United States Patent

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[54] MACHINE FOR FOLDING PLASTIC BAGS

10 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **93/8,** 93/49, 270/61, 270/69
[51] **Int. Cl.** **B31b 1/00**
[50] **Field of Search** 93/8, 49, 93.3; 270/69, 61

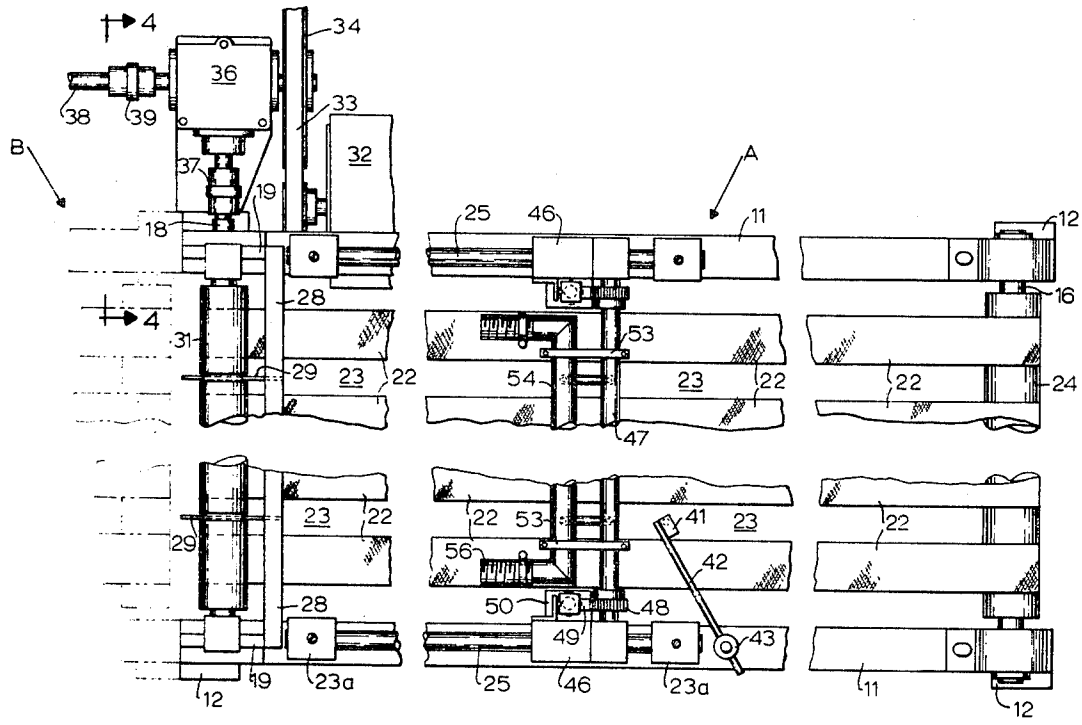
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ABSTRACT: Plastic bags are folded one or more times longitudinally and then transversely preparatory to packaging. Each bag moves longitudinally on spaced belts and the leading edge is lifted above the belts by suction devices which move from an initial position below the belts to an elevated position. Continued movement causes the bag to be folded in half and the fold is squeezed between rollers, pulling the bag out of the grip of the suction devices and creasing the bag at the fold. The operation may be repeated. Each longitudinally folded bag is fed out onto a table having a transverse gap at its center. Suction devices move up into the gap, engage the bag and pull it down, causing it to be transversely folded as it is pulled through the gap, then deposited on belts below the table and discharged.



