United States Patent [19]

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[54] METHOD AND APPARATUS FOR FOLDING LENGTHS OF MATERIAL

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[52] **U.S. Cl.** **270/83**, 53/118, 53/120, 93/1, 93/8, 270/61, 270/69

[51] **Int. Cl.** **B65h 45/18**

[58] **Field of Search**.....270/61, 69, 83–85, 270/67, 76; 93/1, 8; 53/116, 117, 120, 118

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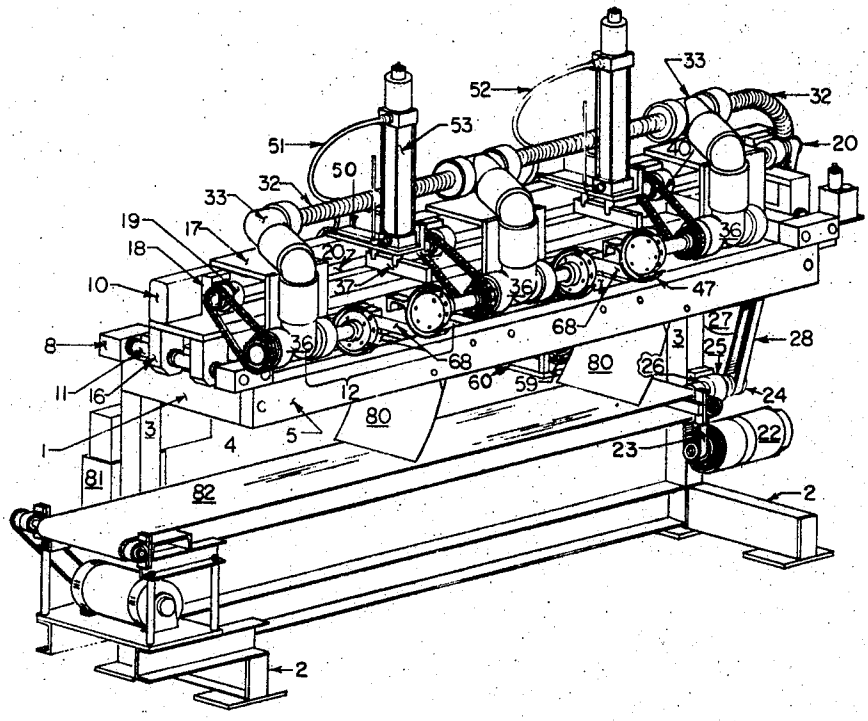
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Assistant Examiner—L. R. Oremland
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[57] **ABSTRACT**

Lengths of material, such as plastic bags, fed from a bag forming machine are individually folded one or more times prepatory to packaging. Each length of material is wrapped around spaced and axially opposed vacuum pickup rollers to form a hollow cylindrical roll on said rollers. The roll is then bent in half by means of a blunt edge blade disposed with its longitudinal axis transversely related to the longitudinal axis of said hollow roll and the hollow roll is pushed in between two creasing rollers which bring both halves of the cylindrical roll together and squeeze each half into a flat creased folded portion.

