June 7, 1955 W. J. FOSTER ET AL 2,709,950

BELLOWS FOLDING MACHINE

Filed Nov. 4, 1948 5 Sheets-Sheet 1

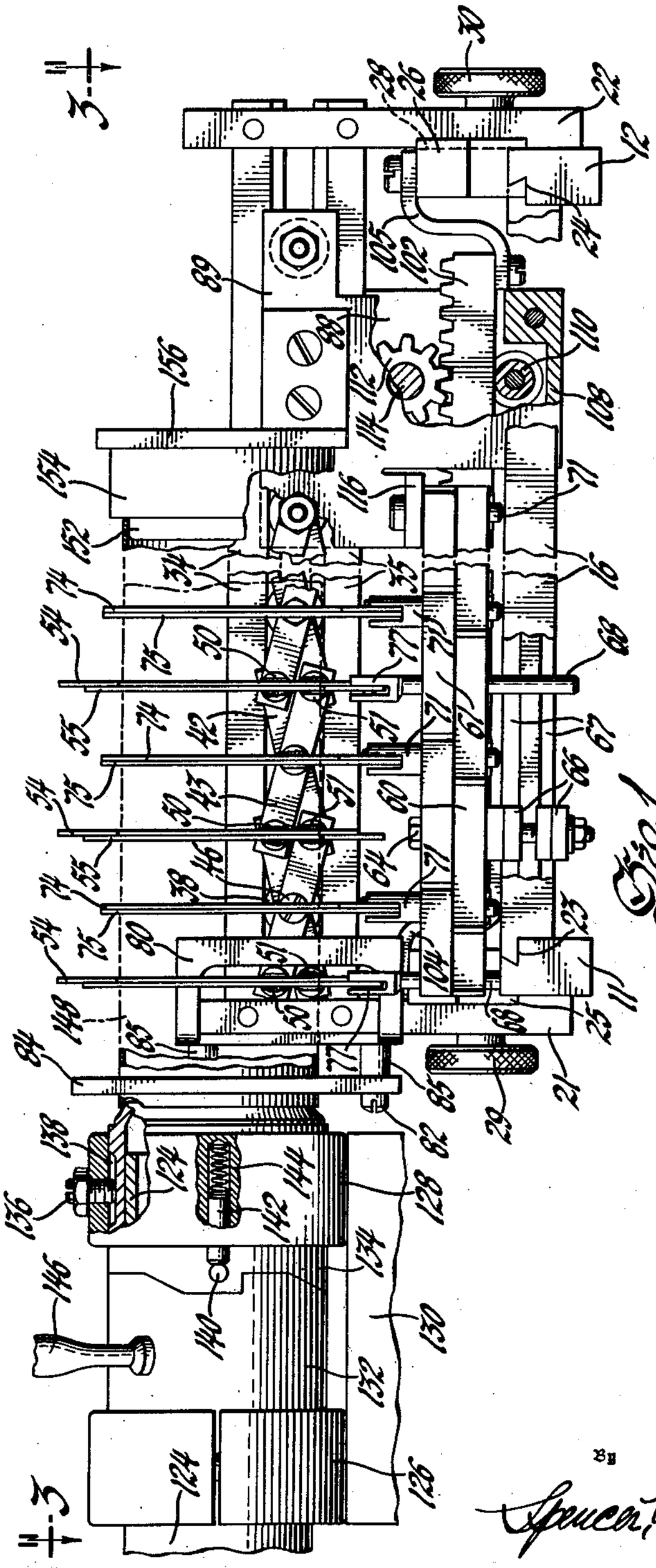

Fig. 1

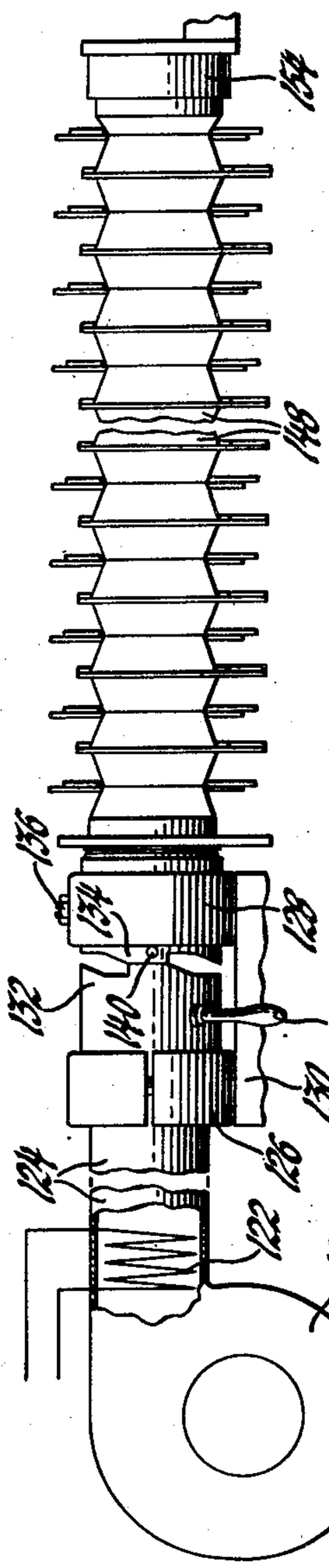

Fig. 2

Inventors
William J. Foster &
John R. Goetzinger
By Spencer, Willits, Helwig & Baillio
Attorneys

