# United States Patent [19]

**Brooks**

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[45] **Feb. 12, 1974**


[54] **METHOD AND APPARATUS FOR MAKING PACKAGES OF INTERCONNECTED PLASTIC BAGS AND THE LIKE**


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[21] Appl. No.: **309,740**

[52] **U.S. Cl.** ..... **93/35 R**, 93/8 R, 93/33 H, 93/93 M, 93/93 HT, 93/DIG. 1, 270/60

[51] **Int. Cl.** ..... **B31b 1/98**, B31b 23/74

[58] **Field of Search** ..... 93/35 R, 8 R, 33 H, DIG. 1, 93/93 R, 93 M, 93 HT, 93 DP; 270/60; 83/924



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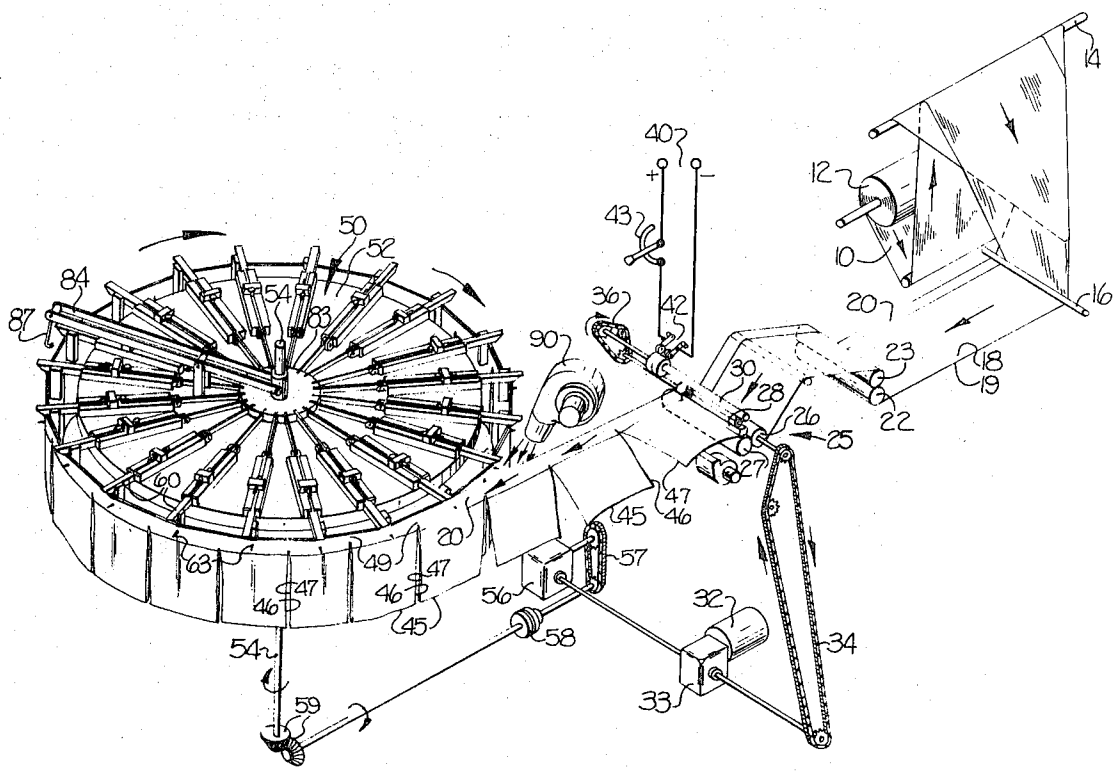
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[57] **ABSTRACT**

A method and apparatus for making a plurality of packages of interconnected flexible plastic bags or the like and wherein an advancing web of thermoplastic sheet material is longitudinally folded to define upper and lower overlying sheets. The sheets are then fusibly joined and simultaneously severed along longitudinally spaced transverse lines while leaving a non-severed connecting portion to thereby form a series of connected bags each having a folded bottom edge, fusibly joined side edges, and an open top. The series of connected bags is formed into a plurality of individual stacks of aligned overlying bags by circularly conveying the series about a central axis to form a plurality of overlying convolutions and with the bags of each convolution generally aligned with the bags of the adjacent convolutions. The bags of each stack may then be interconnected, and the connecting portion severed such that each stack forms a separate package of interconnected bags.


