embodying the present invention;

Fig. 2 is a top plan view of the device shown in Fig. 1;

Fig. 3 is an enlarged more or less diagrammatic sectional view of folding station A shown in Fig. 1 and illustrating a shoelace in its proper position at this station A, the view being taken on the line 3—3 of Fig. 4;

Fig. 4 is a top plan view of that portion of the device shown in Fig. 3;

Fig. 5 is a view corresponding to Fig. 3 but illustrating station B shown in Fig. 1, the view being a sectional view taken on the line 5—5 of Fig. 6;

Fig. 6 is a top plan view of that portion of the device shown in Fig. 5;

Fig. 7 is a view corresponding to Figs. 3 and 5 but illustrating station C shown in Fig. 1, the view being a sectional view taken on the line 7—7 of Fig. 8;

2

Fig. 8 is a top plan view of that portion of the device shown in Fig. 7;

Fig. 9 illustrates a pair of shoelaces in the outstretched condition which they assume when first entering the present machine at station A;

Fig. 10 is a more or less diagrammatic view illustrating the first folding operation performed by the present device on the shoelaces at station A;

Fig. 11 is a diagrammatic view illustrating the relative position of the shoelaces and the folding device at the beginning of the second folding operation performed at station B;

Fig. 12 is a diagrammatic view illustrating the relative position of parts at station B after the second folding operation has been performed;

Fig. 13 is a diagrammatic view illustrating the beginning of the third operation performed at station C;

Fig. 14 is a diagrammatic view illustrating the completely folded shoelaces as they are leaving station C; and

Fig. 15 is a perspective view illustrating the shoeslaces in their final folded condition.

For purposes of disclosure one embodiment of the invention has been selected. Although shoelaces will be specifically mentioned as the product to be folded by the present device, it is recognized that other ribbon or string-like products can be folded with equal effectiveness. It is also contemplated that fabrics and tapes are suitable products to be folded by the present device.

Referring now to Fig. 1 of the drawings, the invention is illustrated in the form of a framework generally indicated at 20 comprising a base 21 having upstanding end pieces 22 and 23 at the opposite ends of the base 21. An upper supporting platform 24 is mounted on the upper ends of the uprights 22 and 23 and a pair of intermediate supporting platforms 25 and 26 extend between the uprights 22 and 23 and are supported on flanges 27 that form part of the uprights 22 and 23.

For purposes of illustration the present device is illustrated in connection with shoelaces and for this reason three folding stations indicated at A, B and C are shown. A greater number of folding stations may be utilized if more than three folds are required.

The upper platform 24 is provided with an upper flat surface 28 that forms in effect a table

top upon which a pair of shoelaces 29 may rest in out-stretched condition. The upper platform 24 is provided with an elongated opening 30 (Fig. 3). In this opening 30 is mounted a supporting block 31 and a guide block 32 that are spaced apart so as to provide a slot 33 therebetween. The supporting block 31 projects downwardly from the upper platform 24 and is provided at its lower end with a journal on which is mounted a guide roller 34. The periphery of the guide roller 34 is directly below the center line of the slot 33.

As shown in Fig. 4 the major portion of the upper ends of blocks 31 and 32 form a continuation of the planar surface 28 of the upper platform 24. A portion of each of blocks 31 and 32 are curved downwardly as at 35 and 36 respectively so as to provide a grooved track merging at least a portion of the upper planar surface 28 downwardly into the vertically disposed slot 33. Separator plates 37 and 38 project upwardly from the curved surfaces 35 and 36 respectively and these plates are centrally disposed so as to provide room for a shoelace on each side of the plates as indicated at 29*a* and 29*b* in Fig. 4.

As shown in Fig. 4 the guide roller 34 is disposed to one side of the slot 33 and the blocks 31 and 32. Projecting downwardly from guide block 32 is a pressure spring 39 that is secured at 40 to the guide block and projects below and across the slot 33. The lower end of spring member 39 indicated at 41 in Fig. 3 is left free.

Referring again to Fig. 1 a second guide roller 42 journalled in a block 43 is mounted on intermediate supporting platform 26. This second guide roller 42 is horizontally spaced from station A. Between this second guide roller 42 and station A is a pressure block 44 that is normally urged downwardly against the intermediate platform 26 by a pressure spring 45 that is secured at 46 to the underneath face of the upper platform 24. The guide block 44 is free to move up and down and is guided in this vertical movement by a guide post 47 that rides in a slot in an angle member 48 that is attached to the supporting block 31.

The intermediate supporting platform 26 is provided with an opening 49 (Fig. 5) in the region between station A (Fig. 1) and the supporting roller 42. In this opening 49 is mounted a supporting block 50 and a guide block 51 that are spaced apart so as to provide a slot 52 (Figs. 5 and 6). The supporting block 50 projects downwardly below the intermediate supporting platform 26 and at the upper end of the supporting block 50 is journalled a guide roller 53 that is so mounted that the right hand edge (Fig. 5) of the slot 52 is substantially tangent to the circumference of roller 53. Mounted at the lower end of the supporting block 50 below the guide roller 53 are a pair of guide rollers 54 and 55, the latter of which is directly below guide roller 53. A pressure spring 56, similar to pressure spring 39, projects downwardly from guide block 51.

