United States Patent [19]

Fish

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[45] **Apr. 22, 1975**

[54] **PRINTER WITH VACCUM DEVICE FOR HOLDING FILM FOR PRINTING**

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[21] Appl. No.: **310,548**

[52] **U.S. Cl.**..... **101/41;** 101/333; 101/382 MV; 101/407 R; 248/363; 271/92

[51] **Int. Cl.**..... **B41f 17/00;** B41f 27/12; B41f 1/32

[58] **Field of Search**.. 101/382 MV, 426, 41, 407 R, 101/333; 226/95, 113, 195; 294/64 R; 271/92; 248/362, 363; 51/362; 269/21

[56] **References Cited**

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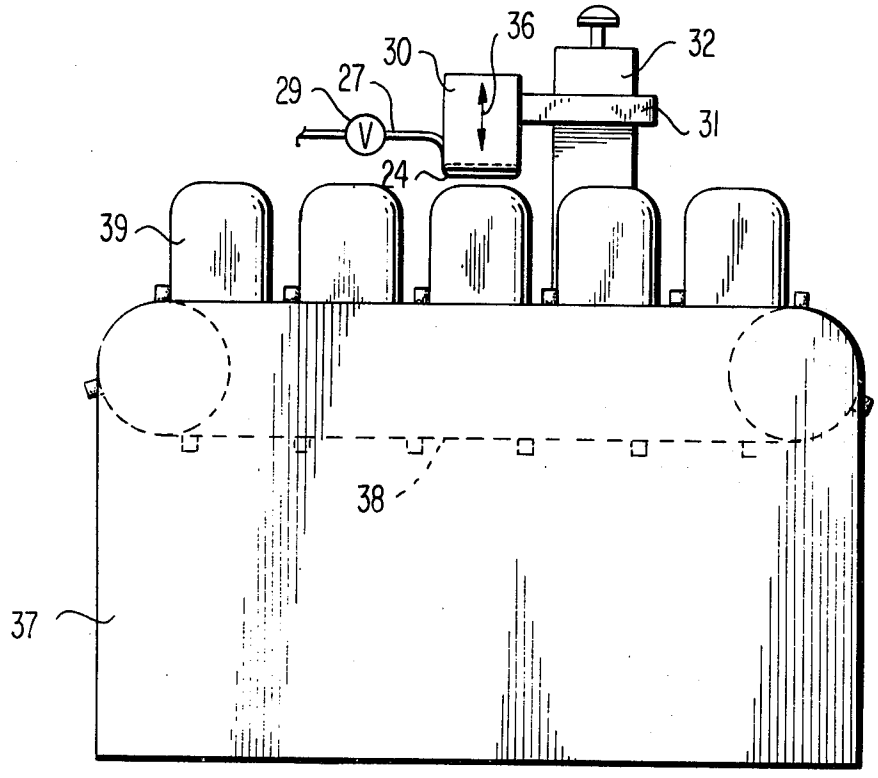
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[57] **ABSTRACT**

A printing apparatus has associated therewith a vacuum frame structure for holding a film in position to be imprinted. The apparatus is used in combination with a conveyor which moves articles, such as bread wrapped in polyethylene film underneath the apparatus. As each package is moved underneath the apparatus the vacuum frame picks up and tensions the film while the imprinting operation occurs.