18 Claims, 7 Drawing Figures



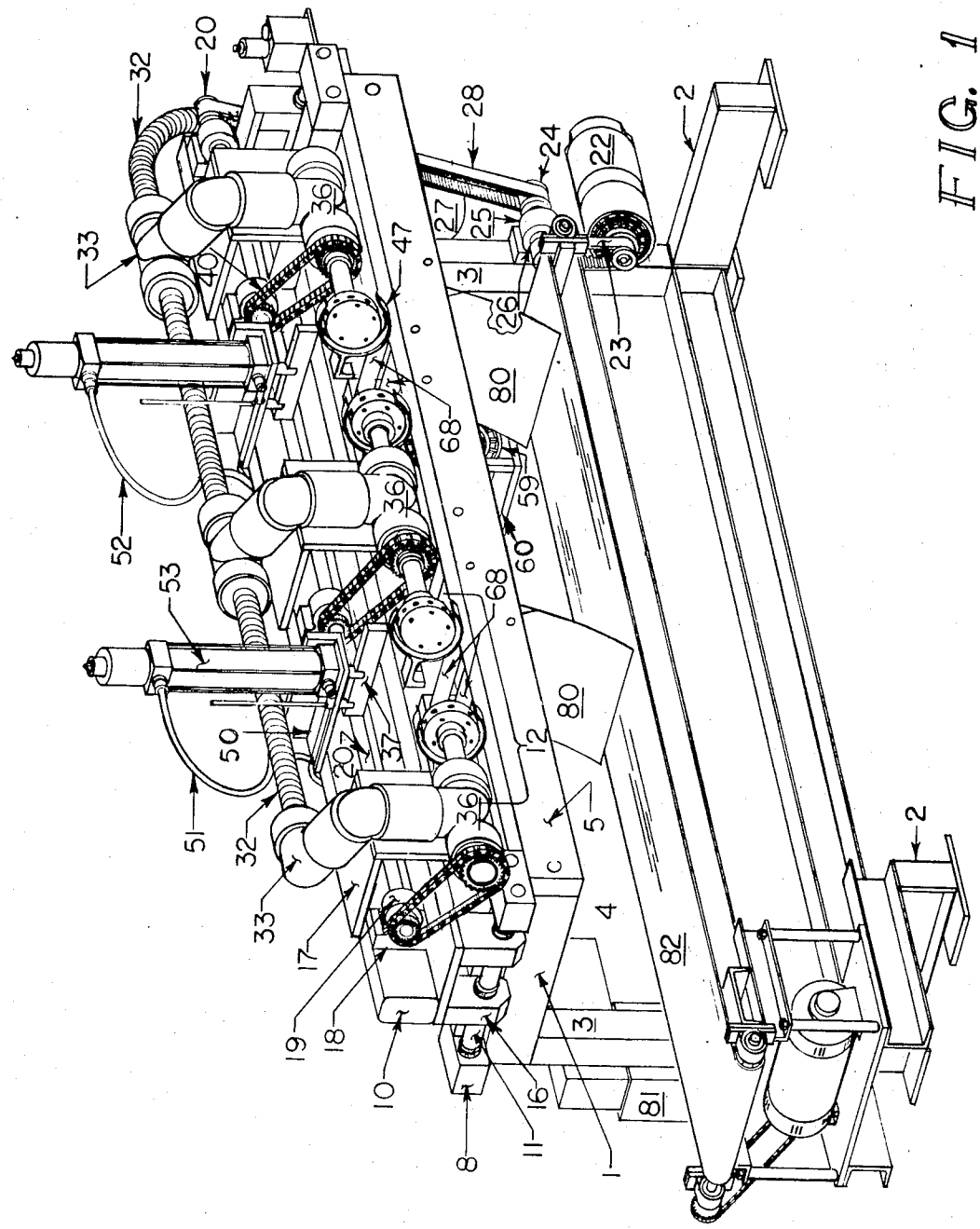


FIG. 1

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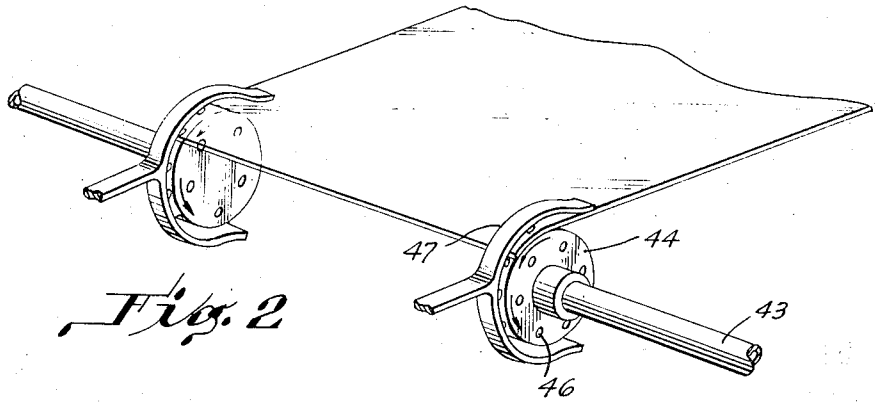