Mounted on the lower intermediate platform 25 is a guide roller 57 journalled in a block 58. This guide roller 57 is horizontally spaced with respect to station B (Fig. 1). Between the guide roller 58 and station B is an opening 60 in the supporting platform 25, similar to the opening 30 in supporting platform 24. Mounted in opening 60 is a pair of supporting blocks 61 and 62 spaced apart so as to provide a slot 63 therebetween. A guide roller 64 is journalled in the supporting block 62 as best shown in Figs. 1, 7 and 8 and journalled in supporting blocks 61 is an upper guide roller 65 and a pair of guide rollers 66 and 67. A pressure spring 68, similar to pressure spring 39, projects downwardly from the supporting block 62.

Resting on the lower intermediate supporting platform 25 between station B and guide roller 57 is a pressure block 70 that is urged downwardly by a pressure spring 71 that is fixed as at 72 to supporting block 50. The pressure block 70 is similar to pressure block 44 and is guided in its upward and downward movement by a guide post 73 that rides in a slot in an angle member 74. The angle member 74 is fixed to the supporting block 50.

Mounted on the upper supporting platform 24 is a supporting bracket 75 on which is journalled a guide roller or pulley 76. This guide roller 76 is disposed with its circumference aligned directly above the slot 33. Also mounted on the upper supporting platform 24 is a second supporting bracket 77 that supports a guide roller 78. A third upstanding supporting bracket 79 is supported on the upper platform 24 and at the upper end of this bracket 79 is journalled a guide roller 80. At the opposite end of the framework 20 is a journal bracket 81 on which is journalled a pair of guide rollers 82 and 83. At the lower end of the frame 20 is a bracket 84 on which is journalled a pair of power rollers 85*a* and 85*b*. A motor generally indicated at 86 powers the power rollers 85*a* and 85*b*.

Referring to Figs. 1 and 2 one of the power rollers 85*b*, together with guide rollers 82, 76, 34, 42, 53, 55, 64 and 67, all lie in one vertical plane and an endless chain or belt 87 passes over these various rollers and is powered by power roller 85*b*. The second power roller 85*a* lies in a common vertical plane with the guide rollers 83, 80, 78, 54, 57, 65 and 66 and an endless chain or belt 88 is threaded over all of the various rollers lying in this last plane.

Each of the endless belts 87 and 88 is provided with a plurality of pins illustrated at 89 on the belt 87 and at 90 on the belt 88. These pins are spaced apart at their respective belts and project laterally outwardly from their belts.

As best shown in Figs. 5 and 7 the upper ends of the blocks 50 and 51 (at station B) and 61 and 62 (at station C) are provided with downwardly sloped and curved grooved portions as indicated at 91 in Fig. 5 and 92 in Fig. 7, these curved portions being similar to those shown in Fig. 3 at 35 and 36 and form narrow tracks, so to speak, as best indicated in Figs. 6 and 8. A dividing partition 93 (Figs. 5 and 6) projects outwardly from the guide block 51 and is centrally disposed in the track portion so as to provide separate channels or tracks, through each of which a shoelace may pass as is best indicated at 94*a* and 94*b* in Fig. 6.

As best shown in Figs. 4, 6 and 8 the belts 87 and 88 are disposed to one side or the other of the various downwardly inclined tracks or grooves formed by the curved and inclined surfaces 35, 36 (Fig. 3) and 91 (Fig. 5) and 92 (Fig. 7) and the pins 89 and 90 project from their respective belts 87 and 88 respectively in a direction so that they pass through the vertical slots 33, 52 or 63 (Figs. 3, 5 and 7) as the case may be. The belts 87 and 88 are rotated by the motor 86 in a direction indicated by the arrows in Fig. 1. Additional rollers 95, 96 and 97 mounted to rotate about a vertical axis serve to guide their respective belts so as to prevent lateral displacement of the belt.

The operation of the present device is as follows:

A pair of shoelaces, for example, are laid side by side in out-stretched condition on the top surface of the upper supporting platform 23 with the center of the shoelaces being disposed approximately over the vertical slot 33 that is formed between blocks 31 and 32 (Fig. 1), the shoelaces thus disposed are shown at 29. The machine is operated so that both belts 87 and 88 are moving in the direction indicated by the arrows.