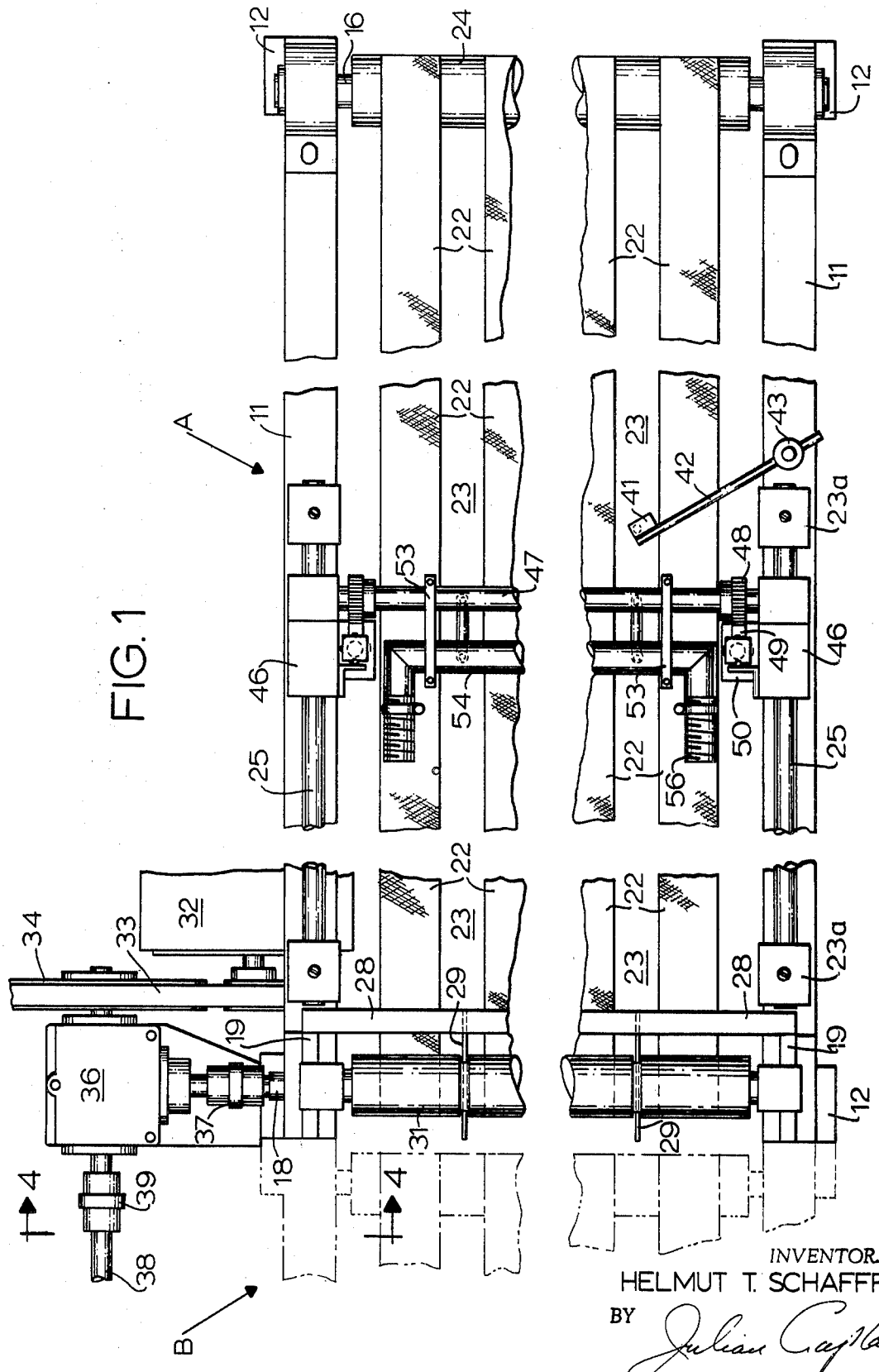


FIG. 1

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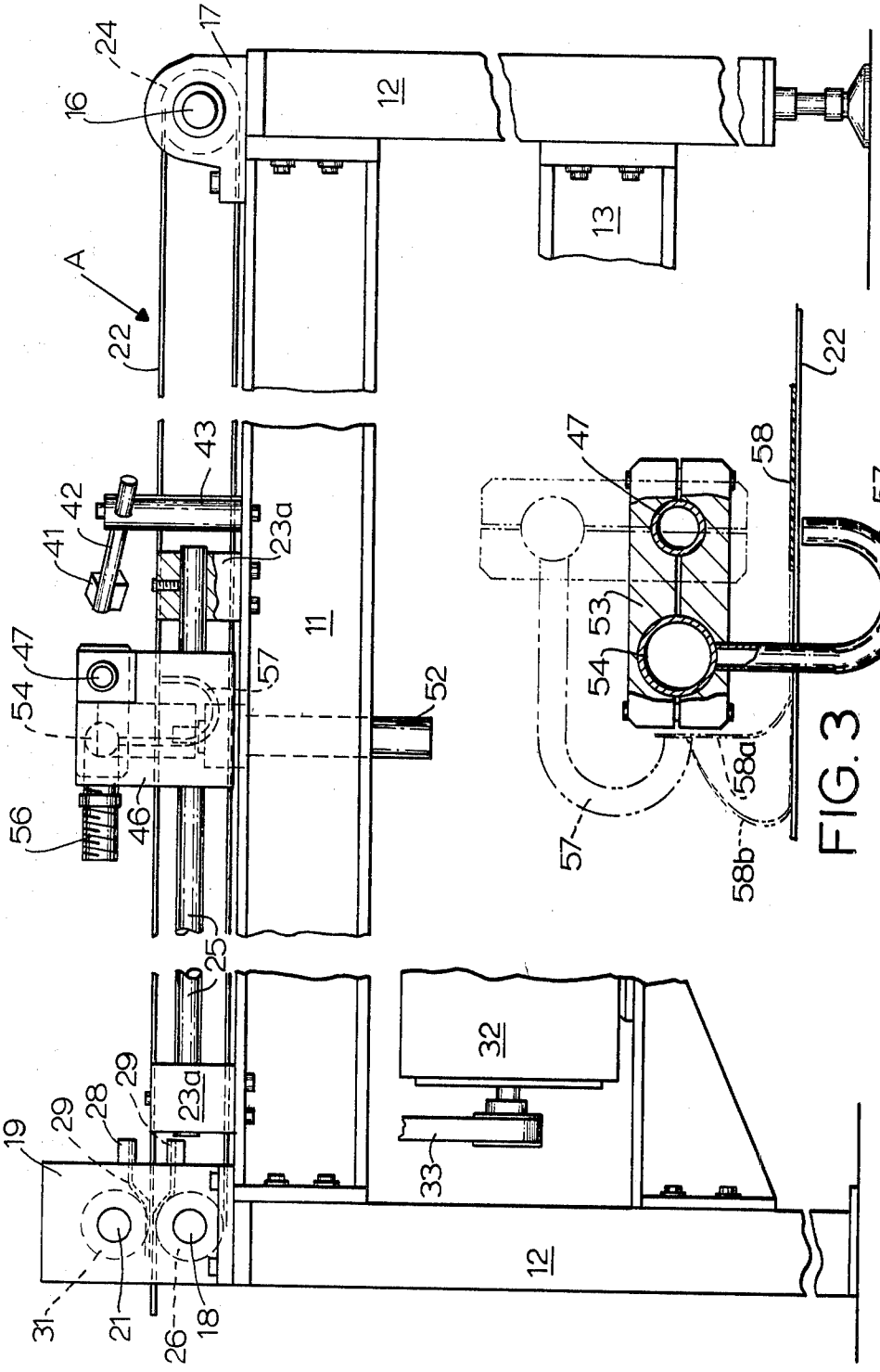


