Nov. 5, 1963 J. R. ZIMMERMAN 3,109,643

FABRIC FOLDING MACHINE

Filed June 7, 1961 4 Sheets-Sheet 1

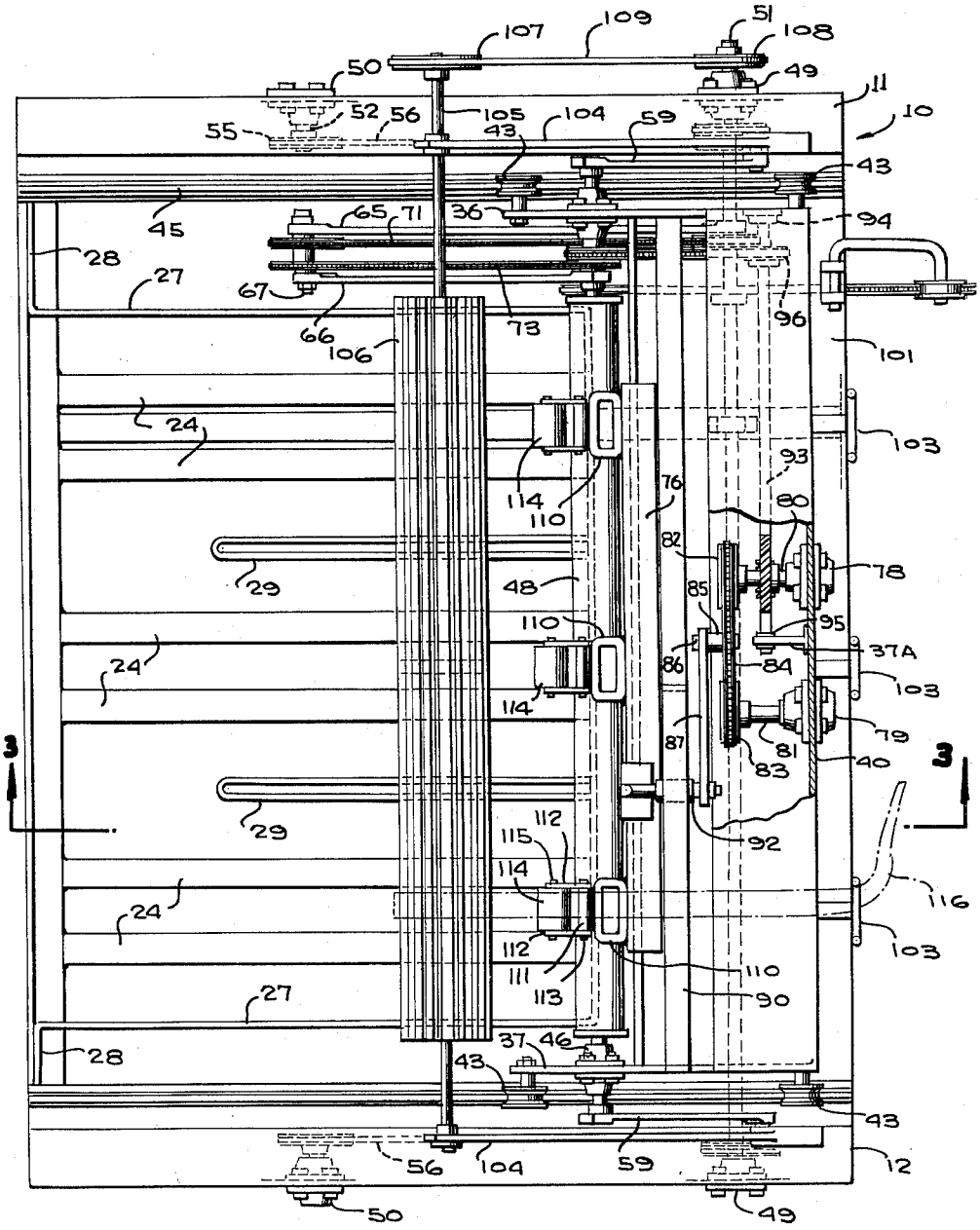


FIG. 1

INVENTOR
JOHN R. ZIMMERMAN

BY Chas R. Allen

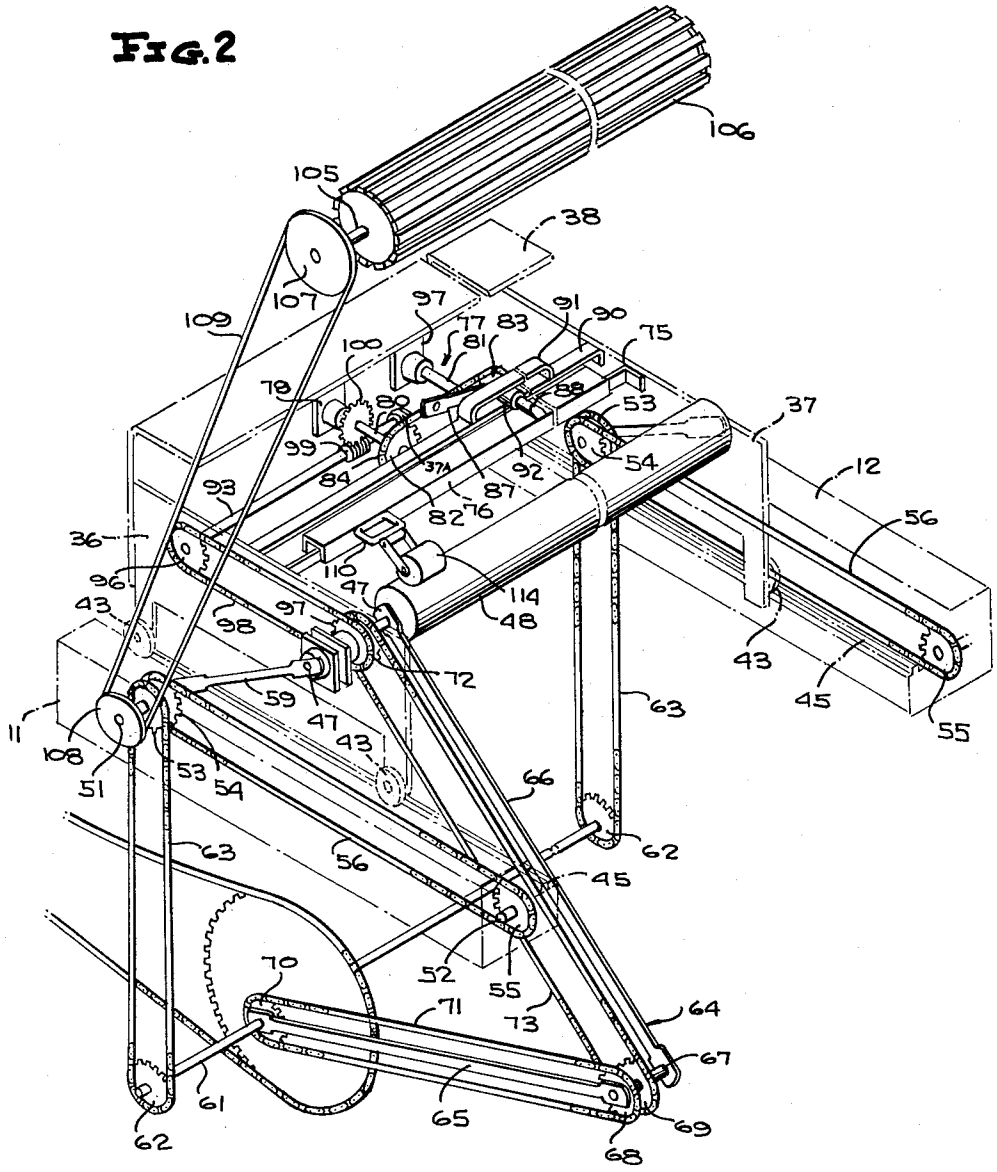
ATTORNEY

Nov. 5, 1963 J. R. ZIMMERMAN 3,109,643

FABRIC FOLDING MACHINE

Filed June 7, 1961 4 Sheets-Sheet 2

FIG. 2



INVENTOR

JOHN R. ZIMMERMAN

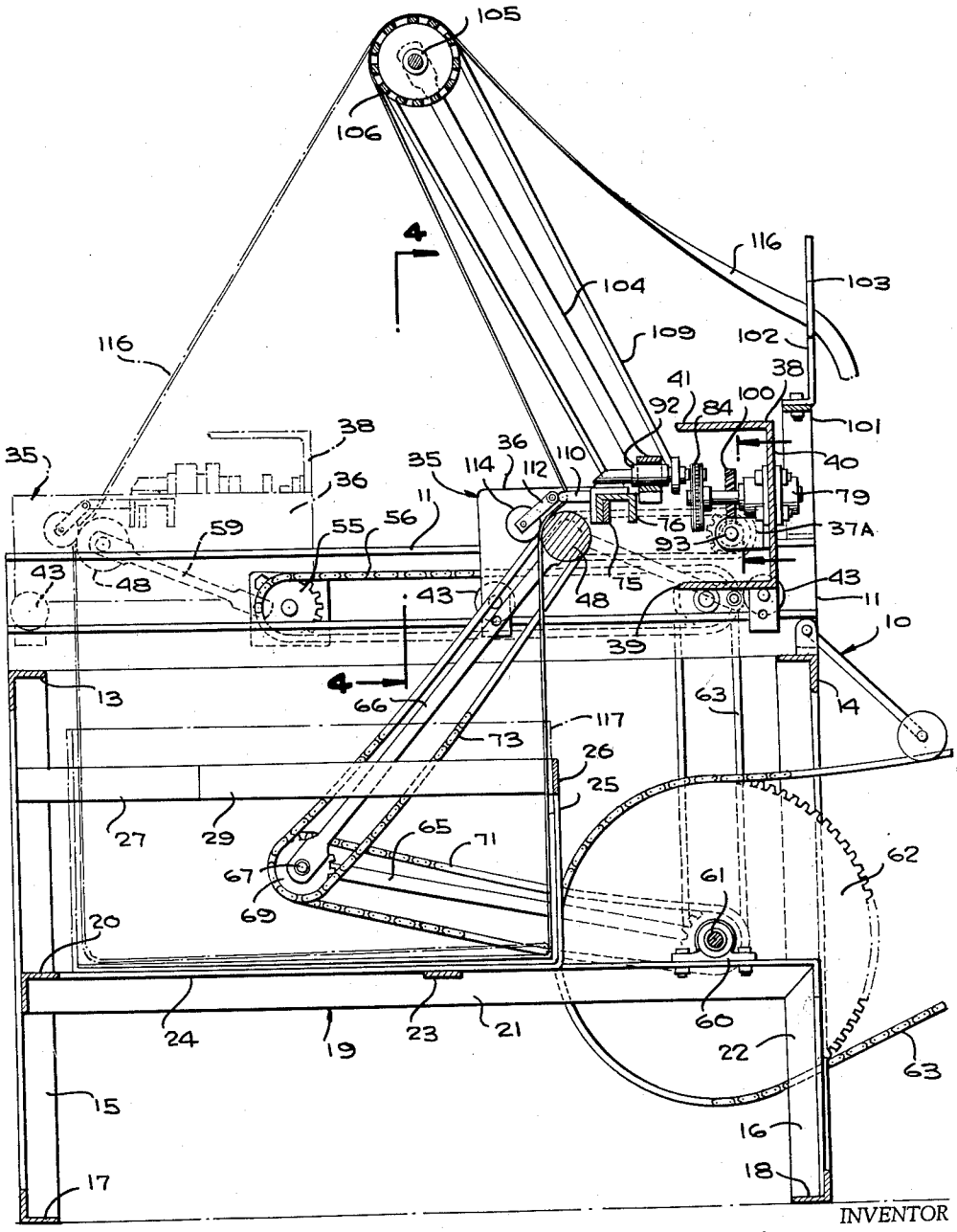
BY Leo R. Allen

ATTORNEY

Nov. 5, 1963 J. R. ZIMMERMAN 3,109,643

FABRIC FOLDING MACHINE

Filed June 7, 1961 4 Sheets-Sheet 3



INVENTOR
JOHN R. ZIMMERMAN

FIG. 3

BY Chas R. Allen
ATTORNEY

Nov. 5, 1963 J. R. ZIMMERMAN 3,109,643

FABRIC FOLDING MACHINE

Filed June 7, 1961 4 Sheets-Sheet 4

FIG. 4

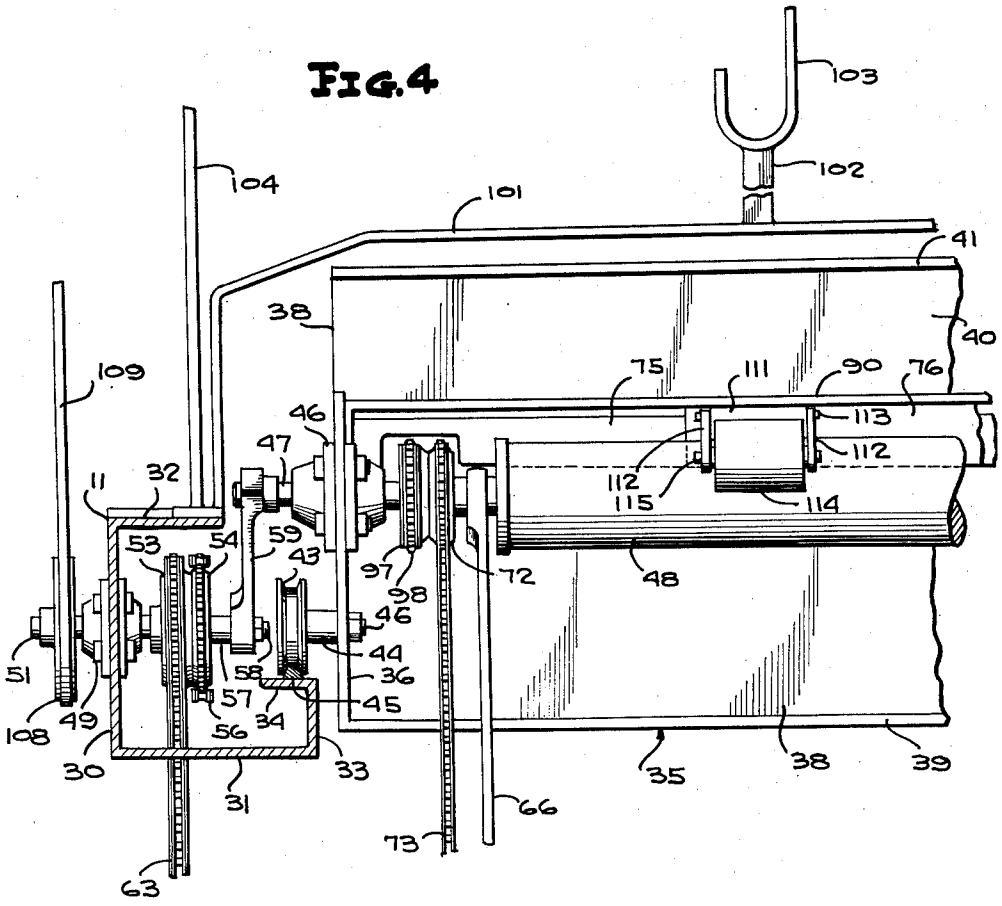
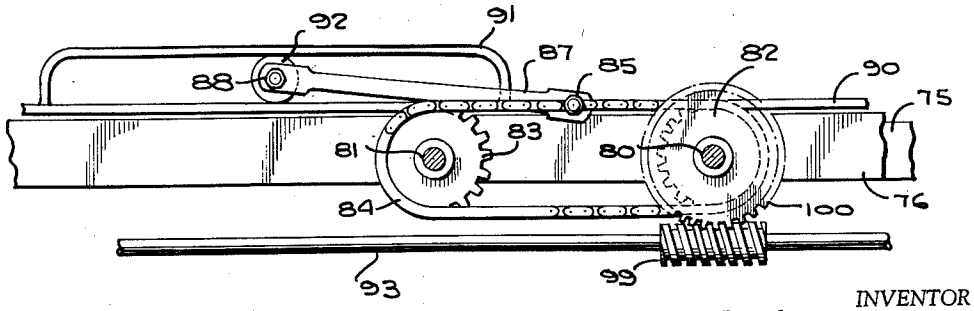


FIG. 5



INVENTOR
JOHN R. ZIMMERMAN

BY Chas. R. Allen

ATTORNEY

United States Patent Office

3,109,643
Patented Nov. 5, 1963

3,109,643

FABRIC FOLDING MACHINE

John R. Zimmerman, 5 Wayne St., Orwigsburg, Pa.

Filed June 7, 1961, Ser. No. 115,425
11 Claims. (Cl. 270—79)

