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Rust, Jr.

[11] **3,727,277**

[45] **Apr. 17, 1973**

[54] **NEEDLE PUNCHING MACHINE FOR ENDLESS WEB AND METHOD OF REMOVING WEB**

[75] Inventor: **Edgar C. Rust, Jr.**, Williamstown, Mass.

[73] Assignee: **Crompton & Knowles Corporation**, Worcester, Mass.

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[52] **U.S. Cl.** .....**28/4 R**, 28/72.2 R

[51] **Int. Cl.** **D04h 18/00**

[58] **Field of Search** .....28/4 N, 72.2 R

[56] **References Cited**

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3,117,359	1/1964	O'Byrne	28/4 R
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Primary Examiner—Louis K. Rimrodt

Attorney—Howard G. Garner, Jr.

[57] **ABSTRACT**

A needle punching machine for manufacturing endless webs wherein a bed beam is releasably mounted on the framework and one end of the framework has an opening large enough for the beam to pass through; and a method of removing the web from the machine which includes the steps of separating the web from the bed beam, supporting the bed beam on bearing means preferably of the "air film" type, releasing the bed beam from the frame and shifting the bed endwise of the frame for easy removal of the web.

12 Claims, 11 Drawing Figures

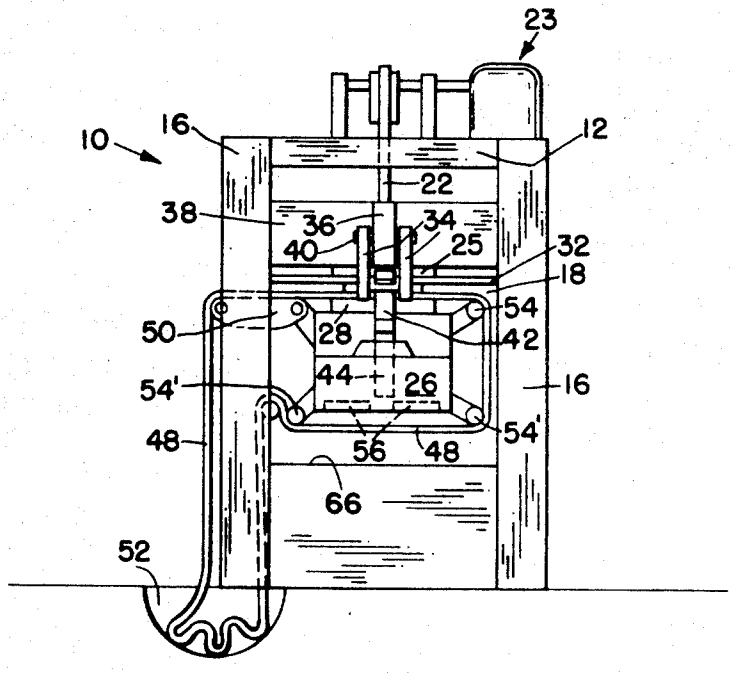
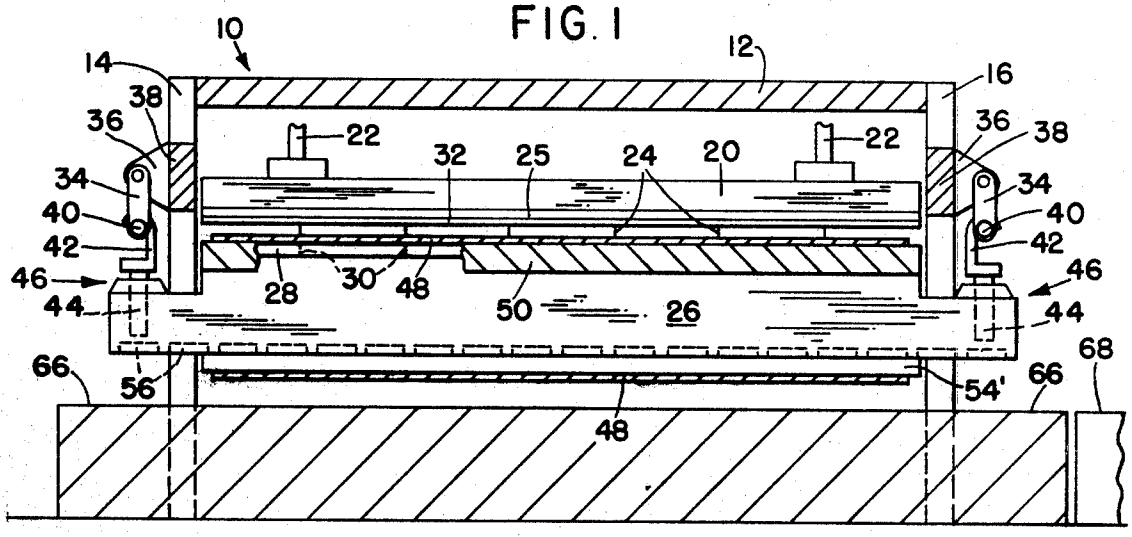