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BELLOWS FOLDING MACHINE

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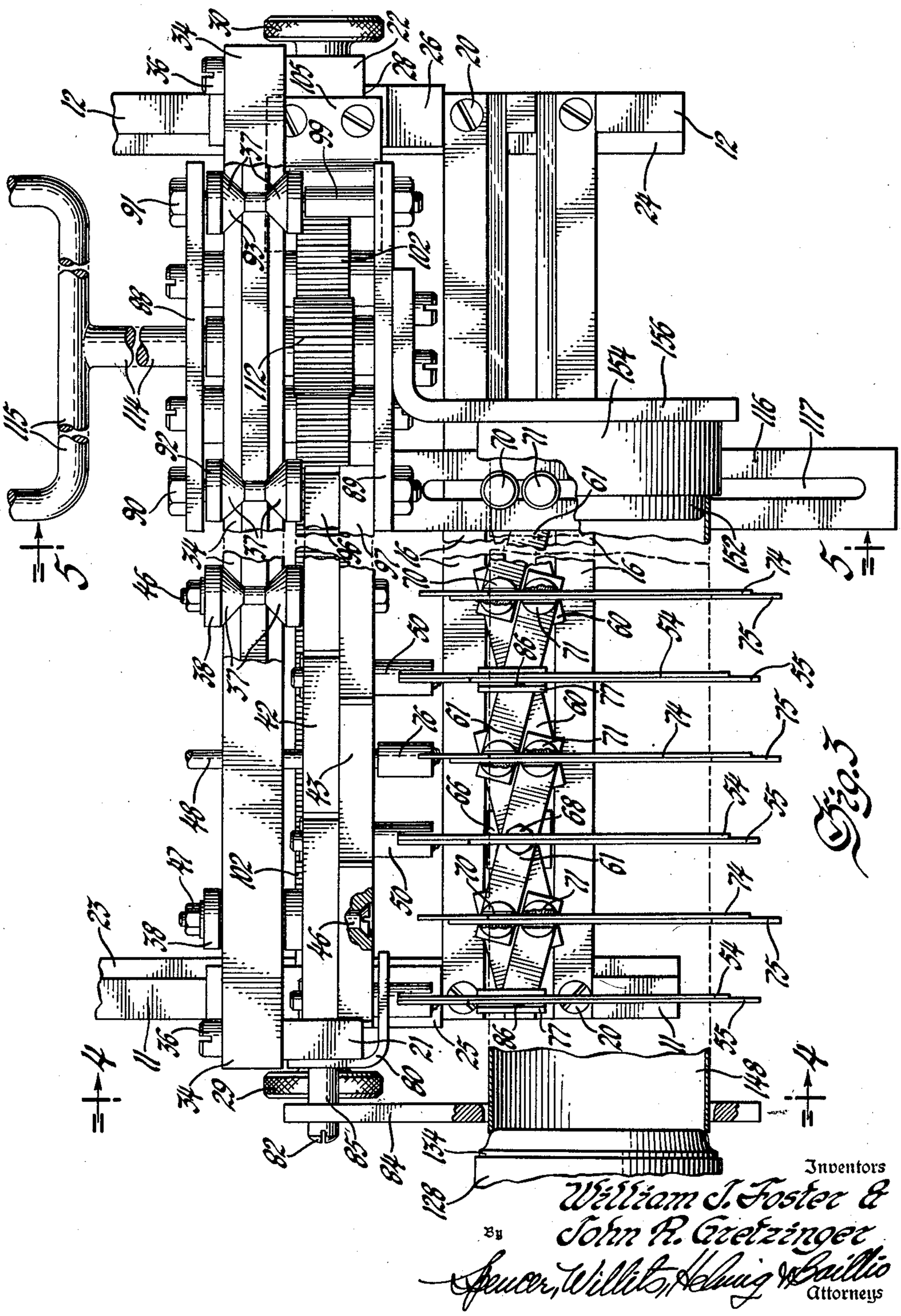

Fig. 3

Inventors
William J. Foster &
John R. Gretzinger
By Bauer, Willits, Helwig & Baillio
Attorneys