This invention relates in general to new and useful improvements in fabric folding machines, and more particularly to a fabric folding machine which will fold continuous strips of fabric back and forth and at the same time from side to side whereby a continuous strip of fabric may be evenly deposited into a suitable container.

A primary object of this invention is to provide a fabric folding machine which is of a relatively simple construction and at the same time of a mechanical design suitable for continuous operation.

Another object of this invention is to provide novel combined drive and guide means for a continuous strip of fabric, the combined drive and guide means including a continuously rotating roller which is driven and is reciprocated back and forth, and a guide member mounted above the roller and reciprocated back and forth axially of the roller with there being associated with the guide a small roller which clamps the fabric to the large roller and which slides relative to the large roller whereby there is a continuous driving of the fabric even though it is moved back and forth along the main roller.

Another object of this invention is to provide a novel fabric folding machine which includes two carriages mounted for reciprocation at right angles to each other, with one of the carriages being carried by the other and the two carriages being driven from a common drive source.

Another object of this invention is to provide a novel fabric folding machine which includes a suitable frame structure having a first carriage reciprocated thereon, and a second carriage carried by the first carriage reciprocated thereon transversely of the movement of the first carriage, and the first carriage carrying a drive roller which is continuously driven, all of the drives for the carriages and the drive roller being driven from a single power source.

Another object of this invention is to provide a novel drive for a continuously rotating drive roller which is carried by a reciprocating carriage, the drive roller being driven from a fixed main drive shaft and the drive between the drive roller and the main drive shaft including a pair of links pivotally connected to the main drive shaft and a shaft of the drive roller with the links also being pivotally connected together by a pivot shaft, and there being mounted on the main drive shaft, the pivot shaft and the drive roller shaft sprockets which are connected together by drive chains with the links pivoting as the drive roller reciprocates back and forth relative to the main drive shaft during the reciprocation of the carriage supporting the drive roller.

A further object of this invention is to provide a novel drive for a reciprocating carriage, the drive including an endless chain having attached thereto a connecting link, and the connecting link being further attached to the carriage whereby as the chain continuously moves, the carriage is advanced and retracted.

A still further object of this invention is to provide a novel fabric folding machine which will simultaneously fold a plurality of strips of fabric into suitable containers, the machine being self-contained and being provided with suitable supports for containers for the fabric, and the operation of the machine being automatic.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawing:

In the drawing:

FIGURE 1 is a plan view of the fabric folding machine with portions broken away and shown in section in order to clearly illustrate the various drive assemblies of the machine.