4 Claims, 8 Drawing Figures



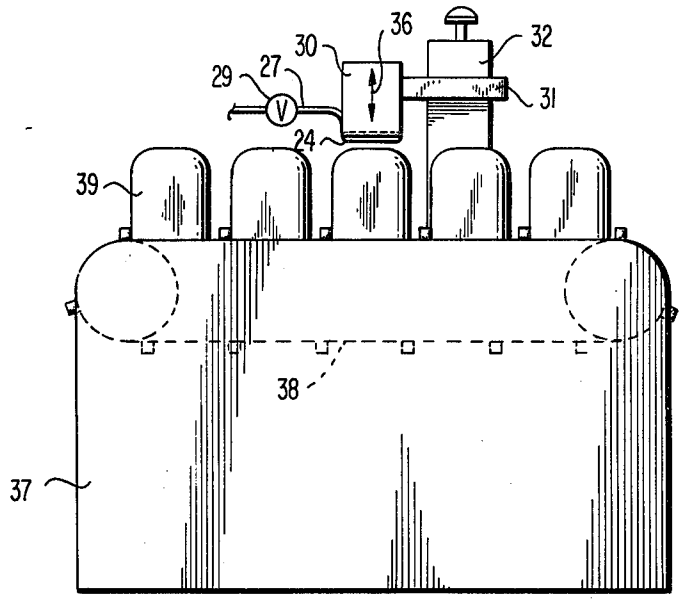


FIG. 1

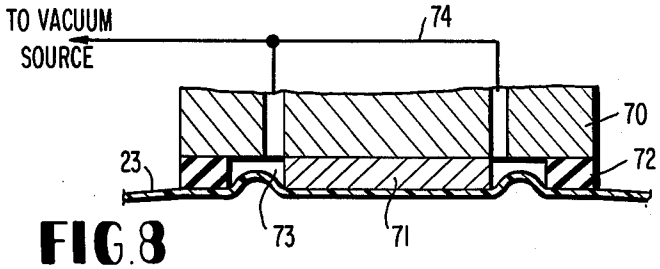


FIG. 8

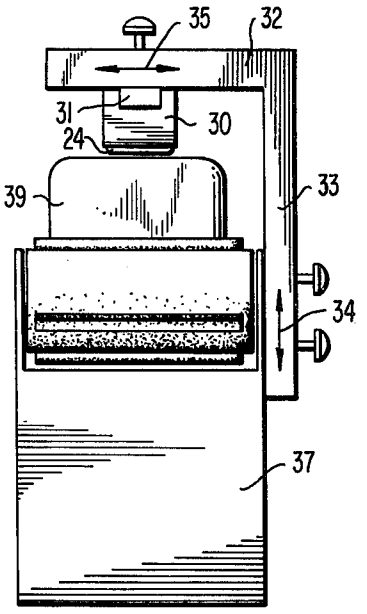


FIG. 2

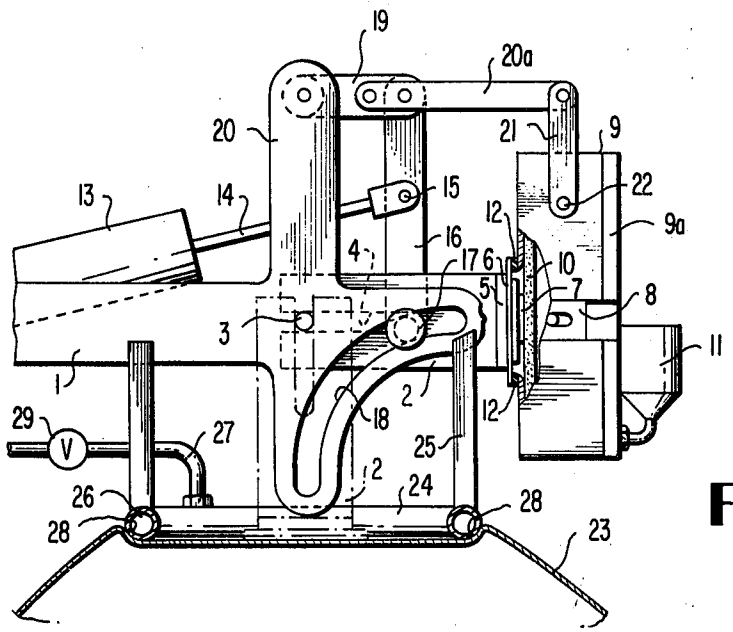


FIG. 3

FIG. 4

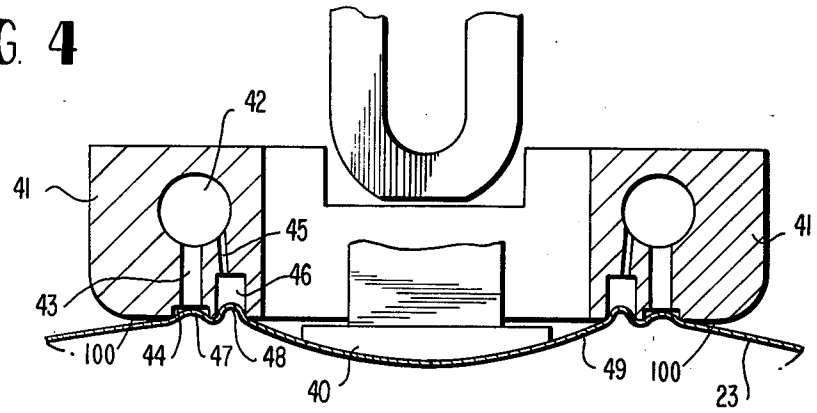


FIG. 5

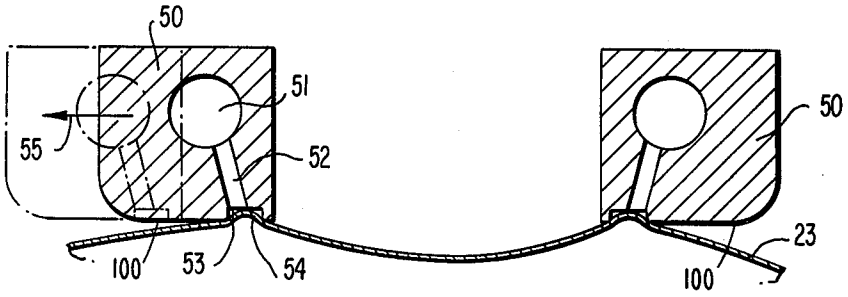


FIG. 6

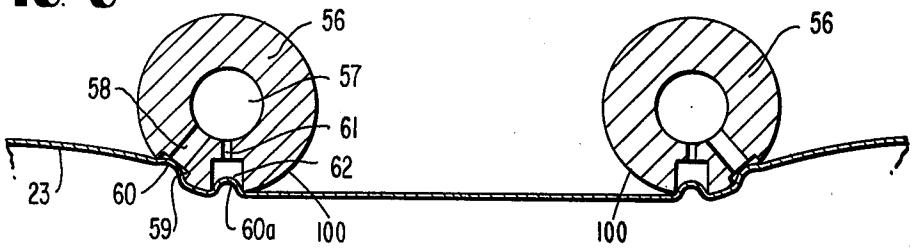
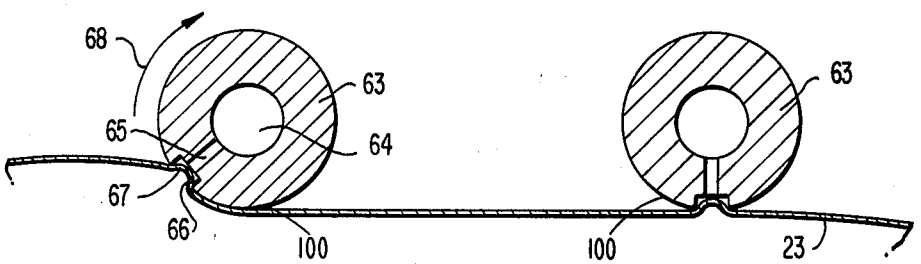


FIG. 7



PRINTER WITH VACCUM DEVICE FOR HOLDING FILM FOR PRINTING

This invention relates to printing on film material.

One of the problems encountered in the production of packaged material such as bread wrapped in polyethylene film is that of printing on the film during the packaging process or immediately thereafter.

An apparatus and method for doing this has been disclosed in U.S. Pat. No.. 3,358,414 issued Dec. 19, 1967 to Lawrence S. Hersh and myself.

It is an object of this invention to improve on the subject matter of this patent, enabling the printing to be done quickly, effectively and by simplified means.

Another object is to use a vacuum to hold the film taut while it is imprinted.

Another object is to provide a frame in combination with a printing apparatus, the frame having vacuum means for holding the film taut while it is being imprinted.

Another object is to take a material or article already packaged by a film wrapping and print on the film while it is held taut by a vacuum means.

Another object is to provide an apparatus which will convey a package having a film wrapping to a printing station, contact the film with a vacuum frame which will stretch the film taut while it is imprinted and then convey the package away to make room for the next package. The apparatus will have the capacity of handling a wide range of sizes of packages, the vacuum frames varying in size in a corresponding manner.

According to one embodiment of the invention a printing means as disclosed in my U.S. Pat. No. 3,599,566 issued Aug. 17, 1971 is used in combination with a vacuum means to tension and hold film while it is being printed. The printing and vacuum means are disposed above a conveyor carrying packages, such as bread wrapped in film material and the printing is done during the conveying operation, the movement of the packages along the conveyor preferably being temporarily halted while the printing is being done.