FIG. 1


10
14
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12
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34
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42
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44
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50
26
54'
66
68
48

FIG. 2

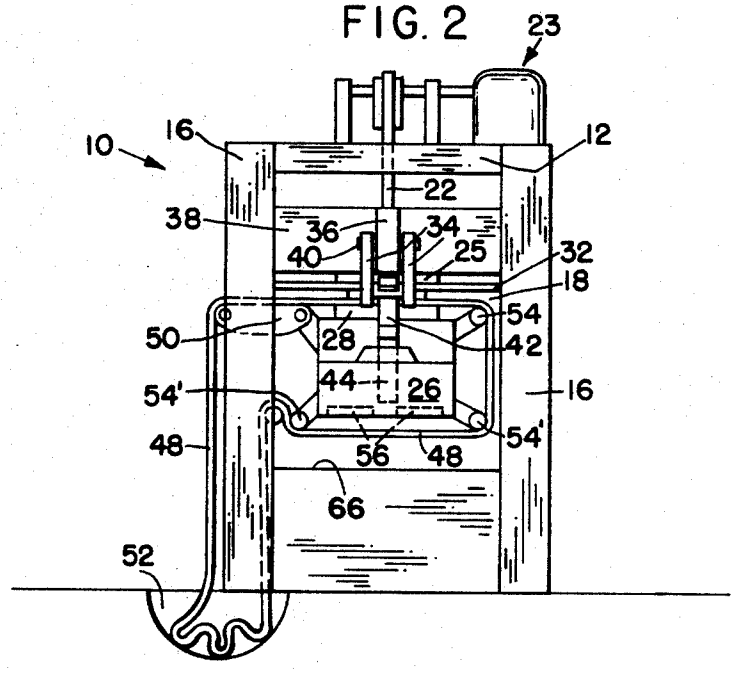
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FIG. 3