Fig. 2

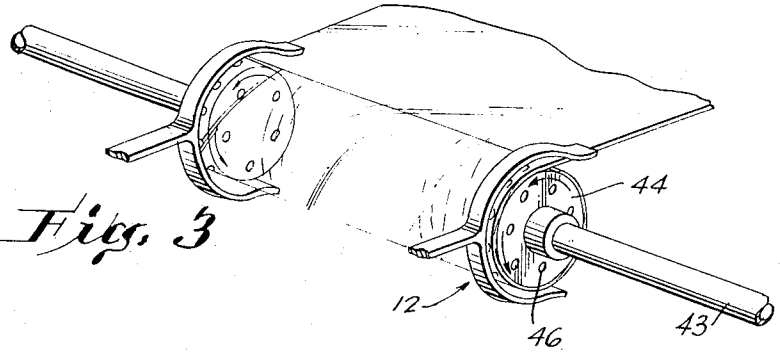


Fig. 3

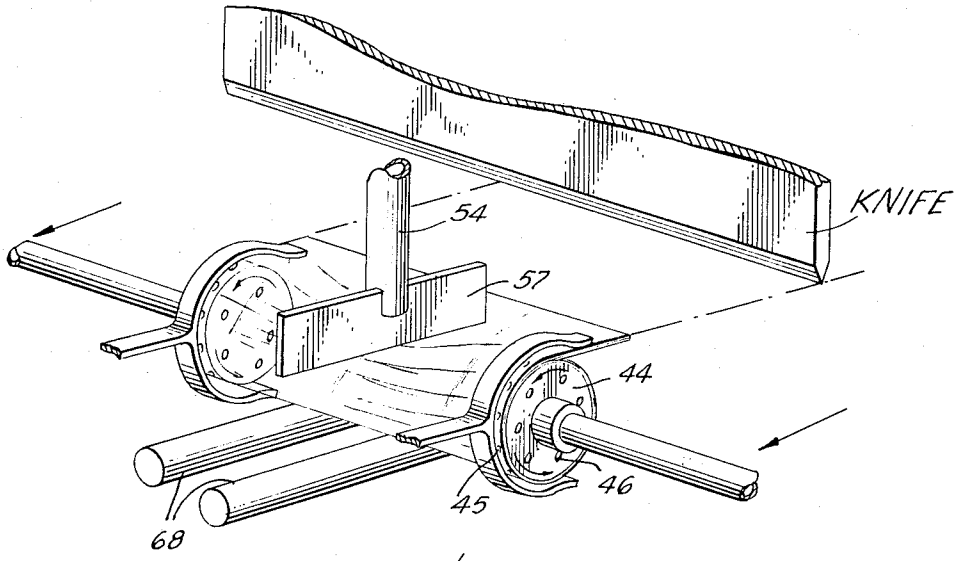


Fig. 4

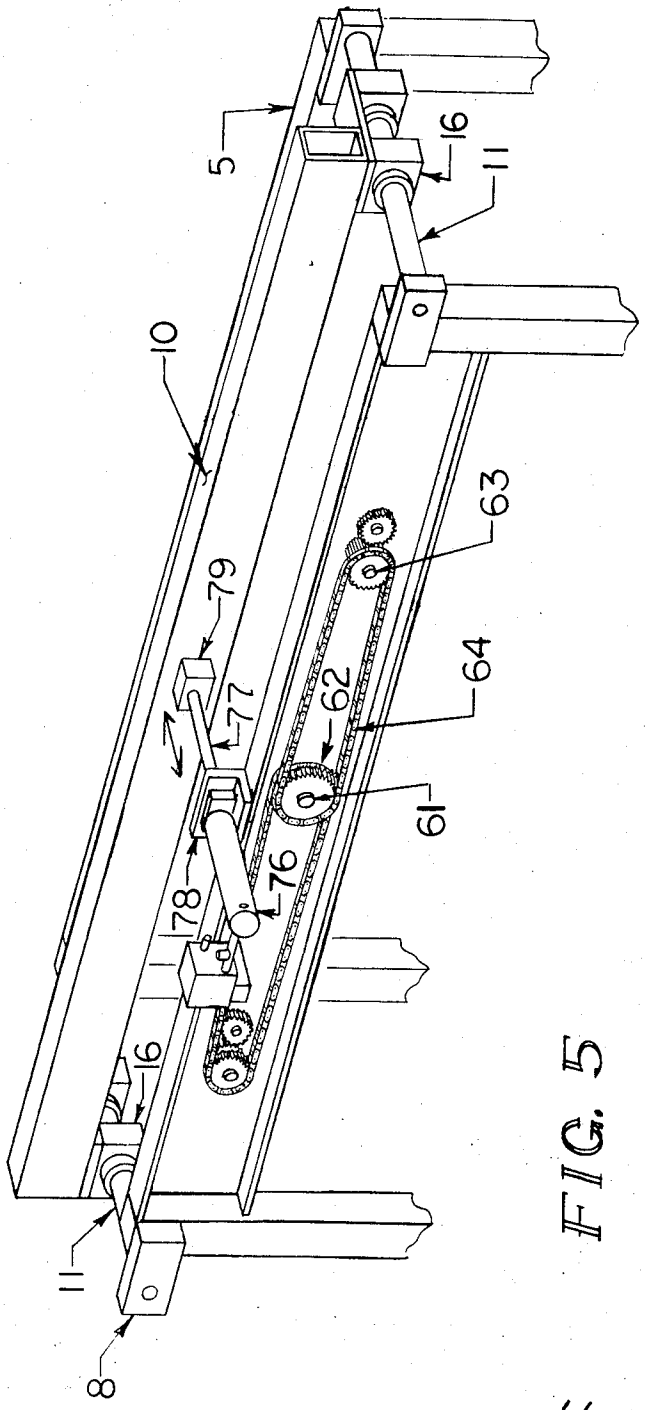


FIG. 5

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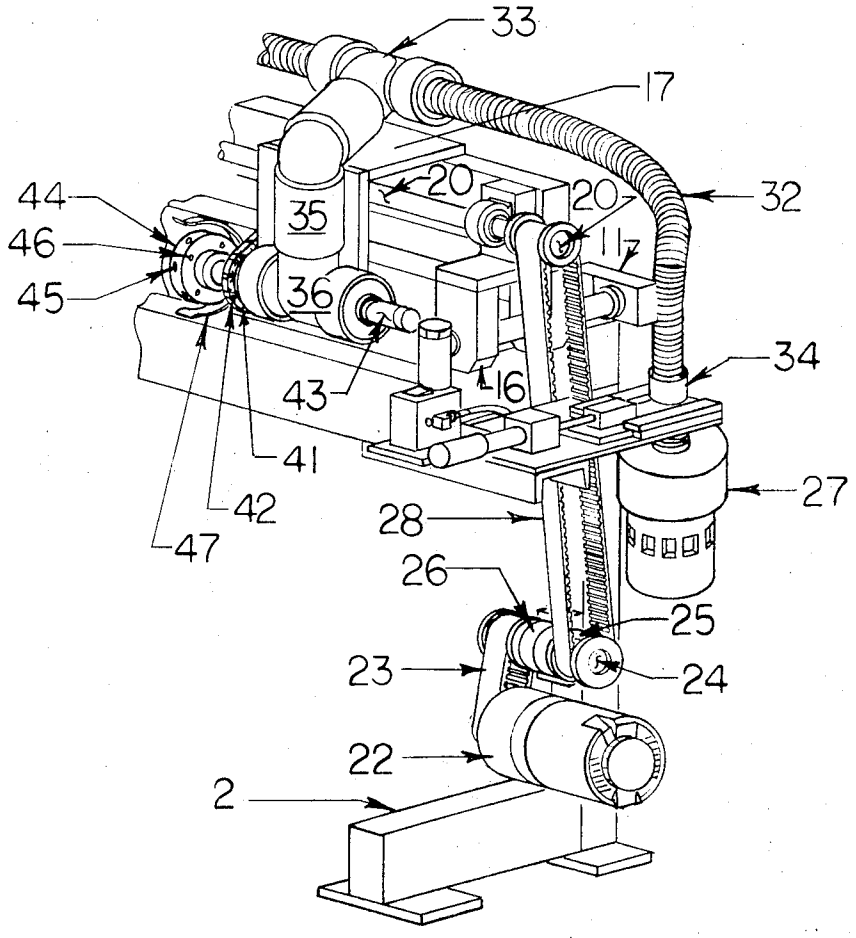
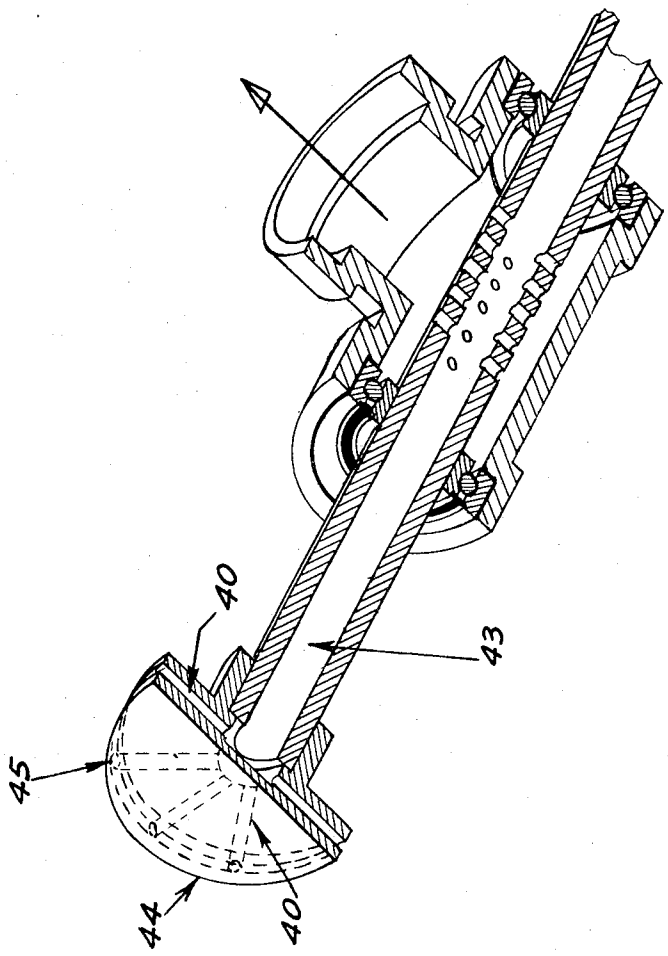


FIG. 6

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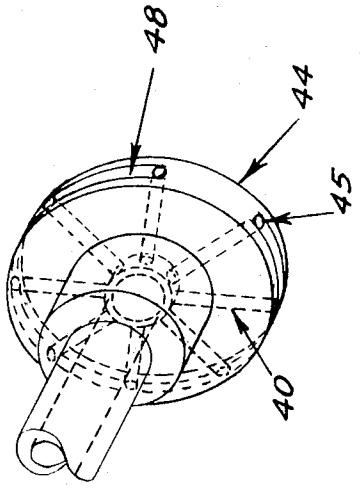


FIG. 7

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METHOD AND APPARATUS FOR FOLDING LENGTHS OF MATERIAL

FIELD OF THE INVENTION

This invention relates to a new and improved machine for individual folding plastic bags or other lengths of material from a material severing device. Plastic bags, which are used to line containers, such as garbage cans, are discharged from a bag forming machine as a tube of extended length. These bags have been batch-folded by hand. This invention relates to a new and improved machine to permit mass individual folding of bags, sheets of plastic and the like for packaging.