Other objects will become apparent from a reading of the specification and drawings in which:

FIG. 1 is a side elevation of a conveyor, printing apparatus and vacuum frame;

FIG. 2 is an end elevation of FIG. 1;

FIG. 3 is a detail elevation of a printing apparatus and vacuum frame;

FIG. 4 is a partly sectional and partly elevational view of a modified vacuum frame and type face;

FIG. 5 is a cross section of another species of vacuum frame;

FIG. 6 is a cross section of a still further species of vacuum frame;

FIG. 7 is a cross section of yet another species of vacuum frame; and

FIG. 8 is a cross section of another species in which the vacuum frame is part of the printing plate.

Turning to FIG. 3, the printing head with which I combine my vacuum holding means has been disclosed in my U.S. Pat. No. 3,599,566 issued Aug. 17, 1971 and comprises a pair of brackets 1, only one of which is shown in FIG. 3, suitably supported on a frame, not shown. A yoke 2 is pivoted between the brackets by means of a pair of pivot pins 3 extending from the brackets and received in slots or recesses 4 in the legs of the yoke. The yoke 2 carries a magnetic plate 5, a steel printing plate 6 magnetically attracted to the magnetic plate 5 and a type face 7. The brackets 1 have extensions 8 to which a housing 9 is attached, the housing having a cover plate 9a. An extension 8 and part of the housing 9 are cut away in FIG. 3 in order to show a portion of the interior of the housing. The housing contains an inking belt 10 which receives ink from a reservoir 11. The type face 7 contacts the inking belt when in the solid line position. In this position also a seal 12 on plate 9 contacts the housing.

In order to move the type face from the ink receiving position to the printing position shown in dotted lines a power unit 13, such as an air cylinder, is provided which actuates rod 14 which is pivotably attached at 15 to link 16. The link 16 is pivoted to the yoke and riding in the arcuate slots 18 in the brackets are pins 17 extending from the yoke. The link 16 is pivoted at its upper end to link 19 which is pivoted to extensions 20 of the brackets. When power unit 13 is energized the rod 14 is moved to the left causing the yoke to be drawn to the left and moved downwardly due to the linkages shown, the pivot pins 3 riding in slots or recesses 4 and the pins 17 riding in the arcuate slots 18. During this motion of the yoke the link 19 will cause link 20*a*, which is pivoted to link 19, to move to the left and this motion will cause link 21, to which link 20*a* is pivoted, to move counterclockwise about pivot 22. Such motion by means of a roller, not shown, having an overrunning clutch, will cause the inking belt to move in one direction. Thus, by causing rod 14 to cyclically reciprocate the type face will be continually supplied with ink and print indicia on film 23.

To hold and tension film 23 in position for printing the frame 24 is provided, the frame being supported by leg members 25 secured thereto and to the brackets 1 or other suitable support. The frame 24 has an interior bore 26 connected by a conduit 27 to a vacuum pump, not shown. The conduit may be provided with a valve 29. The bores 26 and the conduit 27 form a vacuum manifold for the frame 24. The frame 24 has a tubular circular cross section and is provided with openings 28. The openings 28 on each side of the frame are positioned outwardly of the vertical axis of the tubular cross section at an angle of about 45°. Thus, when the frame and the film 23 are brought adjacent each other the vacuum existing in bore 26 acting through openings 28 will cause the film 23 to be drawn against the frame 24 and against the curved positions of the frame between the holes 28 and the vertical axes at the spaced locations shown. The film 23 will therefore be placed in tension between the spaced locations and will be able to resist the pressure of the type face applied to the tensioned portion of the sheet without any other support. It will be understood that only a feather touch is needed for the imprinting so that the vacuum frame holds the film with sufficient firmness to make a clear legible print.

In FIGS. 1 and 2 the apparatus of FIG. 3 is shown at 30 as supported by a bar 31 which is secured to an arm 32 on a stand 33. The stand 33 is vertically adjustable up and down as indicated by arrows 34 and the bar 31 is adjustable horizontally in two directions as indicated by arrows 35. Of course, an adjustment lengthwise of the conveyor may also be provided. The apparatus 30 is cyclically movable up and down as indicated by arrows 36. A conveyor base 37 supports a power conveyor 38 which moves packages 39, such as loaves of

bread wrapped in polyethylene film, past the printing apparatus.