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BELLOWS FOLDING MACHINE

Filed Nov. 4, 1948 5 Sheets-Sheet 3

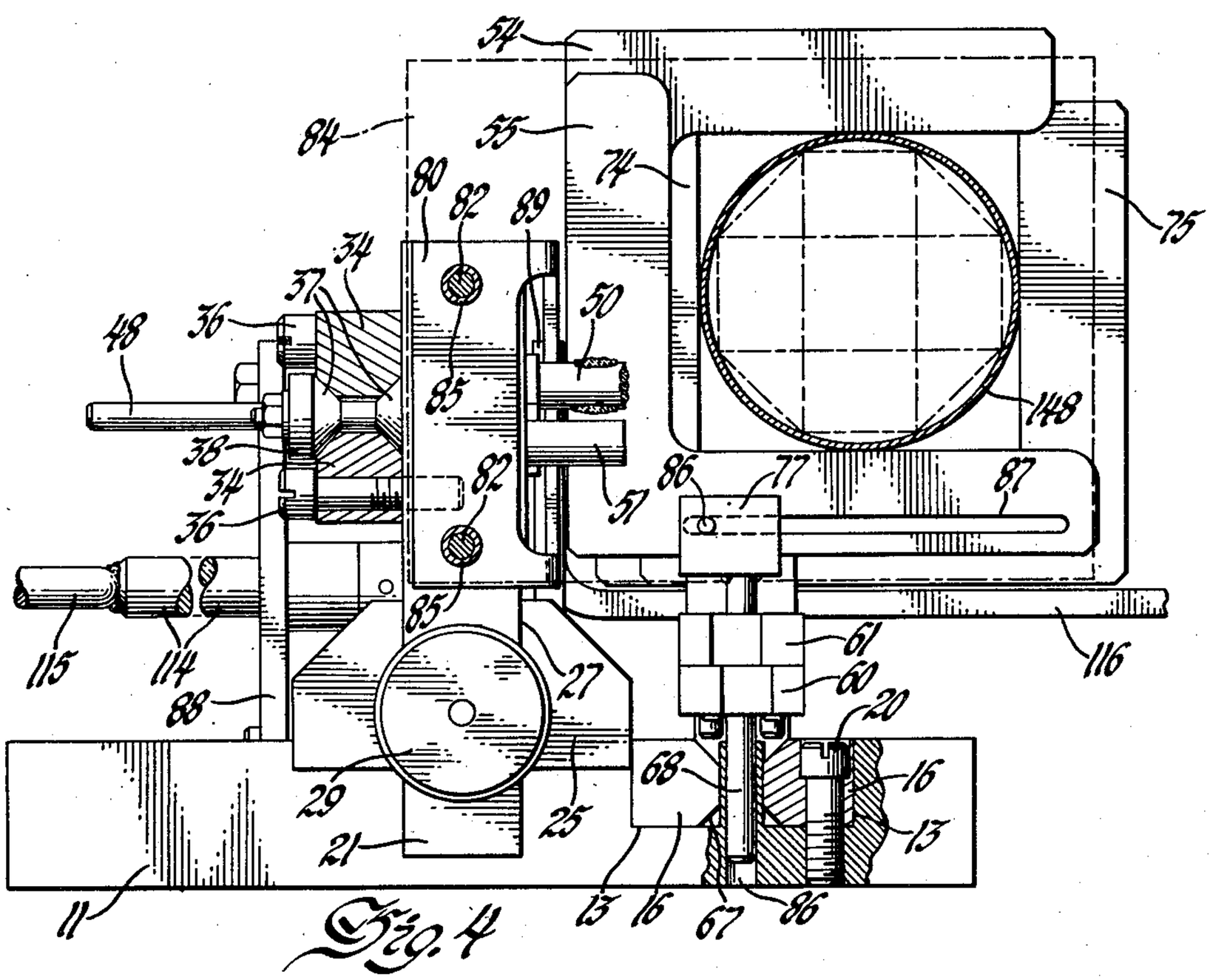

Fig. 4

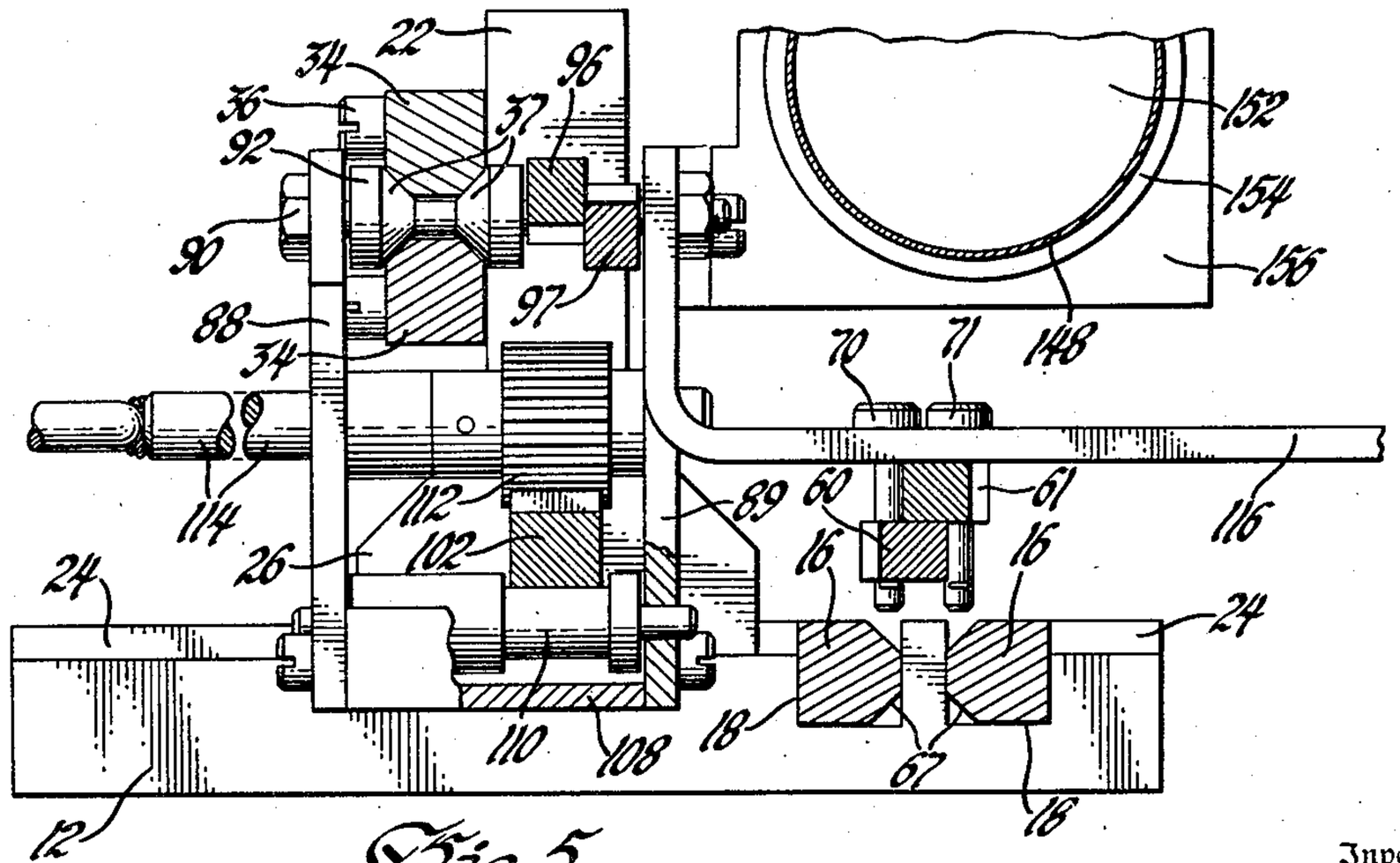

Fig. 5

Inventors
William J. Foster &
John R. Gretzinger
By Spencer, Willits, Helwig & Baillio
Attorneys

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BELLOWS FOLDING MACHINE

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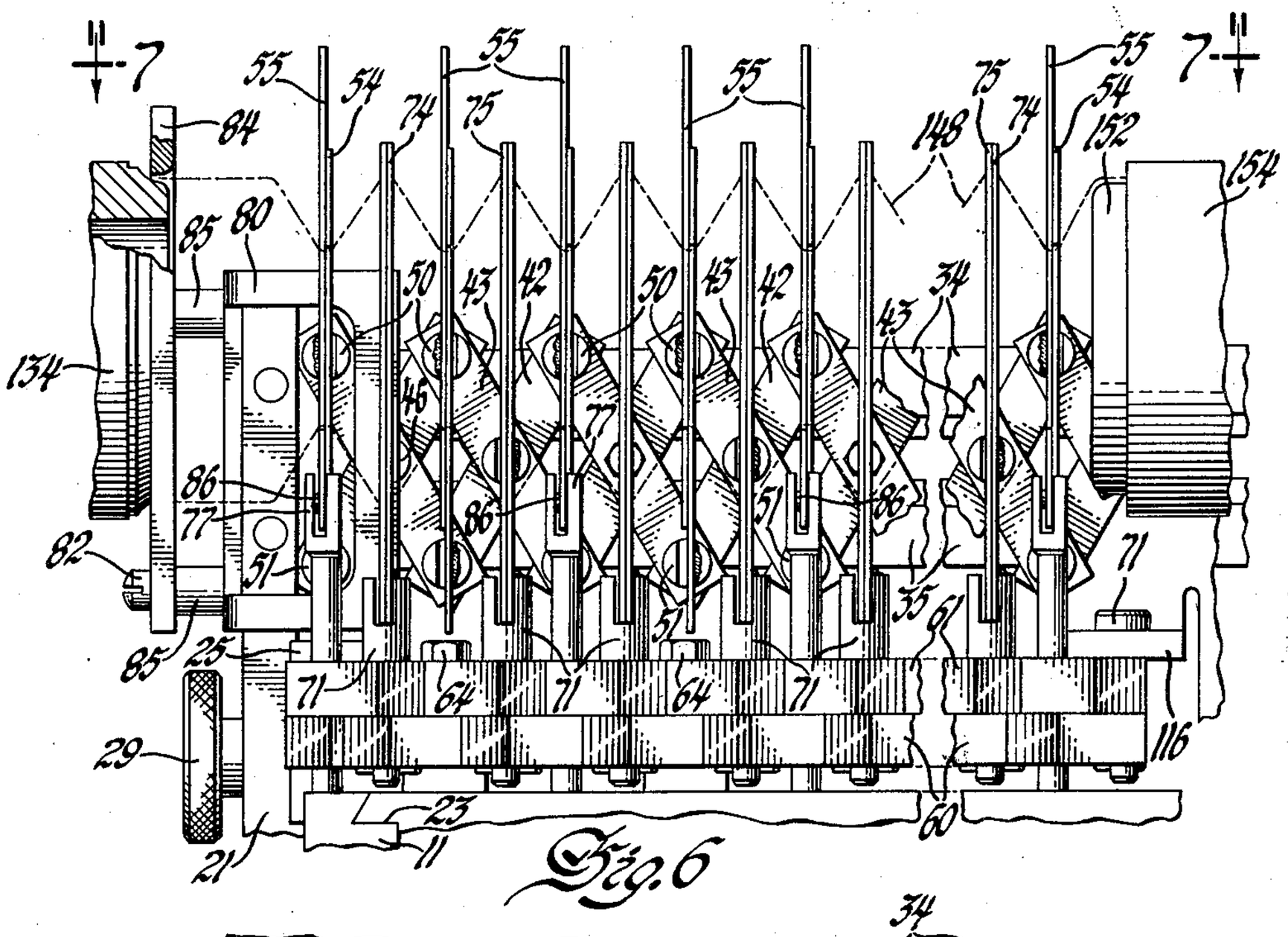