FIGURE 2 is a schematic perspective view with portions broken away and shows the specific details of the drives of the fabric folding machine.

FIGURE 3 is a vertical sectional view taken along the line 3—3 of FIGURE 1 and shows the specific details of the machine.

FIGURE 4 is an enlarged fragmentary vertical sectional view taken along the line 4—4 of FIGURE 3, and shows the specific details of the drive for a longitudinally reciprocating carriage and the manner in which the carriage is supported.

FIGURE 5 is an enlarged fragmentary vertical sectional view taken along the line 5—5 of FIGURE 3, and shows the specific details of the drive for a transversely reciprocating carriage.

Referring now to the drawings in detail, it will be seen that there is illustrated the fabric folding machine, which is the subject of this invention, the fabric folding machine being generally referred to by the numeral 10. The fabric folding machine 10 includes two main upper frame members 11 and 12 disposed at opposite sides of the machine 10 and extending longitudinally thereof. As is best illustrated in FIGURE 3, the frame members 11 and 12 are supported at opposite ends of upper longitudinal frame members 13, 14 which, in turn, are supported by standards 15, 16. The lower ends of the standards 15 are connected together by a transverse frame member 17 whereas the lower ends of the standards 16 are connected together by a transverse frame member 18.

The frame 10 includes a container support assembly, generally referred to by the numeral 19. The container support assembly 19 includes a transverse frame member 20 which extends between the standards 15 intermediate the ends thereof. A pair of longitudinally extending frame members 21 are connected to the transverse frame member 20 inwardly of the sides of the frame 10. The rear ends of the frame members 21 are supported by short standards 22 which have their lower ends connected to the transverse frame member 18. An intermediate transverse strap 23 extends between the longitudinal frame members 21. A plurality of longitudinally extending container supports 24 extend from the transverse frame member 20 over the transverse strap 23 and terminate in upstanding legs 25. The upstanding legs 25 are connected together by a transverse strap 26 which, in turn, has longitudinally extending straps 27 connected to the opposite ends thereof. The straps 27, as is best shown in FIGURE 1, have offset end portions 28 which are connected to respective ones of the standards 15. The transverse strap 26 also includes generally U-shaped longitudinally extending dividers 29.

Reference is now made to FIGURE 4, wherein there is shown the construction of the longitudinal frame member 11. It is to be understood that the construction of the longitudinal frame member 12 will be identical to that of the frame member 11. The frame member 11 is generally of a box-shaped configuration and includes an upstanding outer side wall 30 and a bottom wall 31 disposed in angular relation. The side wall 30 has an upper flange 32 connected thereto and disposed in overlying relation to the bottom wall 31. The flange 32 is not as wide as the bottom wall 31. An upstanding flange 33 is connected to the edge of the bottom wall 31 remote from the side wall 30 and is parallel to the side wall 30. The height of the flange 33 is much less than the height of the side wall 30. An inwardly directed flange 34 is connected to the upper edge of the flange 33 and is dis-

posed in overlying parallel relation to the bottom wall 31. The flange 34 is relatively narrow.

A first carriage, generally referred to by the numeral 35, is carried by the frame members 11, 12 for reciprocation longitudinally of the frame 10. The carriage 35 is formed of a pair of side plates 36, 37 which are primarily connected together by an upright channel member 38 which is connected to the side plates 36, 37 at the rear edges thereof. The channel member 38, as is best shown in FIGURE 3, has a lower flange 39 which extends along the lower edges of the side plates 36, 37. The channel member 38 also includes an upright web 40 which is disposed generally coextensive with the rear edges of the side plates 36, 37 and extends thereabove. The channel member 38 also includes an upper flange 41 which is disposed above the upper edges of the side plates 36, 37.

Each of the side plates 36, 37 is provided with a stub axle 42 which carries a wheel 43, the wheel being disposed outwardly of its respective side plate and being spaced relative thereto by means of a spacer 44 carried by the stub axle 42. Each of the longitudinal frame members 11, 12 is provided with a rail 45 which is suitably secured on the upper surface of a respective one of the flanges 34 of the two longitudinal frame members 11, 12. In this manner, the first carriage 35 is guided for longitudinal reciprocation.

Each of the side plates 36, 37 is provided with a suitable bearing 46. The bearings 46 are aligned, and a shift 47 extends through the bearings 46. As is best shown in FIGURE 1, a drive roller 48 is carried by a major portion of the drive shaft 47 between the side plates 36, 37.

In order to effect the reciprocation of the carriage 35 longitudinally of the frame 10, there are provided first carriage drive means. The first carriage drive means includes longitudinally spaced bearings 49, 50 carried by the side wall 30 of each of the frame members 11, 12. A stub shaft 51 is carried by the bearing 49 and extends through the respective side wall 30. A similar stub shaft 52 is carried by each bearing 50, but extends only inwardly of the respective side wall 30.