DESCRIPTION OF THE PRIOR ART

Previously, large plastic polyethylene bags have been batch-folded manually. Proposals to individually fold such bags mechanically have not been commercially successful.

SUMMARY OF THE INVENTION

According to this invention, a simplified and space conserving apparatus is provided consisting of two spaced and axially opposed vacuum pickup rollers located at the discharge end of a bag forming machine. The flattened tube of a material fed from the web through the bag forming machine feeds onto the vacuum pickup rollers so that the lateral edges of the bag are engaged in gripping relation with the peripheral surfaces of the pickup rollers. The bag is then rapidly rolled or wrapped around the pickup rollers to form a large hollow cylindrical roll. This roll is bent in half by the engagement of a blunt edge blade at its midpoint which pushes the roll downwardly and bends same so that its leading edge comes into engagement with a pair of driven squeezing or creasing rollers which bring the two halves of the roll together. This flattens each half of the roll and forms creases or fold lines. The folded bag is then discharged from the creasing rollers onto a conveyor leading to a packaging station.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in perspective of the rear or feed portion of the machine.

FIGS. 2 through 4 present sequential views in perspective of the web of plastic being fed over the vacuum pickup rollers and pushed into the squeeze or creasing rollers.

FIG. 5 is a fragmentary front view in perspective, illustrating a portion of the driving mechanism for the crushing rollers and illustrating the reciprocating mechanism for the frame of the bag folding device.

FIG. 6 is a view in perspective of a fragment of the feed portion of the machine illustrating the vacuum means for the vacuum pickup rollers and the driving means for the rollers.

FIG. 7 is a sectional view, taken along lines 7—7 of FIG. 6, illustrating the communicating passage between the vacuum outlets of the vacuum pickup rollers and the suction manifold.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, the machine consists of a frame **1**, made up of series of steel channels, comprising a foot portion **2**, an upright portion **3**, a side channel member **4** and front and rear crosspieces **5**. Mounted on the front and rear crosspieces **5** is a bearing support **8** for linear bearing **11**. A movable crosspiece **10** is mounted on the linear bearing **11** by means of mounting bracket **17** and depending pillow blocks **16** supports the pickup roller assembly **12**, so that the entire assembly may reciprocate toward and away from the bag forming apparatus or other material severing device in timed sequence. Mounted on the movable crosspiece **10** is a mounting bracket **18** for journal **19** of shaft **20** which acts to drive the rotatable vacuum pickup rollers of the pickup assembly **12** as will be later described.

Referring now to FIG. **6**, the driving means for the shaft **20** is through variable speed DC motor **22** by way of belt **23** trained over the pulley of the electric brake and clutch assembly **25** and **26**. Shaft **24** controlled by the electric clutch **26** and the electric brake **25** drives belt **28** which in turn is trained over the pulley of the driven shaft **20**. Vacuum pump **27** leads to vacuum hose **32** and contains vacuum cutoff valve **34** which runs to the T fitting **33** for the vacuum hose. Fitting **35** connects the T fitting **33** to the vacuum manifold **36**. Vacuum manifold **36** is in communication with the hollow shaft **43** of pickup roller **44**, which, in turn, is in communication with vacuum passages **40** in the pickup roller **44** which open into the peripheral vacuum outlets **45**. The hollow shaft **43** is connected to the pickup rollers **44** to rotate same and is driven by driven sprocket **41** which in turn is powered by chain **42** off of the drive sprocket **40** of the driven shaft **20**.