Fig. 6

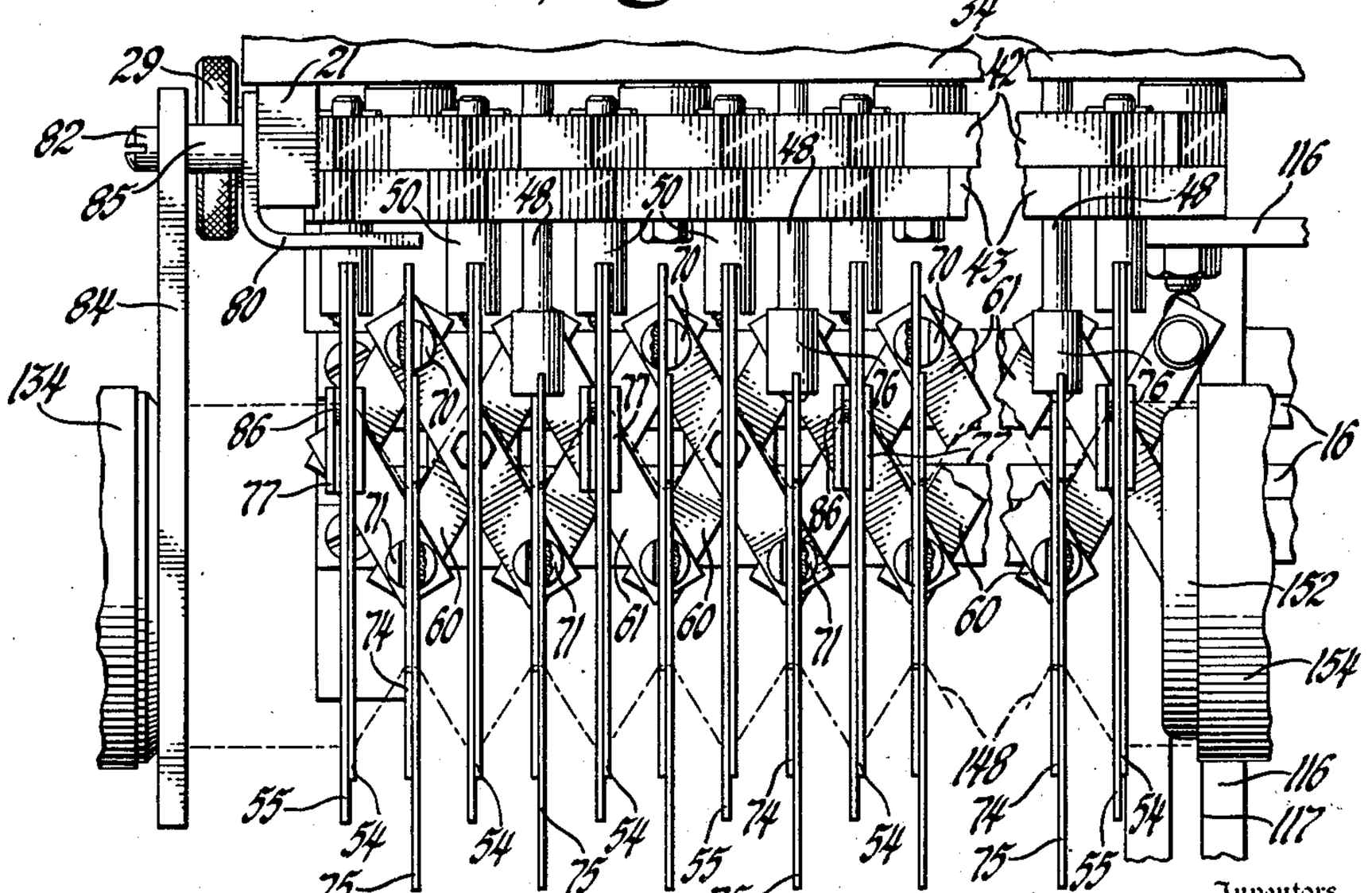

Fig. 7

Inventors
William J. Foster &
John R. Gretzinger
By
Lyon, Willits, Kellogg & Baillio
Attorneys