The first folding operation is performed on the shoelaces 29 at station A and is effected by the movement of pin 89 on belt 87 downwardly through the vertical slot 33 formed between blocks 31 and 32. This pin divides the shoelaces 29 in the middle and carries the laces in a downward direction as diagrammatically indicated in Fig. 10. The shoelaces are retained in their proper position lying side by side by the dividing partitions 37 and 38 (Figs. 3 and 4) and the side walls of the grooves or tracks formed in the blocks 31 and 32 by the downwardly sloping surfaces 35 and 36. As belt 87 continues to advance in the direction shown in arrows the pin 89 moves downwardly through the passage or slot 33 (Figs. 3 and 4) and circles the lower portion of guide wheel 34 pulling the shoelaces 29 along behind the pin. As indicated in broken lines 98 in Fig. 3 the supporting block 31 is provided with a guiding slot along its lower face through which the shoelaces 29 are pulled as the pin 89 is moved in a horizontal direction between station A and the second guide roller 42 shown in Fig. 1. During this movement of pin 89 the pin passes the lower end of pressure spring 39 and moves the pressure spring out of its path. After the pin has passed the lower extremity of the pressure spring 39 the pressure spring engages the shoelaces 29 and holds them taut as they are pulled through the groove 98. As the pin 89 reaches the pressure block 44 the pin engages the rear curved edge of the block and forces its way underneath the block, lifting the block in a vertical direction. The pin then moves beneath the block throughout its length, the block being urged downwardly at all times by the pressure spring 45 so as to hold the shoelaces passing beneath the block in a taut condition. The pin 89 now approaches the second guide wheel 42 shown in Fig. 1 and assumes the position indicated at 89*a* in Fig. 11 with the shoelaces 29 pulled taut by the pressure block 44.

During this movement of belt 87 the belt 88 has likewise been rotated so that the pin 90 now assumes the position indicated at 90*a* in Figs. 1 and 11. This pin 90*a* continues to move downwardly effecting a second fold is the shoelaces 29 as best shown in Figs. 5, 11 and 12, the shoelaces being pulled behind the pin and the pin 89 continuing its path around the guide roller 42 and then following along behind pin 90 at the same rate of speed. This second fold is completed when pin 90 reaches the lower end of the supporting block 50 (Fig. 5) and then pins 90 and 89 move along the top surface of the lower intermediate supporting platform 25 toward the guide roller 64 (in the case of pin 89) and guide roller 57 (in the case of pin 90). Pin 89 is then directed about guide roller 64 (Figs. 7 and 13) and downwardly through slot 63 so as to effect a third fold in the shoelaces. Pin 90 now follows pin 89 and the last fold is finally completed so that the finally folded shoelaces emerge along the lower platform or base 21 as best indicated in Fig. 14. The pins are then retracted and the shoelaces are ready for wrapping.

As previously mentioned a plurality of pins 89 and 90 would be located along the length of each of the belts 87 and 88 respectively so that as soon as one pair of shoelaces 29 has cleared the first station A a second pair of shoelaces is in position to be carried into the station A by another pin on the belt 87. The spacing of the pins and the particular number and arrangement of stations will, of course, depend upon the type of folding operations and the ultimate length of the folded article desired.

Though the present embodiment of the invention has been illustrated in connection with the folding of shoelaces it is, of course, recognized that the invention has much broader application even to the folding of sheet material, such as fabrics and certain plastics. The invention is also applicable to the folding of bed sheets and the like.

I claim:

1. A device for folding shoelaces and the like comprising a plurality of separate folding stations, a pair of belts disposed adjacent to each other and interconnecting the stations, projecting means on one belt for conveying the laces progressively through the stations, and projecting means on the other belt cooperating with the first means to effect the folding at the various stations, and means for moving the belts, the projecting means remaining a constant distance apart throughout their travel through the stations.

2. A device for folding shoelaces and the like comprising a pair of belts disposed in substantially parallel adjoining planes, means for moving the belts, a first engaging member on one belt, a second engaging member on the second belt spaced a predetermined distance from the first engaging member, means supporting the shoelaces in stretched-out condition, means guiding the first engaging member into the laces substantially at right angles thereto so as to fold the laces substantially in the middle, and means guiding the second engaging member into the folded laces substantially at right angles thereto so as to fold the laces a second time, the engaging members at all times remaining a constant distance apart.

3. A device for folding shoelaces and the like comprising a pair of spaced pin-like lace engaging members, means for conveying one engaging member throughout a selected path, second means for conveying the second engaging member throughout a different selected path substantially adjacent to the first path, means initially supporting the shoelaces in linear position, the first conveying means moving the first engaging member into the laces substantially at right angles to the laces while they are thus linearly supported so as to effect a fold in the laces, thereafter guiding the two engaging means while maintaining them spaced a predetermined, fixed linear distance apart with one moving behind the other, and means reversing the relative position of the engaging means thereby effecting an additional fold in the laces.

4. A device for folding shoelaces and the like comprising a pair of endless belts disposed in substantially parallel adjoining planes, means for moving the belts at the same speed, a first pin-like engaging member projecting out from one belt, a second pin-like engaging member pro-

jecting out from the second belt and disposed parallel to the first engaging member, means guiding the first engaging member into the laces substantially at right angles thereto so as to fold the laces substantially in the middle, and means guiding the second engaging member into the folded laces substantially at right angles thereto so as to fold the laces a second time, the engaging members at all times remaining a constant distance apart.

HENRY D. LAWRIE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
959,354	Klinck	May 24, 1910
1,088,456	Schefer	Feb. 24, 1914
2,022,352	Kahn	Nov. 26, 1935
2,238,251	Dahlman	Apr. 15, 1941