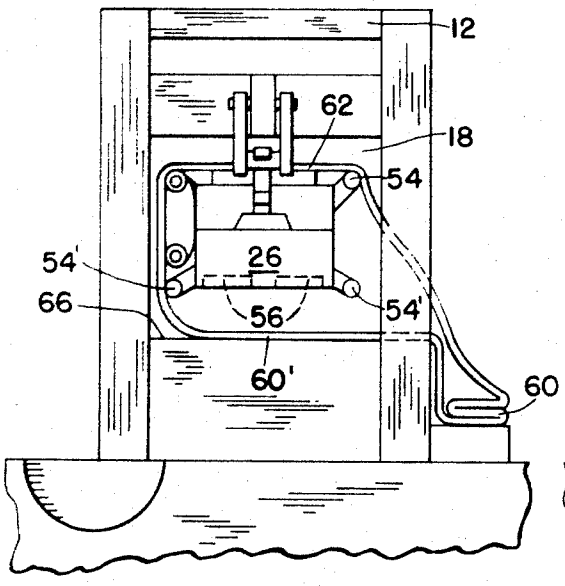


FIG. 4

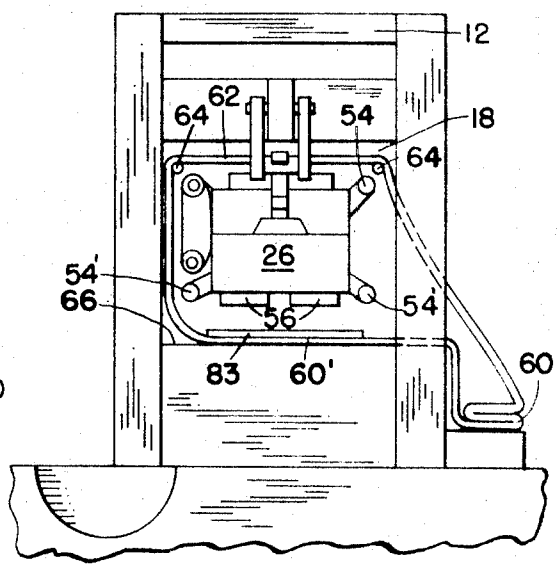


FIG. 5

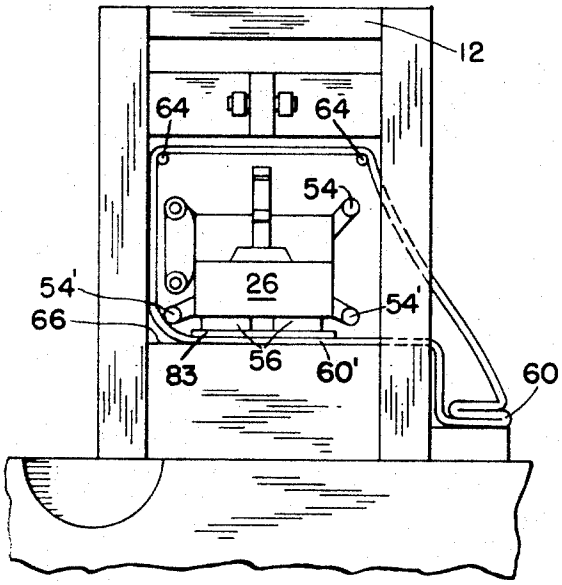


FIG. 7

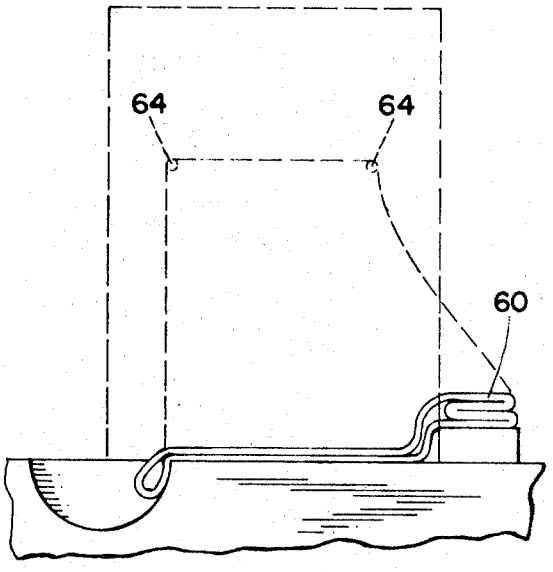


FIG. 6

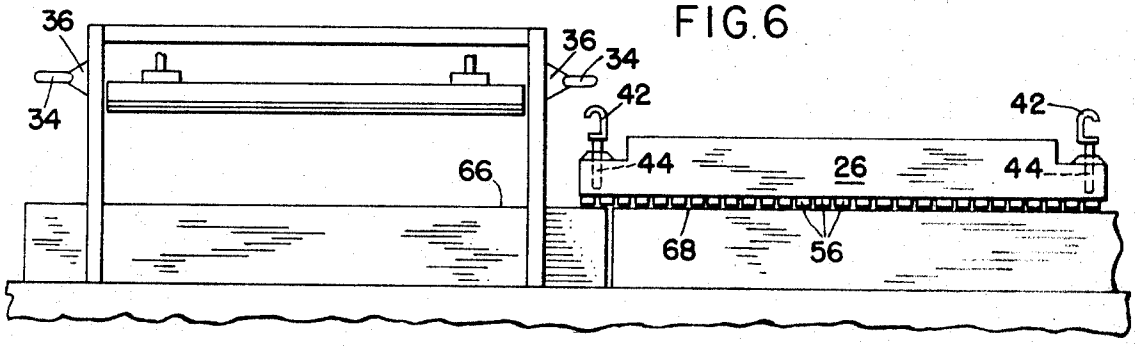


FIG. 8

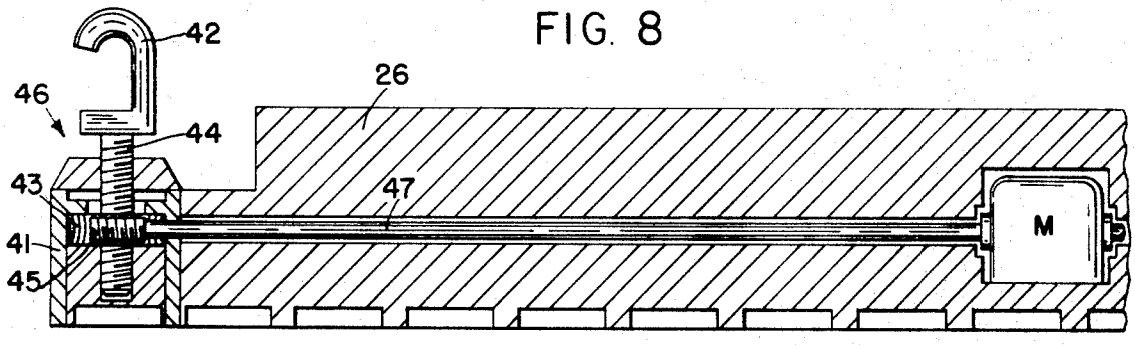


FIG. 9

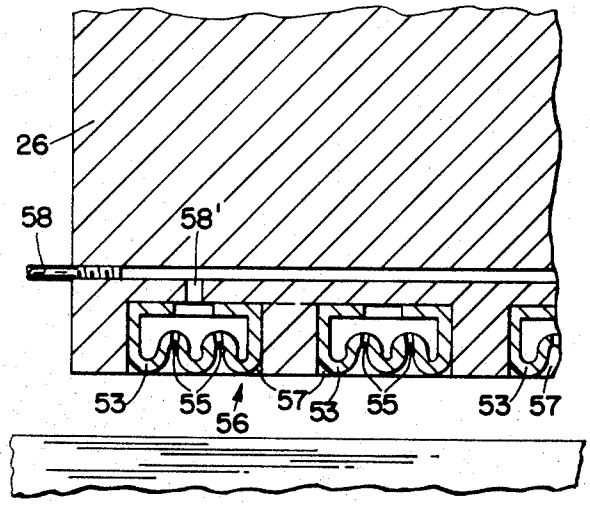


FIG. 10

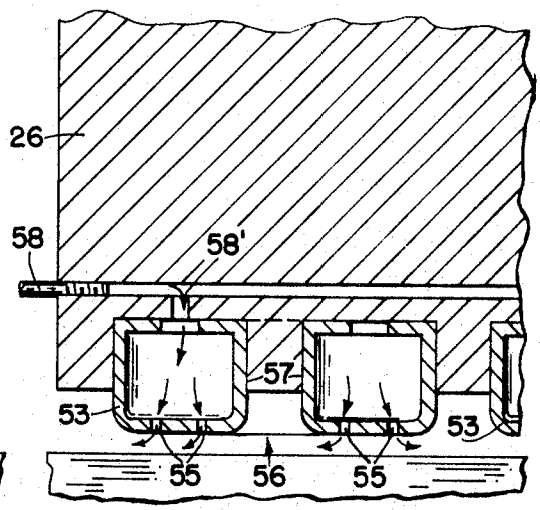
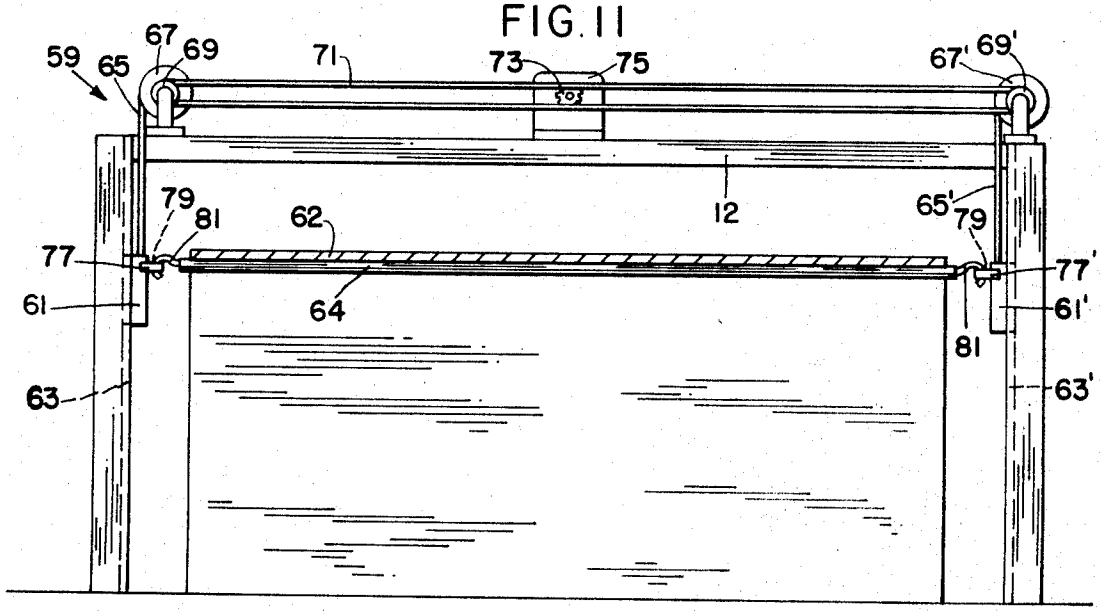


FIG. 11



NEEDLE PUNCHING MACHINE FOR ENDLESS WEB AND METHOD OF REMOVING WEB

BACKGROUND OF THE INVENTION

This invention relates to needle punching machines for use in needling endless webs such as felts for the paper-making industry. The paper-making industry is demanding felts of greater widths which are becoming increasingly more difficult to handle. Numerous problems arise in making machines to cope with the wider felts, such as the difficulty of inserting and withdrawing the endless felts into and from the machine.