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BELLOWS FOLDING MACHINE

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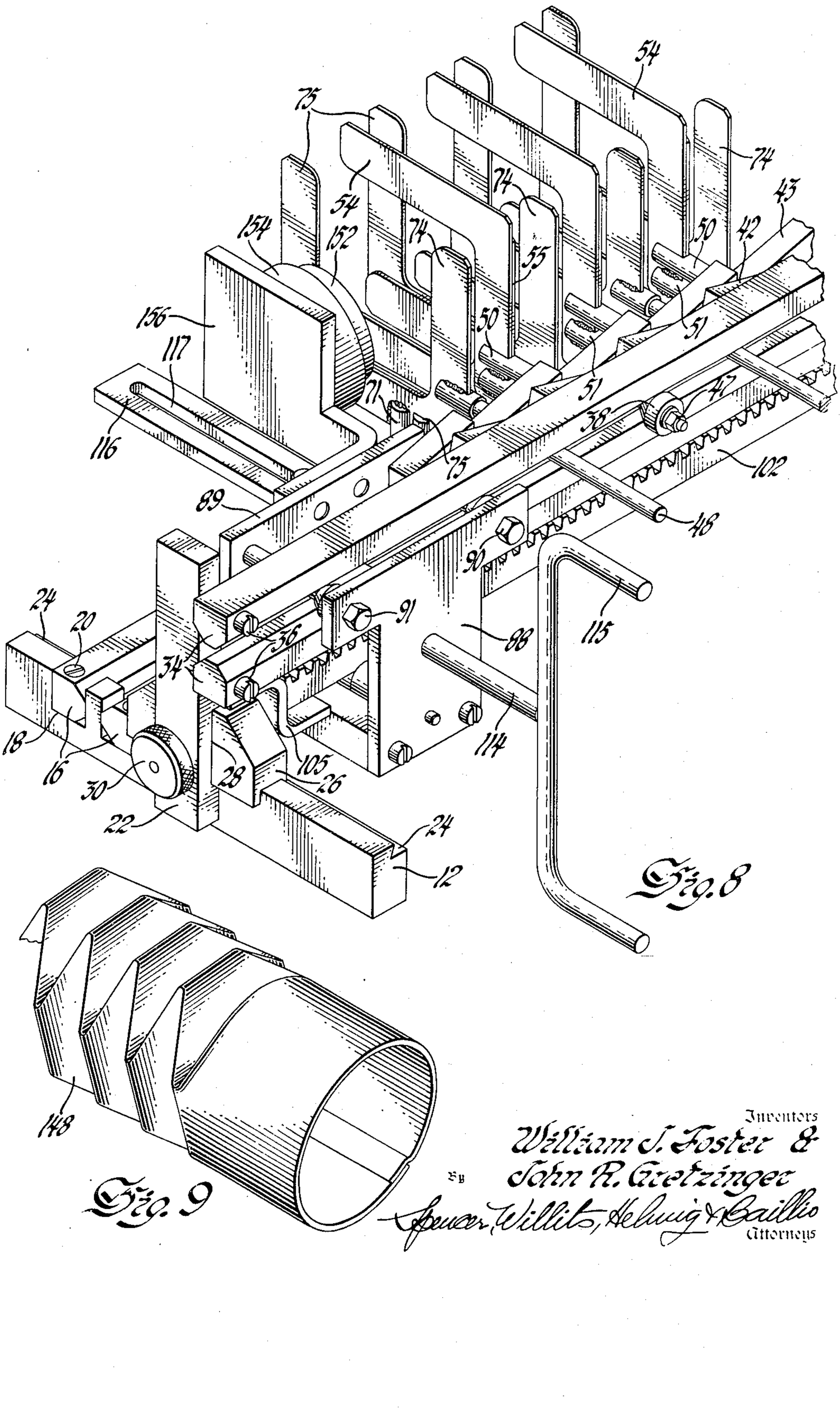

Fig. 8

Fig. 9

Inventors
William J. Foster &
John R. Gretzinger
By Lauer, Willits, Helwig & Baillio
Attorneys

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BELLOWS FOLDING MACHINE

William J. Foster, Flint, and John R. Gretzinger, Lake Fenton, Mich., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application November 4, 1948, Serial No. 58,284

20 Claims. (Cl. 93—1)

This invention relates to folding machines and more particularly to bellows folding machines.

The object of the invention is to provide a simplified bellows folding machine to form a paper tube into a polygonal bellows having pairs of pleats arranged in alternate directions.

Another object is to provide a bellows folding machine having a series of folding blades mounted on lazy tongs to form a plurality of transverse folds in the paper tube to form a bellows.

Another object is to provide a bellows folding machine with a plurality of folding blades which move uniformly inwardly and toward the fixed end of the machine.

Another object is to provide a bellows folding machine for folding a deformable tube into a prismatic bellows in which a plurality of pairs of folding blades alternately form a pair of horizontal and a pair of vertical pleats of a prismatic bellows.

Further objects and advantages of the invention will be apparent from the following description of specific embodiments illustrated in the acompanying drawing, in which—

Figure 1 is a vertical elevation of the bellows folding machine with parts broken away and in section to show the details.

Figure 2 is a schematic view of the bellows folding machine and air supply.

Figure 3 is an enlarged horizontal elevation along the line 3—3 of Figure 1 with parts broken away and in section.

Figure 4 is a section of Figure 3 on the line 4—4 with parts broken away and in section.

Figure 5 is a section of Figure 3 on the line 5—5 with parts broken away and in section.

Figure 6 is a horizontal elevation showing the bellows folding machine in closed position.

Figure 7 is a vertical elevation taken on the line 7—7 of Figure 6 and showing the bellows folding machine in closed position.

Figure 8 shows an isometric view of a portion of the bellows folding machine.

Figure 9 shows a tube with a part thereof folded to form a bellows.

Referring more particularly to the drawing, the folding machine is mounted on base bars 11 and 12 which are mounted and secured in parallel relationship on any suitable support (not shown). The base bar 11 has a pair of recesses 13 to receive the horizontal guide rails 16, which extend to the base bar 12 and are seated in recesses 18 formed therein. Suitable securing means, such as screws 20, may be employed to secure the rails 16 to the base bars 11 and 12.

A vertical support 21 is slidably secured to the base bar 11 and another vertical support 22 is slidably secured to base bar 12. As best shown in Figure 1, the base bar 12 has a longitudinal undercut groove 24 to receive the complementary grooved under surface of block 26 in order to slidably secure the block to the base bar. The

block 26 has a vertical groove 28 on the outer side. The base of groove 28 is flush with the side wall of bar 12 as best shown in Figure 8. The support 22 fits in the groove 28 and is secured by the thumb screw 30, which passes through a hole in the support and is threaded into the block 26. In the same manner the base bar 11 has a groove 23 on the top edge to slidably secure the block 25 thereon. The block 25 has a vertical groove 27, in which the vertical support 21 is similarly secured by a thumb screw 29.

A pair of guide rails 34 are secured by suitable means, such as screws 36, to the supports 21 and 22. The edges of the adjacent faces of the guide rails 34 are beveled at 37 in order to guide and secure a series of hour-glass rollers 38 between the pair of rails 34. A vertical lazy tong linkage is supported on the rollers 38 and employed to impart the proper motion to the folding blades. The lazy tong consists of a series of outer links 42 and inner links 43. As best shown in Figure 1 each pair of links, consisting of an outer link 42 and an inner link 43, are apertured at the center and pivoted in crossed relation on a center pin. The linkage is supported by the alternate center pins 46 which extend through the apertures in the rollers 38. The pin or machine screw is headed and has a nut 47 at the other end to prevent lateral movement of the linkage with respect to the rollers 38. The intermediate center pins 48 are longer and are slidably positioned in the central apertures in the links 42 and 43. The ends of each of the links 42 and 43 are also apertured to receive pivot pins 50 and 51. The pins 50 connect the upper junctures of the inner link 43 and the outer link 42 of each adjacent pair, while the pins 51 connect the lower juncture to complete the vertical lazy-tong linkage.

The ends of both pins 50 and 51 have a slot therein to receive both the upper folding blade 54 and the lower folding blade 55. The upper pin 50 is secured or welded on one side to the lower folding blade 55, while the upper folding blade is slidable in the slot in the pin 50. The lower pin 51 is welded to the upper folding blade 54, while the lower folding blade is slidable in the slot in pin 51. Thus when the lazy-tong is collapsed the pins 50 and 51 move away from each other, and the folding legs of the L-shaped folding blades 54 and 55 move toward each other.