**18 Claims, 8 Drawing Figures**



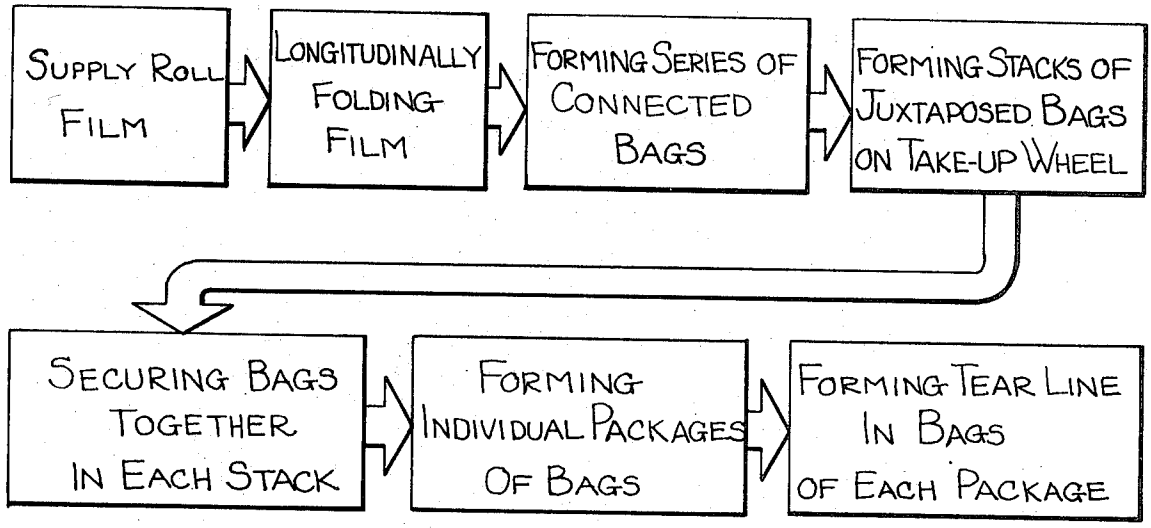

SUPPLY ROLL FILM
LONGITUDINALLY FOLDING FILM
FORMING SERIES OF CONNECTED BAGS
FORMING STACKS OF JUXTAPOSED BAGS ON TAKE-UP WHEEL
SECURING BAGS TOGETHER IN EACH STACK
FORMING INDIVIDUAL PACKAGES OF BAGS
FORMING TEAR LINE IN BAGS OF EACH PACKAGE