A vacuum roller guard **47** acts as a guard and a guide for the web of polyurethane or other material fed onto the vacuum rollers. As the plastic web engages the pickup rollers **44**, vacuum through vacuum outlets **45** is applied to the lateral edges of the web so that the web is wrapped onto the spaced and axially opposed rollers **44** to form a large hollow cylindrical roll. A vacuum transfer groove **48** may be provided between alternate pairs of vacuum outlets **45** of the roller **44**.

At the first stage of this operation, illustrated in FIG. **2**, the entire assembly **12** is pushed into close proximity to the bag forming machine. As the web wraps around the rollers **44**, the entire assembly moves longitudinally away from the bag forming machine, placing some tension on the web and on the roll being formed on the rollers. Thus, as the knife severs the roll from the webb on the machine, as illustrated in FIG. **4**, the rollers manage to roll — due to slippage of electric clutch **25** — and piston rod **54** extends thereby engaging the blunt edge blade **57** with the middle of the roll of plastic, tending to bend it downwardly into engagement with the creasing rollers **68**. As is illustrated, the longitudinal axis of the blunt edge blade **57** lies transversely to the longitudinal axis of the roll formed on the pick up rollers **44** but parallel to the longitudinal axes of the driven creasing rollers **68** below the pickup rollers **44** and the roll formed thereon. Thus, as the rolled up web is bent in the middle, the leading edge of the bent roll is engaged with the creasing rollers **68** the two halves of the cylin-

drical roll are squeezed together and each half of the roll is squeezed together in creasing engagement so that the entire folded roll is discharged from the driven rollers **68** in folded condition.

As will be appreciated, holes **46** running through the body of the roller **44** allows air to escape from the center of the hollow cylindrical roll as the blade **57** bends the roll in half.

Simultaneously therewith, vacuum from the vacuum pump **27** is cut off by means of vacuum cutoff valve **34**, allowing the rolled bag to be released from the vacuum pickup roller **44**.

As is best shown in FIG. **1**, the air cylinder **53** is supported on the movable crosspiece **10** by means of bracket **50**. The cylinder **53** contains lines **51** and **52** which cause the piston rod **54** to extend and retract respectively.

Referring now to FIG. **1** and **5**, the driving mechanism and reciprocating mechanism for the driven rollers and for the bag folding apparatus **10** are shown. Motor **59**, supported on bracket **60** is shown beneath front crosspiece **5**. Referring to FIG. **5**, the driven shaft **61** from the motor **59** drives drive sprocket **62** and driven sprockets **63** are thereby driven by belts **64** to drive the creasing rollers **68** in clockwise and counterclockwise direction respectively. Further, as will be noted, air cylinder **76** is supported by mounting member bracket **78** on crosspiece **5** so that the piston rod **77** is connected to the movable crosspiece member **10** by means of mounting member **79**. Thus extension of the piston rod **77** pushes the entire folding assembly **12** toward the bag forming machine while retraction of the air cylinder **76** pulls the entire apparatus away from the bag forming machine so that the bags can be folded and driven through driven rollers **68** to be deposited down slide **80** onto moving conveyor belt **82**. Control Box **81** is shown in FIG. **1** on upright III.

While many modifications will be apparent to those skilled in the art, the aforesaid description and drawings are meant to be exemplary in nature and non-limiting in scope except as to be commensurate in scope with the appended claims.

I claim:

1. A material folding apparatus, for folding lengths of material fed from a web severing apparatus, which comprises:

A. a frame,

B. a feed portion for feeding said web onto said apparatus;

C. a pair of spaced and axially opposed pickup rollers rotatably journaled in said frame and engagable with the lateral edges of said web, each of said rollers including:

1. vacuum outlets opening around the circumference of said rollers for engaging the lateral edges of said web in gripping relationship,

2. passages in said rollers in communication with said vacuum outlets;

D. a vacuum pump in communication with said passages;

E. means for rotating said rollers to wrap the lateral edges of said web around said roller to form a hollow cylindrical roll between said rollers;

F. a plunger disposed above said hollow cylindrical roll midway between said opposed rollers which includes:

1. a blunt edged blade, disposed above said rollers with its long axis oriented transversely across said cylindrical roll near its midpoint,

2. said plunger, when extended pushing said blade across the middle of said roll to bend it in the middle and push it downwardly;

G. a pair of driven creasing rollers below said roll and disposed so that their long axes are parallel to the long axis of said blade and which are designed to grab the leading edge of said bent cylindrical roll at the point of the bend in creasing engagement and to flatten both halves of said cylindrical roll together and drive same through said rollers to complete the fold.