In operation the conveyor will bring a package **39** to the desired position underneath apparatus **30** and stop it long enough for the imprinting to take place. As the package is being stopped the apparatus **30** will be lowered and a suction or vacuum will be initiated in bores **26.** The frame **24** will contact or almost contact the film as the suction is applied. Initiating the vacuum will pick up the film at the spaced locations shown in FIG. **3** and pull the film taut or place it in tension between these locations as the film is pulled about the lower rounded portions of the frame members. The power unit **13** is activated in proper timed relation to imprint indicia on the film between the spaced locations while the vacuum is effective to tension and hold the film. After imprinting takes place the suction is discontinued and apparatus **30** is lifted to allow free movement of a package **39** away from the imprinting point.

Alternatively, means may be provided to move the package towards and from the vacuum frame. Also the conveyor and packages might be arranged to move continuously and the printing apparatus to move at the same speed as the packages while printing is being done. I prefer, however, to stop the package while printing takes place.

Since there is no effective support under the film while printing takes place, in practice it will give in response to the pressure of the type face as shown in FIG. **4,** rather than remain perfectly straight as idealized in FIG. **3.** If a flat type face is used the film will tend to bridge across imperfections in the type face and the imprinted indicia will have an unsatisfactory appearance. To alleviate this condition the type face is made convex as shown at **40** in FIG. **4.** This form of type face is preferably used with all the species of vacuum frame.

FIG. **4** shows a modified vacuum frame comprising a pair of structural members **41** each of which has a vacuum bore **42.** At outer positions on the members ducts **43** lead from the bore in each member to a groove or channel **44** and at inner positions ducts **45** lead from the bore in each member to a groove or channel **46.** The ducts **43** have greater air carrying capacity than ducts **45** and grooves **46** are each deeper and wider than groove **44.** As a result when a suction or vacuum is created in the bore, grooves **44** will pick up the film as at **47** slightly before grooves **46** pick up the film as at **48.** Also due to the variation in depth of the grooves the film will be sucked into the grooves **46** while maintaining its position in grooves **44.** The film **49** between the frame members will therefore be placed in tension while the film outside of the frame members continues in relaxed condition. When the printing head or type face **40** is in the printing position the film will yield to some extent as shown in FIG. **4** and some material may come out of grooves **46** but the vacuum is still strong enough to support the film for printing with no other support being provided.

Instead of a groove **44** being provided the ducts **43** may be continued to the surface of each member.

In FIG. **5** a species of vacuum frame is shown in which each structural member **50** has a vacuum bore **51** with ducts **52** leading from the manifold to a groove **53** with the film material being drawn into each groove as shown at **54.** In this case tension is created and the film is drawn taut between the members by translating one or both members outwardly relatively to each other as shown by arrow **55** and the dotted outline of member **50.**

In FIG. **6** the vacuum frame members are shown as circular in cross section, each structural member **56** having a vacuum bore **57** and also ducts **58,** a groove **59,** ducts **61** and a groove **62,** the ducts and grooves having the same general proportions and serving the same purpose as the corresponding ducts and grooves in the species of FIG. **4.** The film is shown drawn into groove **59** at **60** and into groove **62** at **60***a* in the same way as in corresponding grooves in FIG. **4.**

In FIG. **7** structural members **63** are circular in cross section, each with a vacuum bore **64,** ducts **65** and groove **66** into which the film material is drawn as shown at **66.** The film material is effectively drawn taut between the frame members by rotating one or both of the frame members relative to each other as indicated by arrow **68.**

In FIG. **8** the vacuum frame is shown as part of the printing plate assembly. The printing plate **70** comprises the type face **71** and surrounding seal **72** and has ducts leading to groove or channel **73** formed between the type face **71** and seal **72.** The ducts connect with a vacuum manifold **74** which may be a passageway in a pivot bolt at the position of pins **17** in FIG. **3.** This arrangement provides great flexibility in altering the size of the printing area.

The structural members of each embodiment discussed above define a surface, such as, surface **100,** which include at least two terminal points lying in a plane which in turn is coincident with the support section of the flexible film.