Fig-1

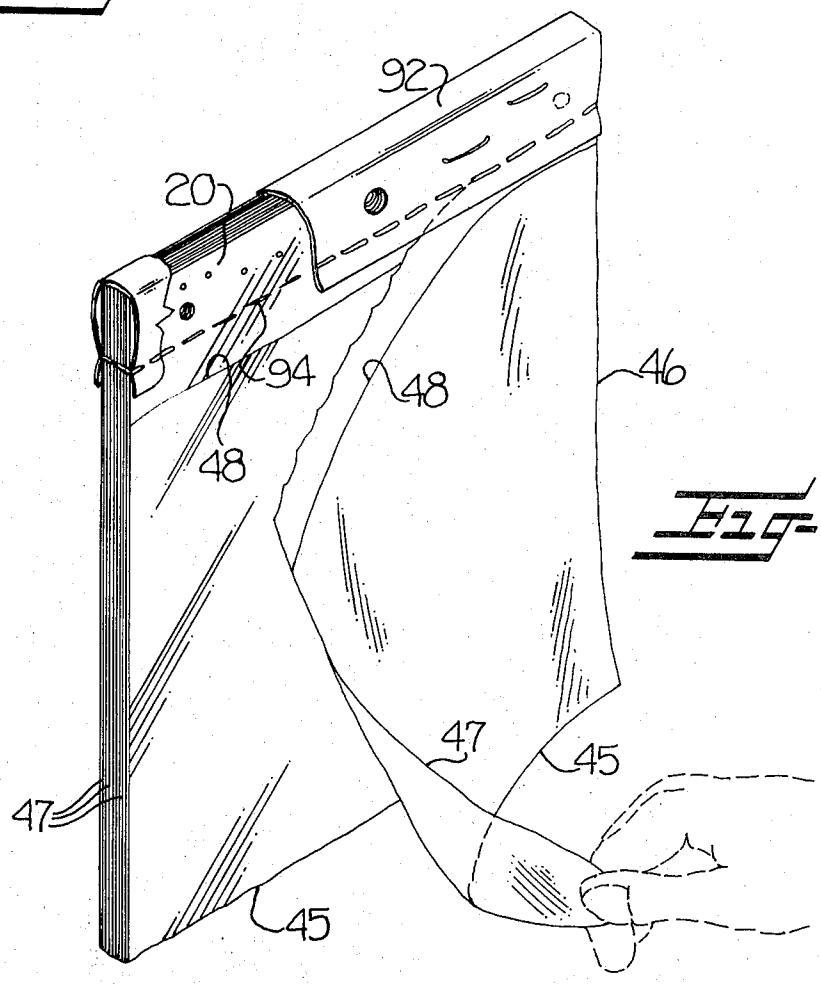

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Fig-2

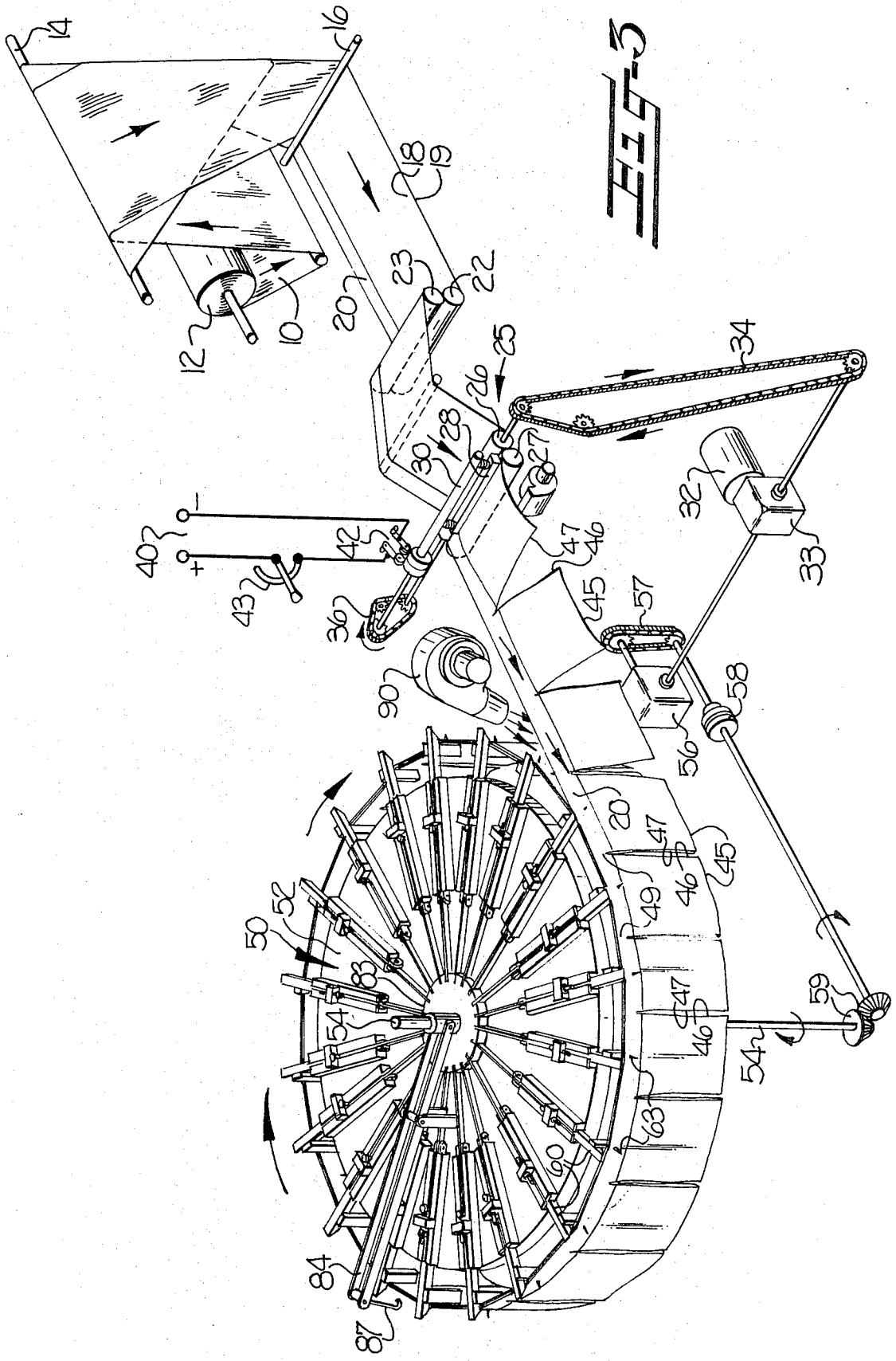

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FIG-3

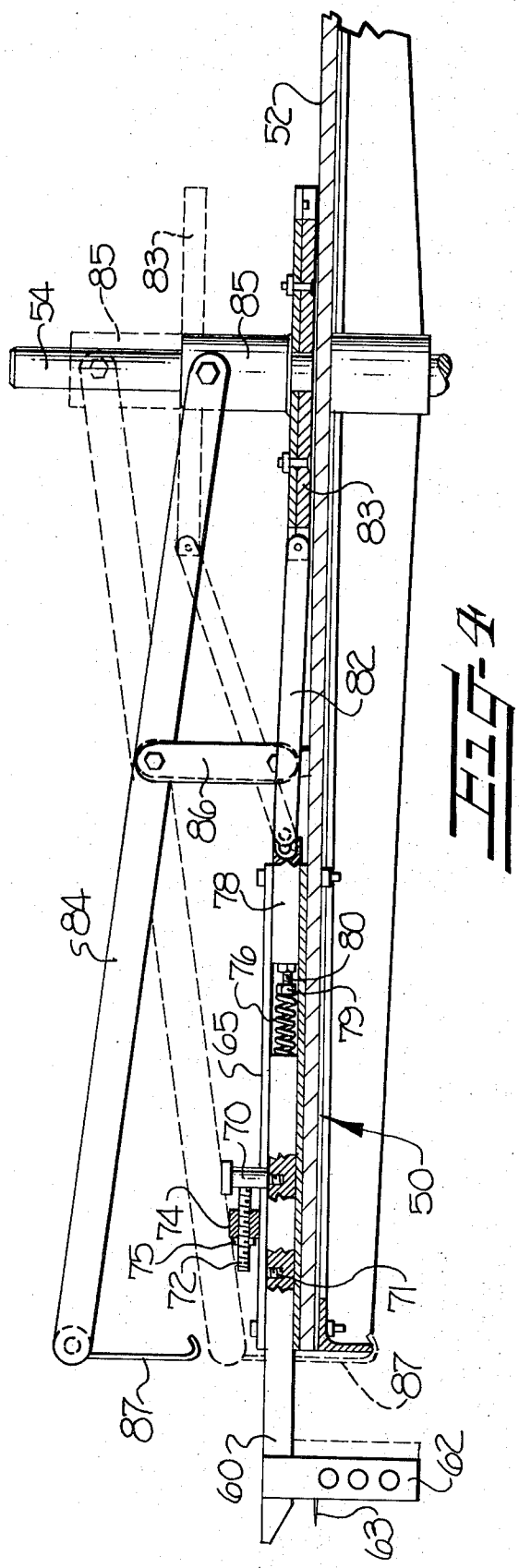

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FIG. 4

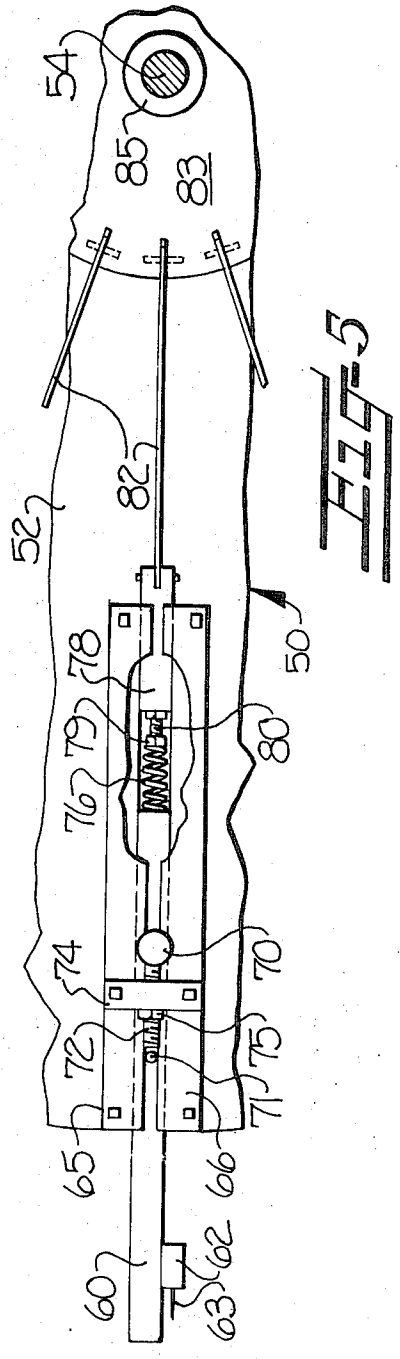

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FIG. 5

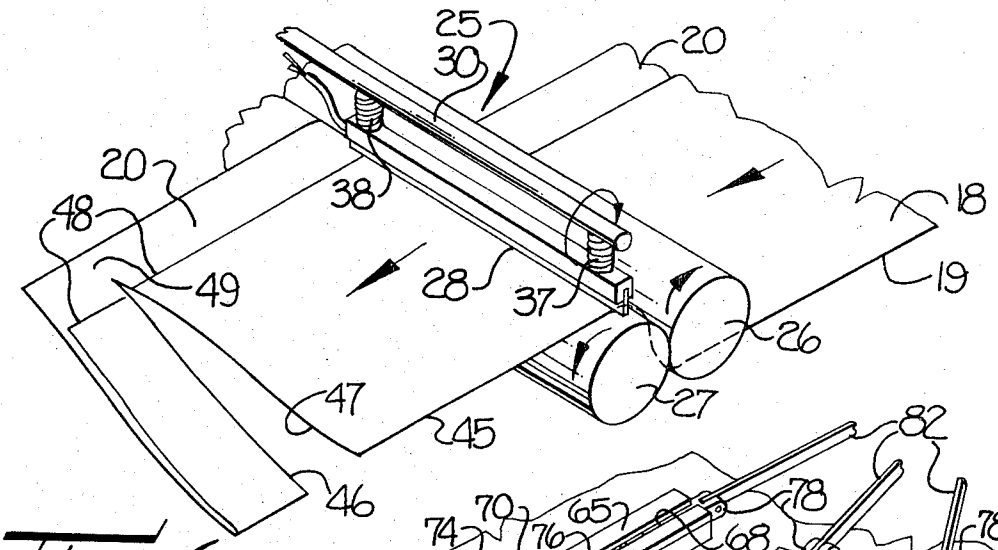



Fig-6

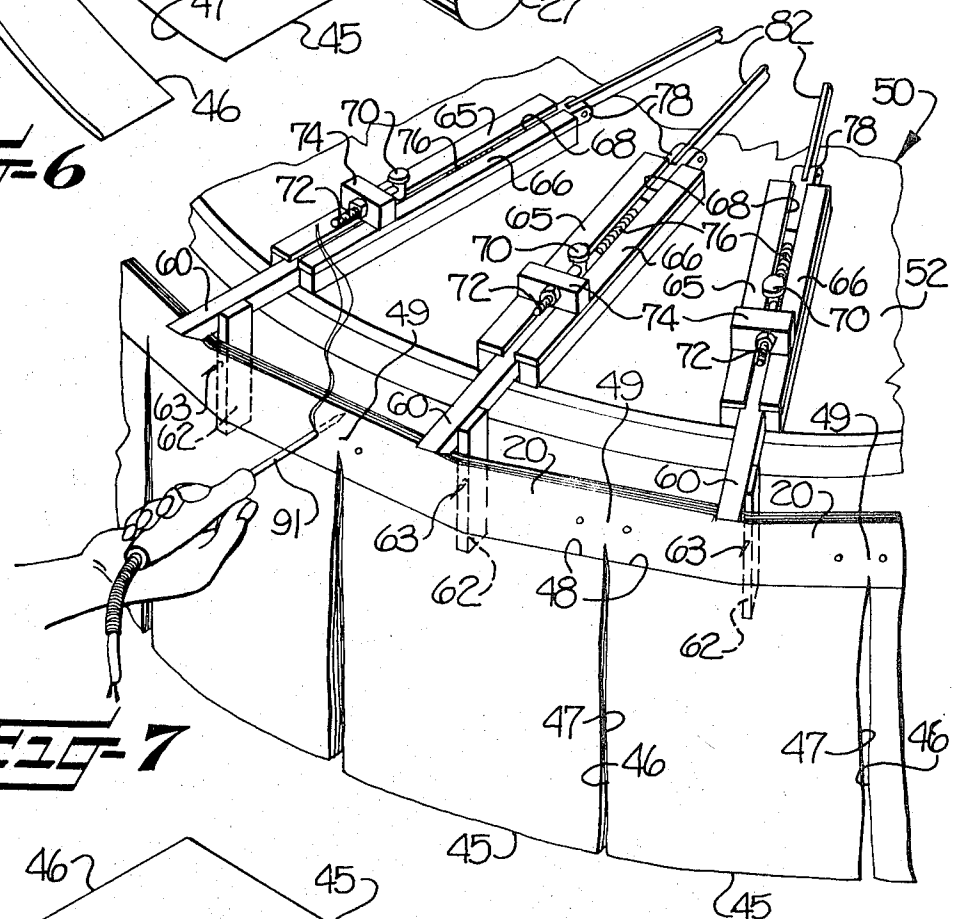



Fig-7

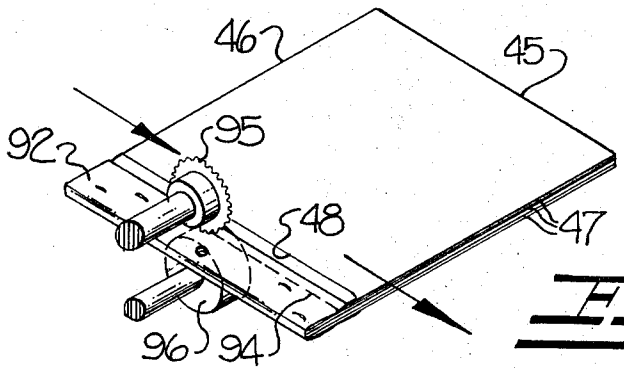



Fig-8

# METHOD AND APPARATUS FOR MAKING PACKAGES OF INTERCONNECTED PLASTIC BAGS AND THE LIKE

The present invention relates to a method and apparatus for making a plurality of individual packages of interconnected flexible plastic bags.

In many industries, large numbers of thin flexible plastic bags are utilized to enclose and protect various products. For example, in the textile industry it is common to use thin plastic bags to protect wound yarn packages, such bags typically being formed from thermoplastic film material having a thickness of about 1/2 mil.

Conventional bag fabricating machines are unable to make bags efficiently out of such thin plastic film material as described above since such machines generally utilize a sequential stop and go operation during the various manufacturing operations, and the film material possesses insufficient strength to withstand the applied forces. As a result, it is common to place a gusset in the plastic film material from which the bags are made so that the machine is able to pull the sheet material therethrough without tearing. However, the use of a gusset adds to the cost of the finished bags, and in addition, the production capacity of such machines is relatively low in view of the sequential nature of their operation.

It is accordingly an object of the present invention to provide a method and apparatus for making plastic bags from a thin plastic film material and which avoids the above noted disadvantages of the presently employed machines.