Another lazy-tong linkage and series of folding blades is supported on the horizontal rails 16. The horizontal lazy-tong linkage, as best shown in Figure 3, is similar to the vertical lazy-tong linkage and consists of the outer links 60 and inner links 61 arranged in pairs pivoted together at their center. Each link has a central aperture to receive a pivot pin. Alternate pivot pins 64 extend through the central apertures in a pair of links and inwardly through apertures in beveled blocks 66 which slide on the mating beveled portion 67 of the rails 16. The headed pin 64 secures the links 60 and 61 against the adjacent block 66 and holds the blocks against the bevels 67 to prevent lateral movement and permit longitudinal sliding movement. The intermediate pins 68 extend through the central holes in the links and project between the rails for sliding engagement. The pins 68 are longer so that they will slide axially when the machine is closed. The end portions of each pair of links 60 and 61 are suitably apertured and pivoted together by the inner pivot pins 70 and outer pivot pins 71. Both of the pivot pins have a slot at the end to receive both the right folding hinge 74 and the left folding hinge 75. The inner pin 70 is secured or welded to the left folding blade 75, and the outer pin 71 is welded to the right folding blade 74. Thus when the horizontal lazy tong is collapsed the vertical leg portion of the hori-

zontal L-shaped folding blades 74 and 75 move toward each other to crease the tube.

The pins 70 and 71 and their folding blades 74 and 75 are in alignment with the pins 46 or 48 of the vertical lazy tong and thus spaced between the folding blades 54 and 55. The pins 48 have a slotted end 76 which engages and is secured to an edge of folding blade 74 to aid in maintaining the proper phase relationship between the two-fold plates. Similarly the intermediate pins 68 of the horizonal lazy tong has a slotted end 77 to receive and secure the edge of folding blade 55. Thus the two lazy-tong linkages are interlocked to maintain an equal spacing between each of the sets of folding blades.

At the left end of the machine as shown in Figure 1 the first set of folding blades 54 and 55 is held in fixed position by a U-shaped guide 80 fixed to the end support 21. As best shown in Figure 1, a vertical slot is formed between the bracket 80 and support 21 to limit the movement of end pins 50 and 51 to a vertical reciprocal movement. While the lazy-tong linkage is being closed the end links 42 and 43 abut against end support 21, and while the linkage is being opened the pins 50 and 51, which extend inside the guide 80, will abut the guide. Thus the folding blades 54 and 55 at the left end of the machine are maintained in fixed position. The guide 80 is secured to the support 21 by screws 82, which also hold the apertured clamping plate 84 spaced by spacers 85 with relation to the support. In order to fix the end of the horizontal lazy-tong the two end links 60 and 61 are cut off just beyond the central aperture and the end pin 68 extends into a bore 86 in the bar 11. The end pin 68, Figure 4, illustrated the slotted head 77 with a transverse pin 86 sliding in slot 87 in the leg of L-shaped folding blade 55.

The lazy-tong linkages are driven by a carriage consisting of side plates 88 and 89, which are connected together by bolts 90 and 91. The bolts form the shafts for the hourglass rollers 92 and 93, which are mounted between the rails 34 to mount the carriage for longitudinal sliding movement. The end links 96 and 97 have end holes similar to the holes in links 42 and 43, which are pivoted in the same way to pins 50 and 51. Another hole in links 96 and 97 spaced from the first hole the same as the center hole in the other links is provided to pivotally mount the links 96 and 97 on the bolt 90. The links 96 and 97 maintain the roller in position on bolt 90, while the spacing sleeve 99 maintains the roller in position on bolt 91. Between the end support blocks 25 and 26 a rack 102 is supported on hangers 104 and 105. As best shown in Figure 1 the hanger 105 is secured by screws to the block 26 and the rack 102. Though not completely shown the hanger 104 is the same as hanger 105. The carriage plates 88 and 89 straddle the rack 102 and are spaced at their lower end by the spacer 108 which is secured by screws to the plates 88 and 89. A roller 110 is rotatably mounted on a pin extending between the plates 88 and 89. The roller 110 engages the under side of the rack 102, while a gear 112 mounted on shaft 114, which is rotatably supported in the side plates, engages the other side or the rack teeth. By means of a crank handle 115 attached to shaft 114 the gear 112 may be rotated to move the carriage and thus operate the vertical linkage. The carriage may also be moved by power means, such as a motor mounted on the carriage with its shaft connected to the shaft 114 or a fixed power cylinder with the piston rod connected to the carriage.

In order to actuate the horizontal linkage with the vertical linkage an arm 116 extends from the carriage plate 89. The arm may be made integral with the plate 89 and bent at right angles thereto, as best shown in Figure 5. The arm 116 has a slot 117 therein to receive the pins 70 and 71 in the end pair of horizontal links 60 and 61.

Adjacent the fixed end of the machine a blower 120 supplies air to a heater, such as the electric heater 122, in order to deliver heated air through a conduit to the sleeve or air induction conduit 124. The conduit 124 is supported and secured in the split clamp 126 and bearings 128, which are fixed to the base 130 for mounting on a suitable support (not shown). The bearing 126 fits tightly around the sleeve 124 and holds it in position. A cylindrical cam 132 surrounds and is rotatably mounted on the sleeve 124 and abuts against the side of clamp 126. A clamping cylinder 134 having an end surface mating with the cylindrical cam surface of cam 132 is slidably mounted in the bearing 128 and prevented from rotation by pin 136 engaging slot 138 in the clamping cylinder 134. In order to maintain the cam surfaces of the cylindrical cam and the clamping cylinder together, an abutment pin 140 in the clamping cylinder contacts pin 142 actuated by spring 144 located in a bore in the bearing 128. Thus movement of the handle 146 downward from the unclamped position shown in Figure 1 will move the clamping cylinder 134 to the right and engage the paper 148 between the clamping cylinder 134 and the plate 84, as shown in Figure 2. At the other end the paper blank 148 fits over a cylindrical bushing 152, which seals the movable end of the tubular blank 148. The bushing 152 is secured to a stop 154 which engages the end of the paper, and which is supported by bracket 156 on the plate 89 of the carriage.

This machine forms the bellows from a tube of sheet material of the proper length. Any suitable machine may be used to roll the sheet material into a tube and glue or otherwise secure the edges. The tubular blank is then cut off to the proper length for the machine. The machine may be made longer with any number of folding blades depending on the number of pleats required in the bellows.