2. A material folding apparatus, as defined in claim **1**, the further combination therewith of:

A. tensioning means for maintaining tension on said web as it wraps multiple layers around said rollers.

3. A material folding apparatus, as defined in claim **2**, in which the web is a tube of plastic material and the tensioning means is a bag forming apparatus, which includes a severing member to sever the web and release the tension on said web.

4. A material folding apparatus, as defined in claim **1**, in which:

A. said frame reciprocates toward and away from said web severing apparatus,

B. the further combination therewith of means for reciprocating said frame in forward and backward strokes.

5. A material folding apparatus, as defined in claim **4**, the further combination therewith of control means operative to correlate the severing of said web as the forward reciprocating stroke of said frame nears its end.

6. A material folding apparatus, as defined in claim **1**, the further combination therewith of a brake to brake the rotation of said pickup rollers.

7. A material folding apparatus, as defined in claim **6**, the further combination therewith of a control means to actuate said brake an instant after the web is severed.

8. A material folding apparatus, as defined in claim **1**, the further combination therewith of a vacuum cutoff valve and a control means to close said valve to cut off vacuum to said vacuum outlets of said rollers as said plunger is extended and said blade bends the middle of said roll.

9. A material folding apparatus, as defined in claim **1**, the further combination of fluid evacuation passages in said pickup rollers to allow air to escape as said blade strokes said roll.

10. A method of folding lengths of material which includes:

A. feeding a web of material onto a pair of spaced and axially opposed pickup rollers;

B. engaging the lateral edges of said web of material on said rollers and wrapping said web around said rollers to form a hollow cylindrical roll;

C. bending said roll in half in a direction perpendicular to the axis of said rollers:

D. disengaging the ends of said roll from said pickup rollers:

E. pressing both halves of said cylindrical roll together so as to flatten the bent roll and flattening each half of said roll in creasing relation.

11. A method of folding lengths of material, as defined in claim 10,

A. the further step of severing the material in proximity to said roll to separate it from said web.

12. A method of folding lengths of material, as defined in claim 11, the further step of:

A. braking the pickup rollers to a stop an instant after said web is severed.

13. A method of folding lengths of material, as defined in claim 10,

A. the step of maintaining tension on said web as successive layers of said material are wrapped on said rollers; and

B. the further step of severing the material in proximity to said roll to separate it from said web, and to release tension on said roll.

14. A method of folding lengths of material, as defined in claim 10, in which the step of wrapping said web around said pickup rollers includes:

A. rotatively driving said pickup rollers.

15. A method of folding lengths of material, as defined in claim 10, which comprises the steps of:

A. applying vacuum to the peripheral surface of said pickup rollers so as to engage the lateral edges of said web in gripping relation;

B. releasing the vacuum simultaneously with bending of said roll so as to release the roll from said pickup rollers.

16. A method of folding lengths of material, as defined in claim 10, in which the steps of bending said roll include:

A. striking the roll transversely at about its midpoint with a blunt edged blade and pushing it downwardly;

B. engaging the leading edge of said roll at the point of the bend with creasing rollers; and

C. driving the material through said rollers so as to press the halves of the roll together and to flatten each half of the roll in creasing relation.

17. A method of folding lengths of material, as defined in claim 16,

A. the improvement of evacuating air from the middle of said roll as the blunt edge blade strikes the midpoint of said roll.

18. A method of folding lengths of material, as defined in claim 10,

A. the further step of evacuating air from the middle of said roll as the roll is bent and as the halves of said roll are flattened.

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