The shaft 51 carries sprockets 53 and 54 disposed in side-by-side relation. The shaft 52 carries a sprocket 55 which is aligned with the sprocket 54. A drive chain 56 is entrained over the sprockets 54, 55.

A fitting 57 is secured to one of the links of the drive chain 56. The fitting 57 includes a shaft 58 on which there is pivotally mounted one end of a connecting link 59. The opposite end of the connecting link 59 is pivotally mounted on an associated end of the drive shaft 47. At this time, it is pointed out that each of the longitudinal frame members 11, 12 has the aforedescribed drive means for reciprocating the first carriage 35, including links 59 disposed at and connected to opposite ends of the shaft 47. It will be apparent from FIGURES 2 and 3 that as the chains 56 move, the links 59 will first push the first carriage 35 forwardly and then pull the first carriage 35 rearwardly.

A pair of bearings 60 are carried by the longitudinal frame members 21 in transverse alignment. A main drive shaft 61 is suitably journaled in the bearings 60 and extends therethrough. A main drive sprocket 62 is carried by an intermediate portion of the main drive shaft 61 and is driven by a chain 63 which, in turn, is driven by a suitable power source (not shown). As is best shown in FIGURE 2, the main drive shaft 61 is provided at opposite ends thereof with sprockets 62. These sprockets 62 are vertically aligned with the sprockets 53 carried by the stub shafts 51. A drive chain 63 is entrained over each pair of the sprockets 53, 62 to drivingly connect the stub shafts 51 to the main drive shaft 61 for constant rotation.

It is desired that the drive roller 48 be constantly rotated as the first carriage, which carries the drive roller 48, reciprocates. In order that a chain drive may be provided for the drive roller 48, there are provided chain drive means, generally referred to by the numeral 64. The chain drive means 64 includes a first link 65 having a first end pivotally mounted on the main drive shaft 61. The drive means 64 also includes a second link 66 having a first end pivotally mounted on the drive shaft 47 for the drive roller 48. A pivot shaft 67 connects together the second ends of the links 65, 66.

The pivot shaft 67 carries two interconnected sprockets 68, 69. A drive sprocket 70 is carried by the main drive shaft 61 in alignment with the sprocket 68 and the sprockets 68 and 70 are connected together by a drive chain 71. A sprocket 72 is secured to the shaft 47 in alignment with the sprocket 69, and the sprockets 69 and 72 are connected together by a drive chain 73.

From FIGURE 2, it will be obvious that as the first carriage 35 reciprocates longitudinally of the frame of the machine 10, the drive roller 48 and the shaft 47 therefor will reciprocate longitudinally of the machine 10 relative to the drive shaft 61. Additional movement will result in the pivoting of the links 65 and 66 with the pivot shaft 67 moving up and down. However, the movement of the links 65 and 66 in no way increases the length of either the drive chain 71 or the drive chain 73, with the result that the movement of the drive roller 48 in no way effects the drive connection between the drive roller 48 and the main drive shaft 61.

A carriage supporting rail 75 extends between the side plates 36, 37 rearwardly of the drive roller 48. A second carriage 76 is carried by the rail 75 for reciprocation transversely of the machine 10 and for movement with the first carriage 35. The second carriage 76 is in the form of an inverted channel member which rests upon the rail 75. The second carriage 76 is driven by suitable drive means, generally referred to by the numeral 77.

The drive means 77 include a pair of bearing assemblies 78, 79 which are carried by the web 40 of the channel 38, as is best shown in FIGURE 1. A stub shaft 80 projects forwardly from the bearing assembly 78 whereas a similar stub shaft 81 projects forwardly from the bearing assembly 79. The shafts 80, 81 carry aligned sprockets 82, 83, respectively, and a drive chain 84 is entrained over the sprockets 82, 83.

As is best illustrated in FIGURE 1, the drive chain 84 has a fitting 85 secured to one of the links thereof. The fitting 85 includes a shaft 86 on which there is pivotally connected one end of a connecting link 87. The other end of the connecting link 87 is pivotally connected to a shaft 88 which, in turn, is welded or otherwise suitably secured to a bracket 89 which is rigidly secured to the carriage 76. Thus, when the chain 84 moves, the second carriage 76 is caused to reciprocate along the rail 75 transversely of the machine 10.

As is best illustrated in FIGURE 2, the connecting link 87, in certain positions thereof, has a tendency to lift the second carriage 76 off the rail 75. In order to prevent this, a strap 90 extends between the side plates 36, 37 intermediate the endless chain 84 and the second carriage 76. The strap 90 carries a guide 91 through which the shaft 88 extends. The guide 91 receives an enlarged roller 92 carried by the shaft 88. The roller 92 bears either against the guide 91 or against the strap 90 and therefore eliminates the transmittal of vertical forces to the second carriage 76.