Needle punching machines generally comprise a needle beam which is reciprocable in a frame, needle boards which are secured to the beam and set with a plurality of depending needles, a perforated stripper, and a bed beam which is mounted in the frame and forms a perforated support for the web. The web extends between the perforated stripper and bed beam and then under the bed beam.

A difficulty which arises in connection with such needle punching machines is that the finished web cannot be readily removed from the machine because the web extends as an endless element around the bed beam and the side members of the machine frame obstruct the removal of the web in the longitudinal direction of the bed beam, transversely to the web feeding direction. One solution might be to remove one side of the machine frame, but this solution can only be effective in machines of smaller widths because the removal of the side portion of the frame will deprive the needle beam and bed beam of support at one end.

A second solution is to construct the machine frame so that it is open at one end and support the bed beam so that it can be supported at one end of the machine alternatively at one of two points to enable an endless felt to be inserted and removed in two stages, as shown, for example, in U. S. Pat. No. 3,129,486 to O'Byrne. This solution requires that the web be crumpled between supports and may result in damage to the web, particularly in the finished stage. With stiffer and more "boardy" felts, this solution may be impossible.

Still another solution is to pivotally support one end of the bed beam to one side of the machine frame and provide releasable locking means for the other end of the bed beam on the other side of the frame, as shown in U. S. Pat. No. 3,488,820 to Fehrer. When it is desired to remove the web from the machine, the locking device is released and the table is swung out of the frame about the pivot. This solution has the advantage of facilitating the handling of boardy felts but still requires that the felts be pulled laterally off the end of the beam which can cause felt damage due to the great lengths and weight of present day felts.