FIG. 2

FIG. 3

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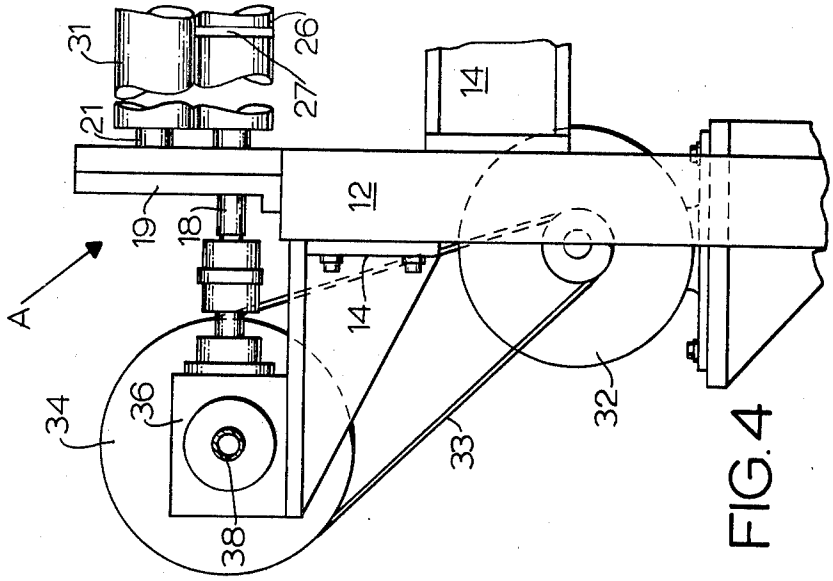