A transverse shaft 93 extends between the side plate 36 and a bracket 37A carried by the channel member 38 is rotatably journaled in bearings 94, 95 carried by the side plate 36 and the extension 37A. The left end of the shaft 93 is provided with a sprocket 96 which is aligned with a sprocket 97 carried by the shaft 47. A drive chain 98 is entrained over the sprockets 96 and 97 to drive the shaft 93 from the shaft 47. The shaft 93 carries a worm 99 which is meshed with a worm wheel 100 carried by the shaft 80. In this manner, the shaft 80 is driven to drive the chain 84.

As is best shown in FIGURE 4, an arched supporting strap 101 extends upwardly from and between the rear ends of the longitudinal frame members 11 and 12. At spaced intervals along the length of the supporting strap 101 bars 102 extend upwardly and are secured to the lower portions of generally J-shaped guides 103. In the machine illustrated, there are three such guides 103, the machine 10 being intended to simultaneously fold three strips of fabric.

A pair of support arms 104 are carried by the longitudinal frame members 11, 12, and extend upwardly and forwardly, as is best shown in FIGURE 3. A shaft 105 extends between and is rotatably journaled in the upper ends of the support arms 104. The shaft 105 carries a fabric feed drum 106. As is best shown in FIGURE 1, the left hand end of the shaft 105, as viewing the machine 10 from the front, is provided with a sprocket 107. This sprocket is aligned with a sprocket 108 on the end of the shaft 51. A drive chain 109 connects the sprocket 107 to the sprocket 108 for the purpose of driving the shaft 105 and the feed drum 106 carried thereby.

Three ring type guides 110 are secured to the second carriage 76 in alignment with the J-shaped guides 103. These ring guides 110 are secured directly to a forward edge of the second carriage 76 in any suitable manner, such as by welding.

A sleeve 111 is secured to the front part of each of the guides 110. A pair of arms 112 are secured to each of the sleeves 111 by means of a pivot pin 113, the arms 112 being disposed at opposite ends of the sleeve 111. A roller 114 is carried by the pair of arms 112 on a shaft 115.

Continuous strips of fabric 116 are fed to the machine 10 from the rear thereof. The fabric 116, as is best shown in FIGURE 3, passes upwardly from the rear of the machine 10 over an associated one of the J-shaped guides 103 continuing upwardly onto and over the feed drum 106, effecting the advancement of the fabric 116 through the J-shaped guides 103. The fabric 116 then passes down through an associated one of the guides 110 and between the drive roller 48 and an associated one of the rollers 114. It is to be understood that the roller 114 is either of sufficient weight to be gravity urged to a proper fabric clamping position or, if necessary, the support for the rail 114 could be spring urged. The rollers 48 and 114 cooperate to pull the fabric 116 from the feed drum 106. The fabric 116 then loosely falls from between the rolls 48 and 114 into a suitable container 117 which is illustrated in phantom lines in FIGURE 3.

In the operation of the machine 10, as the fabric 116 is being fed, the first carriage 35 is reciprocated longitudinally of the machine 10 at the same rate as the fabric is being fed so that the fabric is laid evenly within the container 117. It will be further noted that the stroke of the first carriage 35 is substantially the same as the length of the container 117 so that the fabric 116 is laid into the container 117 for substantially the full length thereof.

As the first carriage 35 is being reciprocated to lay the fabric 116 within the container 117 back and forth of the length of the container 117, the second carriage 76 is simultaneously being reciprocated transversely of the machine 10. The reciprocation of the second carriage 76 is slower than that of the carriage 35, this being primarily controlled by the drive ratio of the worm 99 and the worm wheel 100. The rate of transverse movement of the carriage 76 is so related to that of the carriage 35 that the carriage 76 moves transversely of the machine 10 a distance equal to the width of the fabric 116 as the carriage 35 completes a full cycle of reciprocation. In this manner, the fabric 116 is properly laid within the container 117 in a folded state so as to completely fill the container 117.

The simplicity of the machine 10 is obvious upon reviewing the same. It is convenient in that a single drive

is provided for the two carriages, the drive roller 48 and the feed drum 106. The drives for the two carriages are extremely simple and are of the generally continuous type with the nature of the drives permitting long strokes and yet requiring a minimum of space as opposed to the normal crank type drive. Numerous other advantages of the specific construction of the machine 10 will become apparent upon study thereof.

From the foregoing, it will be apparent that there has been disclosed a highly desirable and novel machine for accomplishing the desired folding of fabric. Although only an example embodiment of the invention has been illustrated and described, it is to be understood that minor modifications and changes may be made in the invention within the spirit and scope of the invention, as defined in the appended claims.