SUMMARY OF THE INVENTION

It is a principal object of the invention to provide a needle felting machine in which an endless web can be easily removed therefrom without folding the web in a transverse direction to its longitudinal axis and without subjecting the web to pulling stresses which may cause damage to the web.

A second object of the invention is a method of removing an endless web from a needling machine in an easy and efficient manner with no damage to the web.

These objects are accomplished by providing a needle felting machine with at least one end of the frame having an opening large enough for a bed beam to pass through and mounting the bed beam on the frame so that it can be detached therefrom and removed from the frame through the opening in the frame. Means are provided for supporting the web while the bed beam is being removed from the frame.

The method of removing the web includes the steps of separating the web from the bed beam, supporting the bed beam by bearing means, preferably of the "air film" type, and releasing the bed beam from the frame. The beam can be shifted endwise of the frame and clear of the web whereupon the web can be folded widthwise and removed from the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevation of the needle punching machine of the present invention, portions being in section;

FIG. **2** is an end view of the machine shown in FIG. **1**;

FIGS. **3–7** are diagrammatic views illustrating the steps in removing an endless web.

FIG. **8** is a detailed section of a bed beam lowering unit;

FIG. **9** is a fragmentary section of a portion of the bed beam showing the details of an air bearing in non-activated position;

FIG. **10** is a view similar to FIG. **9** showing the air bearing in activated position; and

FIG. **11** is a diagrammatic view of a mechanism for lifting a web from the bed beam.

DETAILED DESCRIPTION OF THE INVENTION

Referring particularly to FIGS. **1** and **2**, the needle punching machine of the present invention is generally indicated by the reference numeral **10** and comprises a frame including a top member **12** and two end members **14** and **16**. At least one of the end members, **16**, defines an endwise opening **18**, as shown in FIG. **2**.

A needle beam **20** is supported beneath member **12** by a pair of rods **22** which are vertically reciprocated by drive means **23** in a manner well know in the art. Needles **24** are secured to the bottom of the needle beam by a needle board **25**. Only a few needles are shown for clarity. A bed beam **26** supports a flat bed plate **28** having holes **30** for receiving the needles **24**.

A stripper plate **32** is fixed in a position between the needle beam and the bed beam **20** and is provided with apertures which are in register with respective needles **24**.

The means for detachably supporting the bed beam **26** includes, at each end of the frame, a pair of links **34** pivotally attached to a bracket **36** supported by a cross girt **38** at the end of the frame. A trunnion **40** extends between the lower ends of links **34** for supporting a hook **42** which has a threaded shank portion **44**. Lowering units **46** are attached to the ends of beam **26** and receive the respective shank portions **44**. These units may be of any type of conventional screw jack. Since the units **46** at both ends of beam **26** are identical, only the lefthand unit will be described, see particularly FIG. **8**. As shown in FIG. **8**, unit **46** comprises a housing **41**, a worm gear **43** through which shank **44** is threaded, the latter being movable vertically but held against rotation in the housing **41**. Gear **43** is rotatable

in the housing by a worm **45** but is held against vertical movement in the housing. Worm **45** is rotated by a shaft **47** driven by a motor M. The worms **45** of each unit **46** will be driven synchronously in either direction by shafts **47** from motor M. Rotation of worm **45** will cause the beam **26** to be moved up or down on shank **44**.

During operation of the machine, the endless web, indicated at **48**, is supported on bed plate **28** and a table **50** pivotally supported to the front of bed beam **26**. From table **50** and the bed plate **28**, the web extends downwardly and under the bed beam and then into a well **52** which is used to accommodate webs of great length. Other means such as a conveyor are sometimes used to accommodate the extra length of the web. The web then extends from the well **52** back to the table **50** and the bed plate **28**. Various rolls **54**, one or more of which are driven, guide the web at various points around the bed beam. Two of these rolls, indicated at **54'**, are attached to the lower portion of beam **26**, as shown in FIG. **2**.

The undersurface of bed beam **26** is equipped with air bearings **56** of the type which supports a load by creating a film of air between the load and a supporting surface. These bearings may be of the type designed by Rolair Systems, Inc., Santa Barbara, California.