FIG. 4

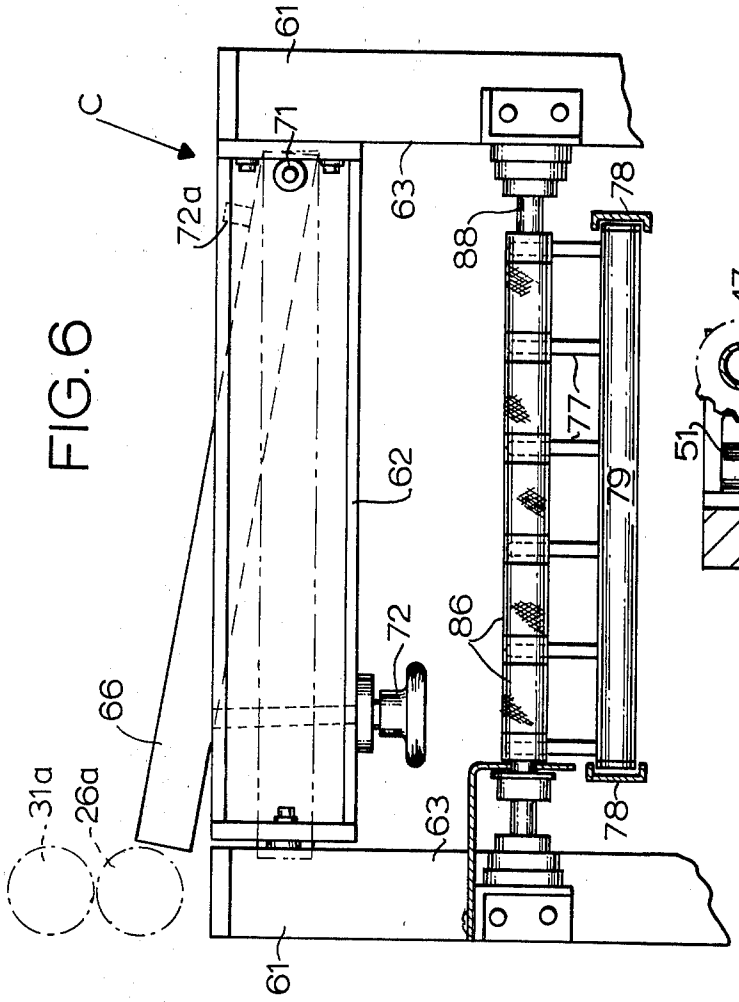


FIG. 6

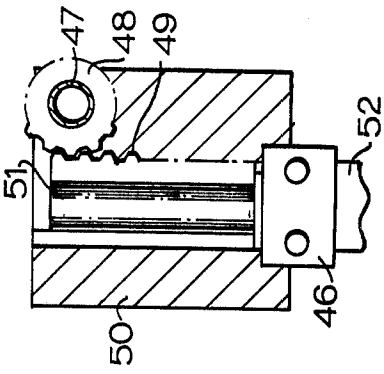


FIG. 5

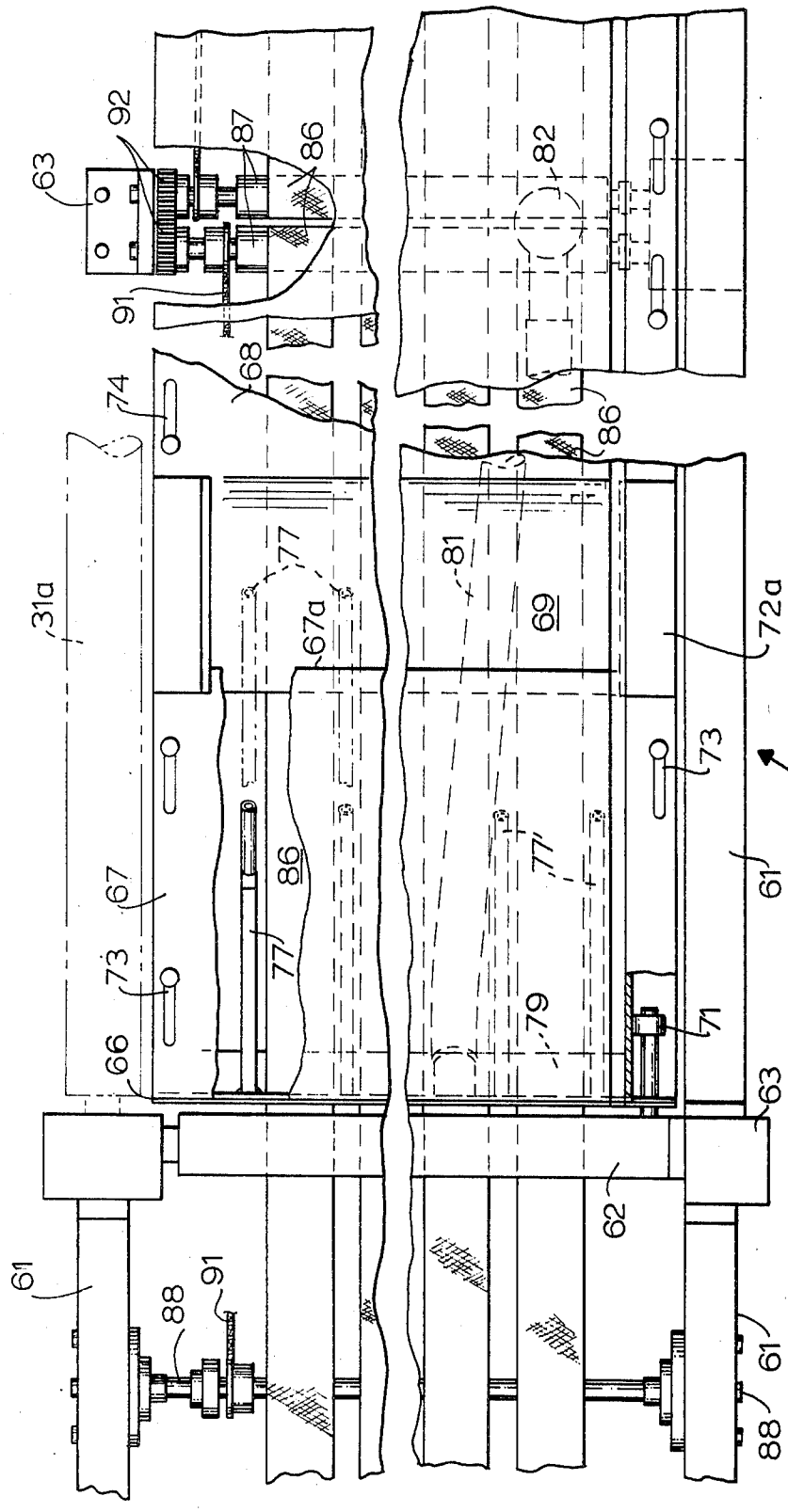

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FIG. 7

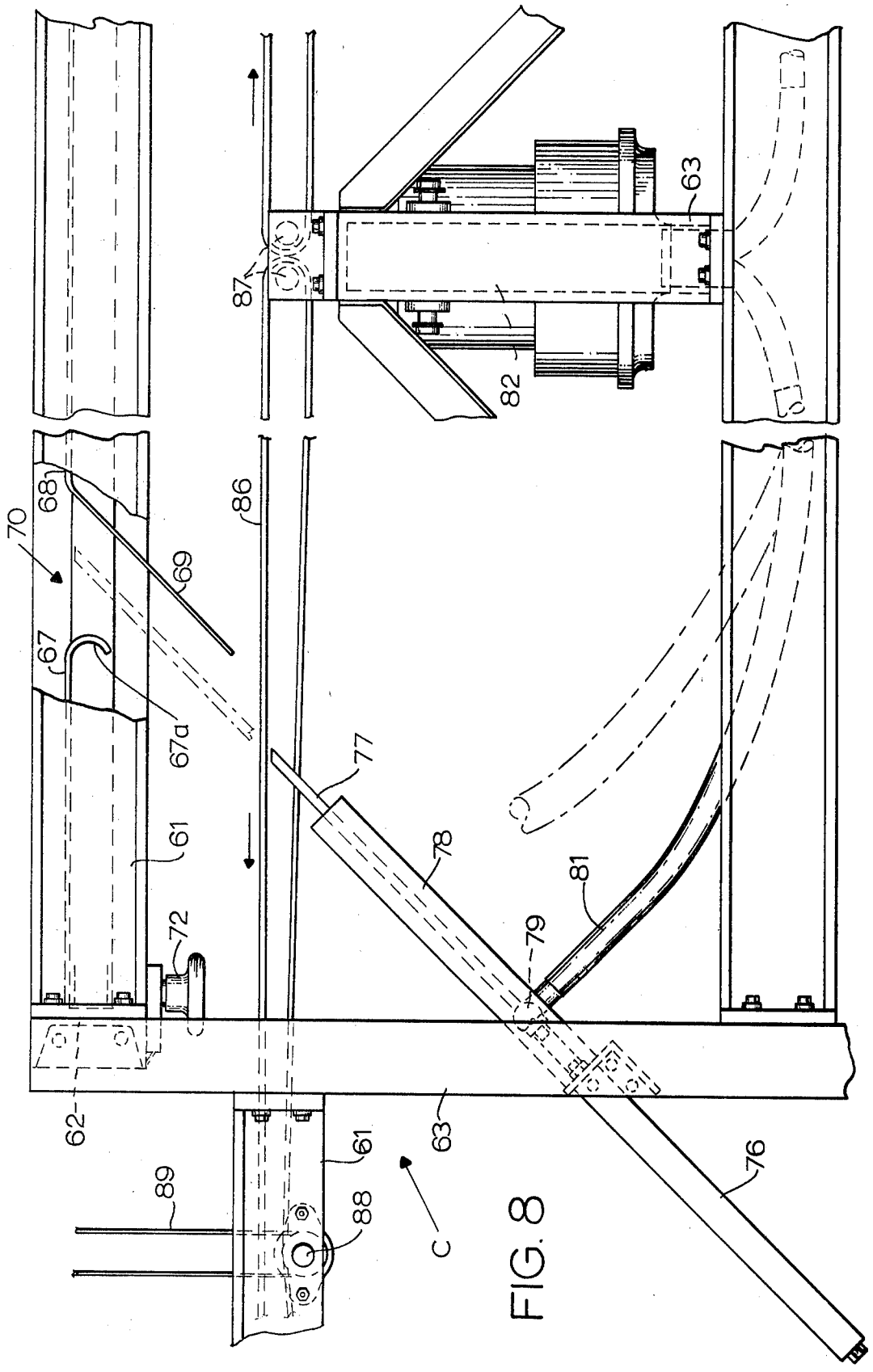


FIG. 8

MACHINE FOR FOLDING PLASTIC BAGS

This invention relates to a new and improved machine for folding plastic bags. Plastic bags of the type used to line drums, garbage cans, and the like are discharged from the bag-forming machine in an accordion-pleated shape of extended length. It is usually necessary to fold such bags one or more times longitudinally and, optionally, transversely to facilitate packaging and transportation. The present invention relates to a machine for mechanically performing whatever longitudinal and transverse folding operations are desired.

A principal object of the present invention is to reduce the considerable hand labor required in folding such bags by methods heretofore employed and also to provide uniformity in the folding operation which, in turn, facilitates packaging.

A feature of the invention is the fact that the machine may be timed to synchronize with the bag-making machine or may be speeded up so that it folds bags faster than the bag-making machine discharges the bags.

Another feature of the invention is the fact that the machine may be used in several stages. Thus the first stage may fold the length of the bag in half and if this fold is sufficient for the user's purpose, no further stages are required. On the other hand, by adding a second stage immediately beyond the first stage, the second fold may be made so that the bag is now folded to one-quarter its original length. Even a third stage may be added if desired. After the longitudinal folds have been performed, a transverse fold may be made if desired. All of the stages of the machine are preferably driven by a single motor in synchronism.