It is another object of the present invention to provide a method and apparatus for making plastic bags from relatively thin film material in a substantially continuous operation and which avoids undue stress on the plastic material.

It is another object of the present invention to provide a method and apparatus for producing packages of interconnected plastic bags at high production speeds to thereby reduce the cost of the bags, and wherein individual bags may be readily removed from the packages.

These and other objects and advantages of the present invention are achieved in the embodiment illustrated herein by the provision of a method for making packages of interconnected plastic bags and which includes advancing a longitudinally folded web of thermoplastic film material along a path of travel, fusibly joining and simultaneously severing the upper and lower web portions along longitudinally spaced transverse lines while leaving a non-severed connection portion to thereby form a series of connected bags, forming the series of connected bags into a plurality of individual stacks, interconnecting the bags of each stack, and then severing the connecting portions to form a plurality of separate packages. In order to form the series of connected bags into a plurality of individual stacks as set forth above, an apparatus is provided which includes a take-up wheel mounted for rotation about a central axis and defining a plurality of bag receiving stations about the periphery thereof. A bag retaining member is positioned at each of the bag receiving stations such that upon rotation of the wheel, the series of connected bags may be conveyed onto the bag receiving stations of the wheel from a tangential direction to thereby form a plurality of overlying convolutions and with the bags of each convolution being aligned with the bags of the adjacent convolutions.



Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which:

FIG. 1 is a flow chart illustrating the various steps in a method embodying the present invention;

FIG. 2 is a perspective view of a package of interconnected flexible plastic bags produced in accordance with the present invention;