I claim:

1. A fabric folding machine for folding a continuous strip of fabric back and forth and progressively from side to side in a container, said machine comprising a frame, a first carriage, cooperating means on said frame and first carriage mounting said first carriage for back and forth movement, a drive roller carried by said first carriage for driving a strip of fabric, a second carriage, cooperating means on said first carriage and said second carriage mounting said second carirage for side to side movement, combined fabric guide and clamping means carried by said second carriage for movement along said drive roller and in clamping fabric driving cooperation therewith, means for driving said first carriage, means for driving said second carriage as said first carriage reciprocates, and means for driving said drive roller as said first carriage reciprocates.

2. The fabric folding machine of claim 1 wherein a main drive shaft is carried by said frame for rotation only and said drive roller is carried by a drive roller shaft, and said drive means for said drive roller includes a flexing chain drive connecting said drive roller shaft to said main drive shaft and driving the same from said main drive shaft.

3. A fabric folding machine for folding a continuous strip of fabric back and forth and progressively from side to side in a container, said machine comprising a frame, a first carriage, cooperating means on said frame and first carriage mounting said first carriage for back and forth movement, a drive roller carried by said first carriage for driving a strip of fabric, a second carriage, cooperating means on said first carriage and said second carriage mounting said second carriage for side to side movement, combined fabric guide and clamping means carried by said second carriage for movement along said drive roller and in clamping fabric driving cooperation therewith, means for driving said first carriage, means for driving said second carriage as said first carriage reciprocates, and means for driving said drive roller as said first carriage reciprocates, a main drive shaft carried by said frame for rotation only and said drive roller being carried by a drive roller shaft, and said drive means for said drive roller including a flexing chain drive connecting said drive roller shaft to said main drive shaft and driving the same from said main drive shaft, said chain drive including a first link having a first end pivotally mounted on said main drive shaft, a second link having a first end pivotally mounted on said drive roller shaft, said links having second ends, a pivot shaft connecting together said link second ends, sprockets on said main drive shaft, said drive roller shaft and said pivot shaft, and drive chains entrained over said sprockets.

4. The fabric folding machine of claim 1 wherein a main drive shaft is carried by said frame for rotation only and said drive roller is carried by a drive roller shaft, and said drive means for said drive roller includes a flexing chain drive connecting said drive roller shaft to said main drive shaft and driving the same from said

main drive shaft, and said drive means for said second carriage being connected to said drive roller shaft.

5. A fabric folding machine for folding a continuous strip of fabric back and forth and progressively from side to side in a container, said machine comprising a frame, a first carriage, cooperating means on said frame and first carriage mounting said first carriage for back and forth movement, a drive roller carried by said first carriage for driving a strip of fabric, a second carriage, cooperating means on said first carriage and said second carriage mounting said second carriage for side to side movement, combined fabric guide and clamping means carried by said second carriage for movement along said drive roller and in clamping fabric driving cooperation therewith, means for driving said first carriage, means for driving said second carriage as said first carriage reciprocates, and means for driving said drive roller as said first carriage reciprocates, said combined fabric guide and drive means including a guide loop for receiving a strip of fabric, and a roller aligned with said guide loop and being adapted to clamp a strip of fabric against said drive roller.

6. The fabric folding machine of claim 1 wherein said first carriage drive means includes a continuous drive chain, a connecting link having one end secured to said drive chain and another end connected to said first carriage, whereby as said drive chain moves said first carriage reciprocates.

7. The fabric folding machine of claim 1 wherein said second carriage drive means includes a continuous drive chain, a connecting link having one end secured to said drive chain and another end connected to said second carriage, whereby as said drive chain moves said second carriage reciprocates.

8. The fabric folding machine of claim 1 wherein each of said carriage drive means includes a continuous drive

chain, a connecting link having one end secured to said drive chain and another end connected to a respective one of said carriages, whereby as said drive chain moves the respective carriage reciprocates.

9. The fabric folding machine of claim 1 wherein a main drive shaft is carried by said frame for rotation only and said drive roller is carried by a drive roller shaft, said drive means for said drive roller includes a flexing chain drive connecting said drive roller shaft to said main drive shaft and driving the same from said main drive shaft, and said first carriage drive means being secured to said drive roller shaft.

10. The fabric folding machine of claim 1 wherein a main drive shaft is carried by said frame for rotation only and said drive roller is carried by a drive roller shaft, said drive means for said drive roller includes a flexing chain drive connecting said drive roller shaft to said main drive shaft and driving the same from said main drive shaft, said first carriage drive means including a continuous drive chain, a connecting link having one end secured to said drive chain and another end connected to said first carriage, whereby as said drive chain moves said first carriage reciprocates.

11. The fabric folding machine of claim 10 wherein said connecting link is secured to said drive roller shaft to form the connection between said connecting link and said first carriage.

References Cited in the file of this patent

UNITED STATES PATENTS

1,321,834	Lyth	Nov. 18, 1919
2,228,050	Collier	Jan. 7, 1941
2,761,678	Cohn et al.	June 5, 1956
2,795,785	Lasker	June 18, 1957
2,971,244	Foller et al.	Feb. 14, 1961