The machine may be made in a width sufficient to accommodate a very wide bag. On the other hand, where bags one-half the maximum width are being produced by the bag-forming machine, the machine may accept two bags side by side and perform all of the folding operations thereon simultaneously. Where a double longitudinal folding operation is being conducted, preferably the transverse folding stage delivers one row of bags to one side of the machine and the other row to the opposite side of the machine.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

FIG. 1 is a top plan view of the first stage of a machine in accordance with the present invention broken away to conserve space and also showing in dot-and-dash lines a portion of a second stage which may be used in juxtaposition to the first stage.

FIG. 2 is a side elevational view of the structure of FIG. 1.

FIG. 3 is an enlarged, fragmentary sectional view of the suction mechanism for lifting the forward edge of the bag.

FIG. 4 is an enlarged, fragmentary end view as viewed substantially along the line 4–4 of FIG. 1.

FIG. 5 is an enlarged, fragmentary sectional view of the mechanism for oscillating the shaft on which the suction devices are mounted.

FIG. 6 is an end view partially broken away in sections, to conserve space, of the final stage of the machine.

FIG. 7 is a top plan, partly broken away to conserve space, of the final stage.

FIG. 8 is a side elevational view of the structure of FIG. 7.

The machine hereinafter described in detail is comprised of three stages. Stage A shown in FIGS. 1—5 performs a longitudinal fold in one or more bags which are fed into the machine from the right as viewed in FIGS. 1 and 2 and proceed toward the left. Stage B is shown partially in FIG. 1 and resembles Stage A, except that it is of a length approximately one-half that of Stage A. Stage B is optional and performs a second longitudinal fold in the bags discharged from Stage A. It will be understood that additional stages similar to Stage B may be added, each of one-half the length of the preceding stage, depending upon the needs of the user. Stage C shown in FIGS. 6—8 performs a transverse fold on each of two series of bags discharged from Stages A and B. Stage A will now be described, it being understood that any similar description applies to optional Stage B.

Stage A is mounted on a frame which is composed of upper horizontal longitudinal members 11 on either side thereof supported at either end and, if necessary, intermediate the ends, by legs 12. Lower horizontal members 13 rigidify the structure and support some of the mechanism hereinafter described. At either end there may be one or more horizontal transverse members 14. Rear transverse horizontal shaft 16 is supported above members 11 by pillow blocks 17 and lower transverse rear shaft 18 is similarly supported by blocks 19 at the forward end of the machine. Above shaft 18 is upper transverse horizontal shaft 21 similarly mounted in block 19. Passing around shafts 16 and 18 and supported thereby is a plurality of continuous belts 22. Belts 22 have a rough top surface which pulls the plastic bags deposited thereon along with the belts. There are gaps 23 between adjacent belts for a purpose which hereinafter appears. The upper stretch of each belt 22 is horizontal and the upper surface moves to the left as indicated by the arrows in FIGS. 1 and 2.

At intervals there are attached to members 11 brackets 23*a* which are interconnected by longitudinal horizontal rods 25 which fit intermediate the upper and lower stretches of belts 22.

Rear shaft 16 carries roller 24 around which the belts travel at their rearward end and shaft 18 carries roller 26 which is formed at spaced intervals with grooves 27. Supported by means of brackets 28 on members 19 are stripper fingers 29, each of which fits into one of the grooves 27. Fingers 29 strip the bags from the roller 26 and also from the upper roller 31 which is driven by shaft 21. Shaft 28 is driven by motor 32 which drives belt 33 turning pulley 34 on a right angle drive 36 which is connected to shaft 18 by coupling 37.

Accordingly as a bag is deposited on the upper surface of the right-hand ends of belts 22 as viewed in FIG. 1, it is carried toward the left. Motor 32 is preferably a variable speed DC motor which is regulated by means of a potentiometer so that its speed is the same as, or faster than, the bag-forming machine. As is apparent from FIG. 1, there is a takeoff shaft 38 connected to drive 36 by coupling 39. This drives the B stage and also the C stage of the machine.

Approximately midway of the length of Stage A is an electric eye 41 which senses the approach of the forward edge of a bag being fed along belts 22. To adjust the timing of the machine, eye 41 is preferably adjustable in position. Thus it may be mounted on the outer end of a horizontal rod 42 which is slidably-adjustable received in a vertical post 42. Post 43 can turn about a vertical axis to adjust the position of eye 41 longitudinally of the machine and rod 42 may be extended or retracted relative to post 43 to adjust the position of eye 41 transversely of the machine.

Forward of eye 41 on either side of the machine is a fitting 46 adjustably slidable along rods 25. Fitting 46 is adjustable in position so that bags of different lengths can be accommodated. The fitting 46 should be spaced from rollers 26, 31 a distance approximately equal to one-half the length of the bags being handled. The shorter the bags, the closer the fittings 46 are moved towards rollers 26,31.

Mounted horizontally transversely of the machine in fitting 46 is shaft 47. As best shown in FIG. 5, shaft 47 carries a pinion 48 which meshes with a vertically reciprocal rack 49 which is mounted adjacent one of the fittings 46. Rack 49 is fixed to the upper end of piston rod 51 of pneumatic cylinder 52 and supported by bracket 50 attached to fitting 46. The reciprocation of rod 51 is controlled by eye 41 by electrical and mechanical means forming no part of the present invention and well understood in the art. Hence, as cylinder 52 is energized and deenergized, shaft 47 oscillates through a 90° arc of travel.