FIG. 3 is a schematic representation of the method and apparatus of the present invention;

FIG. 4 is a sectioned side elevational view of the take-up wheel as shown in FIG. 3 and illustrating one of the slide arms and the release mechanism therefor;

FIG. 5 is a fragmentary top plan view illustrating one of the slide arms of the take-up wheel;

FIG. 6 is a perspective view of the apparatus for fusibly joining and severing the upper and lower portions of the advancing web;

FIG. 7 is a fragmentary perspective view of the take-up wheel and illustrating the method of interconnecting the bags of each stack;

FIG. 8 is a perspective view of an apparatus for forming a serrated tear line across the bags of the package.

Referring more specifically to the drawings, the overall method and apparatus of the present invention is illustrated generally in FIG. 3. As illustrated, a web 10 of thermoplastic film material is withdrawn from a supply roll 12 and advanced over a V-shaped forming guide 14 and then about the guide rod 16. By design, the forming guide 14 and rod 16 serve to fold the advancing web along a line offset from the center line of the web to define upper and lower overlying portions 18 and 19 respectively. Since the fold line is offset from the center of the web, the lower portion 19 is longer in the transverse direction to thereby define a longitudinally extending flap portion 20 which comprises a single layer of the film material.

From the folding operation, the overlying portions 18 and 19 are advanced through a pair of feed rolls 22, 23, and to the bag forming apparatus 25, note also FIG. 6. The apparatus 25 includes a driven feed roll 26, a mating follower roll 27, and a severing blade 28 carried by the rotatable rod 30. The feed roll 26 is rotatably driven by the variable speed electric motor 32 acting through the gear box 33 and drive chain 34, and the rod 30 is operatively connected to roll 26 by the drive chain 36 such that the rod 30 is rotated about its axis and the blade 28 cyclically engages the roll 27.