Before inserting the tubular blank the machine must be opened by moving the handle 146 to the position shown in Figure 1 to withdraw the clamping cylinder 134 from the clamping plate 84. The withdrawal of the clamping cylinder 146 will release the previously formed bellows and remove the clamping cylinder from the aperture in the clamping plate, so that the clamping plate may be moved laterally with respect to the clamping cylinder. Then one of the sides of the machine or one of the ends must be removed to take out the formed bellows and insert another tubular blank. In the preferred form illustrated the vertical folding blades 54 and 55 are moved laterally to clear the horizontal folding blades. These blades, the vertical lazy tong and their supporting structures are mounted on the vertical supports 21 and 22, which are slidably mounted on the transverse support bars 11 and 12. Thus by loosening the thumb screws 29 and 30 the clamping action of the blocks 25 and 26 and the supports 21 and 22 respectively is released. The complete vertical folding blade assembly may be shifted laterally. As best shown in Figure 8, if the vertical blades 54 and 55 are moved to the right, the series of horizontal blades 74 and 75 will provide a troughlike support having a bottom and sides for the tubular blank.

The vertical folding blade assembly is then moved inwardly so that the blades 54 and 55 are above and below the tubular blank respectively. The handle 146 is then rotated to move the clamping cylinder 134 to the right to clamp the tubular blank 148 between the outside surface of the beveled end of the clamping cylinder and the inside of the aperture in the clamping plate 84, as shown in Figure 2. At the other end the tubular blank fits over a short plug or bushing 152 and engages the shoulder of stop 154 to hold and seal the moving end of the tubular blank.

The tubular blank is internally supported by compressed air supplied by the blower 120 shown in Figure 2.

When a resin-impregnated paper is used, it is desirable to heat the air by suitable means, such as the electric heater 122 in order to heat the paper and increase the flexibility and formability of the paper during the folding operation. When the paper cools it becomes stiff in the folded form. The heated compressed air is fed through the induction tube **124** and the clamping cylinder to the interior of the tubular blank **148**.

The carriage is then moved toward the fixed end of the machine by suitable power means such as the crank **115**, which rotates the gear **112** meshing with the rack **102**. The carriage is slidably mounted by rollers **38** on the guides **34** and **35**. The pivot pin at the crossing of the last pair **96** and **97** of links of the vertical lazy tong is secured to the carriage. The upper pivot pin **50** connecting adjacent pairs of links **42** and **43** of the vertical lazy-tong linkage is secured to the folding blade **55** by the weld as shown in Figure 1. The blade **55** is L-shaped with one leg extending vertically and the other horizontally below the lazy tong. The other pivot pin **51** between the adjacent links **42** and **43** at their lower pivot point is attached to the folding blade **54** at the vertical portion. The horizontal portion of the L-shaped folding blade **54** extends from the top of the vertical portion above the linkage.

When the carriage is moved toward the fixed end of the machine the lazy-tong linkage is compressed and the folding blades **54** and **55** move toward the fixed end of the machine, and the horizontal legs move transversely toward each other to the position shown in Figure 6, and form complementary pleats in the tube **148**.

The horizontal lazy-tong linkage consisting of links **60** and **61** has the pins **70** and **71** of the last pair of links connected to the carriage by the slotted arm **116**. The pins **70** and **71** which connect longitudinally adjacent links **60** and **61** also support the folding blades **74** and **75**. The pin **70** on the inner edge of the linkage is connected to the folding blade **75**, while the pin **71** on the outer edge is connected to the folding blade **74**. The folding blade **75** being L-shaped has a horizontal portion or leg extending across the linkage and a vertical leg extending upwardly on the outer side of the linkage. The folding blade **74** has a similar horizontal portion extending to the inner side where a vertical portion extends upwardly. When the horizontal lazy-tong linkage is collapsed the horizontal fold plates move toward the fixed end of the machine and move together to form complementary pleats in the tubular blank **148**.

The vertical portion of blade **74** is secured in the slotted pin **48** to help maintain both the horizontal and the vertical groups of folding blades in proper spaced relationship, as best shown in Figure 3. The folding blade **55** is slidably secured in the slot in the head **77** of the central pivot pins **68** to assist in maintaining the two series in alignment. These pins slide through the apertures in the links when the blades move toward the closed position and away from the adjacent lazy-tong.

When the two series of folding blades move toward the fixed end of the machine, which is shown at the left in Figures 6 and 7, each opposed pair of blades will move toward each other to pleat the tubular blank **148**. The vertically moving blades **54** and **55** mounted on the vertical lazy-tongs move together and form opposed pleats in the top and bottom of the tubular blank. The horizontally moving blades **74** and **75** mounted on the horizontal lazy-tong move together and form opposed pleats in the sides. Since the horizontal and vertical folding blades are alternately arranged, the pleats are formed alternately on the top and bottom, and then on both sides to form a bellows, as shown in Figure 9.

When the bellows is folded the air supply is cut off by suitable means, such as a compressor motor control switch or a valve in the air induction pipe **124**. Since the paper is porous and the seal imperfect, the air pressure in the bellows will quickly escape. Then the carriage is returned to open the folding blades and release the bellows. The handle **146** is then moved upwardly to move the clamping cylinder **134** and release the bellows. The thumb screws **29** and **30** are released to move the vertical supports, lazy-tong linkage and folding blades **54** and **55** away from the horizontal blades **74** and **75** in order to remove the bellows.

Though various elements of the invention such as the lazy-tong linkage are referred to for convenience as the horizontal element or the vertical element, it will be appreciated by those skilled in the art that though the folding machine is illustrated in a horizontal position, it could be operated in any other position. Thus the terms horizontal and vertical are merely intended to define similar parts by their relative location in the machine.

The above described specific embodiment is illustrative of the invention. Other modifications within the terms of the appended claims will be apparent to those skilled in the art.

We claim:

1. In a machine of the character described, a horizontal lazy-tong linkage, means to support said horizontal linkage for longitudinal movement, horizontal blades attached to said horizontal linkage, a vertical lazy-tong linkage, means to support said vertical linkage for longitudinal sliding movement, vertical folding blades attached to said vertical linkage and said horizontal and vertical blades being located adjacent each other to form angularly related folds in an element.

2. The invention defined in claim 1, said horizontal and vertical folding blades being arranged alternately in a series.

3. In a machine of the character described, a lazy-tong linkage consisting of a series of interconnected crossed pairs of links, central pins pivotally connecting each of said crossed links at the center, end pins on each side of the central pins pivotally connecting the ends of the links of said pairs of crossed links, said central pins being slidably mounted in a longitudinal guide, and folding blades mounted on said links adjacent said end pins on one side of the central pins and having folding portions extending from the other side of the central pins.

4. In a machine of the character described for folding a heat softenable tubular blank, a frame, an airtight clamp mounted on said frame for one end of a tubular bellows blank, a plug mounted on said frame for the other end of said blank, means connected to and extending through said clamp to supply heated compressed air connected to said clamp for the inside of the tubular bellows blank to support said tubular blank, said last named means including heating means to heat the compressed air to soften the tubular blank for folding, a plurality of longitudinal series of fold plates located between said clamp and plug surrounding said blank, the fold plates in oppositely disposed series being in transverse alignment, the transversely adjacent fold plates being longitudinally spaced intermediate the adjacent fold plates, means mounted on said frame and connected to each fold plate to move said plates longitudinally and transversely in a fixed path to fold the tubular bellows blank.