At intervals on shaft 47 are brackets 53 which connect shaft 47 to transverse horizontal manifold 54. A vacuum is drawn in manifold 54 through hoses 56. At intervals corresponding to the spacing between belts, 22 hook-shaped sucker tubes 57 extend don vertically between belts 22 and curve forwardly and then upwardly to a location immediately below the level of the belts 22. When the electric eye 41 causes energization of cylinders 52 the sucker tube 57 is moved from the solid-line position of FIG. 3 in a 90° arc of travel about shaft 47 to the dot-and-dash line position. The time lag is such that the forward end of bag 58 (shown partially in FIG. 3) is immediately above the open end of tube 57. Tube 57 sucks a portion of the leading edge of bag 58 below the level of belt 22. Shaft 47 then turns rapidly through 90° sequentially moving the bag to position 58*b* Continued movement of the belt 22 causes the bag to curve forwardly as shown by reference numeral 58*b* of FIG. 3. As the machine continues to operate, the belts continue to move the bags forwardly but the rear edge 58*a* is held stationary by the tube 57 causing the bag to double back on itself in a bend which continuously moves to the left of Stage A.

When the bend 58*b* in the bag reaches the lefthand end of Stage A as viewed in FIGS. 1 and 2, the bend is caught between pinch rollers 26 and 31 which form a crease at the bend and drive the bags forward. Continuous driving movement of the bags pulls the end 58*a* away from the sucker tubes 57 and thus releases the bags held by the sucker tubes. The stripper fingers 29 prevent the bags from wrapping around either of the rollers 26, 31.

As has previously been mentioned, the machine may be made of the extended width; and where narrower bags are being handled, there may be room to accommodate two bags—one on each side of the machine. The two bags are similarly folded and discharged from Stage A.

Stage B, which is optional, is similar in construction to Stage A but is approximately one-half the length thereof. Rollers corresponding to rollers 26 and 31 are driven through shaft 38 in synchronism to rollers 26 and 31.

The third stage is shown in FIGS. 6—8 inclusive. The movement of the bags in Stage C is transverse to the direction of movement of the bags in Stages A and B. A continuation of takeoff shaft 38 drives the machine, as hereinafter appears.

The third stage C receives bags which have been folded in the preceding longitudinal folding stages. The rollers of the preceding stage (which may be Stage A or Stage B) are indicated by reference numerals 26*a*, 31*a* and the direction of discharge of the longitudinally folded bags therefrom is shown by arrows in FIGS. 6 and 7. Stage C is at a slightly lower elevation than the preceding stage as is best shown in FIG. 6, so that the bags are deposited by gravity into the third stage. In the third stage the frame extends transversely to the frame of the preceding stages and also extends laterally thereof as best shown in FIG. 7. Such frame is comprised of horizontal transverse members 61 and horizontal transverse members 62 which are supported by vertical legs 63.

Mounted on the frame is tiltable mounting frame 66 which is rectangular in shape and has a width equal to the width of the preceding stages and a length equal to the length of the longest bag discharged from the preceding stages. Such table mounting frame 66 is dimensioned to accommodate two bags discharged from the preceding station, in those instances where the preceding stage is capable of handling two bags moving parallel. It will be understood, of course, that a single bag may be accommodated by eliminating approximately one-half of the apparatus hereinafter described.

Table mounting frame 66 provides on either side of the machine outer table 67 which has a horizontal sheet metal surface extending from the edge of the machine toward the center to a distance less than the center line of the bag being forwarded and then curls downwardly in an inner edge 67*a*. Frame 66 also carries an inner table 68 which, at its outer edge, has a downwardly slanted apron 69. As is best shown in FIG. 8, there is a gap of considerable extent between the edge 67*a* and the apron 68 and under the gap is the slanted apron 69. Optionally, the frame 66 may pivot relative to the main frame of the third stage. Thus on the far side of table mounting frame 66, on either side of the machine are pivots 71. On the opposite side of the frame is an adjustment screw 72 which is threaded into one of the members 62 and bears against the underside of frame 66. As is shown in FIG. 6, by adjustment of screw 72 frame 66 may slant from slightly below the elevation of rollers 26*a*, 31*a* downward so as to permit the bags discharged from said rollers to slide by gravity over the surface of tables 67,68. A stop 72*a* stops movement of the bags.

Since bags of different widths are to be accommodated by the machine, the tables 67 and 68 may slide relative to table mounting frame 66 as is shown by the slot and pin connection 73, 74 respectively. The center line of the bags, shown by the reference symbol CL in FIG. 7, is approximately halfway between edge 67*a* and the corner where apron 69 slants downward.