Bearings **56** may be "doughnut" shaped, as shown diagrammatically in FIGS. **9** and **10**. Each bearing **56** comprises a "doughnut" shaped bag **53** with vent holes **55** and located within "doughnut" shaped recesses **57** in the lower surface of bed beam **26**. Compressed air is supplied to each recess **57** within its respective bag **53** from a compressed air line **58** via branch line **58'**. When air is supplied to the bags **53**, they inflate and extend beyond the lower surface of beam **26**, as shown in FIG. **10**. Air flows from the bags **53** through holes **55**, as indicated by the arrows, and creates a region of higher than ambient pressure that is capable of supporting beam **26** on a frictionless film of air between the bearings **56** and a supporting surface **66** located beneath the bed beam within the machine.

The steps of removing a web from the above-described machine are diagrammatically illustrated in FIGS. **3–7**. Referring particularly to FIG. **3**, preliminary steps prior to removal of the bed beam are illustrated. First, the table **50** is swung down to a vertical position and then the length of web in the well is taken up and folded in big neat folds, indicated at **60**. The lower run of the web, indicated at **60'**, rests on supporting surface **66**.

After the excess web is taken up, the upper run of the web, indicated at **62**, is lifted from the bed beam and the upper rolls of rolls **54** by a web lifting mechanism generally indicated at **59** and illustrated in FIG. **11**.

The means for lifting the upper run **62** from the bed plate **28** and table **50** need not be of any special design, but FIG. **11** illustrates one mechanism for performing this function. Only one lifting means **59** is shown; it being understood that there will be two, one at the front of the machine and one at the back. As shown in FIG. **11**, lifting means **59** comprises left- and right-hand slides **61** and **61'** slidable in vertical tracks **63** and **63'**, respectively, at opposite ends of the machine frame. Ropes or cables **65** and **65'** are attached to the upper ends of slides **61** and **61'**, respectively, and are trained around pulleys **67** and **67'**, respectively. These pulleys are rotatably mounted on the upper frame member **12**. Sprockets **69** and **69'** are rotatably mounted with pulleys **67** and **67'**, respectively, and are driven in synchronism by a sprocket chain **71** which is in turn driven by a drive sprocket **73** from motor **75**. Each slide is provided with a projection **77** which has an aperture **79** for receiving a hook **81** of a cable or chain **64**. The cable **82** has a hook at each end and extends below the upper run **62** of the web during normal operation of the needling machine. At this time, slides **61** and **61'** are in an intermediate position. Operation of motor **75** in one direction causes slides **61,61'** to slide upwardly and cable **64** will lift portion **62** a short distance from the bed plate **28**, as shown in FIG. **4**.

After portion **62** of the web has been lifted, an air impervious sheet **83** is placed over the lower run of the web and air bearings **56** are activated so that their respective bag portions **53** are in the inflated position shown in FIG. **10**. Units **46** are then operated to lower the bed beam **26** onto this sheet, as shown in FIG. **5**. The activated air bearings **56** support the bed beam **26** so that there is no damage to the web by the bed beam.

Once the bed beam **26** is lowered and supported by the air bearings **56**, it is disengaged from the links **34** and moved through the opening **18** in the frame from supporting surface **66** to a supporting surface **68** outside of the machine but at the same level as surface **66**. Prior to moving bed beam **26** out of the frame, links **34** are swung up out of the way, as shown in FIG. **6**.

Upon removal of the bed beam, motor **75** is reversed so that slides **61**, **61'** are allowed to be pulled down along tracks **63**, **63'** by the weight of the web which is lowered to the position shown in FIG. **7**. The cables are then unhooked from projections **77** and removed from the web. The remaining portions of the web are folded on top of previous folds **60** so that the entire web is therefore removed from the framework of the machine. A new web can now be inserted by repeating the above steps in reverse order.