The blade 28 is mounted to the rod 30 by a pair of springs 37, 38 such that the blade is biased against the roll 27. In addition, the blade is electrically heated, and is supplied with electricity from a suitable source 40 acting through the brush and slip ring device 42 and the controlling rheostat 43. By this arrangement, the heated blade 28 is pressed firmly against the advancing web during each revolution of the rod 30 and for a sufficient time interval to fusibly sever the overlying portions 18 and 19 and simultaneously seal the portions together adjacent the line of severance. Also, it will be noted that the length of the blade 28 is sufficient to overlie the entire transverse length of the top portion 18, but it does not overlie the top edge of the flap por-

tion 20. Thus the apparatus 25 serves to fusibly join and simultaneously sever the upper and lower portions of the advancing web along longitudinally spaced transverse lines to form a series of connected bags, each bag having a folded bottom edge 45, fusibly joined side edges 46, 47, and an open top 48. Also, the flap portion 20 defines a non-severed connecting portion 49 between the adjacent bags of the series.

The series of connected bags is conveyed from the bag forming apparatus 25 to the take-up wheel 50 where the series is formed into a plurality of adjacent stacks of aligned overlying bags. The take-up wheel 50 comprises a circular table 52 mounted for rotation about a central vertical axis defined by the post 54, the table 52 being fixed to the post 54 for concurrent rotation. The post 54 and table 52 are rotated by the variable speed motor 52 which acts through a gear reduction box 56, drive chain 57, slip clutch 58, and bevel gears 59, as best seen in FIG. 3.

A plurality of radially directed slide arms 60 are positioned in an equally spaced radial arrangement on the upper surface of the table 52 to define a plurality of bag receiving stations about the periphery of the wheel. Each of the radially directed slide arms 60 includes a downwardly directed shoulder 62 connected at the remote end thereof, and each shoulder 62 carries an outwardly directed pointed pin 63 which is adapted to pierce each of the bags received at the bag receiving station and retain the same as described in more detail below. The slide arms 60 are each mounted on the table 52 for limited radial movement between a first radially extended position shown in solid lines in FIG. 4 and a second radially withdrawn position shown in dashed lines. More particularly, the slide arms 60 are mounted to the table 52 by an arrangement which includes the side abutments 65 and 66 which together define a slide channel (not numbered) for the associated arm. The side abutments 65 and 66 also define an upper elongated opening 68 which is adapted to receive a pin 70 carried by the upper surface of the slide arm 60. The pin 70 is threadedly received in a selected one of the sockets 71 positioned in the slide arm 60 and is adapted to contact an adjustable stop member 72 in order to limit the outward radial movement of the arm 60. More particularly, the stop member 72 is threadedly carried by the cross bar 74 which in turn is fixedly carried by the side abutments 65 and 66. Thus by rotating the stop member 72, the maximum outward movement of the pin 70 and thus the radially extended position of the slide arm 60 may be selectively controlled. Also, a threaded nut 75 is provided to lock the stop member 72 in its selected position in relation to the cross bar 74.

The mounting arrangement for each of the slide arms 60 further includes a resilient spring 76 carried at the radially inner end of the arm for biasing the arm outwardly toward its first radially extended position with a predetermined force. More particularly, the spring 76 is mounted between the arm 60 and an inner guide member 78, the guide member 78 being radially aligned with the arm 60 and also mounted within the channel defined by the abutments 65 and 66. The biasing force of the spring 76 may be controlled by adjustment of the nut 79 which is threadedly carried on the stud 80, the stud 80 in turn being carried by the guide member 78.

The radially inner end of the guide member 78 is pivotally connected across the connecting arm 82 to the flange 83 slidably carried on the post 54. In its operative position the flange 83 rests on the upper surface of the table 52 in the manner shown in solid lines in FIG. 4 and such that the guide member 78 is retained in a fixed position. However, it will be understood that the slide arm 60 may be moved radially inwardly to its withdrawn position by the application of a sufficient inwardly directed radial force applied to the shoulder 62 to compress the spring 76.

The take-up wheel 50 also includes a mechanism for collectively releasing the outwardly directed biasing force of all of the springs 76 such that each of the arms may be freely moved to its withdrawn position and for the purposes hereinafter set forth. The release mechanism includes the lever arm 84 which is pivotally connected at one end to a socket 85, the socket 85 being fixed to the flange 83. The medial portion of the lever arm 84 is pivotally connected via a pivot arm 86 to the table 52. Thus when the lever arm 84 is rotated about the pivot arm 86 from the position shown in solid lines in FIG. 4 to the position shown in dashed lines, the socket 85 and flange 83 are lifted along the post 54, and the connecting arms 82 act to withdraw the guide member 78 and thereby release the tension on the springs 76. In this configuration, the slide arms 60 are able to freely slide to their withdrawn position. In addition, the lever arm 84 may include a catch 87 which is adapted to grip the periphery of the table 52 in the manner shown in dashed lines in FIG. 4 and thereby retain the lever arm 84 in the dashed line position.