The vacuum frame members may have various configurations in plan view. In some cases it may be sufficient to merely have a pair of members to create tension in the film by a pull in opposite directions. In other cases two pairs of members may be used to create tension in the film at right angles. Also, a frame member of circular or other shape with a closed perimeter may be used to tension the film in all directions within its plane. In each case the vacuum frame will provide at least two spaced locations for pulling on the film and the printing means will be operative between such locations.

That which is claimed is:

1. Apparatus for printing on a section of flexible film, comprising:

a. a vacuum frame;

b. a conduit connecting the vacuum frame to a source of vacuum;

c. a printing head for printing on a supported section of a flexible film; and

d. means for mounting the vacuum frame to the printing head,

the vacuum frame comprising:

i. a structural member having laterally spaced bores formed therein, said bores being connected with said connecting conduit and along with said connecting conduit forming a vacuum manifold, said structural member defining at least one surface which includes at least two terminal points which lie in a plane coincident with the supported section of the flexible film; and

ii. laterally spaced ducts formed within said structural member, said ducts extending from and intersecting a respective one of said bores at one end thereof and extending to and opening into

said plane at the other end thereof, the lateral spacing of said ducts being different from the lateral spacing of said bores, said ducts each including a channel for the reception therein of a segment of the flexible film, the segments being drawn into their respective channels by the vacuum communicated through said bores and ducts and applied against the segments such that a drawing force is applied against the segments and a corresponding tension force is applied to the flexible film between the segments as a result of the different lateral spacing between said ducts, said tension force being applied in a direction substantially transverse to the direction of the drawing force, said drawing force and corresponding tension force serving to support the flexible film against said structural member and define thereby the supported section of the flexible film. structural member defining at least one surface which includes at least two terminal points which lie in a plane coincident with the supported section of the flexible film; and

ii. laterally spaced ducts formed within said structural member, said ducts extending from and intersecting a respective one of said bores at one end thereof and extending to and opening into said plane at the other end thereof, the lateral spacing of said ducts being different from the lateral spacing of said bores, said ducts each including a channel for the reception therein of a segment of the flexible film, the segments being drawn into their respective channels by the vacuum communicated through said bores and ducts and applied against the segments such that a drawing force is applied against the segments and a corresponding tension force is applied to the flexible film between the segments as a result of the different lateral spacing between said ducts, said tension force being applied in a direction substantially transverse to the direction of the drawing force, said drawing force and corresponding tension force serving to support the flexible film against said structural member and define thereby the supported section of the flexible film.

2. An apparatus as defined in claim **1,** wherein said structural member comprises a pair of laterally spaced portions within which a respective one of said bores is formed and within which a corresponding respective one of said ducts is formed, wherein each of said portions defines a surface including at least one terminal point which together lie in a plane coincident with the supported section of the flexible film, and wherein at least one of said portions is displaceable relative to the other of said portions so as to change the lateral spacing of at least said ducts.

3. An apparatus as defined in claim **2,** wherein said portions have a generally rectangular cross section, wherein said ducts extend from their respective bores toward said plane at an angle to said plane, and wherein at least one of said portions is displaceable relative to the other of said portions in a direction parallel to said plane in order to effect the changed lateral spacing of said ducts and said bores.

4. An apparatus for printing on a section of flexible film, comprising:

a. a vacuum frame;

b. a conduit connecting the vacuum frame to a source of vacuum;

c. a printing head for printing on a supported section of a flexible film; and

d. means for mounting the vacuum frame to the printing head,

the vacuum frame comprising:

i. a structural member having laterally spaced bores formed therein, said bores being connected with said connecting conduit and along with said connecting conduit forming a vacuum manifold, said structural member defining at least one surface which includes at least two terminal points which lie in a plane coincident with the supported section of the flexible film; and

ii. a pair of laterally spaced ducts formed within said structural member, each duct of said pair of ducts extending from and intersecting a respective one of the bores formed within the structural member at one end thereof and extending to and opening into said plane at the other end thereof, each duct of said pair of ducts including a channel for the reception therein of a segment of the flexible film, and each pair of ducts being configured so that the farthest laterally spaced ducts in each pair are identical and the closest laterally spaced ducts in each pair are identical, with the channels of the closest laterally spaced ducts being larger than the channels of the farthest laterally spaced ducts so that the film segments associated with these channels will be drawn in further than the film segments associated with the channels of the farthest laterally spaced ducts resulting in a tension force being applied to the supported section of the flexible film.

* * * * *