Having now particularly described my invention, I claim:

1. A needle punching machine for manufacturing endless webs comprising:

a. a needle beam having a plurality of depending needles secured thereto;

b. a bed beam adapted to support said web and having perforations for receiving said needles;

c. a frame for supporting said needle beam and having at least one endwise opening large enough for said bed beam to pass through;

d. means for releasably mounting said bed beam on said frame;

e. means for separating said bed beam from said web;

f. means for supporting the portion of said web which is normally supported by said bed beam upon said separation; and

g. bearing means for supporting said lower bed beam whereby said lower bed beam can be withdrawn through said endwise opening of said frame and clear of said endless web and said web can be removed from said frame.

2. The needle punching machine as described in claim **1**, wherein said bearing means are air bearings of the relatively frictionless air film type.

3. The needle punching machine as described in claim 1, wherein said bed beam includes a hinged table moveable from a horizontal web supporting position to a vertical position for enabling said bed beam to clear said web and frame upon being withdrawn therefrom.

4. The needle punching machine as described in claim 1, wherein said bed beam mounting means has the capacity to positively raise and lower said bed beam.

5. A method of removing an endless web from a needle punching machine having a frame, a bed beam, the upper run of said web being supported by said bed beam and the lower run of said web passing under said bed beam during normal operation of said machine, which method comprises:

a. separating the upper run of said web from said lower bed beam;
b. placing an air impervious sheet over the lower run of said web;
c. providing a layer of air between said bed beam and said sheet;
d. releasing said bed beam from said frame onto said layer of air;
e. shifting said bed beam endwise of said frame and clear of said web; and
f. removing said web from said frame.

6. A method of removing an endless web from a needle punching machine having a bed beam on which said web is normally supported, a frame including side members, one of which has an opening large enough for the beam to pass through and web supporting means, which method comprises:

a. supporting said web within said frame independently of said beam;
b. shifting said bed beam endwise of said frame through said open side member so as to be clear of said web;
c. releasing said web; and
d. removing said web from within said frame.

7. A method of removing an endless web from a needle punching machine having a frame including side members, at least one of said side members having an opening large enough for the beam to pass through, a bed beam releasably mounted on said frame and upon which said web is normally supported, and web supporting means, which method comprises:

a. supporting said web independently of said beam within said frame;
b. supporting said bed beam;
c. releasing said bed beam from said frame;
d. shifting said bed beam endwise of said frame through said opening and clear of said web;
e. releasing said web; and
f. removing said web from within said frame.

8. A needle punching machine for manufacturing endless webs comprising:

a. a needle beam having a plurality of depending needles secured thereto;
b. a bed beam adapted to support said web and having perforations for receiving said needles;
c. feeding means for feeding a web between said needle beam and said bed beam;
d. a frame for supporting said needle beam and said bed beam having side members with at least one of said side members having an opening large enough for said bed beam to pass therethrough;
e. means for releasably mounting said bed beam on said frame;
f. means for raising and lowering said bed beam within said frame; and
g. bearing means for supporting said bed beam in its lowered position whereby said bed beam can be withdrawn through said opening in said side member and from said endless web, thereby permitting said web to be removed from said frame.

9. The needle punching machine as described in claim 8, wherein said bearing means are air bearings of the relatively frictionless air film type.

10. The needle punching machine as described in claim 8, wherein said bed beam includes a hinged table moveable from a horizontal web supporting position to a vertical position for enabling said bed beam to clear said web and frame upon being withdrawn therefrom.

11. A method of removing an endless web from a needle punching machine having a frame which includes side members at least one of which has an opening large enough for said beam to pass through, a bed beam upon which the web is normally supported, which method comprises:

a. shifting said bed beam transverse of the longitudinal axis of said endless web and clear of said frame and web;
b. allowing said endless web to collapse within said frame;
c. removing said web from said frame along its longitudinal axis.

12. A method of removing an endless web from a needle punching machine having a frame which includes side members, at least one of which has an opening large enough for said beam to pass through, and a bed beam releasably mounted within said frame upon which said web is normally supported, which method comprises:

a. lowering said bed beam from its normal operating position;
b. releasing said bed beam from said frame;
c. shifting said bed beam transverse to the longitudinal axis of said endless web through the opening in said side member;
d. allowing said web to collapse within said frame; and
e. removing said web from said frame.

* * * * *