In operation, the lever arm 84 of the wheel 50 is initially positioned in its operative position as shown in FIG. 4 such that each of the slide arms 60 is biased outwardly to its radially extended position. The web 10 of thermoplastic film material is advanced from the supply roll 12 as seen in FIG. 3 and longitudinally folded by the forming member 14 and rod 16 in the manner described above. The upper and lower portions 18 and 19 respectively of the advancing web are then formed into a series of connected bags by the bag forming apparatus 25. More particularly, the heated severing blade 28 of the apparatus 25 serves to fusibly join the upper and lower portions along longitudinally spaced transverse lines and simultaneously sever the web portions along the same transverse lines. Since the blade 28 does not overlie the upper edge of the flap portion 20 of the web, the flap portion serves to define a non-severed connecting portion 49 between the adjacent bags of the series.

The series of connected bags is conveyed from the bag forming apparatus 25 onto the take-up wheel 50 to form a plurality of overlying convolutions. As shown in FIG. 3, each bag is retained about the periphery of the wheel at one of the bag receiving stations defined by the slide arms 60. More particularly, the bags are conveyed onto the bag receiving stations from a tangential direction, and each bag is pierced by the pointed pin 63 carried by the shoulder 62 of the slide arms 60. By design, the circumferential spacing of the pins 63 is adapted to substantially equal the spacing between the bags of the series such that as the convolutions of bags build, the bags of each convolution will be generally aligned with the bags of the adjacent convolutions to thereby form a plurality of adjacent stacks of aligned

overlying bags with one stack being positioned at each bag receiving station.

In order to insure the proper alignment of the overlying bags at each bag receiving station, it will be understood that minor adjustments in the circumference of the convolutions may be effected by making suitable adjustment of the stop members **72.** In addition, the pins **70** may be selectively positioned in one of the sockets **71** of the slide arm **60** to make more substantial adjustments in the circumference and thereby accommodate bags of varying sizes. Such substantial adjustment may also require the substitution of a connecting arm **82** of different length.

It will also be noted that if no adjustment in the radial position of the slide arms **60** is made during the build of the convolutions, the bags of the outer convolutions will be laterally offset somewhat from the bags of the inner convolutions due to the increasing effective diameter of the wheel at the bag receiving stations. To compensate for this problem, the biasing force exerted by the spring **76** is designed to permit the slide arm **60** to radially withdraw during the build of the convolutions such that the diameter of the initial convolutions decreases slightly as the convolutions build to thereby insure that the bags formed in each stack are substantially aligned.

As will be understood, the series of bags are conveyed tangentially onto the take-up wheel from the bag forming station **25** by the rotation of the wheel **50** about the axis defined by the post **54.** The speed of rotation of the wheel is coordinated to the speed of the bag forming apparatus **25** in that both are powered by the variable speed electric motor **32.** In addition, the slip clutch **58** insures that the tension exerted on the series of bags may be controlled so as not to exceed a predetermined level which would tear or stretch the web. It will also be appreciated that during rotation of the wheel **50,** the bags initially received thereon will tend to fly outwardly from the centrifugal force. An air blower **90** may be positioned as shown in FIG. **3** to align the bags carried by the wheel in the vertical direction such that the advancing series of bags is not deflected outwardly prior to being received on the wheel.

When the desired number of convolutions are received on the take-up wheel **50** (typically 100 or more convolutions), the wheel is stopped and the flap portions of the bags of each stack are interconnected. As shown in FIG. **7,** such interconnection may be effected by sequentially advancing and withdrawing a heated pin **91** transversely through the flap portions **20** at each bag receiving station such that the flap portions are fusibly united upon withdrawal of the heated pin. Alternately, the flap portions could be stapled or secured together by any other conventional means.

To remove the convolutions from the wheel, one or more of the connecting portions **49** are severed by a suitable knife or the like. The stacks are then removed from the wheel, and a header board **92** of heavy paper or the like may be then secured to encompass the flap portions of the stacks in the manner shown in FIG. **2** to reinforce the same. Next, a serrated tear line **94** may be formed longitudinally across the flap portions **20** of the stacks to permit individual bags to be readily removed from its package by tearing along the tear line as illustrated in FIG. **2.** Typically, the tear line **94** is formed by feeding the connected stacks through an apparatus illustrated schematically in FIG. **8,** and which includes a serrated knife roller **95** and a back-up roller **96.** Obviously, this serrating operation could be effected either prior to or after application of the header board **92.** Also, it would be possible for the tear line **94** to be formed during the advance of the series of connected bags and prior the positioning of the bags on the take-up wheel **50.**

As a final step in the method of the present invention, the connecting portions **49** of the connected stacks are severed by means of a suitable knife or the like to form a plurality of individual packages of interconnected bags substantially as shown in FIG. **2.** Quite obviously, this severing operation could be conducted immediately upon withdrawal of the stacks from the wheel **50** and either prior to or after the application of the header board **92** and the formation of the tear line **94.**

From the above description, it will be apparent that the present invention provides a method and apparatus for the high volume production of individual packages of interconnected plastic bags, and wherein the individual bags may be readily and individually separated from the packages by tearing along the tear line **94,** note FIG. **2.** Also, the method and apparatus involves a substantially continuous operation, and it avoids undue stress on the plastic material thereby enabling the same to process relatively thin plastic film material, such as 1/2 mil polyethylene. Further, the illustrated method and apparatus is adapted to accommodate bags of a variety of sizes by adjustment of the radial extent of the slide arms **60.**

In the drawings and specification, there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed is:

**1.** A method for making a plurality of individual packages of interconnected flexible plastic bags and comprising the steps of

advancing a longitudinally folded web of thermoplastic film material along a path of travel, the web defining upper and lower overlying portions,

fusibly joining the upper and lower portions of the advancing web along longitudinally spaced transverse lines,

severing the upper and lower portions of the advancing web along the fusibly joined transverse lines while leaving a non-severed connecting portion to thereby form a series of connected bags each having a folded bottom edge, fusibly joined side edges, and an open top,

forming the series of connected bags into a plurality of stacks of aligned overlying bags,

interconnecting the bags of each stack, and

severing the connecting portions to form a plurality of individual packages of interconnected bags.