5. The invention defined in claim 4, said plug being fixed to move with the last fold plate.

6. The invention defined in claim 4, said means connected to each fold plate consisting of a lazy-tong linkage connected to the fold plates in each pair of oppositely disposed series.

7. In a machine of the character described, a first longitudinal series of oppositely disposed folding blades, a second longitudinal series of oppositely disposed folding blades, connected fixed length links having a first and a second longitudinal series of oppositely disposed attaching points moving longitudinally and at the same time moving said oppositely disposed attaching points of each series toward each other in a fixed path, and said first and second longitudinal series of oppositely disposed

folding blades being fixed to said first and second longitudinal series of oppositely disposed attaching points to simultaneously move said folding blades longitudinally and inwardly toward each other.

8. In a machine of the character described, a first longitudinal series of pairs of oppositely disposed folding blades, a second longitudinal series of pairs of oppositely disposed folding blades, said first series being positioned intermediate said second series, rigid links interconnecting each blade in each of said series and positively moving each of said folding blades longitudinally and inwardly toward the oppositely disposed folding blade in a fixed path in accordance with the proportions of the linkage.

9. In a machine of the character described, a first longitudinal series of two oppositely disposed rows of folding blades positioned about an axis, a second longitudinal series of two oppositely disposed rows of folding blades positioned about said axis, said first series of folding blades being positioned at a transverse angle to said second series, rigid links interconnecting each blade in each of said series and positively moving said fold blades longitudinally and inwardly in a fixed path in accordance with the proportions of the linkage to form transversely angularly related folds in an element.

10. In a machine of the character described, a first lazy-tong linkage, means to support said first linkage for longitudinal movement, first blades attached to said first linkage, a second lazy-tong linkage, means to support said second linkage for longitudinal movement and to position said second linkage at a transverse angle to said first linkage, second folding blades attached to said second linkage and said first and second blades being located adjacent each other and at an angle to each other to form angularly related folds in an element.

11. In a machine of the character described for folding a heat softenable tubular blank, a frame, conduit means mounted on said frame, means to connect said conduit means in communication with one end of the tubular blank, a closure mounted on said frame to close the other end of the tubular blank, means connected to said conduit means to supply compressed air to said conduit means to support the inside of the tubular blank, said last named means including heating means to heat the compressed air to soften and increase the flexibility of the tubular blank, a plurality of fold blades movably mounted on said frame, and drive means to move said folding blades inwardly to engage and fold the tubular blank.

12. In a bellows folding machine, a frame having an axis, the combination of a plurality of rows of axially spaced transversely positioned folding blades each having a transverse lineal portion for contacting a blank, said rows extending longitudinally of the axis and being positioned about the axis in a plurality of adjacent rows, said rows of folding blades cooperating such that the transverse lineal portions thereof together define a hollow prism, a drive mechanism including a plurality of attaching points and means interconnecting said attaching points for movement in a fixed path during each cycle of operation axially toward each other to reduce the axial space between said attaching points and transversely inwardly toward the axis to reduce the transverse space between said attaching points, and said folding blades being fixedly mounted on said attaching points to move in said fixed path to form angularly related folds in an element.

13. In a bellows folding machine, a frame having an axis, the combination of a plurality of rows of axially spaced transversely positioned folding blades each having a transverse lineal portion for contacting a blank, said rows extending longitudinally of the axis and being positioned about the axis in a plurality of opposed pairs of rows, said transverse lineal portions of said folding blades facing the transverse lineal portions of the folding blades of the opposed row to define a hollow prism, a drive mechanism including a plurality of attaching points and means interconnecting said attaching points for movement in a fixed path during each cycle of operation axially toward each other to reduce the axial space between said attaching points and transversely inwardly toward the axis to reduce the transverse space between said attaching points, and said folding blades being fixedly mounted on said attaching points to move in said fixed path to form angularly related folds in an element.

14. In a machine of the character described, a lazy-tong linkage consisting of a series of interconnected pairs of crossed rigid links, central pins pivotally connecting each of said pairs of crossed links at the central portion of each link, end pins pivotally connecting the ends of the links of said pairs of crossed links with the ends of the links of adjacent pairs, a longitudinal guide, said central pins being slidably mounted in said longitudinal guide, a plurality of separate and independent folding blades, and each of said folding blades being spaced from and independent of the longitudinally adjacent folding blades and being attached solely to one of said end pins for movement with said one end pin.

15. In a machine of the character described, a frame having an axis, a lazy-tong linkage, means to support said linkage on said frame for longitudinal movement along said axis, a plurality of separate and independent folding blades, and each of said folding blades being mounted independently of the transversely adjacent folding blades on said linkage and attached solely at a single point on said linkage transversely spaced from said axis for movement with said point on said linkage.

16. In a machine of the character described, a plurality of pairs of crossed links, central pivot means pivoting said pairs of crossed links together adjacent the center of the links, a plurality of end pivot means adjacent the ends of said links securing the ends of adjacent pairs of crossed links together on opposite sides of said central pivot means, support means, and central pivot means slidably engaging said support means to support said links for longitudinal movement, a plurality of separate and independent folding blades, and each of said folding blades being attached on said linkage solely at a single point spaced from said central pivot means for movement with said single point.

17. In a machine of the character described in claim 16, and each of said folding blades being attached independently on said linkage solely on a single one of said end pivot means.

18. In a machine of the character described in claim 16, said folding blades being attached independently on said linkage at points on opposite sides of and spaced from said central pivot means.

19. In a machine of the character described, a plurality of pairs of crossed links, central pivot means pivoting said pairs of crossed links together adjacent the center of the links, a plurality of end pivot means adjacent the ends of said links securing the ends of adjacent pairs of links together on opposite sides of said central pivot means, means for supporting said central pivot means for longitudinal sliding movement, a plurality of separate and independent folding blades, and said folding blades being attached independently to said linkage solely at single points located on both sides of and spaced from said central pivot means.

20. In a machine of the character described, a plurality of pairs of crossed links, central pivot means pivoting said pairs of crossed links together adjacent the center of the links, a plurality of end pivot means on each side of the central pivot means for pivoting the ends of adjacent pairs of links together, means for supporting said central pivot means for longitudinal sliding movement, a first group of folding blades, each folding blade of said first group having a support portion solely attached at a single point on one side of the central pivot means, a second group of folding blades, each folding blade of said second group having a support portion solely attached at a single point

on the other side of the central pivot means, and each folding blade having a folding portion on the side of the central pivot means opposite the side having said support portion to move the folding portions of the first and second group of folding blades transversely toward each other when the end pivot means of said crossed pairs of links are moving transversely away from each other.

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