On either side of the machine mounted below the level of tables 67, 68 is a pneumatic cylinder 76 which slants inwardly upwardly in line with gap 70. Extending upwardly and controlled by cylinder 76 is a plurality of sucker rods 77. In their extended position, rods 77 (as shown in dot-and-dash lines in FIG. 8), are slightly below the level of tables 67, 68 and thus grip the bags resting on said tables by vacuum. As the rods contract to the full line position of FIG. 8, the centers of the bags are pulled downwardly and outwardly through the gap 70 causing a fold to be formed therein which makes the transverse fold which is accomplished by Stage C.

The rods 77 project from a horizontal transverse manifold 79 which is guided for its upward inward slanted reciprocation by side guides 79 in which the edges of the manifold roll. The manifold 79 is connected by means of hose 81 to a vacuum tank 82. Thus a vacuum is continuously drawn in all of the tubes 77. The stop 72*a* may be associated with a microswitch (not shown) which controls a valve which in turn governs the energization of cylinder 76. Thus when a bag is deposited on the tables the tubes 77 have been projected and grip the bag and pull it downwardly as has been described.

Extending transversely below the level of tables 67, 68 are a plurality of spaced belts 86 which have extended horizontal stretches and these stretches of the belts move outwardly as shown by the arrows in FIG. 8. The rods 77 are spaced between the belts 86. Thus when a bag is pulled down by the rods 77, it contacts the moving belt 86 which breaks the vacuum contact of the rods 77 and then conveys the bags away to a station where a workman may assemble and package same. The belts 86 pass around pulleys 87 on their inner ends and idler pulleys (not shown) on their outer ends. Intermediate the pulleys 87 and the idler pulleys on at least one side of the machine is a shaft 88 which is driven from the drive for the preceding stages through belt 89. Shaft 88 is connected to one of the shafts 87 by means of chain 91. The two shafts of belt pulleys 87 carry meshing gears 92 so that the belts 86 move in opposite directions at uniform speeds.

What I claim is:

1. A bag folding machine comprising a frame, a plurality of continuous belts, mounting means for mounting said belts for movement along said frame, drive means for driving said belts longitudinally of said frame, bag-engaging means for engaging the leading edge of a bag supported on and being moved by said belts, actuating means for moving said bag-engaging means from a first position adjacent said belts to engage said bag to a second position lifting said leading edge above said belts while the portion of said bag remote from said bag-engaging means advances with said belts to form a fold in said bag, and sensing means sensing the proximity of said leading edge to energize said actuating means.

2. A bag folding machine according to claim 1 which further comprises a pair of rollers rotatable in said frame transverse to and at the level of the upper stretch of said belts positioned to grip said fold as said bag advances on said belts to crease said bag at said fold and feed said bag off said belts and out of engagement with said bag-engaging means.

3. A machine according to claim 2 which further comprises second bagsengaging means on the side of said rollers opposite said first-mentioned bag-engaging means, said second bag-engaging means arranged to engage the leading edge of a bag folded by said rollers and supported on and being moved by said belts, second actuating means for moving said second bag-engaging means from a first position adjacent said belts to engage said folded bag to a second position lifting said leading edge of said folded bag above said belts, sensing means sensing the proximity of said leading edge of said folded bag to energize said second actuating means, and a second pair of rollers positioned to grip a folded portion of said folded bag and feed said folded bag off said belts and out of engagement with said second bag-engaging means.

4. A machine according to claim 2 which further comprises a second frame transverse to and at the discharge end of said first-mentioned frame having a table mounted thereon, said table positioned to support folded bags discharged from said rollers, said table formed with a longitudinal gap, second bag-engaging means mounted for movement between a first position immediately below said gap to engage a folded bag on said table and a second position below said table, a plurality of continuous second belts mounted in said second frame for movement transverse to said first-mentioned belts and located at an elevation above said second position, second actuating means for moving said second belt engaging means between said second belts between first and second positions and second sensing means sensing the position of a folded bag on said table to energize said second actuating means to move said second bag-engaging means to grip a folded bag on said table, pull said folded bag through said gap, thereby forming a transverse fold in said folded bag and deposit said transversely folded bag on said second belts for movement away from said table.

5. A machine according to claim 2 which further comprises stripper means associated with at least one of said rollers to guide said bag through said rollers without wrapping around either of said rollers.

6. A machine according to claim 1 in which said bag-engaging means comprises a plurality of sucker tubes each connected to a source of vacuum, each said tube having its exposed end terminating at said belts when said actuating means is in first position.

7. A machine according to claim 6 in which said tubes are mounted for movement about an axis transverse to and above the level of said belts, said belts being spaced from each other in gaps, said tubes in said gaps, said tubes in first position slightly below, and in second position above, said belts and moving from first to second position in an arc having said axis as its center in the same direction as the direction of movement of the upper stretches of said belts.

8. A machine according to claim 1 in which said actuating means comprises a shaft transverse to said belts, said bag-engaging means mounted eccentric to said shaft, and means for oscillating said shaft.

9. A machine according to claim 1 in which said actuating means, said bag-engaging means and said sensing means are movable along said frame to adjust for bags of different lengths.

10. A machine according to claim 1 in which said sensing means comprises an electric eye sensitive to presence of said bag on said belt approaching said eye.