**2.** The method as defined in claim **1** wherein the step of interconnecting the bags of each stack includes the step of forming an interconnection adjacent the open tops of the bags, and the method comprises the further step of forming a serrated tear line longitudinally across the bag and immediately below the interconnection to permit individual bags to be readily removed from the package by tearing along the tear line.

**3.** The method as defined in claim **2** wherein one of the portions of the folded web is longer in the transverse direction than the other portion to define a longi-

tudinally extending flap portion, and wherein the non-severed connecting portion includes the flap portion.

**4.** The method as defined in claim **3** wherein the interconnection and the serrated tear line are both positioned on the flap portion.

**5.** The method as defined in claim **4** wherein the step of interconnecting the bags of each stack includes advancing and withdrawing a heated pin transversely through the flap portions after the series of connected bags are formed into a plurality of individual stacks whereby the flap portions are fusibly united upon withdrawal of the heated pin.

**6.** The method as defined in claim **5** wherein the step of interconnecting the bags of each stack further includes the step of securing a header board over the flap portions after the series of connected bags are formed into a plurality of individual stacks to thereby reinforce the flap portions.

**7.** The method as defined in claim **1** wherein the step of forming the series of connected bags into a plurality of individual stacks includes conveying the series of connected bags circularly about a central axis to form a plurality of overlying convolutions.

**8.** A method for making a plurality of individual packages of interconnected flexible plastic bags and comprising the steps of

advancing a web of thermoplastic film material along a path of travel,

longitudinally folding the advancing web along a line offset from the center line of the web to define upper and lower overlying portions and with one of the portions being longer in the transverse direction to define a longitudinally extending flap portion,

fusibly joining the upper and lower portions of the advancing web along longitudinally spaced transverse lines,

severing the portions of the advancing web along the fusibly joined transverse lines and without severing the flap portion to thereby form a series of connected bags each having a folded bottom edge, fusibly joined side edges, and an open top, and with the flap portion defining a non-severed connecting portion between adjacent bags,

conveying the series of connected bags circularly about a central axis to form a plurality of overlying convolutions and with the bags of each convolution generally aligned with the bags of the adjacent convolutions to thereby form a plurality of stacks of aligned overlying bags,

interconnecting the flap portions of the bags of each stack, and

severing the connecting portions to form a plurality of individual packages of interconnected bags.

**9.** The method as defined in claim **8** comprising the further step of forming a serrated tear line longitudinally across the flap portions of the bags and after interconnecting the same to permit individual bags to be readily removed from the stack by tearing along the tear line.

**10.** The method as defined in claim **8** wherein the steps of fusibly joining and severing the upper and lower portions of the advancing web occur simultaneously and include applying sufficient heat along the transverse lines to melt and sever the thermoplastic material while sealing the portions together adjacent the line of severance.

**11.** The method as defined in claim **8** wherein the step of conveying the series of connected bags circularly about a central axis includes maintaining a controlled resilient outwardly directed radial force on the convolutions such that the diameter thereof decreases slightly as the convolutions build to thereby insure that the bags being formed into the convolutions are applied at substantially the same radial distance from the central axis and so that the bags of each stack are substantially aligned.

**12.** The method as defined in claim **8** wherein the step of conveying the series of connected bags circularly about a central axis includes maintaining a controlled tension on the series of connected bags while the series is being formed into the convolutions to thereby prevent tearing the web.

**13.** An apparatus for continuously forming a series of connected articles of thin film material into a plurality of stacks of aligned overlying articles to facilitate the formation of a plurality of packages of interconnected articles and comprising

a wheel mounted for rotation about a central axis, said wheel including a plurality of article receiving stations spaced about the periphery thereof,

means for rotating said wheel about said central axis,

means carried at each of said article receiving stations for retaining an individual article of the series such that the series may be conveyed onto the wheel from a tangential direction by rotation of the wheel to thereby form a plurality of overlying convolutions and with the articles of each convolution being positioned at an article receiving station and generally aligned with the articles of the adjacent convolutions to thereby form a plurality of stacks of aligned overlying articles at each article receiving station.

**14.** The apparatus as defined in claim **13** wherein said retaining means comprises a radially directed pointed pin at each article receiving station and adapted to pierce each of the articles received at the article receiving station.

**15.** The apparatus as defined in claim **13** wherein said retaining means comprises a radially directed arm at each of said article receiving stations, each arm including shoulder means at the remote end thereof for supportingly engaging each of the articles positioned at the article receiving station.

**16.** The apparatus as defined in claim **15** wherein said retaining means further comprises means for slidably mounting each of said arms for limited radial movement between a first radially extended position and a second radially withdrawn position, and means for resiliently biasing each of said arms toward said first position with a predetermined force such that the diameter of the convolutions decreases slightly as the convolutions build to thereby insure that the articles formed in each stack are substantially aligned.

**17.** The apparatus as defined in claim **16** wherein said retaining means further includes adjustable stop means for limiting the radial extent of said first position to thereby permit the effective circumference of the wheel to be adjusted and thereby accommodate articles of different sizes.

**18.** The apparatus as defined in claim **17** further comprising means for collectively releasing said biasing means such that each of said arms may be freely moved to said second position to facilitate removal of the stacks of articles from said article receiving stations.

* * * * *